Healthy Futures: Engaging the oral health community in childhood obesity prevention – Conference summary and recommendations

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Abstract

Childhood obesity is a major public health problem. An association between obesity and dental caries, the most prevalent disease of childhood, has been identified. One explanation for the association is that consumption of sugar-sweetened beverages and frequent snacking on carbohydrate-rich foods are common risk factors for development of both obesity and caries. The Robert Wood Johnson Foundation (RWJF) has been at the forefront of national efforts to promote healthy weight in children. As part of these efforts, RWJF sponsored the Healthy Futures: Engaging the Oral Health Community in Childhood Obesity Prevention National Conference, held on November 3–4, 2016, at Georgetown University in Washington, DC. The aim of the conference was to increase awareness of evidence-based recommendations; identify strategies; and promote collaborative efforts that oral health professionals, oral-health-related organizations, and others can employ to prevent childhood obesity. This report summarizes the findings presented at the conference and discusses their implications. The report also reviews recommendations made in the areas of research, education, and policy that resulted from the conference.

Introduction

Childhood obesity is a major public health problem in the United States (1,2) and globally (3). Overweight and obesity are associated with and represent risk factors for a number of chronic diseases across the life span. An association between childhood obesity and dental caries, the most prevalent disease of childhood, has been suggested by several studies (4). One explanation for the association is based on the rationale that consumption of sugar-sweetened beverages (SSBs) and frequent snacking on carbohydrate-rich foods are common risk factors for development of both obesity and caries. As highlighted in a recent editorial by Tinanoff and Holt (5), many foods and beverages that children commonly consume have substantial amounts of sugar, and even a single serving

can exceed the daily sugar consumption recommendation for children. In light of this, the association reported between body mass index (BMI) and caries risk in children (4) points to the value of using interdisciplinary approaches in health promotion and disease prevention to address common risk factors.

The Robert Wood Johnson Foundation (RWJF) has been at the forefront of national efforts to promote healthy weight in children (6). As part of these efforts, RWJF sponsored the Healthy Futures: Engaging the Oral Health Community in Childhood Obesity Prevention National Conference (7), held on November 3–4, 2016, at Georgetown University in Washington, DC. The aim of the conference was to increase awareness of evidence-based recommendations; identify strategies; and promote collaborative efforts that oral health professionals, oral-health-related organizations, and others can employ to prevent childhood obesity (8). The conference brought together a broad spectrum of health professionals, representatives from oral-health-related and other organizations, and experts in childhood obesity around the theme of engaging oral health professionals and organizations in childhood obesity prevention.

Conference findings

The conference was designed to a) increase understanding of the science focusing on oral health and childhood obesity, b) increase understanding of strategies the oral health community can use to prevent childhood obesity, c) increase understanding of how the oral health community can work with non-oral-health professionals and organizations to prevent childhood obesity, and d) provide opportunities for networking and developing relationships to identify and plan activities to prevent childhood obesity. Findings from systematic or scoping reviews of the literature and surveys of pediatric dentists and dental hygienists were presented and informed participants' facilitated discussions.

Frantsve-Hawley et al. (9) presented a systematic review of evidence documenting that consumption of sugar-containing beverages is associated with total and central adiposity among children under age 12. However, the quality of evidence was found to be low to moderate. Chi et al. (10) identified several important modifiable risk factors for childhood obesity, including behavioral factors (poor diet, increased carbohydrate intake, and sedentary lifestyle), psychosocial factors (parenting practices [e.g., restrictive or authoritarian practices], maternal stress, and poor family functioning), and biomedical factors (caregiver obesity, maternal gestational diabetes, and hypertension) (10). A scoping review by Vargas et al. (11) highlighted the fact that a negative social environment, represented by poverty, unhealthy social norms, unhealthy eating habits, and limited social cohesion, is associated with childhood obesity.

Greenberg et al. (12) examined various existing models of medical-dental integration addressing other conditions where oral health professionals play a role in screening for and prevention of systemic diseases, showing that oral health professionals are willing and able to screen, provide education, and refer. A survey of pediatric dentists, commissioned for the conference, found that a large proportion agree that childhood obesity is a serious health problem, see a role for themselves in the effort, and are willing to help (13). The survey found that significant barriers persist, as few pediatric dentists feel qualified or knowledgeable enough to provide effective nutrition education or other obesity-prevention interventions. Drawing lessons from other systemic diseases that are screened for in oral health care settings, the authors conclude that screening for childhood obesity in dental offices or clinics is feasible and potentially an effective strategy for obesity prevention (12).

At the level of health policy, Sanghavi and Siddiqui (14) reported that there is a paucity of evidence on effective engagement of the oral health community in advocating for policies that reduce childhood obesity and SSB consumption. They recommended that oral health professionals should be involved by proactively engaging and collaborating with other professionals in their communities in advocating for policies, disseminating resources on healthy eating habits, and conducting research to evaluate the effectiveness of existing practices and policies. The important responsibilities of dental schools and dental hygiene programs in obesity prevention were noted by Divaris et al. (15), who focused on the role of dental education in addressing the lack of skills among oral health professionals related to preventing childhood obesity in their patients. Although there appears to be a paucity of such efforts currently occurring in dental schools and dental hygiene programs, the authors suggest that opportunities for interprofessional education could be leveraged to address this gap.

When examining interventions in primary care settings to identify those that have had some success in addressing childhood obesity, four major themes emerged. As reported by Dooley et al. (16), these include family-based programs, motivational interviewing, enhanced practice tools (e.g., language interpreters, teach-back approaches), and higher-level interventions to change public policy (16). In their systematic review, Mallonee et al. (17) confirmed that motivational interviewing and active listening techniques have proven most effective in engaging children and their parents in obesity-prevention interventions in health care settings, including dental practices.

Implications and recommendations

The association between BMI and caries risk in children clearly has important implications for interprofessional

collaboration between oral health professionals and other health professionals, in particular those providing care to children. The relationship between dental caries and obesity highlights the role that the oral health care team could play in the nation's battle against childhood obesity. Unlike screening for many other systemic diseases, screening for obesity does not require special equipment or expensive tests. Given that the patients at high risk for dental caries could also be at risk for obesity, screening by dentists and dental hygienists and appropriate referral could have a long-term impact on a child's overall health and well-being. However, it is also evident that not all oral health professionals feel adequately prepared to effectively engage in such efforts. Education and training in this area that targets both dentists and dental hygienists and that promotes their collaboration in obesity prevention are needed.

There is also a need to develop more efficient means to create effective referral mechanisms between oral health professionals and other health professionals. At present, except in those relatively few organizations where oral health care is fully integrated into overall health care, it is cumbersome to attempt to refer dental patients to a physician or dietitian. Initial and continuing education for both dentists and dental hygienists are needed in the areas of nutrition education, motivational interviewing, screening for obesity, and referral for dietary counseling, if oral health care settings are to be useful venues for obesity prevention (18).

Most important, oral health professionals' ability to engage patients in effective and culturally competent communication needs to be improved. The significance of health literacy as a determinant of oral health outcomes and oral health disparities is now well recognized, and research that focuses on children and their caregivers is a high priority (19). In addition to learning how to improve their patients' health literacy, oral health professionals also need to enhance their own ability to clearly communicate with all individuals. Ideally, oral health professionals would begin developing better communication and patient-education skills early, while they are students.

Although there is substantial evidence linking children's consumption of foods and beverages with added sugars to childhood obesity, effective interventions to reduce children's consumption of foods and beverages with added sugars need to be developed and tested. At minimum, all health professionals should become familiar with, and educate their patients about, current dietary guidelines and recommendations issued by both U.S. and international authorities, in particular those focused on reducing intake of sugars (3,20-24). However, as was noted at the conference, for many families, trying to consume healthy foods and beverages is like swimming upstream. We need to make healthy nutritional choices affordable, available, and appealing. To make choosing healthy foods and beverages easy, we must do much more than try to change individual patients' behaviors. It is also necessary to effect changes in policies at the local, state, and national levels that can promote and incentivize making healthier choices. There is much to be learned from tobacco-related fiscal policies that have resulted in improved health, such as levying taxes on purchases of tobacco products resulting in reduced tobacco use. We are already learning from emerging SSB-related policies domestically and internationally.

The World Health Organization has reported on how taxation and related fiscal policies in a number of countries have been effective at changing behaviors and promoting healthier food and beverage choices (25). In Mexico, a national excise tax imposed on SSBs in 2014 resulted in a 7.6 percent reduction in consumption of taxed beverages over 2 years (26). In 2015, the city of Berkeley, CA, became the first jurisdiction in the United States to impose an excise tax (of $0.01/oz.) on SSBs. Consumption of SSBs decreased 21 percent within a year, demonstrating how an apparently simple fiscal policy change can result in a significant health behavior change (27). To Galea and Vaughan (28), such findings raise the key public health question: "Can excise taxes on SSBs make a dent in obesity across the country?" They suggest that there is much to be learned from the type of natural experiment occurring in Berkeley and other settings, as it "offers rationale and perhaps motivation for broader-based policies based on this particular jurisdictional effort." Related to oral health outcomes, recent work by Schwendicke et al. (29), using German national data, supports a role for SSB taxation in reducing caries incidence and associated treatment costs.

Although simple in concept, however, implementing these sorts of macro-level changes in fiscal policy is complicated. Any changes of this type occur amidst the complexities of interacting social, cultural, political, and financial forces that rarely line up in favor of promoting healthy nutritional choices. As in the case of public health efforts to reduce tobacco consumption, there exist powerful corporate interests with strong incentives to oppose or undermine these efforts. This has been long-recognized in the case of the tobacco industry and is becoming better recognized in the case of the food and beverage industry. It is important to note that industry-led efforts have aimed to influence scientific research (30,31), including oral, dental, and craniofacial research in the United States (32). In addition, many health professional organizations have been the targets of influence-peddling efforts by the food and beverage industry (33).

So, where do we go from here? Clearly, the relative paucity of robust, high quality scientific evidence highlights the need for new research to improve our understanding of the effect of SSB consumption on obesity and dental caries in children. There also is a need to identify and test effective interventions (at the behavioral, biomedical, and policy levels) to prevent childhood obesity and dental caries in children. Nevertheless, given the association between BMI and caries risk in children,

there exists sufficient evidence to support a broad range of activities that oral health professionals and oral health professional organizations can engage in to help prevent childhood obesity. For example, they can:

- Modify pre-doctoral dental school and dental hygiene program curricula to include risk factors associated with obesity in children, as well as the role of oral health professionals in preventing obesity.
- Through continuing education courses and campaigns, improve oral health professionals' knowledge about childhood obesity, screening, and patient referrals to pediatric primary care health professionals or dietitians.
- Develop guidelines and other resources to help oral health professionals screen for childhood obesity, educate children and their parents about obesity prevention, refer children who are overweight, and reinforce healthy weight and healthy eating behaviors.
- Engage in screening for obesity and make referrals to pediatric primary care health professionals or dietitians.
- Incorporate behavior-modification techniques such as motivational interviewing to provide nutrition education to children and parents, and create financially sustainable models for the provision of such services.
- Proactively engage with community leaders in advocating for health-conducive policies (e.g., taxation of SSBs, banning sale of SSBs in public schools, improving the built environment to make it easier and safer for children to engage in physical activity).
- Develop interdisciplinary models of care within academic settings, community health centers, federally qualified health centers, and other health-care-delivery systems to engage in efforts to prevent childhood obesity and dental caries.

Oral health professionals, in their roles as both direct providers of health care and as thought leaders in their communities, are uniquely positioned to play an important part in preventing childhood obesity and improving the oral health and overall health and well-being of their patients.

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References

1. U.S. Public Health Service, Office of the Surgeon General. *The surgeon general's call to action to prevent and decrease overweight and obesity.* Rockville, MD: U.S. Public Health Service, Office of the Surgeon General; 2001.
2. Ogden CL, Carroll MD, Lawman HG, Fryar CD, Kruszon-Moran D, Kit BK, Flegal KM. Trends in obesity prevalence among children and adolescents in the United States, 1988–1994 through 2013–2014. *JAMA*. 2016;**315**(21): 2292-9.
3. World Health Organization. *Report of the commission on ending childhood obesity.* Geneva, Switzerland: World Health Organization; 2016.
4. Hayden C, Bowler JO, Chambers S, Freeman R, Humphris G, Richards D, Cecil JE. Obesity and dental caries in children: a systematic review and meta-analysis. *Community Dent Oral Epidemiol.* 2013;**41**(4):289-308.
5. Tinanoff N, Holt K. Children's sugar consumption: obesity and dental caries. *Pediatr Dent.* 2017;**39**(1):10-1.
6. Robert Wood Johnson Foundation. Healthy children, healthy weight [website]. [cited 2017 Apr 1] Available from http://www.rwjf.org/en/our-focus-areas/focus-areas/healthy-children-healthy-weight.html
7. Tinanoff N, Holt K. Introduction to proceedings of Healthy Futures: engaging the oral health community in childhood obesity prevention national conference. *J Public Health Dent.* 2017; Forthcoming.
8. Healthy Futures: Engaging the Oral Health Community in Childhood Obesity Prevention National Conference [website]. 2016. [cited 2017 Apr 1] Available from http://www.oralhealth4healthyfutures.org
9. Frantsve-Hawley J, Bader J, Welsh J, Wright T. A systematic review of the association between consumption of sugar-containing beverages and excess weight gain among children under age 12. *J Public Health Dent.* 2017; Forthcoming.
10. Chi D, Chu F, Luu M. A scoping review of epidemiologic risk factors for pediatric obesity: implications for future obesity and dental caries prevention research. *J Public Health Dent.* 2017; Forthcoming.
11. Vargas C, Stines E, Granado H. Health equity issues related to childhood obesity: a scoping review. *J Public Health Dent.* 2017; Forthcoming.
12. Greenberg BL, Glick M, Tavares M. Oral health professionals' efforts to address systemic health issues. *J Public Health Dent.* 2017; Forthcoming.
13. Wright R, Casamassimo P. Assessing attitudes and actions of pediatric dentists toward childhood obesity and sugar-sweetened beverages. *J Public Health Dent.* 2017; Forthcoming.
14. Sanghavi AA, Siddiqui NJ. Health policy and advocacy to prevent childhood obesity and reduce children's

consumption of sugar-sweetend beverages. *J Public Health Dent.* 2017; Forthcoming.
15. Divaris K, Bhaskar V, McGraw K. Pediatric obesity-related curricula content and training in dental schools and dental hygiene programs: systemic review and recommendations. *J Public Health Dent.* 2017; Forthcoming.
16. Dooley D, Moultrie NM, Sites E, Crawford PB. Effectiveness of primary care interventions to reduce childhood obesity and directions beverages consumption: a review and directions for the future. *J Public Health Dent.* 2017; Forthcoming.
17. Mallonee L, Boyd L, Stegeman C. A scooping review of skills and tools oral health professionals need to engage children and parents in dietary changes to prevent childhood obesity and consumption of sugar-sweetened beverages. *J Public Health Dent.* 2017; Forthcoming.
18. Khan SY, Holt K, Tinanoff N. Nutrition education for oral health professionals: a must, yet still neglected. *J Dent Educ.* 2017;**81**(1):3-4.
19. Casamassimo PS, Lee JY, Marazita ML, Milgrom P, Chi DL, Divaris K. Improving children's oral health: an interdisciplinary research framework. *J Dent Res* 2014;**93**(10): 938-42.
20. Robert Wood Johnson Foundation, *Healthy eating research: recommendations for healthier beverages.* Princeton, NJ: Robert Wood Johnson Foundation; 2013.
21. World Health Organization. *Guideline: sugars intake for adults and children.* Geneva, Switzerland: World Health Organization; 2015.
22. U.S. Department of Health and Human Services and U.S. Department of Agriculture. *2015–2020 Dietary guidelines for Americans.*, 8th ed. Washington, DC: U.S. Department of Health and Human Services and U.S. Department of Agriculture; 2015.
23. U.S. Food & Drug Administration. Changes to the nutrition facts label [website]. 2016 May 20. [cited 2017 Apr 1] Available from http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/LabelingNutrition/ucm385663.htm
24. Vos MB, Kaar JL, Welsh JA, Van Horn LV, Feig DI, Anderson CA, Patel MJ, Munos JC, Krebs NF, Xanthakos SA, Johnson RK. Added sugars and cardiovascular disease risk in children: a scientific statement from the American Heart Association. *Circulation.* 2016;134. [cited 2017 Apr 1] Available from http://circ.ahajournals.org/content/early/2016/08/22/CIR.0000000000000439
25. World Health Organization. *Fiscal policies for diet and prevention of noncommunicable diseases.* Geneva, Switzerland: World Health Organization; 2016.
26. Cochero MA, Rivera-Dommarco J, Popkin BM, Ng SW. In Mexico, evidence of sustained consumer response two years after implementing a sugar-sweetened beverage tax. *Health Aff.* 2017;**36**(3):564-71.
27. Falbe J, Thompson HR, Becker CM, Rojas N, McCulloch CE, Madsen KA. Impact of the Berkeley excise tax on sugar-sweetened beverage consumption. *Am J Public Health.* 2016; **106**(10):1865-71.
28. Galea S, Vaughan R. A public health of consequence: review of the October 2016 issue of AJPH. *Am J Public Health. 2016;***106**(10):1730-1.
29. Schwendicke F, Thomson WM, Broadbent JM, Stolpe M. Effects of taxing sugar-sweetened beverages on caries and treatment costs. *J Dent Res.* 2016;**95**(12):1327-32.
30. Nestle M. Food industry funding of nutrition research. The relevance of history for current debates. *JAMA Intern Med* 2016;**176**(11):1685-6.
31. Kearns CE, Schmidt LA, Glantz SA. Sugar industry and coronary heart disease research. *A historical analysis of internal industry documents. JAMA Intern Med* 2016;**176**(11):1680-5.
32. Kearns CE, Glantz SA, Schmidt LA. Sugar industry influence on the scientific agenda of the National Institute of Dental Research's 1971 National Caries Program: a historical analysis of internal documents. *PLoS Med.* 2015;**12**(3):e1001798.
33. Burros M. Dental group is under fire for Coke deal. The New York Times 2003 March 4. [cited 2017 Apr 1]. Available from http://www.nytimes.com/2003/03/04/us/dental-group-is-under-fire-for-coke-deal.html

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ORIGINAL ARTICLE

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Exploring the role of the dental hygienist in reducing oral health disparities in Canada: A qualitative study

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Abstract

Objectives: Reducing oral health disparities has been an ongoing challenge in Canada with the largest burden of oral disease exhibited in vulnerable populations, including Aboriginal people, the elderly, rural and remote residents, and newcomers. Dental hygienists are a unique set of professionals who work with and within communities, who have the potential to act as key change agents for improving the oral health of these populations. The purpose of this qualitative study was to explore, from the dental hygiene perspective, the role of dental hygienists in reducing oral health disparities in Canada.

Methods: Dental hygienists and key informants in dental hygiene were recruited, using purposeful and theoretical sampling, to participate in a non-directed, semi-structured one-on-one in-depth telephone interview using Skype and Call Recorder software. Corbin and Strauss's grounded theory methodology was employed with open, axial, and selective coding analysed on N-Vivo Qualitative software.

Results: The resulting theoretical framework outlines strategies proposed by participants to address oral health disparities; these included alternate delivery models, interprofessional collaboration, and increased scope of practice. Participants identified variation in dental care across Canada, public perceptions of oral health and dental hygiene practice, and lack of applied research on effective oral health interventions as challenges to implementing these strategies.

Conclusion: The research confirmed the important role played by dental hygienists in reducing oral health disparities in Canada. However, due to the fragmentation of dental hygiene practice across Canada, a unified voice and cohesive action plan is needed in order for the profession to fully embrace their role.

KEYWORDS

dental hygienist, health disparities, health services, oral health, professional role, qualitative research

1 | INTRODUCTION

In Canada, several sub-populations are known to be disproportionately affected by poorer health and oral health outcomes than the general population; this includes Aboriginal populations* , the elderly, families of low to middle income, newcomers to Canada, and populations residing in remote and rural communities.[1-4] Compared to the general Canadian population, these groups experience higher rates of decay and edentulism, report higher rates of oral pain and poorer levels of oral health-related quality of life, and are less likely to visit a dental professional.[5-7] Despite the number of reports and supporting evidence that emphasize the need to address oral health disparities, in the Canadian context there has

*In the context of this research, *Aboriginal populations* refer to an all-encompassing term that includes First Nations (Indians), Inuit and the Métis. See Section 35(2) of the Constitution Act, 1982.

been little uptake of such interventions across these communities.[8-15]

Dental hygienists provide a unique perspective as to how oral health disparities can be reduced. They work in a variety of practice settings, including traditional practice settings of delivering oral care services in private or public dental clinics, but also in non-traditional settings such as independent and mobile clinics, long-term care settings, and multidisciplinary environments.[16] In addition, through various opportunities across Canada, dental hygienists also work in non-traditional jobs such as academia, research, government regulation and policy, and are involved in a variety of public health and health organizations or associations not limited to dental care; all of which allows for the acquisition of additional knowledge and skills on how to reduce oral health disparities.[16]

Although dental hygienists have first-hand experience in working in a variety of practice settings and interacting with vulnerable groups, the question of how dental hygienists perceive themselves as resources and agents to reducing oral health disparities in Canada is not clearly understood. Qualitative methods using grounded theory enable an inductive approach to explaining social and psychosocial processes.[17] These methods have been previously employed in the dental literature to explore aspects of social processes and interventions that cannot be obtained quantitatively.[18-20] Therefore, the purpose of this study is to provide insight on the dental hygiene perspective of improving oral health outcomes in vulnerable populations in Canada and how dental hygienists are preparing themselves to achieve this goal.

2 | STUDY POPULATION AND METHODOLOGY

A qualitative study based on grounded theory methodology was performed in order to explore the dental hygiene perspective of reducing oral health disparities in Canada. Specifically, the facilitators and barriers to reducing oral health disparities in four dental hygiene practice settings (public health, non-traditional practice settings, aboriginal communities, and education) were explored.

We recruited dental hygienists who had experience working with vulnerable populations in Canada across ten provinces through purposive sampling; this involves selecting individuals who give a richness of information that is suitable for detailed research.[17,21] Theoretical sampling continued until theoretical saturation was achieved, which was tested with three additional participants. Dental hygienists were recruited through email invitation and were asked to review and complete an informed consent form prior to their participation.

Sixteen one-on-one interviews were conducted between the dental hygienist (interviewee) and principal investigator between January and August 2015. Prior to and during interviews, the educational and clinical background of the principal investigator was disclosed to participants in order to ensure symmetry of power, which helped establish a comfortable non-threatening environment for the participant.[17] In addition, reflexivity was performed prior to participant contact in order for the interviewer to acknowledge her potential biases and remain cognizant of such biases during the data collection and analytic stages.[17] This included critical self-reflection and acknowledgement of the researcher's interaction between herself and the participants, sensitivity to the potential for differences in interpretations of events among participants, and awareness of potential contradictions between theoretical preconceptions of the results and actual findings.[17]

An interview script consisting of five open-ended, non-directive questions served as the guide for discussion (Table 1). Such non-directive questions ensured an inductive approach and a means of surfacing the participants' main concerns and not those emanating from the existing literature.[17] This also provided dental hygienists with the freedom to control the pace and subject matter of the interview. These in-depth interviews enabled dental hygienists to discuss their views and past experiences, while allowing the interviewer to prompt and explore ideas and issues that emerged during each interview. Interviews lasted between 60 and 90 minutes.

Corbin & Strauss (1998) grounded theory methodology was applied to examine social processes and understand relationships and patterns among these elements and generate hypotheses related to oral health disparities.[21,22] Constant comparative analysis was performed, which requires that each interview be transcribed and analysed prior to recruiting any future participants.[22] This ensured that the generated hypotheses were continuously verified and developed until no additional information was reported.

Coding was arranged into a Corbin & Strauss (1998) coding paradigm: causal, phenomenon, context, intervening conditions, actions/interaction strategies, consequences.[22] Causal conditions lead to the core category/phenomenon. Intervening conditions influence the phenomenon or impact of causal conditions on the phenomenon. Contextual conditions situate phenomenon in a time and place to which individuals respond through action/interaction strategies. Finally, consequences result from the strategies.[22]

For each transcript, coding occurred in four stages. Initial/open coding was performed through line-by-line coding to identify important words, or groups of words, in the data and labelled into categories. Axial coding involved descriptive and conceptual linkage of categories identified in opening coding in order to develop a range of properties and their dimensions. Selective coding involved identifying relationships between categories and their integration into the axial coding paradigm/model in order to develop hypotheses around the phenomenon.[22] Finally, advanced coding was performed to situate the final theory in relation to the theoretical body of knowledge.

TABLE 1 Interview guide for non-directed semi-structured interviews

1. Tell me about your experience working with marginalized communities in Canada.
2. What is it like interacting with these individuals?
3. What do you think contributes to their poor oral health?
4. What do you think are the most effective ways to improve their oral health?
5. What is it that dental hygienists, specifically, can do to help reduce these disparities? Or to improve oral health of these populations?

Member checks were performed with emerging concepts/categories shared and reviewed with participating dental hygienists. This process of member checking helped ensure that the results of the research reflected the participants' experiences and provided an accurate interpretation of the data.[17] Interviews were conducted through Skype[23] and were audio-recorded and transcribed verbatim using Call Recorder software for Mac and N-Vivo Qualitative Analysis software. Due to budget restrictions, in-person interviews of dental hygienists across Canada were not feasible. Thus, telephone interviews through Skype ensured reach and access to participants across different jurisdictions in Canada and allowed for accommodation of participant's schedules.[24] It also enabled participants to control the privacy and comfort of their own environment. Ethical approval was obtained through the University of Toronto Research Ethics Board (Protocol #30391). All participant information was de-identified and all were given a participant identification number.

3 | RESULTS

A total of n=16 dental hygienists were recruited. Participants worked across different dental hygiene practice settings ranging from public health, academia, private practice, independent practice, long-term care, and on- and off-reserve Aboriginal communities. Some participants had experience in more than one practice setting. Years of practice varied from entry-to-practice to near retirement (Table 2).

Figure 1 outlines the theoretical framework stemming from our analyses. As identified, strategies to address oral health disparities were brought forward. The *Core Category* or *Phenomenon* is described as dental hygienists acting as change agents to reducing oral health disparities. This phenomenon is related to the development of actionable strategies that consider the causal, contextual, and intervening conditions in which they would exist.

3.1 | Causal conditions in the context of oral health disparities

Dental hygienists acknowledged that contributors to poor oral health are multifaceted and are a result of the interplay between the individual, community, and external environment. The social determinants of health as well as barriers related to awareness, affordability, availability, accessibility, and accommodation were commonly reported as causal to accessing care and maintaining optimal oral health for vulnerable populations. Due to the interplay among these factors, it was noted that "*… some have other barriers in their life than changing their oral health behaviours. It's not their first priority"*(DH, public health). This concept of low priority for dental care extended not only for recipients of care, but also at the provider and community level.

> *Communities have so many priorities, and oral health is not quite frankly always on the top of the agenda. They sometimes just simply have bigger fish to fry than this. So when some of those other things are addressed and are*

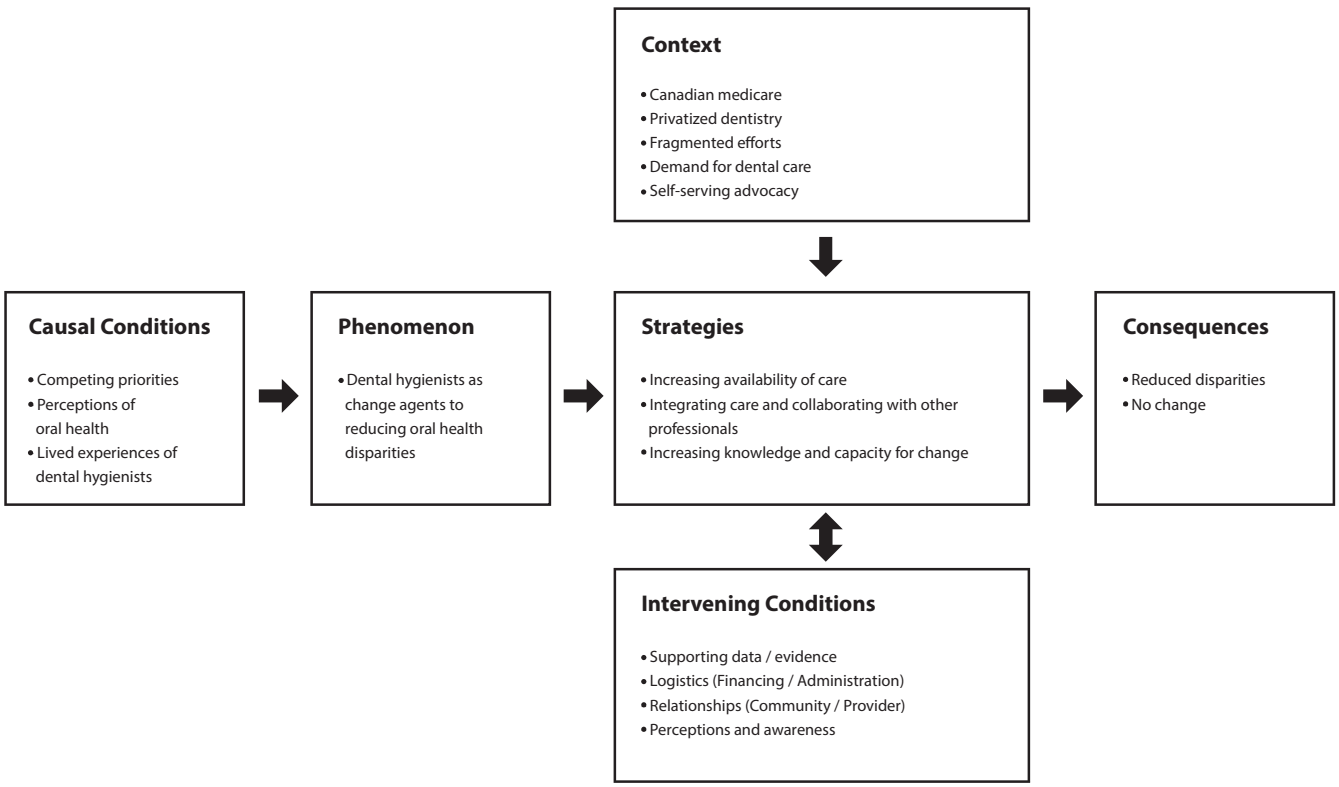

FIGURE 1 Theoretical framework

> *being addressed actively, they can start looking at this. It would be the same for you and me if we were in the same situation. If we were concerned about what we would feed our kids we wouldn't care about brushing our teeth. If we don't have water from the tap or food, if our house is falling apart, if we don't have any money to pay for heat, then oral health is not necessarily going to be a priority.*
>
> *(DHa, public health/First Nations)*

The relationship between individual, community, and external environment on influencing oral health outcomes were unique for each population being addressed such that "*every vulnerable population is different in one way or another and the challenges are different.*"(DHb, public health/First Nations)

3.2 | Context in which oral health disparities exist as they relate to oral health strategies

The phenomenon of oral health disparities and strategies to reduce such disparities were also explained within the context of privatized dentistry in Canada and its separation, in terms of financing, organization, and delivery, from the healthcare system.

> *The worst thing that ever happened was that the mouth was separated from the body. They just don't seem to realize that if the mouth is not healthy the body is not healthy. It's how you eat and smile, it's so important but they don't want to take care of it. It's frustrating.*
>
> *(DH, Long-Term Care)*

Dental hygienists described how financing and organization of dentistry influences advocacy and change in Canada. In a sense, dental hygienists recognized that "*sometimes people see it as self-serving if it's only oral health professionals to advocate for something*"(DH, multiple experiences). This tied into the concept of privatized dentistry in Canada.

> *We are a different issue than the hospitals, because dentistry is a fee for service and private practice. If there was an outcry by the dentists saying you have to change reimbursement rates, the public would perceive that they're invested in this and you want to make more money and you're already making a lot. I don't think there is any sympathy that dentists should be paid more. I don't see dentists being an advocacy group because of that reason. They are seen more as business people more than health professionals.*
>
> *(DH, non-traditional setting)*

Outside of the dental profession, dental hygienists recognized a limited demand for improvements in dental care. One dental hygienist explained,

> *It's hard to get a real strong voice going, because that group doesn't have a strong voice on its own, and it's hard to get the public to rally on that. We know that people cannot eat properly on welfare and they haven't increased that either. The government just isn't under pressure to change things unless there is a huge public outcry and I don't see a change when the average person who has sway in the public has a dental plan.*
>
> *(DH, non-traditional setting)*

In addition, the relationship between oral health disparities and legislation regarding the provision of dental care across and within provinces, as well as social and political environments were recognized. One dental hygienist noted differences in legislation across jurisdictions, "*in other provinces it's mandated that everyone have a dental checkup. There is no mandatory check-up here.*" (DHc in Long-Term Care) Another described the impact of present but ambiguous legislation such that, "*there is a standard, and it says to provide mouth care, but doesn't have much around to clarify what that mouth care looks like.*"(DHd, Long-Term Care)

3.3 | Intervening conditions influencing oral health disparities as they relate to oral health strategies

The scarcity of evidence on interventions and their impact on oral health outcomes were described as impeding change. This included data availability from scientific research as well as mandatory reporting from institutions.

> *If we can show how mouth care really has value, and that it does return money to the system, that it decreases costs to the system, I think that's where we can see funding come back in. Somehow we have to show that mouth care lessens the burden on the medical system.*
>
> *(DH, public health)*

Logistical aspects related to the administration, structure, and sustainability of programmes were also perceived as impacting change. Sustainability was described in the context of budgetary constraints within government. One dental hygienist described administrative barriers and limited service coverage within oral health program as an impeding characteristic to improvements in oral health, in the sense that "*…you just wish that the fee guide was more realistic to people's actual needs.*"(DH, independent practice)

The relationships between dental hygienists and stakeholders were also described, where community involvement and partnership were perceived as influential components to successful strategies. This was described as the need to establish common ground and shared goals between dental hygienists and stakeholders prior to and during strategy implementation. Stakeholder groups brought forward by dental hygienists included clients, parents and caregivers, community members, healthcare providers, educators, researchers, and political representatives. The statement below describes the positive changes encountered as a result of partnering with members of a First Nations community when planning an oral health program.

> *That's where I've seen the biggest change over the years. It's becoming more of a partnership. We've always had the best intentions, but working with them [First Nations community] on a more collaborative basis has been very successful.*
>
> *(DHa, public health/First Nations)*

Community involvement and partnership were deemed important at the planning level as well as provider level as one dental hygienist indicated,

> *Having service providers that the community can get to know and trust is a pivotal part. Community members learn to recognize them as part of the community and part of the health care team. I think that regular care by the same providers is really important.*
>
> *(DH, public health)*

The perceived capacity of dental hygienists by other professionals and the public in responding to change was also significant in reducing disparities. One hygienist explained, "*the public views us as being somebody who does the cleaning for the dentists, and collects the dentists data in a cubicle in the dental office.*" (DH, Long-Term Care/Academia)

This was echoed and further discussed by another hygienist citing the need to improve capacity, "*If we are going to be taken seriously we have to come to the table with the same credentials. And you could be the best dental hygienist in the world and you're sitting at the table with people of higher credentials, they won't think of you the same ways.*"(DH, public health)

In addition, the communication approach between dental hygienists and other professionals was also reported as critical to establishing change. To some degree, dental hygienists should "*think about how they think.*"(DH, public health) when collaborating with other professionals. One hygienist described the importance of this open-minded approach in a sense that "*you cannot parachute into these situations and be the person who is going to solve all these problems, because you're never going to be able to do it on your own.*"(DH, multiple experiences)

3.4 | Strategies for reducing oral health disparities

Provided the contextual and intervening conditions surrounding oral health disparities, dental hygienists acknowledged the need to address causal conditions, but also elaborated on their role in reducing oral health disparities within the context of dentistry in Canada. As one example, they recognized the need for alternate models of dental care delivery through non-traditional practice environments. One dental hygienist described that traditional private practice settings were, "*only for certain types of people in the population: those with insurance and you know, who have close physical access*"(DH, non-traditional practice). It was perceived that "*people who are vulnerable need more time. They get the time they deserve when I attend to their needs in their own setting. And in private practice, when they're rushed, it's different when they're in a dental office setting*" (DH Long-Term Care/Academia).

Alternative to traditional practice settings, hygienists also viewed the need for integrating themselves within other healthcare settings in advisory or consulting roles. "*We just need someone there who knows about oral health to advise the other professionals that we are working. Ideally yes we need a dental hygienist. If we could have a dental hygienist on site.*" (DH, multiple experiences)

In this regard, one dental hygienist described how technology has been used to facilitate and increase access to care in alternate environments that may not have a dental operatory, such as primary healthcare centres, long-term care facilities, and remote healthcare settings (eg nursing stations on First Nations reserves):

> *We have some intraoral cameras… we're training community workers to operate the camera in the persons mouth if they have pain. We can see the images from a distance, we don't need to be in the community to see a kid. So we can say that that child needs to see a dentist as soon as possible and put them on the list. That's going to help a lot in terms of access.*
>
> *(DHa, public health/First Nations)*

Dental hygienists also perceived the need to branch out from dentistry such that, "*we cannot deliver oral health in a vacuum*"(DHb, public health/First Nations). The importance of collaborating with other healthcare providers was also reported and as one hygienist described, "*we are doomed if we don't link with other providers or health care providers within communities. We would be doomed if we don't work with child health, maternal health, and school staff. This is how we access a lot of our clients*".

They acknowledged that reducing oral health disparities requires increasing knowledge and awareness both within and between healthcare professions. Knowledge was described as improving perceptions of oral health care and delivery of preventive dental services by non-dental professionals. As such, dental hygienists noted the need for improved interprofessional education so that dental and healthcare professionals are not "*developed in silos*"(DH, multiple experiences) where there is "*no crossover and no contact with one another*"(DH, independent practice).

Beyond healthcare professionals, dental hygienists also perceived the need "*to educate the community as well*". This also included the need to promote advocacy such that, "*when family members have issues, let your politicians know, let your government know*"(DH, Long-Term Care). The goal of this strategy would be, "*making sure that you have a variety of information that will go to the right people, so that they can have an informed decision about policies and things like that.*"(DH, public health)

This included reorienting research agendas, where one dental hygienist expressed their concerns, "*I think we need to stop researching it and start doing something about it. Why are we assessing that the plaque scores are high, but we're not doing anything about it? We need to start doing more research on improving it.*"(DH, Long-Term Care/Academia)

Building capacity within the dental profession, such as increasing scope of practice and strengthening and structuring oral health program and policies, was also reported as strategies to reduce disparities. Increased scope of practice would increase access and availability of

appropriate dental care to vulnerable populations. Dental hygienists reported the need to increase knowledge and skill capacity within and beyond their formal dental hygiene education; this included emphasis on non-traditional practice settings, public health, and policy within the dental hygiene curriculum and advocacy for higher education in expanded clinical duties and non-clinical roles. *"Dental hygienists need to be trained and able to use their full scope of practice in order to be the first point of contact to care."*(DH, independent practice)

Overall, the interplay between causal, contextual, and intervening conditions provides insight into how dental hygienists perceive themselves as change agents to reducing oral health disparities. Thus, our resulting framework serves to confirm preconceptions on the role of dental hygienists as change agents, and provides insight as to how external factors influence this role. From our findings, we proposed several testable hypotheses that will help further explain and test the role of dental hygienists as change agents. These were predominately related to how intervening conditions influenced oral health strategies within the context of dental care in Canada.

(H1) Expanded dental hygiene education will improve credibility of dental hygienists as change agents as perceived by other professionals and the general public.

(H2) Increased interaction and learning opportunities with other healthcare providers during academia will improve perceptions of dental hygienists as change agents by other healthcare providers.

(H3) Standardizing legislation/mandates related to the provision of dental care across Canadian jurisdictions will improve dental hygienists ability to act as change agents.

(H4) Community involvement and partnerships with dental hygienists and dental hygiene organizations/associations will increase awareness and importance of oral health by individuals.

(H5) Increased evidence around strategies to improve oral health outcomes will increase uptake of strategies by institutions (public health/LTC) and communities.

4 | DISCUSSION

Results stemming from the accounts from dental hygienists who have first-hand experience with vulnerable populations in Canada describe the enabling and intervening conditions to acting as key change agents. From these conditions, we have formulated dimensions for change presented by actionable items; these include change in: education (curriculum expansion or integration); research (reorienting agendas for interventional studies); public health (incorporation of dental hygienists in managerial roles); dental and health care (increasing interprofessional collaboration, integrating care into healthcare settings); and in communities and the general public (increasing awareness, addressing social determinants of health).

Our resulting framework identified that the perceptions and awareness of others and the relationship between providers and communities influence the successful implementation of strategies to reducing oral health disparities. Such community-provider relationships are characterized as those between dental hygienist and community members including, recipients of care, leaders within organizations, and other healthcare professionals. These relationships may be influenced by past experiences as well as current perceptions of the role of dental hygienists. Arguably, these two intervening conditions are influenced by the credibility of dental hygienists as perceived by others.

The evolution of the dental hygiene education curriculum and its effect on the credibility of dental hygienists has been identified by several academics and organizations over the past decade, with the shift towards baccalaureate education endorsed by national dental hygiene organizations.[20,22,25-31] Evidence regarding the effect of baccalaureate education has shown changes in self-perception, values, and knowledge base exhibited among dental hygienists who pursued dental hygiene degree-completion programmes.[31] With only four provinces (British Columbia, Alberta, Manitoba, Nova Scotia) offering baccalaureate dental hygiene degree programmes, the anticipated transition of remaining jurisdictions to such programmes provides a unique opportunity to explore changes in perception of dental hygienists by the public and other healthcare providers.

Along with advancing the dental hygiene curriculum, integrating dental hygiene and non-dental health profession education is needed, not only to improve relationships and perceptions among professionals but also to improve the preparedness of dental hygienists in understanding the structure and culture of different communities and practice settings. Indeed, there has been increased interest in the role of dental hygienists in non-dental practice settings, such as community health clinics, long-term care homes, and hospital-based settings.[32-37] Theile and colleagues identified how dental hygienists can embrace their role in interprofessional practice, not only through traditional practice settings, but also by contributing to oral-systemic health research and facilitating implementation science[34]; all of which would require knowledge of different delivery settings. Although frameworks to implement an interprofessional curriculum for medical, nursing, and dental students exist,[38,39] given the separation of dental and health care in Canada—in terms of organization, financing, and delivery—there may be little drive for professions to establish shared learning environments.[40]

One reoccurring strategy identified by dental hygienists to reducing oral health disparities was the need to increase availability of care; however, the fragmentation and lack of standardization of the dental hygiene scope of practice across Canada was identified as a barrier to accessing preventive services. Although successful completion of the National Dental Hygiene Board Exam is a requirement for all practicing dental hygienists, opportunities for expanded scope of practice, such as self-initiation, restorative dental hygiene, and local anaesthesia, are restricted to certain jurisdictions.[41] For example, the administration of local anaesthesia is only permitted in certain

TABLE 2 Characteristicsof participating dental hygienists[a]

	Count (n=16)	
Years in dental hygiene practice		
<5 y	3	
5-15 y	6	
>15 y	6	
	Past experience[b]	**Current experience**
Type of practice		
Administration/managerial	3	6
Academia/education	2	3
Research	1	2
Traditional practice setting (chairside)	11	5
Practice setting		
Aboriginal populations (on- and off-reserve)	5	3
Independent/mobile practice	-	2
Long-term care/home care	1	5
Private practice	10	3
Public health	4	3

[a]To ensure anonymity of participants, further stratification of participant characteristics was not performed.
[b]Groups are not mutually exclusive.

provinces (British Columbia, Alberta, Saskatchewan, Manitoba), and legislation regarding independent practice varies by jurisdiction, with some provinces requiring patients to visit a dentist within 365 days before receiving care by independent practicing dental hygienists.[36,41] Such restrictions limit the opportunity for dental hygienists to provide therapeutic interventions in non-traditional practice settings. These are ultimately the result of political structures and population needs unique to individual jurisdictions that have influenced dental hygiene legislation across Canada, where opportunities to expand the dental hygiene scope of practice are impeded by inter-professional politics and conflict.[42-44]

Operationalizing the role of dental hygienists as change agents to reducing oral health disparities requires an understanding of social, political, and economic structures of society that shape education, public policy decision-making, and perceptions of the dental hygiene profession by interested stakeholders. Such contextual characteristics, as identified in our framework, are important considerations. Complexities within different practice settings have been previously explored[35,45] and describe the importance of interprofessional and cultural competence and strong relationships within communities and organizations.

Ultimately, supporting evidence on effective strategies is required in order to reduce oral health disparities in Canada. Given that the overwhelming majority of dental care services are outside the scope of the Canada Health Act and remain privately financed and delivered, there is little demand for policy decision-makers to improve the oral health of Canadians.[40] Therefore, strategies that can be employed by dental hygienists, as identified by our framework, require evaluation and dissemination to key stakeholders in health and oral health fields. In addition, as acknowledged by participants, advocacy efforts by the dental hygiene profession pertaining to the social determinants of health are also needed in order to ensure that such strategies can be effectively delivered to vulnerable populations.

Overall, our findings provide insight into how the organization and financing of dental care and the broader medical context have influenced oral health disparities and the role of the dental hygiene profession. However, it is important to note that our resulting theoretical framework is strictly related to the accounts of the participants and therefore may not be generalizable to all dental hygienists across Canada. Further exploration of the role and associated facilitators and barriers for dental hygienists is imperative. Consequently, our findings suggest that further research as identified by our proposed hypotheses could help the dental hygiene profession establish its role as change agents to improving oral health outcomes and reducing disparities.

Reducing oral health disparities in the Canadian population requires multisectorial involvement and action, with dental hygienists playing key advocacy and provider roles. Effectively reducing oral health disparities requires an understanding of how the dental hygiene profession is perceived by the public, policy makers, and healthcare professionals, which may be addressed by evaluating the testable hypotheses generated from our framework.

CLINICAL RELEVANCE

Scientific rationale of the study

This research serves to expand on the professional role of dental hygienists in reducing oral health disparities in the Canadian population, which may be applicable to other international settings.

Principal findings

Our findings generated a theoretical framework that highlights facilitators and barriers to dental hygienists acting as change agents to reducing oral health disparities in the Canadian context.

Practical implications

The testable hypotheses resulting from our theoretical framework can be implemented and evaluated by dental hygienists in various practice settings; all of which will aid in understanding how to improve and sustain positive oral health outcomes in vulnerable populations.

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REFERENCES

1. Kanatami IT. Inuit oral health survey report 2008-2009. Health Canada; 2011.
2. Report on the findings of the oral health component of the Canadian health measures survey 2007-2009. 2010. http://publications.gc.ca/collections/collection_2010/sc-hc/H34-221-2010-eng.pdf. Last accessed December 02, 2015.
3. American Academy of Pediatrics Committee on Native American Child Health, Canadian Pediatric Society, First Nations, Inuit and Métis Committee. Early childhood caries in indigenous communities. *Pediatrics*. 2011;127:1190-1198.
4. Ramraj C, Quinonez C. Self-reported cost prohibitive dental care needs among Canadians. *Int J Dent Hyg*. 2013;11:115-120.
5. Millar WJ, Locker D. Dental insurance and use of dental services. *Health Rep-Stat Canada*. 1999;11:55-75.
6. Lawrence HP, Binguis D, Douglas J, et al. Oral health inequalities between young Aboriginal and non-Aboriginal children living in Ontario, Canada. *Community Dent Oral Epidemiol*. 2009;37:495-508.
7. Kotzer RD, Lawrence HP, Clovis JB, Matthews DC. Oral health-related quality of life in an aging Canadian population. *Health Qual Life Outcomes*. 2012;10:1-12.
8. Plutzer K, Spencer AJ. Efficacy of an oral health promotion intervention in the prevention of early childhood caries. *Community Dent Oral Epidemiol*. 2008;36:335-346.
9. Lawrence HP. Oral health interventions among Indigenous populations in Canada. *Int Dent J*. 2010;60:229-234.
10. Freudenthal JJ, Bowen DM. Motivational interviewing to decrease parental risk-related behaviors for early childhood caries. *J Dent Hyg*. 2010;84:29-34.
11. Harrison R, Benton T, Everson-Stewart S, Weinstein P. Effect of motivational interviewing on rates of early childhood caries: a randomized trial. *Pediatr Dent*. 2007;29:16-22.
12. Weintraub JA, Ramos-Gomez F, Jue B, et al. Fluoride varnish efficacy in preventing early childhood caries. *J Dent Res*. 2006;85:172-176.
13. Nicol R, Petrina Sweeney M, McHugh S, Bagg J. Effectiveness of health care worker training on the oral health of elderly residents of nursing homes. *Community Dent Oral Epidemiol*. 2005;33:115-124.
14. Macnab AJ, Rozmus J, Benton D, Gagnon FA. 3-year results of a collaborative school-based oral health program in a remote First Nations community. *Rural Remote Health*. 2008;8:882.
15. Lawrence HP, Binguis D, Douglas J, et al. A 2-year community-randomized controlled trial of fluoride varnish to prevent early childhood caries in Aboriginal children. *Community Dent Oral Epidemiol*. 2008;36:503-516.
16. Canadian Dental Hygienists' Association. Practice setting and non-traditional jobs. Ottawa: Canada. http://www.cdha.ca/pdfs/education/scene/practice_settings_and_non.pdf. Accessed July 17, 2016.
17. Charmaz K, Belgrave LQ. Qualitative interviewing and grounded theory analysis. In: Gubrium J, Holstein J, eds. *The SAGE Handbook of Interview Research: The Complexity of the Craft*. Los Angeles, California: SAGE Publications; 2012:347-366.
18. Bower E, Scambler S. The contributions of qualitative research towards dental public health practice. *Community Dent Oral Epidemiol*. 2007;35:161-169.
19. Finkleman GI, Lawrence HP, Glogauer M. The impact of integration of dental services on oral health in long-term care: qualitative analysis. *Gerodontology*. 2012;29:e77-e82.
20. Sunell S, McFarlane R, Biggar H. Differences between diploma and baccalaureate dental hygiene education in British Columbia: a qualitative perspective. *Intl J Dent Hyg*. 2016;47:109-121.
21. Urquhart C. *Grounded Theory for Qualitative Research: A Practical Guide*. London, United Kingdom: SAGE; 2012.
22. Strauss A, Corbin J. *Basics of Qualitative Research: Procedures and Techniques for Developing Grounded Theory*. Thousand Oaks, CA: Sage; 1998.
23. Cater JK. Skype a cost-effective method for qualitative research. *Rehabil Couns Bull*. 2011;4:3-4.
24. Shuy R. In-person versus telephone interviewing. In: Holstein J, Gubrium J, eds. *Inside Interviewing: new lenses, new concerns*. London, United Kingdom: SAGE Publications;2003:175-193.
25. Stolberg RL, Tilliss T. The Baccalaureate educated dental hygienist. *J Evid Based Dent Prac Suppl*. 2016;16:136-143.
26. Walsh MM, Ortega E, Heckman B. Dental hygiene's scholarly identity and roadblocks to achieving it. *J Dent Hyg Suppl*. 2015;89:9-12.
27. Cobban S, Edgington E, Compton S. An argument for dental hygiene to develop as a discipline. *Int J Dent Hyg*. 2007;5:13-21.
28. Sunell S, McFarlane RD, Biggar HC. Differences between diploma and baccalaureate dental hygiene education: a quantitative perspective. *Can J Den Hyg*. 2013;47:109-121.
29. Kanji Z, Sunell S, Boschma G, Imai P, Craig B. A discourse on dental hygiene education in Canada. *Int J Dent Hyg*. 2011;9:242-249.
30. Kanji Z, Sunell S, Boschma G, Imai P, Craig BJ. Dental hygiene baccalaureate degree education in Canada: motivating influences and experiences. *Can J Dent Hyg*. 2010;44:147-155.
31. Kanji Z, Sunell S, Boschma G, Imai P, Craig BJ. Outcomes of dental hygiene baccalaureate degree education in Canada. *J Dent Educ*. 2011;75:310-320.
32. Brown EJ. Dental hygienist providers in long-term care: meeting the need. *J Evid Based Dent Pract Suppl*. 2016;16:77-83.
33. Juhl JA, Stedman L. Advocacy for the provision of dental hygiene services within the hospital setting: development of a dental hygiene student rotation. *J Evid Based Dent Pract Suppl*. 2016;16:129-135.
34. Theile CW, Strauss SM, Northridge ME, Birenz S. The oral health care manager in a patient-centered health facility. *J Evid Based Dent Pract Suppl*. 2016;16:34-42.
35. Zarkowski P, Aksu MN. Complexities of providing dental hygiene services in community care settings. *J Evid Based Dent Pract Suppl*. 2016;16:113-121.
36. Wallace BB, MacEntee MI, Pauly B. Community dental clinics in British Columbia, Canada: examining the potential as health equity interventions. *Health Soc Care Community*. 2015;23:371-379.
37. Jones ML, Boyd LD. Interdisciplinary approach to care: the role of the dental hygienist on a pediatric feeding team. *J Allied Health*. 2012;41:190-197.

38. Reeves S. Community-based interprofessional education for medical, nursing and dental students. *Health Soc Care Community*. 2000;8:269-276.
39. Furgeson D, Kinney JS, Gwozdek AE, Wilder R, Inglehart MR. Interprofessional education in US dental hygiene programs: a national survey. *J Dent Educ*. 2015;79:1286-1294.
40. Shaw J, Farmer J. An environmental scan of publicly financed dental care in Canada: 2015 update. Ottawa, ON, 2016. https://www.researchgate.net/publication/311409250_An_environmental_scan_of_publicly_financed_dental_care_in_Canada_2015_Update. Accessed July 16, 2016.
41. Canadian Dental Hygienists' Association. Dental hygiene regulation: a comparison. Ottawa, ON: Canadian Dental Hygienists Association, 2013. https://www.cdha.ca/pdfs/profession/RegulatoryComparisonCharts_final.pdf. Accessed July 18, 2016.
42. Adams TL. Attitudes to independent dental hygiene practice: dentists and dental hygienists in Ontario. *J Can Dent Assoc*. 2004;70:535-538.
43. Adams TL. Inter-professional conflict and professionalization: dentistry and dental hygiene in Ontario. *Soc Sci Med*. 2004;58:2243-2252.
44. Leake JL. Why do we need an oral health care policy in Canada? *J Can Dent Assoc*. 2006;72:317a-317j.
45. Charbonneau CJ, Kelly DM, Donnelly LR. Exploring the views of and challenges experienced by dental hygienists practising in a multicultural society: a pilot study. *Can J Dent Hyg*. 2014;48:139-146.

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BMJ Open

Association between toothbrushing and risk factors for cardiovascular disease: a large-scale, cross-sectional Japanese study

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ABSTRACT

Objectives: To clarify the association between toothbrushing and risk factors for cardiovascular disease—namely, hypertension (HT), diabetes mellitus (DM), dyslipidaemia (DL), hyperuricaemia (HUA) and chronic kidney disease (CKD).

Design: A large-scale, single-centre, cross-sectional study.

Setting: St Luke's International Hospital, Center for Preventive Medicine, Tokyo, Japan, between January 2004 and June 2010.

Participants: This study examined the toothbrushing practices of 85 866 individuals according to the 3-category frequency criterion: 'after every meal', 'at least once a day' and 'less than once a day'. The ORs by frequency were calculated for the prevalences of HT, DM, DL, HUA and CKD according to binominal logistic regression analyses adjusted for age, gender, body mass index and lifestyle habits—smoking, drinking, walk time and sleep time.

Results: The prevalences of the risk factors were as follows: HT ('after every meal': 13.3%, 'at least once a day': 17.9% and 'less than once a day': 31.0%), DM (3.1%, 5.3% and 17.4%, respectively), DL (29.0%, 42.1% and 60.3%, respectively), HUA (8.6%, 17.5% and 27.2%, respectively) and CKD (3.8%, 3.1% and 8.3%, respectively). The prevalences were significantly higher in the 'less than once a day' group than in the 'after every meal' group for DM (OR=2.03; 95% CI 1.29 to 3.21) and DL (OR=1.50; 95% CI 1.06 to 2.14), but not for HT, HUA and CKD.

Conclusions: Even taking into account lifestyle habits, a lower frequency of toothbrushing was associated with high prevalences of DM and DL. Toothbrushing practices may be beneficial for oral health improvement and also for prevention of certain systemic diseases.

Strengths and limitations of this study

- This study is a large-scale, cross-sectional Japanese study to clarify the association between toothbrushing practices and risk factors for cardiovascular disease.
- This study used binominal logistic regression analyses adjusted for lifestyle habits—smoking, drinking, walk time and sleep time.
- Even taking into account lifestyle habits, a low frequency of toothbrushing was significantly associated with the high prevalences of diabetes mellitus and dyslipidaemia, but not with hypertension, hyperuricaemia and chronic kidney disease.
- A limitation of the study is residual selection bias due to a single-centre study.

INTRODUCTION

Good oral hygiene, in which toothbrushing has a central role,[1] is important to prevent gingivitis and tooth decay. Some toothbrushing intervention programmes have shown promising results in reducing dental plaque formation.[2] However, the extent of association between toothbrushing practices and cardiovascular disease remains unknown. Poor oral hygiene was associated with higher levels of risk for cardiovascular disease in a study conducted by de Oliveira *et al*.[3] However, Yeung[4] pointed out that the study had not determined the causality between oral hygiene and cardiovascular disease because of biased health consciousness. Recent studies reported that a low frequency of toothbrushing was associated with endothelial dysfunction[5] and that an improvement in periodontal status prevented intima-media thickness progression in the carotid arteries.[6] Daily toothbrushing was shown to be related to a lower prevalence of type 2 diabetes mellitus (DM), hypertension (HT) and dyslipidaemia (DL).[7] Furthermore, a higher frequency of toothbrushing was found to be associated with a higher rate of good diabetes control in patients with DM.[8 9] However, these

mechanisms were unclear, but there was a report that a low frequency of toothbrushing facilitated the proliferation of *Porphyromonas gingivalis*. *P. gingivalis* proliferates in the presence of increased insulin resistance and systemic inflammation, with the alteration of gut microbiota.[10] Increased insulin resistance and systemic inflammation also cause DM.

A great number of people, especially the elderly, are still affected by cardiovascular disease despite recent advances in medical knowledge and technology. Therefore, there is an increasing need to implement public health measures, including oral hygiene, to enable them to acquire healthier lifestyle habits. Toothbrushing is one of the most familiar and easiest methods of improving oral hygiene in the general population. Based on the possible link between dental disease and cardiovascular disease,[11] toothbrushing may be an easily applicable preventive method for cardiovascular disease.

We conducted this epidemiological study to examine the association between frequency of toothbrushing and risk factors for cardiovascular disease—HT, DM, DL, hyperuricaemia (HUA) and chronic kidney disease (CKD)—in addition to considering lifestyle habits of the healthy general population.

MATERIALS AND METHODS

Study design and participants

This large-scale, single-centre, epidemiological study of cross-sectional design retrospectively analysed the medical records of 90 143 individuals who had undergone an annual medical checkup at St Luke's International Hospital Center for Preventive Medicine, Tokyo, Japan, between January 2004 and June 2010. This centre for preventive medicine conducted a conventional medical check-up. This medical system has ideal conditions for clinical measurements. These records used data only from the first visit between January 2004 and June 2010, so that participants who had more than one annual check-up during these periods were not double counted. Our previous study used this database and methods in a similar way to the present study.[12]

Of the 90 143 individuals, 85 866 people, aged 30–84, were analysed. Individuals arriving at our hospital, submitted a self-administered questionnaire including details of toothbrushing practices. The study population was split into the following three groups according to their toothbrushing practices: 'after every meal', 'at least once a day' and 'less than once a day'. The prevalences of risk factors for cardiovascular disease—HT, DM, DL, HUA and CKD—were calculated in each group.

The smoking subgroup comprised individuals who had a current or past history of smoking. The drinking subgroup was composed of individuals with a drinking habit and did not include non-habitual drinkers. Walk time and sleep time were calculated based on information provided by the self-administered questionnaire.

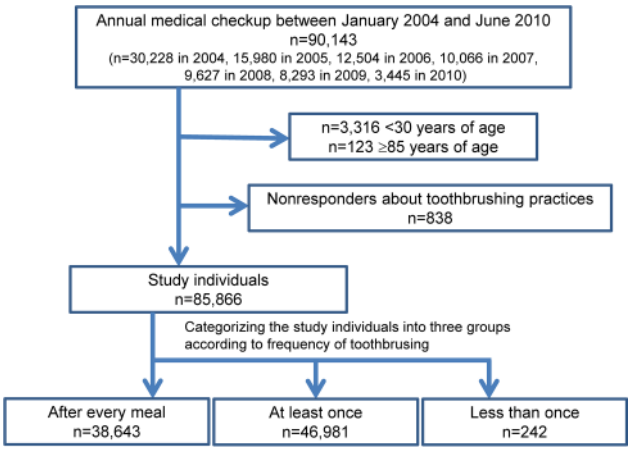

Figure 1 Flow diagram of study enrollment.

Blood pressure (BP) was recorded using an automatic brachial sphygmomanometer (OMRON Corporation, Kyoto, Japan). BPs of each person were measured twice—after sitting and remaining quiet for >5 min, with the feet on the ground and the back supported. The mean values of systolic and diastolic BP of each person were calculated from the recorded measurements. HT was defined as a systolic BP of ≥140 mm Hg and/or a diastolic BP of ≥90 mm Hg. DL was defined as a low-density lipoprotein cholesterol level of ≥140 mg/dL, a high-density lipoprotein cholesterol level of <40 mg/dL or a triglyceride level of ≥150 mg/dL. DM was defined as a glycated haemoglobin (HbA_{1c}) concentration of ≥6.5% (according to the National Glycohemoglobin Standardization Program). HUA was defined as a serum uric acid concentration of >7.0 mg/dL. CKD was defined as an estimated glomerular filtration rate of <60 mL/min/1.73 m^2. The HT, DL, DM and HUA subgroups included patients who were followed up and who received medication for their diseases.

Ethical considerations

All data were collected and held in a password-protected computer database. Individual data were anonymised. St Luke's International Hospital ethics committee approved the use of these data and the protocol for this study (approval number: 14-R033; 30 June 2014).

Statistical analysis

Analysis of variance (ANOVA) with Tukey's post hoc method was conducted to compare the characteristics and lifestyle habits of individuals among the three groups. Statistical differences in toothbrushing between the groups were evaluated using binominal logistic regression models, with the 'after every meal' group as reference. Binominal logistic regression analyses were conducted, adjusted for age, gender, body mass index (BMI), HT, DM, DL, HUA and CKD, and for lifestyle habits— smoking, drinking, walk time and sleep time. A value of $p<0.05$, two-sided, was considered statistically significant. All statistical analyses were performed using the

Table 1 Individual characteristics

Characteristics	Overall (n=85 866)	Frequency of toothbrushing per day: After every meal (n=38 643)	At least once (n=46 981)	Less than once (n=242)	p Value
Age, years	47.0±11.5	46.4±11.6	47.4±11.4	51.7±15.0	<0.001
Male gender (%)	49.0	32.7	62.2	92.6	<0.001
Height, cm	164.2±8.6	162.3±8.2	165.9±8.7	168.5±7.3	<0.001
Weight, kg	60.9±11.2	57.3±11.2	63.8±12.5	71.6±13.2	<0.001
BMI, kg/m^2	22.4±3.3	21.6±3.1	23.1±3.4	25.1±3.9	<0.001
AC, cm	80.3±10.3	78.0±10.9	82.2±9.4	88.8±10.4	<0.001
SBP, mm Hg	117.7±17.4	115.5±17.3	119.4±17.3	126.9±11.7	<0.001
DBP, mm Hg	73.2±11.2	71.7±11.1	74.3±11.2	77.9±10.6	<0.001
PR, bpm	73.9±10.9	74.3±10.9	73.5±10.8	72.9±11.8	<0.001

Values are expressed as mean±SD.
AC, abdominal circumference; BMI, body mass index; DBP, diastolic blood pressure; PR, pulse rate; SBP, systolic blood pressure.

SPSS Statistics software (IBM SPSS Statistics V.19 for Windows; IBM, New York, New York, USA).

RESULTS

This study analysed the medical records of 90 143 individuals (men: 49.1%; age, mean±SD 46.3±12.0 years) who had undergone annual medical checkup between January 2004 and June 2010; 30 228 individuals in 2004, 15 980 individuals in 2005, 12 504 individuals in 2006, 10 066 individuals in 2007, 9627 individuals in 2008, 8293 individuals in 2009 and 3445 individuals in 2010 were enrolled. Of them, 85 866 (men: 49.0%; mean±SD age: 47.0±11.5 years) met the inclusion criteria for this study. The following individuals were excluded: 3316 <30 years of age; 123 ≥85 years of age; and 838 non-responders about toothbrushing practices. Individuals were categorised according to the three-category toothbrushing frequency criterion: 38 643 (45.0%)—'after every meal', 46 981 (54.7%)—'at least once a day' and 242 (0.3%)—'less than once a day' (figure 1). Among individual characteristics, low frequency of toothbrushing was significantly (p<0.001) associated with older age, the higher prevalence of male gender, greater height, greater weight, higher BMI, larger abdominal circumference, higher BP and lower pulse rate (table 1).

Lifestyle habits—that is, smoking, drinking, walk time and sleep time, were associated with frequency of

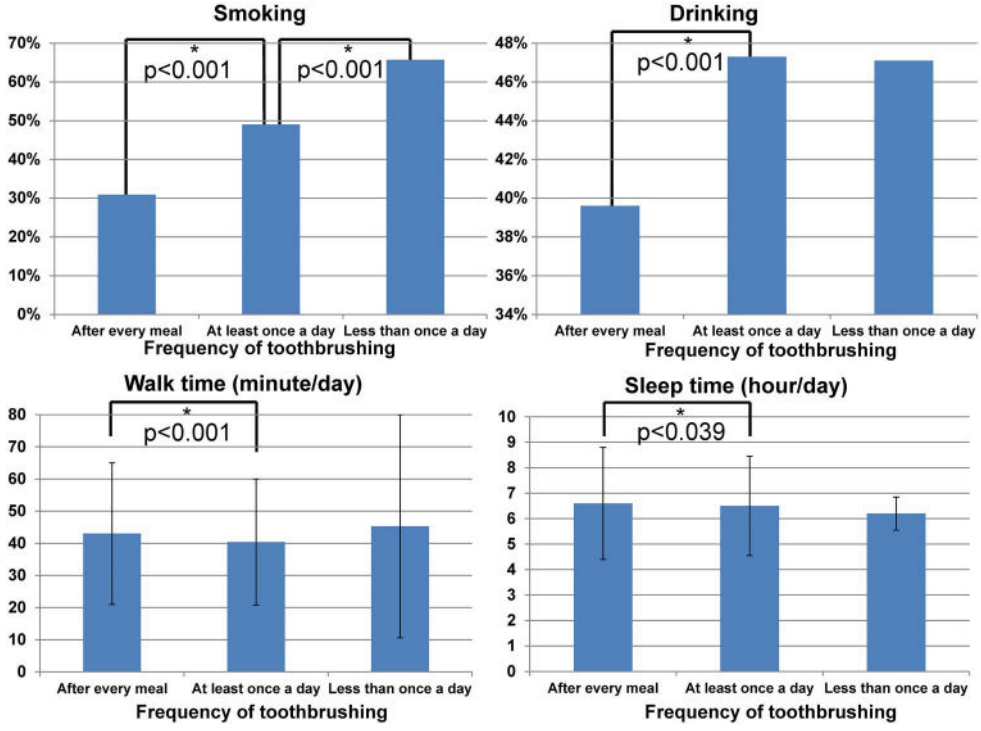

Figure 2 Lifestyle habits and frequency of toothbrushing practices. *Significant difference between the groups (p<0.05 between groups by analysis of variance with Tukey's post hoc method).

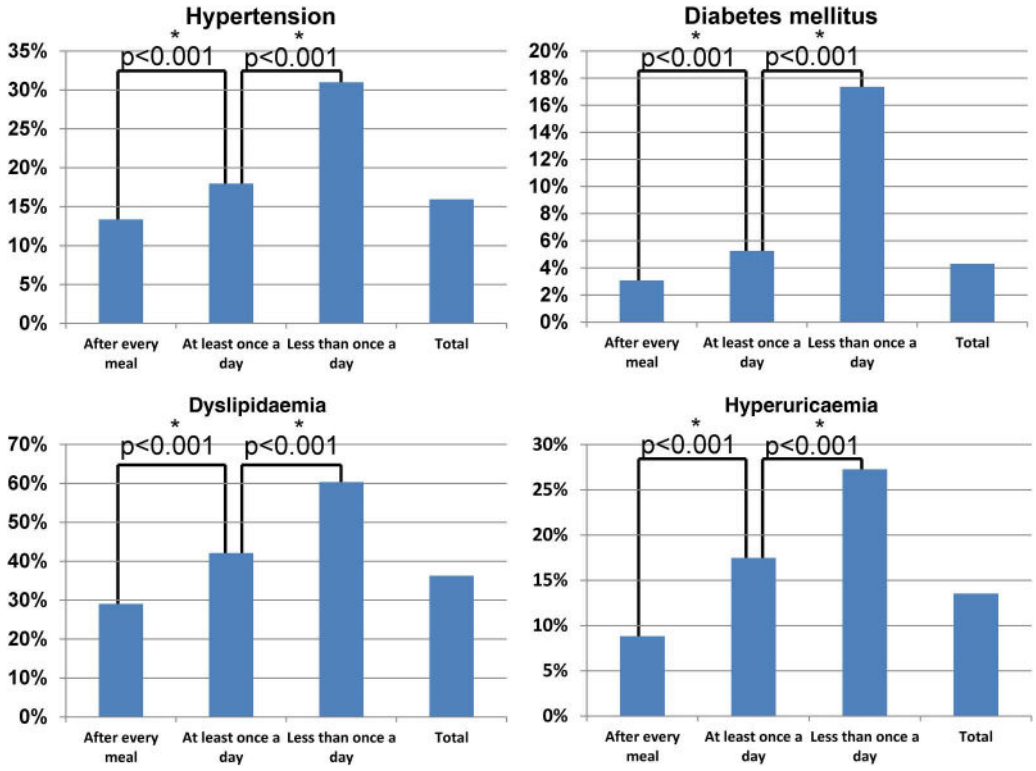

Figure 3 Risk factors for cardiovascular disease and frequency of toothbrushing practices. Analysis of variance with Tukey's post hoc method indicated that differences between the groups were statistically significant: hypertension (OR=1.34 for 'at least once a day' against 'after every meal' and OR=2.32 for 'less than once a day' against 'after every meal'; p<0.001); diabetes mellitus (1.71 and 5.65, respectively; p<0.001); dyslipidaemia (1.45 and 2.08, respectively; p<0.001); and hyperuricaemia (1.98 and 3.09, respectively; p<0.001). *Significant difference between the groups (p<0.05 between groups by analysis of variance with Tukey's post hoc method).

toothbrushing. A low frequency of toothbrushing was associated with heavy smoking ('after every meal': 30.9%, 'at least once a day': 49.0%, 'less than once a day': 65.7%), heavy drinking ('after every meal': 39.6%, 'at least once a day': 47.3% and 'less than once a day': 47.1%), short walk time (mean±SD 'after every meal': 43.0±44.0 min, 'at least once a day': 40.4±39.3 min, 'less than once a day': 45.3±69.5 min) and short sleep time (mean±SD 'after every meal': 6.6±4.4 h, 'at least once a day': 6.5±3.9 h, 'less than once a day': 6.2±1.3 h). ANOVA with Tukey's post hoc method showed that significant differences between groups were mostly between 'after every meal' and the 'at least once a day' categories and differed significantly between the 'at least once a day' and the 'less than once a day' category only for smoking (figure 2).

A low frequency of toothbrushing was associated with high prevalences of HT ('after every meal': 13.3%, 'at least once a day': 17.9% and 'less than once a day': 31.0%), DM (3.1%, 5.3% and 17.4%, respectively), DL (29.0%, 42.1% and 60.3%, respectively), HUA (8.6%, 17.5% and 27.2%, respectively) and CKD (3.8%, 3.1% and 8.3%, respectively). ANOVA with Tukey's post hoc method indicated that differences between the groups were statistically significant: HT (OR=1.34 for 'at least once a day' against 'after every meal' and OR=2.32 for 'less than once a day' against 'after every meal'; p<0.001), DM (1.71 and 5.65, respectively; p<0.001), DL (1.45 and 2.08, respectively; p<0.001), HUA (1.98 and 3.09, respectively; p<0.001) and CKD (0.82 and 2.18; p<0.001) (figure 3).

In binominal logistic regression analyses, the prevalence of DM increased significantly with low frequency of toothbrushing (OR=1.17 and 95% CI 1.07 to 1.29 for 'at least once a day' against 'after every meal'; OR=2.03 and 95% CI 1.29 to 3.21 for 'less than once a day' against 'after every meal'). The prevalence of DL showed the similar changes: (OR=1.18 and 95% CI 1.14 to 1.23 for 'once a day' against 'after every meal'; OR=1.50 and 95% CI 1.06 to 2.14 for 'less than once a day' against 'after every meal'). No statistically significant differences were found between the three groups for HT, HUA and CKD (table 2).

DISCUSSION

This large-scale epidemiological study provides a high-quality medical record database because of the low exclusion rate. Adjusted binominal logistic regression analyses showed that a low frequency of toothbrushing was significantly associated with the high prevalences of DM (OR=2.03) and DL (OR=1.50), but not with HUA

Table 2 Binominal logistic regression analyses on frequency of toothbrushing and risk factors for cardiovascular disease

			Crude		Adjusted*		
Toothbrushing	Prevalence (disease/total)	%	OR	p Value	OR	95% CI	p Value
Hypertension							
After every meal	5158/38 642	13.3	(reference)		(reference)		
At least once a day	8430/46 980	17.9	1.34	<0.001	0.99	0.94 to 1.05	0.837
Less than once a day	75/242	31.0	2.32	<0.001	0.89	0.60 to 1.33	0.579
Total	13 663/85 864	15.9					
Diabetes mellitus							
After every meal	1188/38 642	3.1	(reference)		(reference)		
At least once a day	2468/46 977	5.3	1.71	<0.001	1.17	1.07 to 1.29	0.001
Less than once a day	42/242	17.4	5.65	<0.001	2.03	1.29 to 3.21	0.002
Total	3698/85 861	4.3					
Dyslipidaemia							
After every meal	11 221/38 642	29.0	(reference)		(reference)		
At least once a day	19 778/46 978	42.1	1.45	<0.001	1.18	1.14 to 1.23	<0.001
Less than once a day	146/242	60.3	2.08	<0.001	1.50	1.06 to 2.14	0.023
Total	31 145/85 862	36.3					
Hyperuricaemia							
After every meal	3341/38 643	8.6	(reference)		(reference)		
At least once a day	8206/46 981	17.5	1.98	<0.001	1.08	1.02 to 1.15	0.011
Less than once a day	66/242	27.3	3.09	<0.001	0.87	0.60 to 1.26	0.446
Total	11 613/85 866	13.5					
Chronic kidney disease							
After every meal	1464/38 643	3.8	(reference)		(reference)		
At least once a day	1454/46 981	3.1	0.82	<0.001	0.93	0.77 to 1.14	0.482
Less than once a day	20/242	8.3	2.18	<0.001	1.35	0.38 to 4.72	0.642
Total	2938/85 866	3.4					

*Adjusted for age, gender, body mass index, hypertension, diabetes mellitus, dyslipidaemia, hyperuricaemia and chronic kidney disease, and also for lifestyle habits—smoking, drinking, walk time and sleep time.

and CKD. This suggests the involvement of DM and DL, associated with a low frequency of toothbrushing, in cardiovascular disease.

A previous study showed that a low frequency of toothbrushing was associated with hypertriglyceridaemia only and that more frequent toothbrushing was associated with a low prevalence of metabolic syndrome.[13] Another study indicated that a low frequency of toothbrushing was associated with high prevalences of DM, DL and HT,[7] which is in agreement with our study for DM and DL; the prevalences of raised BP and HT were significantly higher with a low frequency of toothbrushing than with a high frequency. However, the previous study did not examine renal function and sleep time, which may explain the difference between the studies. Our present study provides a higher quality of research because it examines a greater number of lifestyle-related variables.

There are two possible reasons why a low frequency of toothbrushing is associated with DM and DL. One is that periodontal disease causes DM and DL. A low frequency of toothbrushing increases periodontal disease,[1] and this disease is a risk factor for cardiovascular disease[14 15] and DM.[16 17] However, the causality between periodontal disease and DL remains controversial: both contrary[18] and positive[19] results have been published. The other theory is that DM and DL are strongly associated with *P. gingivalis*—a major pathogenic bacterium of periodontal disease. A low frequency of toothbrushing facilitates the proliferation of *P. gingivalis*. Furthermore, DL impairs the innate immune response to *P. gingivalis*[20] that proliferates in cases of increased insulin resistance and systemic inflammation, with the alteration of gut microbiota.[10] Increased insulin resistance and systemic inflammation also cause DM and DL. These theories can also explain why a low frequency of toothbrushing is associated with endothelial dysfunction.[5]

This study has several limitations. First, the study has a possible residual selection bias as it is a single-centre study, but all data were well-controlled and reported. A cohort and multicenter study is expected. Second, this study could not assess the duration and details of toothbrushing (eg, use of dental floss, interdental cleansers and water irrigation under pressure). Nevertheless, we consider that this study strictly considered possible confounding factors— age, gender, BMI, HT, DM, DL, HUA and CKD, and also lifestyle habits (smoking, drinking, walk time and sleep time). Third, the 'less than once a day' group was much smaller than the other two groups, comprising only 242 participants. Fourth, the 'less than once a day' group was composed of almost completely male participants (>90%) and we conducted logistic regression analyses adjusted for gender. Fifth, this study could not evaluate the association between

toothbrushing and the incidence of cardiovascular disease. A previous study reported that a low frequency of toothbrushing was associated with a higher incidence of cardiovascular disease,[3] but our study focused on the association between toothbrushing and the risk factors for cardiovascular disease.

CONCLUSIONS

Our study confirmed that, even when considering lifestyle habits, a low frequency of toothbrushing was associated with the prevalences of DM and DL in a large adult general population, which possibly explains the association of toothbrushing with cardiovascular disease. A longitudinal cohort study will be needed to confirm whether toothbrushing prevents DM and DL.

Even when taking into account lifestyle habits, a lower frequency of toothbrushing was associated with high prevalences of DM and DL. Better toothbrushing practices may be beneficial for oral health improvement and for prevention of certain systemic diseases.

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Competing interests None declared.

Ethics approval St Luke's International Hospital ethics committee approved the protocol for this study (approval number: 14-R033; 30 June 2014).

Provenance and peer review Not commissioned; externally peer reviewed.

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REFERENCES

1. Glickman I. Periodontal disease. *N Engl J Med* 1971;284:1071–7.
2. Stefanovska E, Nakova M, Radojkova-Nikolovska V, *et al*. Tooth-brushing intervention programme among children with mental handicap. *Bratisl Lek Listy* 2010;111:299–302.
3. de Oliveira C, Watt R, Hamer M. Toothbrushing, inflammation and risk of cardiovascular disease: results from Scottish Health Survey. *BMJ* 2010;340:c2451.
4. Yeung CA. Gums and heart disease. Healthy gums, healthy heart? *BMJ* 2010;341:c3710.
5. Kajikawa M, Nakashima A, Maruhashi T, *et al*. Poor oral health, that is, decreased frequency of tooth brushing, is associated with endothelial dysfunction. *Circ J* 2014;78:950–4.
6. Desvarieux M, Demmer RT, Jacobs DR, *et al*. Changes in clinical and microbiological periodontal profiles relate to progression of carotid intima-media thickness: the Oral Infections and Vascular Disease Epidemiology study. *J Am Heart Assoc* 2013;2:e000254.
7. Fujita M, Ueno K, Hata A. Lower frequency of daily teeth brushing is related to high prevalence of cardiovascular risk factors. *Exp Biol Med (Maywood)* 2009;234:387–94.
8. Aggarwal A, Panat SR. Oral health behavior and HbA1c in Indian adults with type 2 diabetes. *J Oral Sci* 2012;54:293–301.
9. Merchant AT, Oranbandid S, Jethwani M, *et al*. Oral care practices and A1c among youth with type 1 and type 2 diabetes. *J Periodontol* 2012;83:856–63.
10. Arimatsu K, Yamada H, Miyazawa H, *et al*. Oral pathobiont induces systemic inflammation and metabolic changes associated with alteration of gut microbiota. *Sci Rep* 2014;4:4828.
11. Persson GR, Persson RE. Cardiovascular disease and periodontitis: an update on the associations and risk. *J Clin Periodontol* 2008;35(8 Suppl):362–79.
12. Kuwabara M, Niwa K, Nishi Y, *et al*. Relationship between serum uric acid levels and hypertension among Japanese individuals not treated for hyperuricemia and hypertension. *Hypertens Res* 2014;37:785–9.
13. Kobayashi Y, Niu K, Guan L, *et al*. Oral health behavior and metabolic syndrome and its components in adults. *J Dent Res* 2012;91:479–84.
14. Bahekar AA, Singh S, Saha S, *et al*. The prevalence and incidence of coronary heart disease is significantly increased in periodontitis: a meta-analysis. *Am Heart J* 2007;154:830–7.
15. Howell TH, Ridker PM, Ajani UA, *et al*. Periodontal disease and risk of subsequent cardiovascular disease in U.S. male physicians. *J Am Coll Cardiol* 2001;37:445–50.
16. Salvi GE, Carollo-Bittel B, Lang NP. Effects of diabetes mellitus on periodontal and peri-implant conditions: update on associations and risks. *J Clin Periodontol* 2008;35(8 Suppl):398–409.
17. Chavarry NG, Vettore MV, Sansone C, *et al*. The relationship between diabetes mellitus and destructive periodontal disease: a meta-analysis. *Oral Health Prev Dent* 2009;7:107–27.
18. Almeida Abdo J, Cirano FR, Casati MZ, *et al*. Influence of dyslipidemia and diabetes mellitus on chronic periodontal disease. *J Periodontol* 2013;84:1401–8.
19. Pejcic A, Kesic L, Brkic Z, *et al*. Effect of periodontal treatment on lipoproteins levels in plasma in patients with periodontitis. *South Med J* 2011;104:547–52.
20. Lei L, Li H, Yan F, *et al*. Hyperlipidemia impaired innate immune response to periodontal pathogen porphyromonas gingivalis in apolipoprotein E knockout mice. *PLoS ONE* 2013;8:e71849.

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Organisation mondiale de la Santé

Rapport sur la santé bucco-dentaire dans le monde 2003

Poursuivre l'amélioration de la santé bucco-dentaire au XXIe siècle – l'approche du Programme OMS de santé bucco-dentaire










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2003

Poursuivre l'amélioration de la santé bucco-dentaire au XXI^{e} siècle – l'approche du Programme OMS de santé bucco-dentaire

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TABLE DES MATIÈRES

PRÉFACE

Les maladies chroniques et les traumatismes sont les principaux problèmes de santé dans pratiquement toutes les régions du monde. Le tableau de la morbidité évolue partout rapidement. Il est étroitement lié à l'évolution du mode de vie avec notamment une alimentation riche en sucre et l'augmentation de la consommation de tabac et d'alcool.

La santé bucco-dentaire dépend des facteurs sociaux et environnementaux et aussi, fortement, de ceux liés au mode de vie. Ces facteurs constituent des risques pour la plupart des maladies chroniques ou au contraire des facteurs protecteurs, comme une exposition appropriée aux fluorures ou une bonne hygiène. Les maladies bucco-dentaires peuvent être qualifiées de problèmes de santé publique majeurs en raison de leur prévalence et de leur incidence élevées dans toutes les régions du monde et par le fait que, comme pour toutes les maladies, elles atteignent principalement les populations défavorisées et socialement marginalisées. Il faut également prendre en considération les effets qu'elles peuvent avoir en terme de douleur, de déficience fonctionnelle et de détérioration de la qualité de vie.

Le traitement classique des maladies bucco-dentaires est extrêmement coûteux dans nombre de pays industrialisés et est inaccessible dans la plupart des pays à revenu faible ou intermédiaire. La stratégie mondiale OMS de Prévention et de Contrôle des Maladies Non Transmissibles et l'approche fondée sur les facteurs communs de risque constituent une nouvelle façon d'aborder la prévention et le contrôle des maladies bucco-dentaires. Le Programme OMS de Santé Bucco-Dentaire a été renforcé en vue d'améliorer la santé bucco-dentaire partout dans le monde grâce à des liens avec d'autres programmes techniques au sein du Département Prévention des Maladies non Transmissibles et Promotion de la Santé.

Le présent rapport décrit la situation actuelle dans le monde ainsi que les stratégies et méthodes destinées à améliorer la santé bucco-dentaire au XXI^{e} siècle.

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INTRODUCTION

Le **Rapport sur la santé dans le monde 2002** décrivait l'étendue de la morbidité, de la mortalité et de l'incapacité imputables aujourd'hui à certains des principaux risques pour la santé (*1*). Ce rapport soulevait un point important, à savoir, la manière d'éviter cette morbidité au cours des 20 prochaines années par la réduction des facteurs communs de risque. Le rapport recensait quelques interventions ayant un bon rapport coût/efficacité pour lutter contre certains de ces facteurs de risque. Le terme « intervention » y était utilisé dans son sens le plus large, désignant « toute action sanitaire promotionnelle, préventive, curative ou de réhabilitation dont l'objectif premier est l'amélioration de la santé ». En dehors des avantages évidents qu'elle présente pour la santé, la réduction des risques favorise un développement durable et la réduction des inégalités sociales.

La mission du Groupe OMS Maladies Non Transmissibles et Santé Mentale est d'assurer un leadership mondial dans la promotion de la santé tout au long de la vie et d'aider les Etats Membres à réduire les taux de morbidité, d'invalidité et de mortalité prématurée causés par ces maladies. Il s'agit avant tout de réorienter les ressources disponibles sur les priorités recensées dans la stratégie mondiale de prévention des maladies non transmissibles (MNT).

Les mesures recommandées pour promouvoir la santé sont les suivantes:

* Elaborer des politiques de prévention des risques, y compris en soutenant davantage la recherche scientifique, en améliorant les systèmes de surveillance et en facilitant l'accès à l'information;

* Donner la priorité à l'élaboration de politiques efficaces et engagées de prévention des risques qui progressent dans le monde: tabagisme, mauvaise alimentation, eau non potable, absence de réseaux d'assainissement et d'hygiène, et rapports sexuels à risque en lien avec le VIH/SIDA;

* Renforcer la collaboration internationale et intersectorielle pour améliorer la gestion des risques et la sensibilisation du public par une meilleure compréhension de leurs effets sur la santé;

* Rechercher un équilibre dans l'action entre les niveaux gouvernemental, communautaire et individuel;

Les maladies chroniques non transmissibles, qui restent prédominantes dans les pays à revenu intermédiaire ou élevé, sont également de plus en plus répandues dans un grand nombre de pays en développement parmi les plus pauvres. Leurs poids vient s'ajouter à celui des maladies infectieuses dont ces pays continuent de souffrir (*1*).

Les objectifs du **Programme Mondial de Santé Bucco-Dentaire de l'OMS**, l'un des programmes techniques du Département Prévention des Maladies Non Transmissibles et Promotion de la Santé (NPH), ont été réorientés en fonction de la nouvelle stratégie de prévention des maladies et de promotion de la santé. Une importance accrue est accordée à l'élaboration de politiques mondiales pour la promotion de la santé bucco-dentaire et la prévention des maladies bucco-dentaires, coordonnées plus efficacement avec les autres programmes prioritaires de NPH et ceux des autres groupes ou de partenaires extérieurs.

PRINCIPES DE BASE DU PROGAMME OMS DE SANTÉ BUCCO-DENTAIRE

La santé bucco-dentaire est une composante essentielle et à part entière de la santé

La santé bucco-dentaire n'est pas uniquement synonyme de dents saines: elle fait partie intégrante de l'état de santé générale et est essentielle au bien-être. Etre en bonne santé bucco-dentaire signifie ne pas souffrir de douleurs oro-faciales chroniques, de cancers de la cavité buccale ou du pharynx (gorge), de lésions des tissus de la cavité buccale, d'anomalies congénitales comme le bec de lièvre et la fente palatine, et d'autres maladies ou troubles affectant les tissus buccaux, dentaires et maxillo-faciaux, connus sous le nom de complexe maxillo-facial.

La santé bucco-dentaire est un facteur déterminant de qualité de vie

Le complexe maxillo-facial nous permet de parler, de sourire, d'embrasser, de toucher, de sentir, de goûter, de mâcher, d'avaler et de pleurer sans éprouver de douleur. Il nous protège contre les infections microbiennes et les menaces liées à l'environnement. Les maladies bucco-dentaires restreignent les activités scolaires, professionnelles et personnelles, entraînant la perte de millions d'heures d'étude et de travail chaque année partout dans le monde. De plus, l'impact psychologique et social de ces maladies diminue sensiblement la qualité de vie.

Santé bucco-dentaire - santé générale

La relation entre la santé bucco-dentaire et l'état de santé générale a été établie scientifiquement; des formes sévères de maladies parodontales sont, par exemple, associées au diabète (*2*). La forte corrélation entre plusieurs maladies bucco-dentaires et des maladies non transmissibles chroniques est principalement due à des facteurs communs de risque. De nombreuses affections générales peuvent avoir des manifestations bucco-dentaires qui accroissent le risque de maladies bucco-dentaires, lesquelles, à leur tour, représentent un facteur de risque pour un certain nombre d'affections générales.

Cette conception élargie de la santé bucco-dentaire ne diminue en rien l'importance des deux principales pathologies bucco-dentaires au plan mondial – la carie dentaire et les maladies parodontales. Il est possible de les prévenir et de les traiter grâce à un ensemble de mesures individuelles, communautaires et professionnelles.

Des soins de santé bucco-dentaires adaptés réduisent la mortalité prématurée

Le dépistage précoce de la maladie est, dans la plupart des cas, essentiel pour sauver des vies. Un examen bucco-dentaire approfondi peut permettre de déceler des signes de carence nutritionnelle ainsi qu'un certain nombre de maladies générales telles que les infections microbiennes, les troubles immunitaires, les traumatismes et le cancer de la cavité buccale. Les tissus maxillo-faciaux permettent également de mieux connaître des organes les moins accessibles du corps. Par exemple, les glandes salivaires sont un modèle des glandes exocrines, et une analyse de la salive peut apporter des indices importants sur l'état de santé générale.

Quel est le poids des maladies bucco-dentaires?

Malgré les progrès considérables dans le domaine de la santé bucco-dentaire, des problèmes subsistent dans de nombreuses communautés – en particulier parmi les groupes défavorisés des

pays développés comme des pays en développement. La carie dentaire et les maladies parodontales ont toujours été considérées comme les deux principales affections dans ce domaine. A l'heure actuelle, la répartition et la gravité des maladies bucco-dentaires varient selon les continents et à l'intérieur même d'un pays ou d'une région. Un grand nombre d'enquêtes épidémiologiques ont montré le rôle non négligeable des facteurs sociologiques ainsi que de ceux liés au comportement et à l'environnement, dans les pathologies et la santé bucco-dentaires.

La carie dentaire reste un problème de santé bucco-dentaire majeur dans la plupart des pays industrialisés, puisqu'elle touche 60 à 90% des élèves et la grande majorité des adultes. Elle est également répandue dans plusieurs pays d'Asie et d'Amérique latine. Elle semble plus rare et moins grave dans la plupart des pays d'Afrique. La **Figure 1** illustre la situation de la carie dentaire chez les enfants âgés de 12 ans dans les six Régions OMS en 2000 (*3,4*), sur la base de l'indice CAOD (dents cariées, absentes et obturées). Cet indice mesure les antécédents carieux de la dentition permanente. A l'heure actuelle, le niveau de morbidité est élevé en Amérique mais relativement faible en Afrique. Avec l'évolution des conditions de vie, on s'attend à ce que l'incidence de la carie dentaire augmente dans de nombreux pays en développement en Afrique, en particulier en raison de la consommation croissante de sucres et d'une exposition insuffisante aux fluorures.

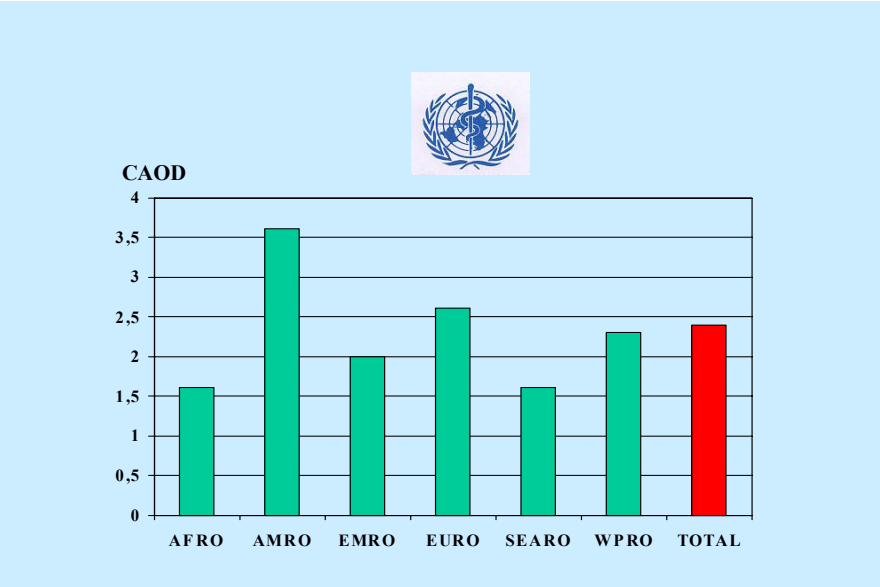

Figure 1 Caries dentaires (indice CAOD) chez les enfants âgés de 12 ans selon les bureaux régionaux OMS *(Source: Banque de données de l'OMS sur la santé bucco-dentaire et Programme OMS sur les profils de santé bucco-dentaire par pays/région, 2000)* (*3,4*).

Dans de nombreux pays en développement, l'accès aux services de santé bucco-dentaire est limité. Les dents sont souvent laissées sans traitement ou extraites en raison de la douleur ou de la gêne provoquée. Partout dans le monde, le fait de perdre ses dents est encore considéré par beaucoup de personnes comme une conséquence naturelle du vieillissement. Dans certains pays industrialisés, on observe une tendance à la diminution des édentations chez l'adulte depuis quelques années, alors que la proportion d'adultes édentés âgés de 65 ans et plus est encore élevée dans d'autres pays (**Tableau 1**).

Tableau 1 Prévalence d'édentés totaux (%) chez les personnes âgées dans une sélection de pays *(Source: Banque de données de l'OMS sur la santé bucco-dentaire et Programme OMS sur les profils de santé bucco-dentaire par pays/région, 2000)* (*3,4*).

Région/pays OMS	Pourcentage d'édentés	Groupe d'âge (ans)
Afrique		
Gambie	6	65+
Madagascar	25	65-74
Amériques		
Canada	58	65+
Etats-Unis d'Amérique	26	65-69
Méditerranée orientale		
Arabie Saoudite	31-46	65+
Egypte	7	65+
Liban	20	64-75
Europe		
Albanie	69	65+
Autriche	15	65-74
Bosnie-Herzégovine	78	65+
Bulgarie	53	65+
Danemark	27	65-74
Finlande	41	65+
Hongrie	27	65-74
Islande	15	65-74
Italie	19	65-74
Lituanie	14	65-74
Pologne	25	65-74
Roumanie	26	65-74
Royaume-Uni	46	65+
Slovaquie	44	65-74
Slovénie	16	65+
Asie du Sud-Est		
Inde	19	65-74
Indonésie	24	65+
Sri Lanka	37	65-74
Thaïlande	16	65+
Pacifique occidental		
Cambodge	13	65-74
Chine	11	65-74
Malaisie	57	65+
Singapour	21	65+

Dans le monde, la plupart des enfants présentent des signes de gingivite, et parmi les adultes, les stades initiaux de maladies parodontales sont courants. La **Figure 2** illustre l'état de santé parodontale des 35-44 ans par Région OMS (*3-4*), en se basant sur l'Indice Parodontal Communautaire. La parodontite sévère, qui peut entraîner la perte de dents, touche 5 à 15% de la plupart des populations. La parodontite aigüe juvénile ou précoce, forme sévère de maladie parondontale touchant les jeunes pendant la puberté et entraînant la perte prématurée de dents, concerne près de 2% des jeunes (*5*).

Dans les pays industrialisés, des études montrent que le tabagisme est un facteur de risque majeur de maladie parodontale chez l'adulte pour qui il est responsable de plus de la moitié des cas de parodontites (*6*). Le risque diminue si les personnes cessent de fumer. La prévalence des maladies parodontales a diminué dans les pays où une diminution de la consommation de tabac (*7*) a été enregistrée.

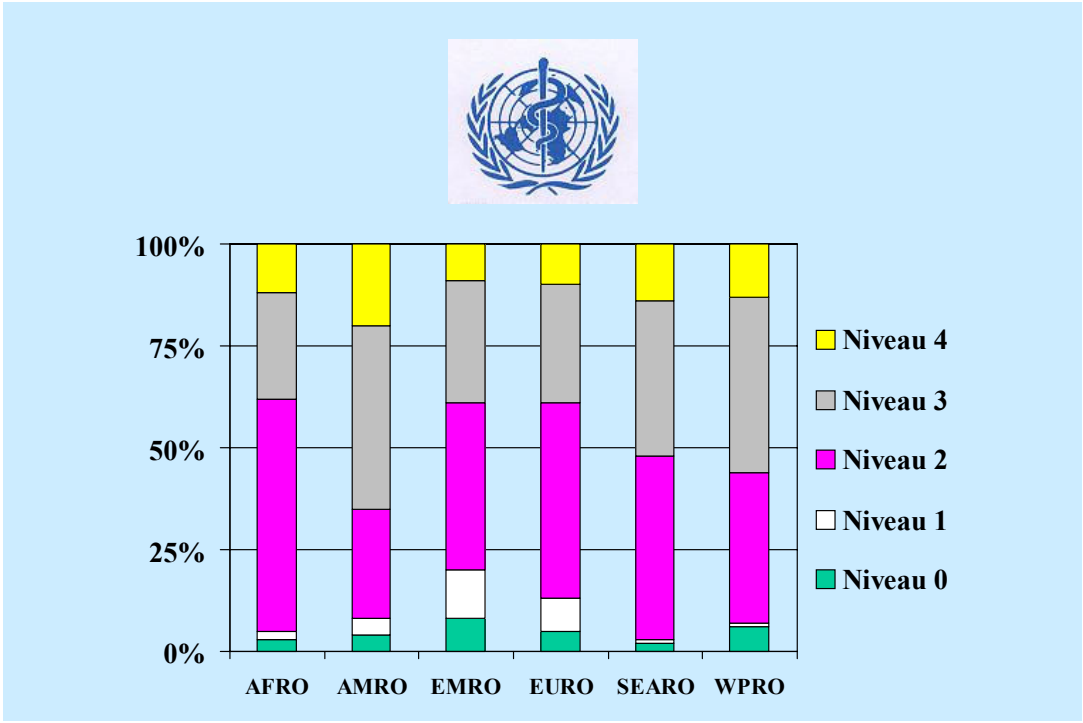

Figure 2 Pourcentages moyens de personnes de 35 à 44 ans par niveau maximum de l'Indice Parodontal Communautaire d'après les bureaux régionaux OMS *(Source: Banque de données de l'OMS sur la santé bucco-dentaire et Programme OMS sur les profils de santé bucco-dentaire par pays/région, 2000)* (*3,4*).

Si les cancers de la cavité buccale et du pharynx sont évitables, ils restent un problème majeur pour les programmes de santé bucco-dentaire. La prévalence du cancer de la cavité buccale est particulièrement élevée chez les hommes puisqu'il arrive au huitième rang des cancers les plus fréquents dans le monde (**Figure 3**) (*8*); le taux d'incidence varie chez les hommes de 1 à 10 cas pour 100 000 habitants dans de nombreux pays. En Asie du sud et du centre, il figure parmi les 3 types de cancer les plus courants. Toutefois, de nettes augmentations de l'incidence des cancers de la cavité buccale et du pharynx ont été signalées dans divers pays et régions comme l'Allemagne, le Danemark, l'Ecosse, l'Europe centrale et orientale et, dans une moindre mesure, l'Australie, le Japon, la Nouvelle-Zélande et les Etats Unis d'Amérique (*8*).

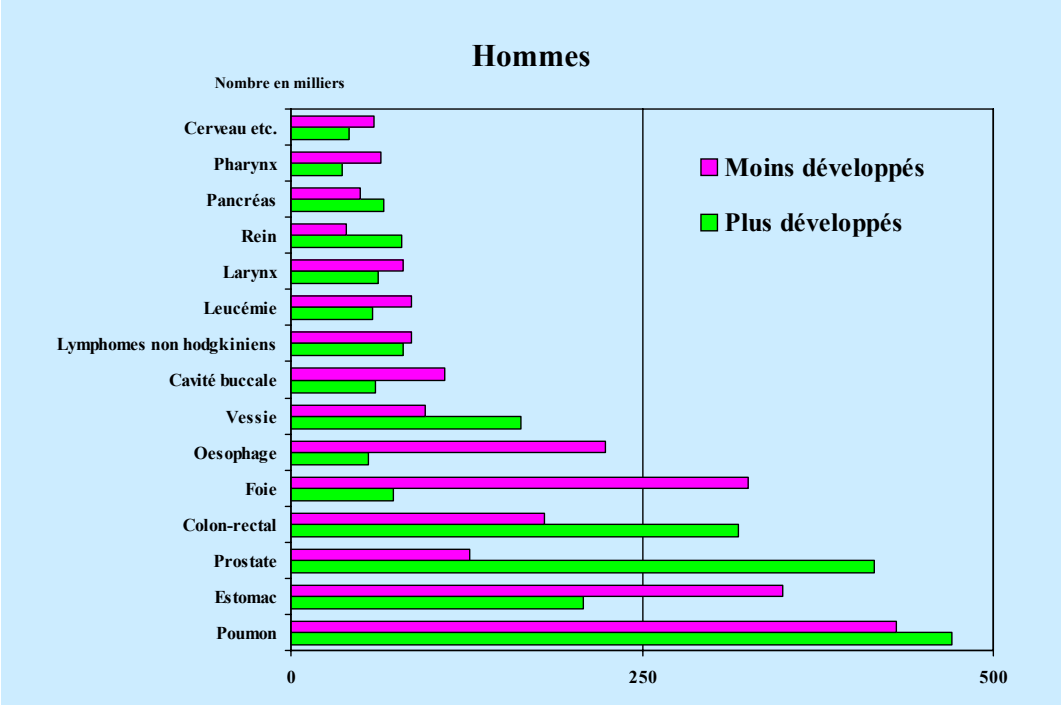

Figure 3 Comparaison des cancers les plus répandus chez l'homme dans les pays plus ou moins développés, 2000 *(Source: Centre International de Recherche sur le Cancer, OMS, 2003)* (*8*).

En Asie, le taux d'incidence, standardisé selon l'âge, du cancer de la cavité buccale pour 100 000 habitants varie de 0,7 en Chine à 4,6 en Thaïlande et 12,6 en Inde. Les taux d'incidence élevés sont directement liés aux comportements à risque comme le tabagisme, la consommation de tabac sans fumée (chique de noix de bétel ou de miang, par exemple) et la consommation d'alcool. En Thaïlande, par exemple, la prévalence du tabagisme est d'environ 60%, celle de la chique de noix de bétel de 15% et la consommation d'alcool de 35% (*9*).

Il est intéressant de noter que peu d'études épidémiologiques systématiques sur les maladies des muqueuses buccales ont été effectuées. Les taux de prévalence de leucoplasie de la cavité buccale sont compris entre 0,1% et 10,6% selon les régions ou les zones géographiques (*4*). L'érythroplasie semble plus rare, avec un taux de prévalence de 1% ou moins (*4*).

Le qat, un arbuste à feuilles dont on tire un stupéfiant, est prisé dans plusieurs pays d'Afrique de l'est et dans la péninsule arabique. Le qat peut être consommé en boisson sous forme de thé ou fumé comme le tabac. Néanmoins, le mode le plus courant d'ingestion reste la mastication de feuilles fraîches. La consommation de qat peut avoir des conséquences dans la cavité buccale, telles que des lésions des muqueuses, une sécheresse buccale, une coloration des dents, une mauvaise hygiène et des maladies parodontales.

Il existe des variations dans les profils de santé bucco-dentaire d'une région à l'autre. Dans certains pays en développement, les maladies bucco-dentaires sont en augmentation et les pays d'Afrique et d'Asie doivent s'attaquer d'urgence à plusieurs affections très graves comme le noma (cancrum oris), la gingivite ulcéro-nécrotique aigüe ainsi qu'à des lésions précancéreuses et cancéreuses de la cavité buccale. Des cas de noma sont signalés chez les jeunes enfants âgés

de 3 à 5 ans en Afrique, en Amérique latine et en Asie (**Figure 4**); 90% des victimes meurent sans avoir reçu aucun soin.

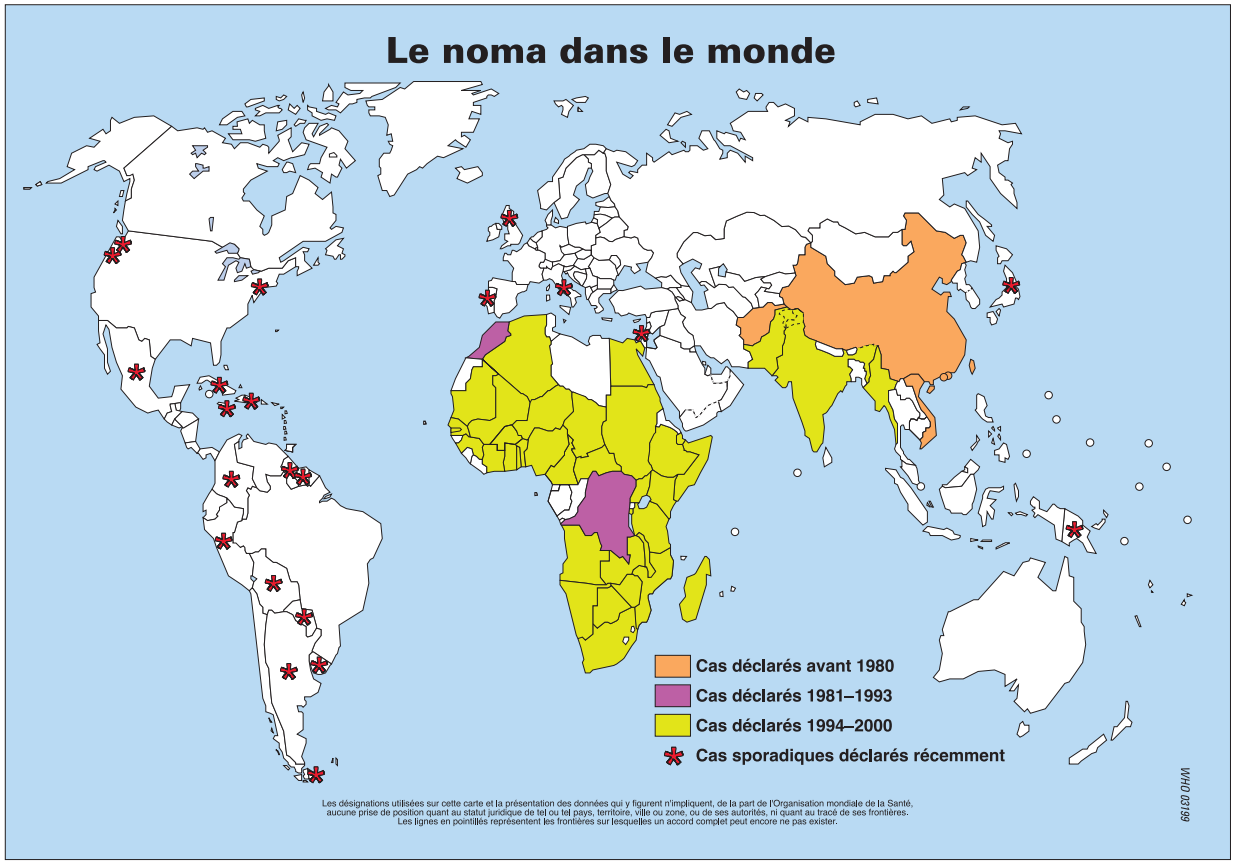

Figure 4. Cas de noma signalés dans le monde *(Source: Programme OMS de Santé Bucco-Dentaire, Genève, Suisse)*

De même, l'Afrique et l'Asie enregistrent la plus forte prévalence du VIH/SIDA, dont les manifestations bucco-dentaires sont très répandues (*10*). L'analyse des cas de VIH/SIDA montre que les manifestations bucco-dentaires telles que les candidoses, la leucoplasie chevelue, les ulcères de la cavité buccale, les gingivorragies, la parodontite nécrotique, la leucoplasie et le sarcome de Kaposi sont fréquentes.

Contrairement à la carie dentaire et aux maladies parodontales, on manque encore de données fiables sur la fréquence et la gravité des traumatismes bucco-dentaires dans la plupart des pays, en particulier les pays en développement (*11*). Dans certains pays d'Amérique latine environ 15% des élèves présentent des traumatismes dentaires, alors qu'au Moyen-Orient on observe des taux de prévalence de 5 à 12% chez les enfants de 6 à 12 ans. Des études récentes provenant de pays industrialisés ont révélé que la prévalence des traumatismes dentaires était en augmentation, variant de 16 à 40% chez les enfants de 6 ans et de 4 à 33% chez les enfants âgés de 12 à 14 ans (*11*). Une proportion non négligeable des traumatismes dentaires est liée aux activités sportives, au manque de sécurité dans les écoles ou sur les terrains de jeux, aux accidents de la circulation ou aux actes de violence. Dans les pays industrialisés, les coûts de la prise en charge de l'urgence et du suivi des patients atteints de traumatismes dentaires sont élevés.

On dispose d'estimations sur la fréquence des différents types de malocclusions pour un certain nombre de pays, principalement en Europe du Nord et en Amérique du Nord. Par exemple, les taux de prévalence des anomalies dento-faciales seraient de 10% selon l'indice d'esthétique dentaire (*12*). La malocclusion n'est pas une maladie, mais plutôt un ensemble de malpositions dentaires qui, dans certains cas, peuvent avoir des répercussions sur la qualité de vie. Les données attestant que le traitement orthodontique améliore la santé et la mastication sont encore insuffisantes. Le traitement est souvent justifié par l'amélioration potentielle du bien-être social et psychologique lié à l'amélioration de l'apparence (*13*).

Le diagnostic et le traitement des anomalies cranio-faciales telles que le bec de lièvre et la fente palatine présentent un certain nombre de défis de santé publique. Ces anomalies surviennent dans environ 1 cas pour 500 à 700 naissances, le taux variant considérablement selon les groupes ethniques et les zones géographiques (*14*). D'autres affections peuvent entraîner des besoins particuliers en matière de soins, notamment le syndrome de Down (trisomie 21), la paralysie spasmodique, les difficultés d'apprentissage et de développement ainsi que des troubles génétiques et héréditaires avec anomalies oro-faciales. Les fentes oro-faciales semblent dues en grande partie à des causes liées à l'environnement, le risque le plus élevé associé au tabagisme de la mère, à l'alcoolisme et à des facteurs nutritionnels. Il n'existe pas de données scientifiques prouvant l'effet du facteur temps et l'influence des conditions socio-économiques, ces aspects n'ayant pas été étudiés de manière adéquate (*14*). D'autre part, on ne dispose que de peu d'informations sur la fréquence des anomalies cranio-faciales et en particulier pour certaines régions d'Afrique, d'Asie centrale, d'Europe orientale, de l'Inde ou du Moyen-Orient.

Poids des maladies bucco-dentaires et facteurs communs de risque

Compte tenu de leur ampleur, les maladies bucco-dentaires constituent un problème majeur de santé publique. Leurs répercussions sur les individus et les communautés, du fait de la douleur, des déficiences fonctionnelles et de la diminution de qualité de vie, sont considérables. De plus, le traitement classique de ces maladies est extrêmement onéreux, puisqu'il arrive au quatrième rang en terme de coût dans la plupart des pays industrialisés. Dans de nombreux pays à faible revenu, si le traitement de la carie dentaire était accessible, le coût seul du traitement chez les enfants dépasserait le budget total des soins de santé qui leur est consacré (*15*). Quelques facteurs de risque, pouvant être modifiés, sont communs à de nombreuses maladies chroniques ou traumatismes. Les quatre principales maladies non transmissibles – à savoir les maladies cardio-vasculaires, le diabète, le cancer et les pneumopathies obstructives chroniques – ont des facteurs communs de risque avec les maladies bucco-dentaires; ces facteurs de risques sont liés au mode de vie et peuvent être évités. Par exemple, les habitudes alimentaires ont un rôle important dans l'apparition des maladies non transmissibles et influencent celle de la carie dentaire. Le tabagisme serait responsable de plus de 90% des cancers de la cavité buccale et est associé à une aggravation des maladies parodontales, à une moins bonne hygiène bucco-dentaire et donc à la perte prématurée de dents.

Le poids le plus important est supporté, pour toutes les maladies, par les populations défavorisées et socialement marginalisées. L'un des principaux avantages de l'approche fondée sur les facteurs communs de risque est de se concentrer sur l'amélioration des conditions de vie de toute la population et sur les groupes à risque, ce qui réduit les inégalités. Les solutions aux problèmes associés aux maladies chroniques résident souvent dans des approches intégrées. La Stratégie Mondiale OMS pour la Prévention et le Contrôle des Maladies Non Transmissibles

est une nouvelle conception de la prise en charge des maladies bucco-dentaires par la prévention et leur contrôle. Une surveillance continue des niveaux et de la tendance des facteurs de risque est fondamentale pour planifier et évaluer les activités de prévention et de promotion menées dans la communauté.

Surveillance de la santé bucco-dentaire et objectifs

En 1979, l'OMS a annoncé l'objectif le plus important jamais formulé en matière de santé bucco-dentaire dans le monde. En 2000, la moyenne mondiale de l'indice CAOD ne devrait pas dépasser 3 à 12 ans. Lors de l'Assemblée Mondiale de la Santé de 1979, cette déclaration a été unanimement reconnue comme une priorité majeure pour l'OMS. En 1983, la santé bucco-dentaire était inscrite dans la stratégie de la santé pour tous (résolution WHA36.14) et, en 1989, l'Organisation approuvait la promotion de la santé bucco-dentaire comme partie intégrante de la santé pour tous d'ici l'an 2000 (WHA42.39). De plus, la Journée Mondiale de la Santé de 1994 a été consacrée à la santé bucco-dentaire, ce qui montre également l'importance attachée à cette question.

L'OMS a mis sur pied il y a déjà plusieurs années des systèmes de surveillance des maladies bucco-dentaires, en particulier en ce qui concerne la carie dentaire chez l'enfant. La première carte du monde assortie de données sur l'indice CAOD chez les enfants de 12 ans a été présentée en 1969. Elle montrait une forte prévalence de la carie dans les pays industrialisés, mais des valeurs généralement inférieures étaient observées dans les pays en développement. Une base de données a été créée et, au fil des ans, un nombre croissant d'études épidémiologiques ont fait état d'une évolution de la prévalence de la carie, à savoir une augmentation dans des pays en développement et une baisse dans de nombreux pays industrialisés. Plusieurs études épidémiologiques ont été effectuées au moyen de la méthodologie et des critères OMS (*16*). Les **Figures 5-6** présentent les cartes actuelles de la carie dentaire chez les enfants de 12 ans et les adultes de 35-44 ans (*3,4*).

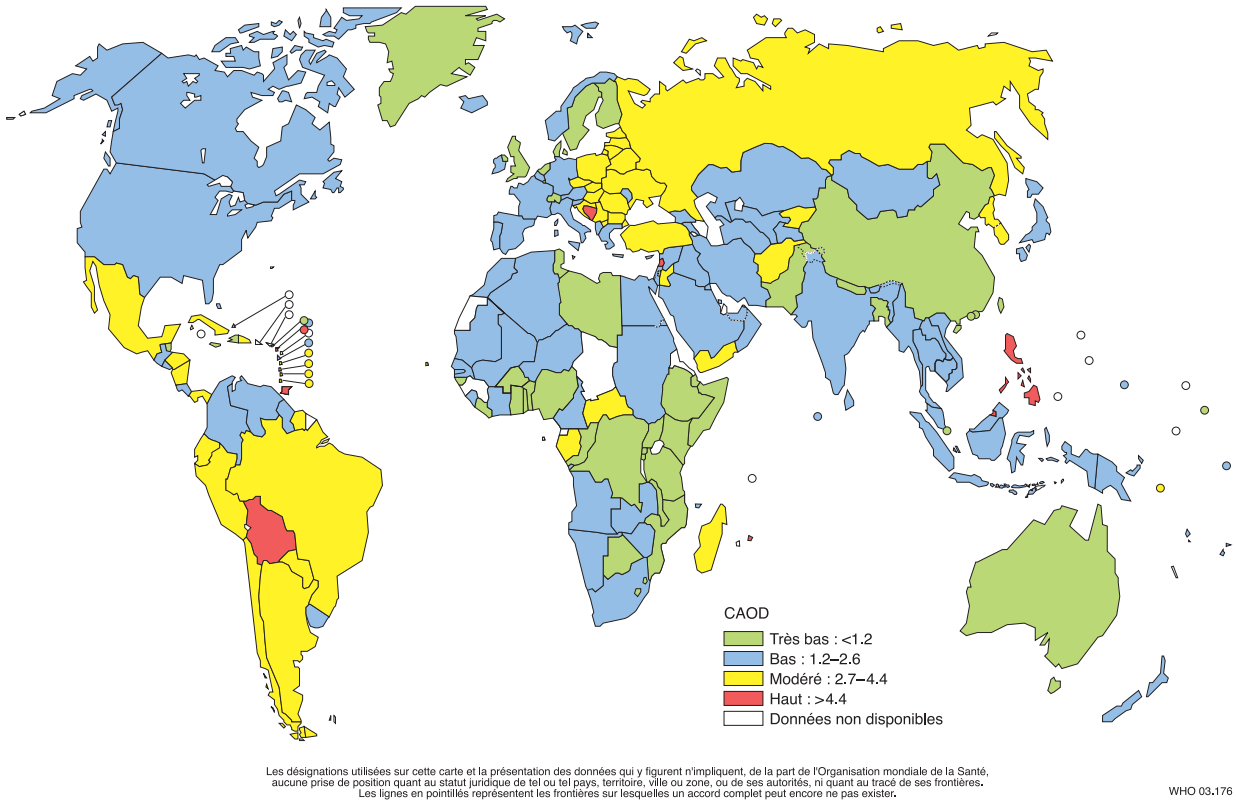

Figure 5. La carie dentaire (CAOD) dans le monde chez les enfants de 12 ans (*3,4*)

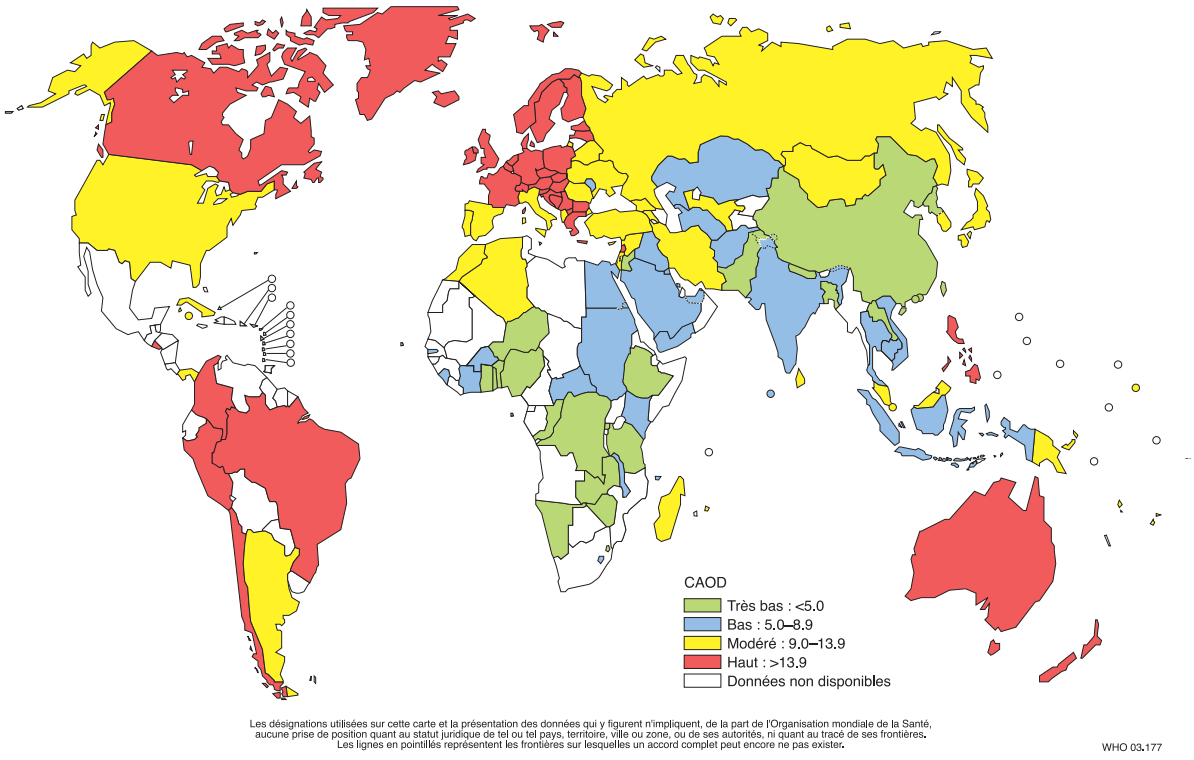

Figure 6. La carie dentaire (CAOD) dans le monde chez les adultes de 35-44 ans (*3,4*)

En 1980, la banque de données OMS sur la santé bucco-dentaire (*3*) disposait des valeurs du CAOD à l'âge de 12 ans pour 107 pays sur 173, 51% des pays avaient un CAOD inférieur ou égal à 3, alors que les autres avaient des valeurs supérieures. En l'an 2000, le Programme OMS sur le profil de la santé bucco-dentaire par pays/région disposait de données pour 184 pays (*4*). Parmi eux, 68% avaient un CAOD inférieur à 3.

La diminution de la carie dentaire observée dans de nombreux pays développés (**Figure 7**) est due aux mesures de santé publique, liées aux changements de mode de vie et d'habitudes d'hygiène. Dans certains pays, cette tendance risque de dissuader les pouvoirs publics de continuer à prendre des mesures pour améliorer la santé bucco-dentaire ou maintenir les résultats acquis. Cette tendance pourrait porter à croire que les problèmes de caries n'existent plus, du moins dans les pays développés, et entraîner une redistribution des budgets actuellement consacrés à la prévention de la carie. Pourtant, il convient de souligner que la carie dentaire, en tant que maladie, n'est pas éradiquée mais uniquement contrôlée jusqu'à un certain point.

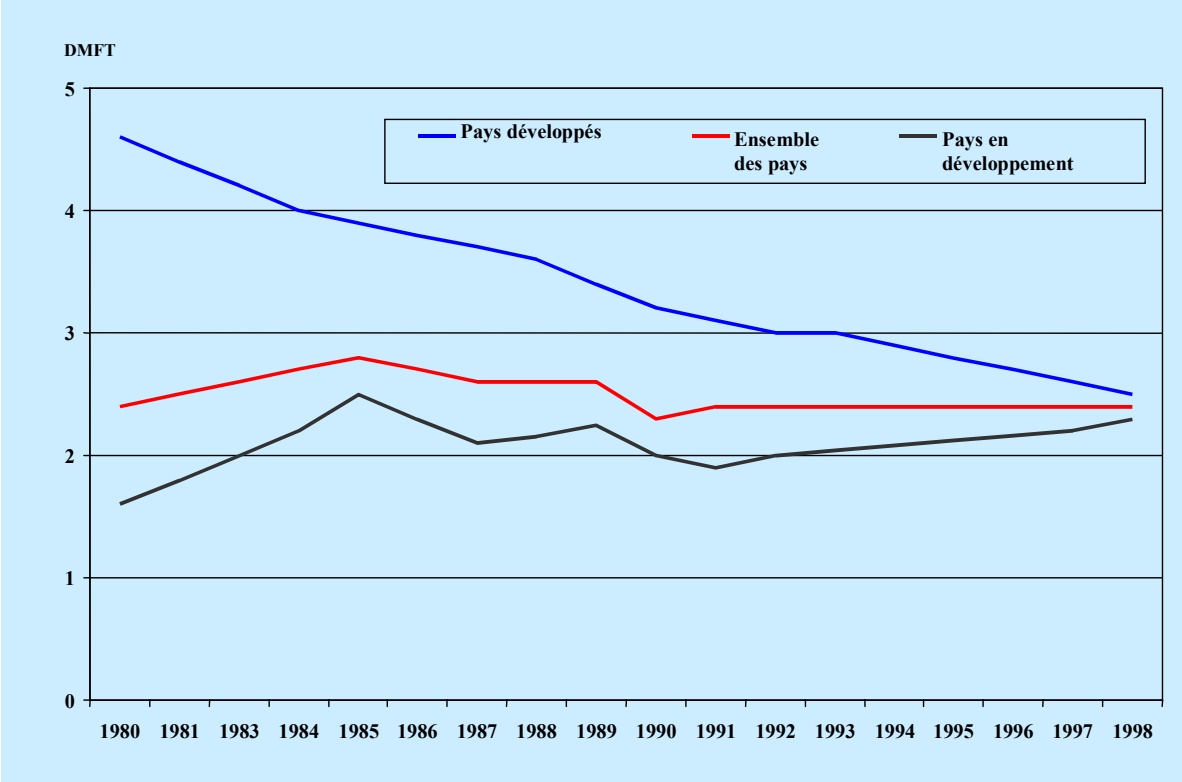

Figure 7. Evolution de la carie dentaire (indice CAOD) chez les enfants de 12 ans dans les pays développés et en développement (*3,4*)

En 1981, l'OMS et la Fédération Dentaire Internationale (FDI) ont formulé des objectifs à atteindre avant l'an 2000 pour la santé bucco-dentaire (*17*), à savoir:

1. 50% des enfants de 5-6 ans indemnes de carie dentaire;
2. Moyenne mondiale du CAOD ne dépassant pas 3 à 12 ans;
3. 85% de la population ayant toutes ses dents à l'âge de 18 ans;
4. Réduction de 50% d'édentés totaux chez les 35-44 ans par rapport au niveau de 1982;
5. Réduction de 25% d'édentés totaux à l'âge de 65 ans et plus par rapport au niveau de 1982;
6. Création d'une base de données pour surveiller les changements survenus dans la santé bucco-dentaire.

Pour le nouveau millénaire, il convient de fixer d'urgence de nouveaux objectifs en matière de santé bucco-dentaire, non seulement pour renforcer le contrôle de la carie dentaire et les activités de prévention, mais aussi pour tenir compte d'autres éléments importants influençant le poids des maladies bucco-dentaires telles que les maladies parodontales, les lésions de la muqueuse buccale, les lésions précancéreuses et cancéreuses de la cavité buccale, les traumatismes cranio-faciaux, la douleur et la qualité de vie liée à la santé bucco-dentaire. Au niveau mondial, ces objectifs, aideront les planificateurs de santé bucco-dentaire à élaborer des programmes de prévention ciblés sur les populations et les groupes à haut risque, et à améliorer encore la qualité des systèmes de santé bucco-dentaire dans les régions, les pays et au niveau local.

CADRE POLITIQUE DU PROGRAMME OMS DE SANTÉ BUCCO-DENTAIRE

A la fin du XX^{e} siècle, on a assisté à une transformation, sans précédent dans l'histoire, de la santé générale et de la santé bucco-dentaire en particulier. Jusqu'a maintenant, malgré les progrès remarquables de ces dernières décennies, des millions de personnes dans le monde sont encore exclues des retombées du développement socio-économique et ne bénéficient pas des progrès scientifiques qui ont amélioré les soins de santé et la qualité de vie d'une bonne partie de la population. Au cours des dix dernières années, des changements très importants sont notamment survenus en matière de santé, au niveau mondial. On comprend mieux maintenant les causes et les conséquences des problèmes de santé. Les déterminants sociaux, économiques, politiques et culturels de la santé sont désormais considérés comme importants et on peut faire valoir qu'en réduisant la pauvreté, il est possible d'améliorer la santé. Les systèmes de santé, y compris celui de la santé bucco-dentaire, ont leur rôle à jouer. Or, ils deviennent de plus en plus complexes et les attentes des populations ont considérablement évolué vis-à-vis des soins de santé. Dans de nombreux pays, le rôle de l'Etat évolue rapidement avec l'émergence du secteur privé et de la société civile comme acteurs importants. Dans les pays en développement en particulier, un nombre croissant d'organisations de développement, de fondations privées et d'organisations non gouvernementales (ONG) prennent une part active dans le secteur de la santé.

Les objectifs de l'OMS visent à promouvoir la santé des communautés et des populations. Quatre orientations stratégiques définissent le cadre général de l'action technique de l'OMS et elles ont également des répercussions pour le Programme de Santé Bucco-Dentaire:

1. Réduire le poids des maladies bucco-dentaires et leurs conséquences invalidantes potentielles, notamment auprès des populations pauvres et marginalisées;

2. Promouvoir des modes de vie sains et réduire les facteurs de risque, pour la santé bucco-dentaire, liés à l'environnement, au comportement ainsi qu'à des causes économiques et sociales;

3. Développer des systèmes de santé bucco-dentaire qui améliorent celle ci équitablement répondent aux demandes légitimes de la population et qui soient financièrement acceptables;

4. Elaborer des politiques fondées sur l'intégration de la santé bucco-dentaire aux programmes de santé nationaux et communautaires ainsi que promouvoir la santé bucco-dentaire en tant que dimension de la politique de développement d'une société.

Conformément aux priorités de l'OMS, le Programme Mondial de Santé Bucco-Dentaire a adopté les priorités et orientations stratégiques décrites dans les pages suivantes.

PRÉVENTION DES MALADIES BUCCO-DENTAIRES ET PROMOTION DE LA SANTÉ: STRATÉGIES ET APPROCHES

La menace que représentent les maladies non transmissibles et la nécessité d'apporter des réponses urgentes et efficaces sur le plan de la santé publique ont amené à la formulation d'une stratégie pour la prévention et le contrôle de ces maladies, entérinée en 2000 par la Cinquante-Troisième Assemblée Mondiale de la Santé (résolution WHA 53.17). La priorité est donnée aux maladies (dont la santé bucco-dentaire) ayant des facteurs communs de risque évitables et liés aux modes de vie (mauvaise alimentation, tabagisme, par exemple). Les principaux facteurs sociaux et environnementaux impliqués dans la promotion de la santé bucco-dentaire sont indiqués à la **Figure 8**. Elle illustre également certains des principaux comportements à risque susceptibles d'être modifiés.

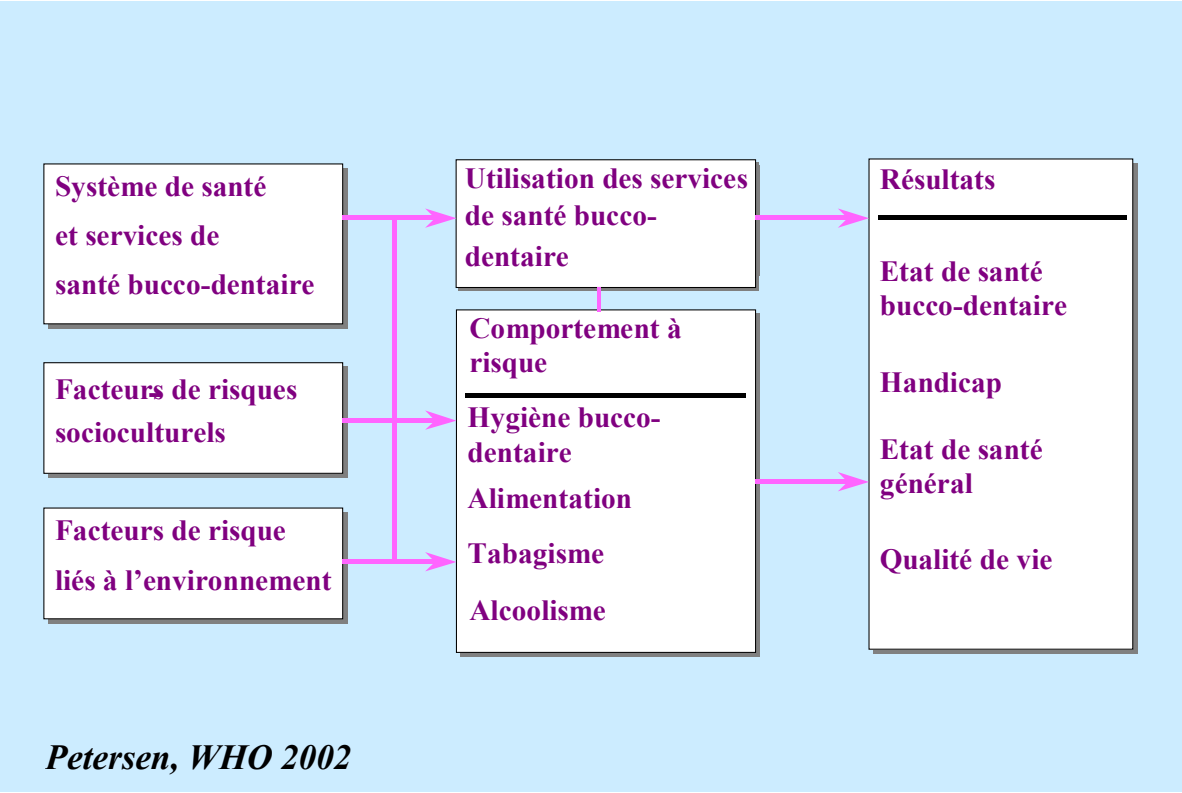

Figure 8. Approche de la promotion de la santé bucco-dentaire fondée sur les facteurs de risque

Certains déterminants socioculturels sont associés à un risque relatif élevé de maladies bucco-dentaires, tels que de mauvaises conditions de vie, un faible niveau d'instruction ainsi que l'absence de traditions, de croyances et de culture favorables à la santé bucco-dentaire. Les communautés et les pays où les apports en fluorures sont inadéquats ont un risque accru de carie dentaire. Le manque d'accès à l'eau potable ou à des installations sanitaires est un facteur de risque lié à l'environnement pour la santé bucco-dentaire comme pour la santé en général. Le contrôle des maladies bucco-dentaires est également tributaire de l'existence et de l'accessibilité à des systèmes de santé spécialisés, mais la réduction des risques n'est possible que si les services sont orientés vers les soins de santé primaires et la prévention. En plus des facteurs socioculturels et environnementaux, le modèle souligne le rôle des comportements dans la modification des facteurs de risque, telles que les habitudes en matière d'hygiène

bucco-dentaire, la consommation de sucres (quantité, fréquence d'ingestion, types de sucre consommés) ainsi que le tabagisme et la consommation excessive d'alcool. Ces comportements peuvent non seulement avoir des effets négatifs sur l'état de santé bucco-dentaire constaté par des mesures cliniques mais aussi se répercuter sur la qualité de vie.

Les recherches cliniques et en santé publique ont montré qu'un certain nombre de mesures préventives prises à l'échelon individuel, professionnel ou communautaire étaient efficaces pour prévenir la plupart des maladies bucco-dentaires (*18*). Il n'existe toutefois pas d'intervention optimale dans ce domaine qui soit universellement accessible ou d'un coût abordable, en raison de l'escalade des coûts et des ressources qui, elles, sont de plus en plus limitées. Cela, d'autant plus que l'accent n'est pas suffisamment mis sur la prévention primaire. Cela pose un problème considérable pour de nombreux pays, plus particulièrement dans les pays en développement et les pays dont l'économie et le système de santé sont en transition.

La plupart des données dont on dispose ont trait à la prévention de la carie dentaire et au contrôle des maladies parodontales. La gingivite peut être évitée avec une bonne hygiène bucco-dentaire, à savoir le brossage des dents et l'utilisation du fil dentaire, qui sont également importants pour le contrôle des lésions parodontales avancées. La fluoration de l'eau est efficace pour prévenir la carie dentaire chez l'enfant comme chez l'adulte. La fluoration de l'eau bénéficie à tous les habitants desservis par des réseaux publics d'adduction d'eau et ce quelle que soit leur situation sociale et économique. Il a été démontré que les systèmes de fluoration du sel ou du lait ont les mêmes effets lorsqu'ils sont mis en place dans le cadre de programmes de prévention. Les mesures individuelles et professionnelles, y compris l'utilisation de bains de bouche, de gels et de dentifrices fluorés ainsi que l'application d'agents de scellement sont d'autres moyens pour prévenir la carie dentaire. Dans certains pays en développement, l'introduction de dentifrices fluorés à un coût abordable s'est révélée être une stratégie précieuse car elle permet un accès approprié de la population aux fluorures.

Dans la prévention de la maladie et le maintien de la santé, les individus peuvent agir pour eux-mêmes mais aussi pour leurs proches dont ils ont la charge. Moyennant une alimentation et une nutrition appropriées, la prévention primaire de nombreuses maladies bucco-dentaires et maxillo-faciales est possible. Les comportements liés au style de vie et qui ont des effets sur la santé générale tels que le tabagisme, la consommation excessive d'alcool ou les mauvaises habitudes alimentaires ont aussi des répercussions sur la santé bucco-dentaire et maxillo-faciale. Ces comportements individuels sont associés à un risque accru d'anomalies congénitales cranio-faciales, de cancers du pharynx et de la cavité buccale, de maladie parodontale, de carie dentaire, de candidose buccale ou d'autres affections de la bouche.

Il est possible de développer les connaissances et les pratiques en matière de prévention et de promotion de la santé dans le grand public par des programmes communautaires et de santé. Les personnels délivrant des soins bucco-dentaires peuvent également jouer un rôle pour promouvoir un mode de vie sain en incorporant des programmes de sevrage tabagique et des conseils nutritionnels dans leurs pratiques.

Il existe toutefois des disparités profondes en matière de santé bucco-dentaire selon les pays et les régions et à l'intérieur même de ceux-ci. Elles peuvent être liées au statut socio-économique, à l'appartenance raciale ou ethnique, à l'âge, au sexe ou à l'état de santé générale. Même si les maladies dentaires les plus répandues sont évitables, tous les membres de la communauté ne sont pas bien informés ou capables de bénéficier de mesures appropriées de

promotion de la santé bucco-dentaire. On retrouve des groupes de populations défavorisées aussi bien dans les pays développés que dans les pays en développement. Par ailleurs, dans de nombreux pays, les soins de santé bucco-dentaire ne sont pas pleinement intégrés aux programmes de santé nationaux ou communautaires.

Les principaux défis pour l'avenir consistent à traduire les connaissances en matière de prévention de la maladie en programmes d'action. Les facteurs sociaux, économiques, culturels ainsi que l'évolution démographique ont des incidences sur la distribution des services de santé bucco-dentaire et la façon dont les gens s'occupent de leur santé. Pour réduire les disparités, il faut pouvoir mettre en place des approches d'envergure susceptibles d'atteindre les populations les plus exposées à des maladies bucco-dentaires spécifiques et améliorer l'accès aux soins existants. En attendant, dans plusieurs pays en développement, le principal défi consiste à proposer des soins de santé bucco-dentaire essentiels dans le cadre des programmes de soins de santé primaires. Ces programmes doivent répondre aux besoins sanitaires de base de la population, développer les soins de proximité, organiser les soins primaires et assurer une orientation efficace des patients.

Pour mettre en oeuvre des programmes de prévention des maladies bucco-dentaires à l'échelon mondial, les partenariats existants devront être renforcés, notamment avec les ONG nationales et internationales et les centres collaborateurs OMS pour la santé bucco-dentaire. L'OMS coordonnera des alliances, en collaboration avec la communauté internationale dans le domaine de la santé bucco-dentaire afin de répartir les responsabilités de la mise en oeuvre de la stratégie mondiale. L'une des principales responsabilités qui incombera à l'OMS consistera à cartographier les tendances des pathologies bucco-dentaires et à analyser ses déterminants, plus particulièrement en ce qui concerne les populations pauvres et défavorisées. L'action de l'OMS dans le domaine de la santé bucco-dentaire ciblera également: la mise au point d'outils pour une collaboration intersectorielle, la participation communautaire, l'aide à la prise de décision, la réforme des soins de santé bucco-dentaire et l'élaboration de stratégies à base communautaire pour contrôler les maladies bucco-dentaires.

Promotion de la santé et santé bucco-dentaire

Une bonne santé est une ressource capitale pour le développement social, économique et personnel. Certains facteurs politiques, économiques, sociaux, culturels, environnementaux, comportementaux et biologiques peuvent améliorer la santé ou au contraire lui nuire. L'action de promotion de la santé vise à rendre ces conditions favorables à la santé. Elle va donc au-delà des seuls soins de santé. Elle place la santé au centre de l'action des politiques dans tous les secteurs et à tous les niveaux, leur enjoignant de tenir compte des conséquences de leurs décisions sur la santé et d'accepter leur responsabilité en la matière. La politique de promotion de la santé allie des méthodes variées mais complémentaires s'appuyant sur la législation, les mesures financières ou fiscales ou le changement organisationnel. Il s'agit d'un effort concerté en faveur de la création d'environnements propices et du renforcement de l'action communautaire. Promouvoir la santé, c'est mettre en oeuvre un certain nombre d'actions communautaires concrètes et efficaces pour définir des priorités, prendre des décisions, prévoir des stratégies et les mettre en oeuvre pour améliorer la santé. Le développement de la communauté et son autonomie consistent à tirer parti des ressources humaines et matérielles existantes pour faciliter la prise en charge individuelle, le soutien social et la participation à part entière de la communauté.

La promotion de la santé traite des déterminants de la santé au sens large et vise à réduire les risques à travers des politiques et des mesures adaptées. Promouvoir la santé là où les gens vivent, travaillent, étudient ou jouent est manifestement le moyen le plus créatif et qui a le meilleur rapport coût/efficacité pour améliorer la santé bucco-dentaire et donc la qualité de la vie.

L'eau est essentielle à la vie, à la santé et à la production des aliments. Pourtant, près de 20 % de la population mondiale n'a pas accès à l'eau potable et près de 40 % n'a pas accès à un assainissement adéquat (*19*). Un peu partout dans le monde, des contaminants biologiques et des polluants chimiques compromettent la qualité de l'eau, entraînant tout un éventail de maladies souvent mortelles. Les mauvais systèmes d'assainissement, observés dans la plupart des pays en développement, ont des répercussions sur l'hygiène générale et bucco-dentaire en particulier. Dans de nombreuses communautés des pays en développement, promouvoir l'éducation en matière d'hygiène et de changements de comportement auprès des parents, des personnes qui s'occupent des enfants et les enfants eux-mêmes, reste un véritable défi. Les communautés doivent également se battre pour élaborer des programmes efficaces d'assainissement en milieu scolaire et de traitement approprié de l'eau pour promouvoir l'hygiène bucco-dentaire.

L'urbanisation croissante, l'évolution démographique ainsi que les changements sociaux et environnementaux, exigent des approches différentes de la santé bucco-dentaire. Il est peu probable que l'on puisse obtenir des améliorations dans ce domaine au moyen d'interventions isolées ciblées sur des comportements particuliers. Les interventions les plus efficaces et les plus durables se fondent à la fois sur une politique sociale et sur des mesures individuelles de nature à promouvoir des conditions et des modes de vie sains.

Au niveau mondial, le soutien technique et politique de l'OMS est nécessaire pour permettre aux pays d'intégrer la promotion de la santé bucco-dentaire à la promotion de la santé en général. L'expertise des centres collaborateurs OMS est précieuse à cet égard. Les pays peuvent également s'inspirer des expériences locales et des atouts des communautés pour les encourager à contribuer activement à leur santé future et faciliter l'autonomisation et l'action communautaire en vue de la promotion de la santé. Le Programme OMS de santé bucco-dentaire applique la philosophie « penser globalement – agir localement » (*20*). L'élaboration de programmes de promotion de la santé bucco-dentaire, dans des pays ciblés, est axée sur:

* L'identification des déterminants de la santé; la mise en place de mécanismes visant à améliorer la capacité de concevoir et de mettre en oeuvre des interventions pour promouvoir la santé bucco-dentaire;

* La mise en oeuvre de projets de démonstration dans la communauté pour promouvoir la santé bucco-dentaire, en privilégiant les groupes de populations pauvres et défavorisés;

* Le renforcement des capacités de planification, d'évaluation des programmes nationaux de promotion de la santé bucco-dentaire et des interventions mises en place;

* La mise au point de méthodes et d'outils pour analyser le déroulement et les résultats des interventions de promotion de la santé bucco-dentaire dans le cadre des programmes nationaux de santé;

* La création de réseaux et d'alliances visant à renforcer les mesures nationales et internationales de promotion de la santé bucco-dentaire. L'accent est également mis sur la création de réseaux pour l'échange de données d'expérience dans le cadre du programme OMS Mega.

DOMAINES D'ACTION PRIORITAIRES POUR LA SANTÉ BUCCO-DENTAIRE A L'ÉCHELON MONDIAL

Santé bucco-dentaire et fluorures

Les recherches ont montré que la mesure la plus efficace pour prévenir la carie dentaire était de maintenir en permanence un faible niveau de fluorures dans la cavité buccale (*21*). L'objectif des programmes communautaires de santé publique devrait donc être de mettre en oeuvre le moyen le plus approprié pour maintenir ce niveau faible mais constant de fluorures chez autant de personnes que possible. Pour cela, on peut avoir recours à l'eau de boisson, au sel, au lait, aux bains de bouche et aux dentifrices fluorés, ou à l'application de fluorures par un professionnel ou bien encore à une combinaison de dentifrice fluoré et d'une autre source de fluorures. Les données montrent clairement que l'exposition prolongée à un niveau optimal de fluorures se traduit par une diminution de la carie tant chez l'enfant que chez l'adulte.

Toutefois, il peut y avoir des effets secondaires indésirables à l'apport excessif de fluorures. L'expérience a montré qu'il n'est pas toujours possible d'obtenir une prévention efficace de la carie à base de fluorures sans un certain degré de fluorose dentaire, quelle que soit la méthode choisie pour maintenir ce faible niveau de fluorures dans la cavité buccale. Les administrateurs de la santé publique doivent chercher à réduire au maximum la carie tout en minimisant les risques de fluorose dentaire.

Les fluorures sont largement utilisés à l'échelle mondiale et avec profit. Plus de 500 millions de personnes dans le monde utilisent des dentifrices fluorés, près de 210 millions ont accès à une eau fluorée, quelque 40 millions à du sel fluoré. D'autres formes d'applications de fluorures (applications topiques, bains de bouche, comprimés/gouttes) sont administrées à près de 60 millions de personnes. Par contre, les populations de nombreux pays en développement n'ont pas accès aux fluorures pour la prévention de la carie dentaire, pour des raisons tant pratiques qu'économiques.

Dans le N° 846 de la Série de Rapports techniques de l'OMS intitulé « Fluorures et santé bucco-dentaire » (1994) (*21*), la recommandation concernant l'utilisation des dentifrices fluorés est la suivante:

> *Etant donné que les dentifrices fluorés constituent un moyen efficace de lutte contre la carie, tous les efforts devraient être faits pour mettre au point des produits d'un coût abordable pour les pays en développement. L'utilisation des dentifrices fluorés constituant une mesure de santé publique, il serait dans l'intérêt des pays d'exempter ces produits des droits et taxes appliqués aux cosmétiques.*
>
> Recommandation 12, page 36

Une des politiques de l'OMS consiste à soutenir l'usage généralisé des dentifrices fluorés à un coût abordable dans les pays en développement. Ceci est particulièrement important compte tenu de l'évolution de l'alimentation et de l'état nutritionnel dans ces pays. Des études récentes menées localement ont montré que des dentifrices fluorés, d'un coût abordable, sont efficaces dans la prévention de la carie et devraient être mis à disposition des autorités sanitaires dans les

pays en développement (*22*). Le Programme mondial OMS de Santé Bucco-Dentaire met actuellement en oeuvre des projets de démonstration en Afrique, en Asie et en Europe afin d'évaluer les effets de ces dentifrices, de même que ceux de la fluoration du lait et du sel.

Alimentation, nutrition et santé bucco-dentaire

Nous sommes aujourd'hui confrontés dans le monde à deux types de malnutrition, le premier associé à la faim ou aux carences nutritionnelles et le second à la suralimentation. L'urbanisation et le développement économique entraînent des changements rapides du régime alimentaire et des modes de vie. La mondialisation des marchés a des répercussions importantes en matière de suralimentation, entraînant des maladies chroniques comme l'obésité, le diabète, les maladies cardio-vasculaires, le cancer, l'ostéoporose et les maladies bucco-dentaires. L'alimentation et la nutrition ont des répercussions sur la santé bucco-dentaire à différents titres. La nutrition, par exemple, influence le développement cranio-facial, le cancer de la cavité buccale et les maladies infectieuses de la bouche. Les pathologies dentaires liées à l'alimentation comprennent notamment la carie dentaire, les anomalies de développement de l'émail, l'érosion dentaire et les maladies parodontales.

Les effets des changements nutritionnels montrent comment des risques communs influencent la santé publique, y compris la santé bucco-dentaire. Les acteurs de santé publique s'occupant de santé bucco-dentaire aurait intérêt à mieux comprendre les effets sur la santé de ces facteurs complexes sur la santé afin de prévenir ou de contrôler les maladies bucco-dentaires.

Les principaux défis à relever sont les suivants:

* Mettre en place des conseils nutritionnels, en soulignant les bienfaits d'une bonne alimentation sur la santé en général et en insistant également sur les aspects liés directement à la santé bucco-dentaire. L'effet de la consommation de sucre après l'éruption des dents est l'un des facteurs étiologiques de la carie dentaire;

* Faciliter des actions de sensibilisation lors de la promotion de l'allaitement maternel. Parmi d'autres avantages importants pour la santé, le lait maternel prévient la survenue des caries de la petite enfance, provoquées par une exposition fréquente et prolongée des dents au sucre et souvent dues au fait que l'on met l'enfant au lit avec un biberon d'eau sucrée ou qu'on l'autorise à boire de l'eau sucrée à volonté pendant la journée;

* Faire connaître les avantages d'une diminution de la consommation de boissons sucrées, qui est le risque majeur pour la carie dentaire. L'érosion dentaire semble également être un problème croissant qui, dans certains pays, est associé à une augmentation de la consommation de boissons contenant des acides;

* Promouvoir une alimentation saine et rationnelle parmi les personnes vivant dans des zones défavorisées ou isolées des pays à revenu faible ou intermédiaire en encourageant le recours aux produits naturels de bonne valeur nutritionnelle à la place de produits alimentaires raffinés et industrialisés;

* Préconiser une alimentation saine qui peut également aider à prévenir le cancer de la cavité buccale. Les fruits et légumes frais, jaunes ou verts, seraient bénéfiques, tout comme les suppléments de vitamines A, C et E. La consommation excessive d'alcool est un important facteur de risque dans l'étiologie des lésions précancéreuses et cancéreuses de la cavité buccale. Ces habitudes doivent être modifiées.

L'OMS et la FAO ont récemment publié une stratégie mondiale sur l'alimentation, l'activité physique et la santé (*23*), reposant sur l'analyse des meilleures données disponibles concernant la relation entre l'alimentation et l'activité physique et les principales maladies chroniques d'origine nutritionnelle. La stratégie vise à réduire le poids croissant des maladies non transmissibles tant dans les pays développés que dans les pays en développement. Des recommandations ont été faites pour faciliter l'élaboration de stratégies régionales et de directives nationales visant à réduire le fardeau de ces maladies. Entre autres recommandations, la part du sucre libre (ajouté) devrait rester inférieur à 10% de l'apport énergétique et le nombre de prises alimentaires et de boissons contenant du sucre ajouté devrait être limitée à quatre par jour au maximum. Pour les pays où la consommation est élevée, il est recommandé que les autorités sanitaires nationales et les responsables fixent des objectifs spécifiques au pays et à la communauté concernant la réduction de la consommation de sucres libres. De nombreux pays vivent actuellement une transition nutritionnelle et leur population n'a pas un apport en fluor suffisant. C'est donc aux autorités sanitaires nationales qu'il incombe de faire en sorte que des programmes de fluoration réalisables soient mis en oeuvre dans leur pays.

Afin de réduire au maximum la survenue de l'érosion dentaire, qui semble étroitement liée à la consommation de boissons contenant des acides, il faudrait limiter la quantité et la fréquence des boissons sucrées et de jus de fruits consommés. L'élimination de la sous-alimentation permet d'éviter l'hypoplasie de l'émail et d'autres effets potentiels sur la santé bucco-dentaire (atrophie des glandes salivaires, maladies parodontales, maladies infectieuses de la cavité buccale, par exemple).

Le Programme OMS de Santé Bucco-Dentaire contribue à la mise en oeuvre de la Stratégie Mondiale sur l'Alimentation, l'Activité Physique et la Santé. De nombreuses interventions peuvent être mises en place au niveau national, particulièrement dans les domaines suivants:

* services de santé bucco-dentaire;
* écoles: programmes des études, cantines et santé scolaire;
* industrie alimentaire, supermarchés;
* restauration, etc;
* ONG (en lien avec la santé et autres);
* législation et politique;
* médias;
* suivi, surveillance et recherche.

Les ministères de la santé devraient veiller à ce que les mécanismes de collaboration intersectorielle soient examinés attentivement. Les stratégies devraient porter à la fois sur les taxes, les prix, l'étiquetage des aliments, les cantines scolaires et l'appui aux programmes de nutrition.

Tabac et santé bucco-dentaire

La prévalence du tabagisme a baissé dans certains pays à haut revenu, mais continue à augmenter dans les pays à revenus faibles et intermédiaires, notamment parmi les jeunes et les femmes (*1,24*). Il ne fait pas de doute que le nombre croissant de fumeurs et de consommateurs de tabac sans fumée parmi les jeunes, dans certaines régions du monde, aura des effets considérables sur l'état de santé générale et la santé bucco-dentaire des générations futures. La prévalence du tabagisme est généralement plus élevée chez les personnes ayant un faible niveau d'instruction ou parmi les populations pauvres et marginalisées.

Le tabagisme est la principale cause évitable de décès prématuré et de plusieurs grandes maladies. En outre, la cigarette, la pipe, le cigare et le "bidi", le bétel, le "guhtka" et d'autres formes traditionnelles du tabagisme ont divers effets sur la cavité buccale (*25,26*). Le tabac est un facteur de risque pour le cancer de la cavité buccale, les récidives de ce cancer, les maladies parodontales de l'adulte et les anomalies congénitales telles que le bec de lièvre et la fente palatine chez l'enfant. Le tabac supprime la réponse immunitaire aux infections bucco-dentaires, compromet la guérison après une intervention chirurgicale bucco-dentaire ou une blessure accidentelle, favorise la dégénérescence du parodonte chez les diabétiques et a des effets défavorables sur le système cardio-vasculaire. En outre, les risques liés à la consommation de tabac augmentent considérablement lorsqu'elle est associée à l'alcool ou à la noix d'arec. La plupart des conséquences bucco-dentaires du tabagisme ont des répercussions sur la qualité de la vie, aussi simples que la mauvaise haleine, aussi complexes que les anomalies congénitales bucco-dentaires, aussi répandues que les maladies parodontales et aussi pénibles que les complications de la cicatrisation d'une plaie.

Le Programme OMS de Santé Bucco-Dentaire vise à lutter contre les maladies bucco-dentaires liées au tabac et autres affections à travers diverses stratégies. A l'OMS, le Programme est rattaché à l'initiative OMS pour un monde sans tabac, et complètement intégré à d'autres programmes en rapport avec la santé bucco-dentaire. A l'extérieur, il encourage l'adoption et l'application des politiques OMS de contrôle et de sevrage du tabagisme par les organisations nationales et internationales intervenant dans le domaine de la santé bucco-dentaire. Ses principaux partenaires sont les centres collaborateurs OMS pour la santé bucco-dentaire et les ONG en relations officielles avec l'OMS, à savoir l'Association Internationale de Recherche Dentaire (IADR) et la Fédération Dentaire Internationale (FDI). Plusieurs projets ont été mis en place au Canada, dans les pays de l'Union européenne, au Japon, en Nouvelle-Zélande et aux Etats-Unis d'Amérique, et d'autres encore sont envisagés en Chine et en Inde.

Les professionnels de la santé bucco-dentaire sont invités à renforcer leur contribution aux programmes incitant à cesser de fumer et ce, pour diverses raisons éthiques, morales et pratiques, dont les suivantes:

* Ils sont particulièrement concernés par les effets néfastes de la consommation de tabac sur la sphère oropharyngée;

* Ils rencontrent régulièrement des enfants et des jeunes ainsi que des personnes qui s'en occupent. Ils ont donc la possibilité de les inciter à éviter de fumer, à retarder le moment où ils commenceront ou à cesser de fumer avant une dépendance trop forte;

* Ils passent souvent plus de temps avec les patients que d'autres cliniciens, ce qui leur donne la possibilité d'intégrer éducation et intervention;

* Ils traitent souvent des femmes en âge de procréer et sont donc en mesure d'informer ces patientes des risques potentiels pour leurs enfants de la consommation de tabac;

* Ils sont tout aussi efficaces que d'autres personnels de santé pour aider les consommateurs de tabac à abandonner leur habitude et les résultats n'en sont que meilleurs lorsque plusieurs disciplines interviennent dans le processus;

* Ils peuvent motiver leurs patients en leur montrant les dégâts du tabac dans la cavité buccale.

L'objectif du Programme OMS de Santé Bucco-Dentaire dans le domaine du tabac consiste à faire en sorte que les équipes de santé bucco-dentaire et les organisations compétentes soient directement, judicieusement et systématiquement impliquées dans l'éducation des patients et du grand public afin de les inciter à éviter toute forme de tabagisme ou à arrêter de consommer du tabac.

Le but de la lutte contre le cancer est de réduire à la fois l'incidence de la maladie, la morbidité et la mortalité. Cela exige non seulement la connaissance de l'histoire de la maladie, mais également une bonne compréhension des facteurs sociaux, économiques et culturels sous-jacents. Le dépistage précoce peut sauver des vies. Plusieurs pays développés et en développement mettent en oeuvre des programmes de prévention du cancer comprenant celui de la cavité buccale. Il est indispensable d'apprendre aux individus à reconnaître les signes et symptômes précoces du cancer de la cavité buccale. Dans les pays en développement en particulier, les agents de soins de santé primaires formés au dépistage du cancer de la cavité buccale sont appelés à devenir une force de prévention considérable grâce au dépistage précoce et à la promotion de la santé en vue de sensibiliser la communauté. Un système d'orientation efficace doit être trouvé pour permettre la prise de mesures vitales.

Le Programme OMS de Santé Bucco-Dentaire soutient l'intégration de la prévention du cancers de la cavité buccale dans les programmes nationaux de lutte contre le cancer, sur la base d'une planification, d'un suivi et d'une évaluation rigoureux ainsi que la constitution de partenariats (*27*).

Santé bucco-dentaire et promotion de la santé à l'école

L'initiative mondiale de l'OMS pour la santé à l'école, lancée en 1995, vise à mobiliser et à renforcer les activités d'éducation et de promotion de la santé aux niveaux local, national, régional et mondial. L'initiative est destinée à améliorer la santé des enfants, du personnel scolaire, des familles et autres membres de la collectivité, et cela à travers l'établissement scolaire. La promotion de la santé à l'école est un enseignement qui veille constamment à renforcer la capacité à instaurer un cadre de vie, d'apprentissage et de travail sain. L'initiative mondiale de l'OMS pour la santé à l'école comprend quatre grandes stratégies (*28*):

1. Développer les capacités de sensibilisation en vue d'améliorer les programmes de santé scolaire.

2. Créer des réseaux et des alliances afin de développer le concept de promotion de la santé à l'école.

3. Renforcer les capacités nationales.

4. Mener des recherches afin d'améliorer les programmes de santé scolaire.

Afin d'aider les particuliers et les associations à soutenir le développement de la promotion de la santé à l'école, l'OMS a publié une « série d'informations sur la santé à l'école ». On y trouve des lignes directrices destinées à aider les écoles et les responsables de la collectivité à améliorer la santé et l'éducation des jeunes, chaque document ayant pour but d'encourager les écoles à traiter un ou plusieurs problèmes de santé importants.

Le Programme OMS de Santé Bucco-Dentaire a rédigé un document technique afin de renforcer la mise en oeuvre d'un élément santé bucco-dentaire dans le programme pour la promotion de la santé à l'école (*29*). Les arguments importants en faveur de la promotion de la santé bucco-dentaire par l'école sont les suivants:

* Pendant leurs années de formation, de l'enfance à l'adolescence, les élèves sont accessibles. Ce sont des stades importants dans la vie de l'individu car c'est à ce moment-là qu'il adopte des comportements mais aussi des croyances et des attitudes vis-à-vis de la santé bucco-dentaire qu'il gardera toute sa vie;

* Les écoles peuvent offrir un environnement propice à la promotion de la santé bucco-dentaire. L'accès à l'eau potable, par exemple, peut favoriser les programmes d'hygiène en général et d'hygiène bucco-dentaire en particulier. De même, un environnement matériel de sécurité peut contribuer à réduire le risque d'accidents et par conséquent le risque de traumatismes dentaires;

* Le poids des maladies bucco-dentaires chez l'enfant est important. La plupart d'entre elles, une fois établies, sont irréversibles et auront un impact sur la qualité de vie et l'état de santé générale;

* Des politiques scolaires, un environnement propice et une éducation pour la santé sont essentiels à l'instauration de la santé bucco-dentaire et au contrôle des comportements à risque comme la consommation d'aliments et de boissons sucrés, le tabagisme ou la consommation d'alcool;

* Les écoles peuvent offrir une plate-forme pour la prestation de soins bucco-dentaires préventifs et curatifs.

Grâce à un réseau étendu de promotion de la santé à l'école (Health Promoting Schools), l'OMS collabore, aux niveaux régional et mondial, avec Education International, l'ONUSIDA et l'UNESCO pour permettre aux organisations représentatives des enseignants du monde entier de mettre à profit leur capacité et leur expérience pour améliorer la santé par l'école. Le

Programme OMS de Santé Bucco-Dentaire est rattaché à ces réseaux comme aux réseaux scolaires de santé bucco-dentaire établis dans les divers pays et régions.

Des programmes de formation de formateurs, à l'intention des instituteurs, sont organisés pour développer les capacités nationales d'intégration de la promotion de la santé bucco-dentaire à l'école. Dans le cadre de la mise en place du réseau OMS (MEGA) de Promotion de la Santé dans les pays les plus peuplés, le Programme OMS de Santé Bucco-Dentaire encourage l'échange de bonnes pratiques entre responsables de santé scolaire et de promotion de la santé.

L'OMS rassemble les travaux de recherche portant sur les interventions susceptibles d'améliorer la santé par l'école afin de développer des capacités au niveau national et de surveiller l'état de santé des enfants et des enseignants (*30*). Le Programme OMS de Santé Bucco-Dentaire a élaboré des méthodologies permettant d'évaluer le processus et le résultat des programmes de santé bucco-dentaire à l'école, en vue de renforcer la mise en oeuvre de ces programmes et l'action des centres collaborateurs OMS pour la santé bucco-dentaire.

La santé bucco-dentaire des jeunes

Les adolescents, âgés de 10 à 19 ans selon la définition de l'OMS, représentent un cinquième de la population mondiale. Un jeune ayant confiance en lui, bien intégré socialement, qui croit en des valeurs et a accès aux informations pertinentes est mieux à même de prendre des décisions positives pour sa santé. Les facteurs extérieurs ont un impact énorme sur la façon dont les adolescents pensent et se comportent ; les valeurs et les comportements de leurs pairs sont de plus en plus importants tandis que les parents et les autres membres de la famille gardent toujours une influence. L'environnement plus large de ces jeunes a également une importance (médias, industries, institutions communautaires, par exemple). Les programmes visant à améliorer la santé bucco-dentaire des jeunes doivent tenir compte de ces facteurs, notamment la consommation de bonbons, de boissons sucrées, de tabac ou d'alcool. Des alliances efficaces entre l'environnement familial, le milieu scolaire, les professionnels et les organisations communautaires sont nécessaires si l'on veut contrôler les risques pour la santé bucco-dentaire des jeunes.

Amélioration de la santé bucco-dentaire chez les personnes âgées

La répartition selon l'âge de la population mondiale évolue. Avec les progrès de la médecine et l'allongement de l'espérance de vie, la proportion de personnes âgées va continuer à augmenter partout dans le monde. Par exemple, le Rapport sur la santé dans le monde 1998 dénombrait 390 millions de personnes âgées de plus de 65 ans, par exemple. On estime que ce chiffre devrait doubler d'ici 2025 (*31*). La génération du baby boom d'après-guerre aura 65 ans en 2011, venant grossir sensiblement les rangs des personnes âgées.

D'ici 2025, dans de nombreux pays en développement, en particulier en Asie et en Amérique latine, on attend une augmentation de la population âgée pouvant aller jusqu'à 300%. D'ici 2050, il y a aura 2 milliards de personnes de plus de 60 ans, dont 80% dans les pays en développement (*32*). La croissance de cette population est gigantesque et pose des problèmes énormes du point de vue de la prise en charge des personnes âgées. A mesure que les gens vieillissent, leur susceptibilité aux maladies chroniques et aux maladies qui engagent le pronostic vital ainsi qu'aux infections aigües augmente, et est encore aggravée par des déficits du système immunitaire (*33*). Dans ce groupe d'âge, le cancer, les maladies cardio-vasculaires,

le diabète, les infections et une mauvaise santé bucco-dentaire (avec notamment la perte de dents ou des formes sévères de maladie parodontale) sont plus fréquentes. Les conséquences de ces maladies et affections sont significatives, entraînant des incapacités et une qualité de vie diminuée.

Les maladies bucco-dentaires sont généralement évolutives et cumulatives. Le processus du vieillissement peut directement ou indirectement accroître le risque de maladies bucco-dentaires et de perte des dents, phénomène que compliquent encore un mauvais état de santé générale, la présence de maladies aigües ou chroniques (*34*). Parmi les personnes âgées, on observe une prévalence élevée de co-morbidité et des obstacles aux soins, en même temps que des problèmes de santé bucco-dentaire liés aux phénomènes suivants:

* évolution de l'état de la dentition;
* prévalence de la carie et besoins de soins non satisfaits;
* poches parodontales/perte d'attache parodontale et mauvaise hygiène bucco-dentaire;
* édentation et perte fonctionnelle;
* conséquences de prothèses dentaires amovibles mal adaptées;
* cancer de la cavité buccale;
* xérostomie;
* douleur et gêne cranio-faciales.

L'interrelation entre la santé bucco-dentaire et l'état de santé générale est particulièrement prononcée chez les personnes âgées. Une mauvaise santé bucco-dentaire peut accroître les risques pour la santé générale et se répercuter sur l'apport nutritionnel lorsque les capacités de mastication et d'alimentation sont amoindries. De même, les maladies systémiques et/ou les effets secondaires indésirables de leur traitement peuvent entraîner un risque accru de maladies bucco-dentaires, une diminution du flux salivaire, une altération du goût et de l'odorat, des douleurs dento-faciales, une hypertrophie des gencives, une résorption de l'os alvéolaire et la mobilité des dents (*34*). La prévalence élevée de traitements associant plusieurs médicaments dans ce groupe d'âge peut encore aggraver les effets sur la santé bucco-dentaire. Parmi les autres déterminants figurent une alimentation à forte teneur en sucre, une mauvaise hygiène bucco-dentaire par manque de dextérité, la consommation d'alcool ou de tabac, autant de facteurs de risque pour la santé bucco-dentaire (*35*).

Les obstacles aux soins de santé bucco-dentaire pour les personnes âgées sont considérables. La perte de mobilité les empêche d'avoir accès aux soins, en particulier pour celles qui habitent en milieu rural lorsque les moyens de transport public sont insuffisants (*36*). La situation est plus grave encore dans les pays en développement s'il n'existe pas de services de santé bucco-dentaire et de soins à domicile. Certaines personnes âgées pouvant par ailleurs éprouver des difficultés financières après leur retraite, le coût réel ou l'idée qu'elles se font du coût du traitement dentaire, allié à des attitudes négatives à l'égard de la santé bucco-dentaire, peuvent les décourager de consulter un dentiste. La peur de la violence peut rendre les personnes âgées craintives face à des étrangers, ce qui peut gêner la communication avec les personnels soignants.

Dans certains pays, les personnes âgées ont tendance à vivre seules, loin de leurs amis ou de leur famille. L'absence de soutien social et les sentiments de solitude et d'isolement peuvent se répercuter sur leur santé mentale et leur bien-être. Il existe à l'évidence des besoins non satisfaits dans ce groupe d'âge. Il est important que les personnels des services de santé

tiennent compte des facteurs psycho-sociaux non négligeables ayant une incidence sur la santé et le bien-être des personnes âgées. Il faut donc fournir des services de santé bucco-dentaire adaptés, qui soient accessibles, appropriés et acceptables. L'état de santé des personnes âgées doit également être pris en compte avant de planifier un traitement complexe pouvant comporter des interventions chirurgicales. Le diagnostic de ces besoins particuliers et la planification en cas de traitement sophistiqué sont essentiels. Enfin, les incidences pour la recherche et la formation sont considérables (*33,37*).

Le Programme OMS de Santé Bucco-Dentaire entend élaborer des stratégies pour améliorer la santé bucco-dentaire des personnes âgées. Sur la base de l'expérience acquise dans le cadre des programmes de démonstration dans les pays, les planificateurs nationaux de la santé bucco-dentaire sont encouragés à intégrer des activités systématiques dans ce domaine afin d'améliorer la qualité de la vie. Le Programme appliquera ces stratégies en collaboration avec le Centre de l'OMS à Kobe (Japon), les bureaux régionaux de l'OMS, les centres collaborateurs de l'OMS pour la santé bucco-dentaire et les ONG.

Santé bucco-dentaire, état de santé générale et qualité de vie

La santé bucco-dentaire fait partie intégrante de la santé au sens large. Les maladies parodontales, par exemple, sont associées à des problèmes de santé comme les maladies cardio-vasculaires et le diabète. Les personnes présentant des affections complexes sont plus exposées au risque de maladies bucco-dentaires qui compliquent encore leur état de santé générale (*38*). Certaines maladies ont des manifestations buccales, et ces lésions peuvent être le premier signe d'autres maladies potentiellement mortelles comme le VIH/SIDA. En outre, certains médicaments ou traitements courants utilisés pour traiter des maladies systémiques peuvent compromettre la santé et le fonctionnement de la sphère bucco-dentaire.

Non traitées, même pendant peu de temps, les maladies bucco-dentaires peuvent avoir des conséquences néfastes. Une infection bucco-dentaire peut tuer. Une infection bucco-dentaire est considérée comme un facteur de risque dans nombre d'affections générales. La propagation de bactéries peut entraîner ou aggraver sérieusement des infections dans l'organisme tout entier, en particulier chez les personnes immunodéprimées. Les personnes souffrant de maladies cardio-vasculaires ou de diabète sont particulièrement vulnérables. Des études ont montré que les maladies bucco-dentaires (carie dentaire et maladie paradontale, par exemple) étaient associées à d'autres maladies non transmissibles (*38-41*), et cette interrelation mérite des recherches plus approfondies.

Une mauvaise santé bucco-dentaire peut avoir des répercussions importantes sur la qualité de vie. La douleur, la survenue d'abcès dentaires, des difficultés à mastiquer ou à se nourrir, une gêne provoquée par la forme des dents ou des dents manquantes, colorées ou abîmées peuvent avoir des répercussions sur la vie quotidienne et le bien-être des individus. Ces dernières années, de nombreuses recherches ont montré l'impact de la santé bucco-dentaire sur la qualité de la vie (*42*). Plusieurs mesures de la qualité de vie liée à la santé bucco-dentaire ont été élaborées afin d'évaluer les répercussions fonctionnelles, psychologiques, sociales et économiques; mesures très importantes pour l'évaluation des programmes de santé bucco-dentaire dans la communauté.

Les facteurs de risque pour la santé tels qu'une consommation excessive d'alcool, le tabagisme ou d'autres formes de consommation du tabac et de mauvaises habitudes alimentaires peuvent également se répercuter sur la santé bucco-dentaire. La corrélation entre ces comportements liés au mode de vie et le risque accru de caries dentaires, de maladies parodontales, d'infections de la bouche, d'anomalies maxillo-faciales, de cancers de la cavité buccale et d'autres affections de la bouche montre bien la nécessité d'adopter une approche intégrée de la promotion à la fois de la santé bucco-dentaire et de la santé générale. L'approche fondée sur des facteurs communs de risque offre une possibilité intéressante d'intégrer la promotion de la santé bucco-dentaire dans la promotion de la santé générale. Une telle approche devrait être plus efficace que les programmes dirigés contre une seule maladie ou affection.

Le Programme OMS de Santé Bucco-Dentaire fournira des informations sur l'analyse des différentes politiques de santé afin d'élaborer des politiques destinées à faciliter l'intégration de la santé bucco-dentaire dans les programmes nationaux et communautaires. Ces initiatives passent par une analyse des dernières connaissances disponibles et la création de banques de données mondiales sur la santé bucco-dentaire, la santé générale et les facteurs communs de risque.

Systèmes de santé bucco-dentaire

Plus de 20 ans après son adoption, la stratégie de la Santé pour Tous basée sur les soins de santé primaires n'a pas encore été pleinement mise en oeuvre (*43*). Dans de nombreux pays, les capacités et les ressources nationales – humaines, financières et matérielles – sont encore insuffisantes pour assurer l'offre de services de santé essentiels de qualité et l'accès à ceux-ci pour tous, notamment dans les communautés défavorisées. Plusieurs pays sont désormais engagés dans un processus de changement. Certains procèdent à une réforme du secteur public dans son ensemble, d'autres ne réforment que le secteur de la santé en décentralisant les services publics, en favorisant la participation du secteur privé et en réorganisant leur mode de financement et de prestation de services. Ces changements ont principalement pour but de réduire les inégalités dans l'accès aux services de santé, de promouvoir une couverture universelle et d'améliorer l'efficacité de l'ensemble du système de santé.

La transition des services de santé bucco-dentaire coïncide avec la tendance générale de la réforme des services de santé. Plusieurs pays industrialisés occidentaux offrent à leur population des services de santé bucco-dentaire, aussi bien préventifs que curatifs, qui reposent sur des systèmes privés ou publics. Par contre, les personnes appartenant à des groupes défavorisés ou à certaines minorités ethniques, les sans-logis, les personnes handicapées ou les personnes qui ne peuvent sortir de chez elles et les personnes âgées ne sont pas suffisamment couvertes par les soins bucco-dentaires. Dans les pays d'Europe centrale et orientale, une décentralisation et une déréglementation des services de santé bucco-dentaire ont eu lieu ces dernières années. Avec la privatisation, un nombre croissant de personnes ne peuvent plus s'offrir des soins dentaires privés. Dans certains pays d'Europe orientale, des systèmes de tiers payant ont été mis en place, mais la priorité n'est pas donnée aux soins préventifs. La demande de traitements sophistiqués a augmenté, en particulier dans les groupes à faible revenu. De plus, de nombreux enfants ne sont pas couverts car les services dentaires scolaires anciennement proposés dans la plupart des pays d'Europe orientale ont été supprimés.

Dans les pays en développement, les services de santé bucco-dentaire sont principalement offerts par les hôpitaux centraux ou régionaux des centres urbains, peu d'importance étant donnée aux soins préventifs ou conservateurs. De nombreux pays d'Afrique, d'Asie et d'Amérique latine connaissent une pénurie de personnels de santé bucco-dentaire et, d'une manière générale, la capacité des systèmes de santé se limite au soulagement de la douleur ou aux soins d'urgence. En Afrique, le nombre de dentistes par habitant est d'environ 1 pour 150 000 contre 1 pour 2000 dans la plupart des pays industrialisés.

Le Programme OMS de Santé Bucco-Dentaire est favorable au développement de services correspondant aux besoins de chaque pays. La réorientation des services de santé bucco-dentaire en faveur de la prévention et de la promotion de la santé se fait en collaboration avec les bureaux OMS régionaux ou nationaux. Un module de base de soins bucco-dentaires (*44*) a été mis au point et les outils proposés peuvent être utiles dans certains pays. Pour les pays en développement, en particulier, des modèles de soins de santé primaires applicables aux soins bucco-dentaires essentiels sont encouragés et plusieurs projets de démonstration dans la communauté basés sur le contexte socioculturel sont soutenus ou mis en oeuvre conjointement avec le Programme OMS de Santé Bucco-Dentaire. En outre, ce Programme a mis au point une composante santé bucco-dentaire dans le cadre du projet de prise en charge intégrée des maladies de l'adolescent et de l'adulte *Integrated Management of Adolescent/Adult Illness – Guidelines for First-level Facility Health Workers in Low Resource Settings* (*45*).

La question du personnel de santé bucco-dentaire – à savoir les catégories de personnel à former, leurs fonctions et les effectifs dans chaque catégorie – retient l'attention depuis de nombreuses années. Son importance est apparue plus clairement dans certains pays où la formation de dentistes est inadaptée aux besoins et à la demande de soins de santé bucco-dentaire. Certains pays connaissent encore un problème de formation, de catégories et d'effectifs inadaptés des professionnels de la santé bucco-dentaire. On a signalé, en particulier, que dans les pays en sureffectif, les fonctions traditionnellement dévolues aux assistants sont maintenant réalisées par les dentistes eux-mêmes. Dans ces pays, l'introduction de personnel auxiliaire a été retardée. L'évolution du tableau de morbidité bucco-dentaire et des facteurs socio-démographiques indique qu'un ajustement des structures existantes du personnel de santé bucco-dentaire est nécessaire dans plusieurs pays développés. Dans les pays en développement, le problème consiste à encourager les programmes de formation pour les types de personnel correspondant aux besoins et à l'infrastructure de santé bucco-dentaire du pays.

VIH/SIDA et santé bucco-dentaire

L'épidémie de VIH/SIDA est l'une des plus graves qu'ait connue l'humanité. Près de 40 millions de personnes étaient infectées par le VIH en 2001 et des millions sont déjà mortes du SIDA. Beaucoup d'autres sont touchées parce que leurs parents, d'autres membres de leur famille, des amis ou des collègues sont morts du SIDA ou sont séropositifs. Le VIH/SIDA est la menace la plus dangereuse pour le développement aujourd'hui et l'épidémie est particulièrement grave en Afrique subsaharienne et en Asie. Les programmes nationaux, les organisations internationales, la société civile, la communauté et les particuliers font face à l'épidémie. Les efforts déployés au départ ont souvent été insuffisants et trop dispersés, car on n'avait pas encore saisi toute l'étendue du problème. A mesure que l'épidémie a progressé, on en a mieux compris les causes et les effets. Le principal défi de l'action contre le VIH/SIDA à l'heure actuelle est de faire en sorte que des stratégies de prévention et de soins ayant fait leur

preuve, soient largement mises en oeuvre au niveau où elles sont susceptibles d'avoir un impact décisif sur l'épidémie.

Le Programme OMS de Santé Bucco-Dentaire peut apporter une contribution importante au diagnostic précoce, à la prévention et au traitement de cette maladie. Plusieurs études ont montré qu'environ 40 à 50% des personnes séropositives présentaient des infections virales, bactériennes ou mycosiques de la bouche, qui surviennent souvent à un stade précoce de la maladie (*10*). Les lésions buccales directement associées à l'infection à VIH sont la candidose buccale pseudomembraneuse, la leucoplasie chevelue buccale, la gingivite et la parodondite liées au VIH, le sarcome de Kaposi, les lymphomes non hodgkiniens et la sécheresse buccale due à une diminution du flux salivaire.

Le Programme OMS de Santé Bucco-Dentaire a rédigé un guide (*46*) qui propose une approche systématique de la mise en oeuvre d'études épidémiologiques portant sur les affections de la cavité buccale associées à l'infection au VIH. Il contient des directives pour la collecte, l'analyse, le rapport et la diffusion des données, ce qui devrait faciliter les comparaisons des résultats de différentes études. Il vise également à encourager le personnel de santé bucco-dentaire et les praticiens de santé publique à faire de l'état de santé bucco-dentaire un élément de prise en charge optimale des cas et des activités de surveillance des maladies associées à l'infection au VIH.

En collaboration avec d'autres programmes techniques de l'OMS et les centres collaborateurs OMS pour la santé bucco-dentaire, le Programme OMS de Santé Bucco-Dentaire facilitera et coordonnera l'élargissement des initiatives efficaces grâce à un soutien technique et gestionnaire.

Ces activités porteront principalement sur:

* l'identification des manifestations buccales les plus révélatrices du VIH/SIDA;

* la participation du personnel de santé bucco-dentaire à la documentation du VIH/SIDA pour assurer une évaluation médicale, une prévention et un traitement appropriés;

* la formation des autres professionnels de santé au dépistage des lésions buccales et des manifestations extrabuccales; l'utilisation d'une méthode de « formation de formateurs » pour atteindre les agents de santé au niveau du village et de la communauté;

* la diffusion d'informations sur la maladie et sa prévention par tous les moyens de communication possibles;

* l'appui technique de l'OMS aux réunions organisées au niveau régional ou inter-régional pour mettre en commun les expériences des pays en matière de prévention du VIH/SIDA et la modification des modes de vie à travers des campagnes et des programmes communautaires.

Systèmes d'information sur la santé bucco-dentaire, bases scientifiques pour une politique de santé bucco-dentaire et formulation d'objectifs.

Le poids des maladies bucco-dentaires et les besoins des populations évoluent. De même, les systèmes de santé bucco-dentaire et les connaissances scientifiques changent rapidement. Afin

de répondre à ces besoins, les acteurs de santé publique et les décideurs ont besoin d'outils, de moyens et d'informations pour évaluer et suivre les besoins de santé, choisir les interventions, élaborer des options politiques adaptées à leur situation et améliorer la performance du système de santé bucco-dentaire.

Dans les objectifs pour la santé bucco-dentaire d'ici l'an 2000, l'OMS et la FDI invitaient les Etats Membres à établir des systèmes d'information sur la santé bucco-dentaire, ce qui reste un défi dans la plupart des pays. Le Programme OMS de Santé Bucco-Dentaire est prêt à aider les pays à mettre sur pied de tels systèmes d'information comprenant des données complémentaires sur les indicateurs épidémiologiques.

Les informations qui peuvent être obtenues à travers un système d'information sanitaire peuvent être utilement classées dans les sous-systèmes connexes suivants:

* surveillance épidémiologique;

* couverture de la population par les services;

* dossiers et comptes rendus des services;

* administration et gestion des ressources;

* qualité des soins dispensés;

* surveillance du programme de santé bucco-dentaire et évaluation des résultats.

Les évaluations systématiques des systèmes de santé bucco-dentaire font défaut et le Programme OMS de Santé Bucco-Dentaire préconise un modèle complet permettant de mesurer les ressources, le processus, les services produits et les résultats (**Figure 9**).

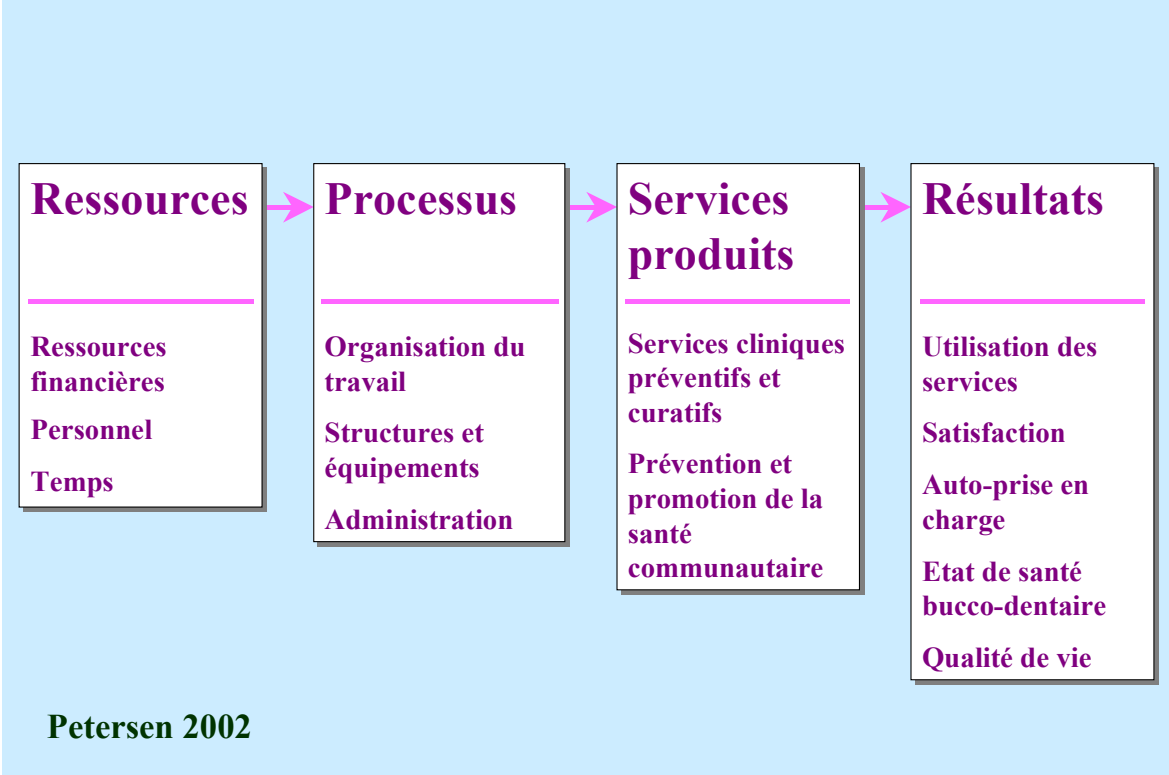

Figure 9 Modèle d'évaluation des systèmes de santé bucco-dentaire

A l'OMS, des systèmes d'information sont mis en place pour la surveillance des tendances mondiales des maladies bucco-dentaires et des facteurs de risque. La banque de données de l'OMS sur la santé bucco-dentaire réunit des informations utiles au suivi du tableau épidémiologique mondial et des évolutions, dans le temps, de la santé bucco-dentaire. Le Programme OMS de Santé Bucco-Dentaire a commencé à intégrer la base de données existante aux autres bases de données sanitaires et systèmes de surveillance des facteurs de risque de l'OMS. Le principal instrument de surveillance est baptisé "STEPS" (approche par étapes de la surveillance). Il s'agit d'une approche simple offrant aux pays des méthodes normalisées communes, mais qui laissent suffisamment de souplesse pour élargir leurs outils en y ajoutant les informations intéressantes pour leur situation propre (*47*).

Le Programme OMS de Santé Bucco-Dentaire propose des systèmes modernes d'information sanitaire, au niveau mondial, à travers diverses activités:

* La révision des méthodes fondamentales d'enquête sur la santé bucco-dentaire, tenant compte du nouveau tableau de la morbidité bucco-dentaire (par exemple l'érosion dentaire et la consommation de boissons sucrées) et permettant d'enregistrer des facteurs de risque et des facteurs liés à la qualité de vie (y compris les comportements à risque tels que les habitudes alimentaires, le tabagisme, la consommation d'alcool et les habitudes en matière d'hygiène bucco-dentaire);

* La mise au point de techniques de gestion et d'analyse des données utilisant les technologies de l'information;

* Le rattachement de la banque de données mondiale sur la santé bucco-dentaire au système d'information du Programme des profils de pays/région;

* L'élaboration de méthodologies et d'approches pour l'évaluation de l'efficacité des programmes communautaires de santé bucco-dentaire, axés sur la promotion de la santé et la prévention de la maladie. Cette évaluation comprend également une documentation des procédés pour permettre une mise en commun des expériences des différents programmes.

Les programmes OMS de santé bucco-dentaire au niveau du siège et des régions ont récemment évalué le degré de réalisation des objectifs OMS/FDI pour la santé bucco-dentaire d'ici l'an 2000. L'OMS a commencé à élaborer de nouveaux objectifs. Le Bureau Régional de l'Europe a défini des cibles en la matière (cible 8.5) pour 2020 dans le cadre de sa politique Santé 21 (*48*). L'OMS, la Fédération Dentaire Internationale (FDI) et l'Association Internationale de Recherche Dentaire (IADR) ont conjointement préparé de nouveaux objectifs pour la période allant jusqu'à 2020. Les objectifs et les cibles ont été élargis de façon à couvrir des indicateurs significatifs liés à la santé bucco-dentaire de groupes de population. Les buts fixés à l'échelle mondiale n'ont pas de caractère normatif. Ce cadre est conçu principalement pour encourager les responsables de l'élaboration des politiques de santé aux niveaux régional, national et local à fixer des normes de santé bucco-dentaire en ce qui concerne la douleur, les troubles fonctionnels, les maladies infectieuses, le cancer de l'oropharynx, les manifestations buccales de l'infection au VIH, le noma, les traumatismes, les anomalies maxillo-faciales, la carie dentaire, les anomalies de développement des dents, les maladies parodontales, les maladies des muqueuses buccales, les troubles des glandes salivaires, la perte de dents, les services de santé et les systèmes d'information sanitaire.

Le Programme OMS de Santé Bucco-Dentaire aidera directement les pays à travers les bureaux régionaux et nationaux à élaborer des objectifs, des cibles et des normes.

Recherche en santé bucco-dentaire

La recherche est un processus systématique visant à produire des connaissances nouvelles. Sur la base des progrès des sciences sociales et biomédicales, de la santé publique et des technologies de l'information, de nouveaux concepts peuvent conduire à des interventions novatrices ayant un impact direct sur le diagnostic, la prévention, le traitement, mais aussi les aspects éthiques et sociaux de la maladie. Les progrès dans le domaine des connaissances n'ont, toutefois, pas encore pleinement bénéficié aux pays en développement. On estime par exemple que 10% seulement des fonds alloués au niveau mondial à la recherche en santé sont consacrés à des problèmes qui touchent 90 % de la population mondiale (*49*). Les disparités évidentes sur les plans économique, politique, des ressources, des moyens scientifiques, et d'accès aux réseaux mondiaux de l'information ont, en réalité, élargi l'écart entre pays riches et pays pauvres dans le domaine des connaissances.

Le Programme OMS de Santé Bucco-Dentaire contribue à redresser le déséquilibre dans la répartition des connaissances en matière de santé bucco-dentaire de telle sorte que les résultats de la recherche profitent à tous, y compris aux pauvres, et cela de manière durable et équitable. Les connaissances étant un moyen important d'améliorer la santé des pauvres en particulier, le Programme se concentrera sur la promotion de la recherche en santé bucco-dentaire dans les pays développés et les pays en développement afin de réduire les facteurs de risque et la charge de morbidité bucco-dentaire et d'améliorer les systèmes de santé bucco-dentaire et l'efficacité

des programmes communautaires. Il faudrait notamment consacrer davantage de recherches aux aspects suivants: les inégalités en matière de santé bucco-dentaire; les répercussions psycho-sociales de la santé ou de la maladie bucco-dentaire; l'alimentation, la nutrition et la santé bucco-dentaire; les programmes de sevrage tabagique; les relations entre santé bucco-dentaire, état de santé générale et qualité de vie; et le VIH/SIDA.

Le renforcement des capacités de recherche est l'une des stratégies les plus efficaces, les plus rentables et les plus durables pour permettre aux pays en développement de profiter des progrès des connaissances, en particulier à travers la promotion de réseaux régionaux et inter-pays de recherche en santé bucco-dentaire. Le Programme OMS de Santé Bucco-Dentaire entend favoriser la recherche effectuée dans ce domaine pour, avec et par les pays en développement, de plusieurs façons:

* En soutenant les initiatives susceptibles de renforcer les moyens de recherche des pays en développement, de sorte que la recherche soit reconnue comme le fondement d'une politique de santé bucco-dentaire;

* En associant davantage les centres collaborateurs OMS pour la santé bucco-dentaire dans les domaines prioritaires de recherche dans le cadre des réseaux de centres nationaux, régionaux ou inter-régionaux;

* En encourageant les programmes de formation à la recherche en santé bucco-dentaire au niveau local ou sur la base de programmes concertés inter-universités;

* En offrant aux universités des pays en développement un accès aisé à la littérature scientifique sur la santé bucco-dentaire par un accès en ligne aux revues scientifiques;

* En réduisant l'écart 10/90 en matière de recherche en santé bucco-dentaire par une action dans le cadre du Forum mondial pour la recherche en santé (*49*). Ce forum aide à fixer les priorités, à diffuser les conclusions de la recherche et à mesurer les résultats afin de rompre le cercle vicieux de la maladie et de la pauvreté.

CONCLUSION

De mauvaises habitudes alimentaires, le tabagisme ou d'autres formes d'usage du tabac, la consommation d'alcool et le stress sont parmi les facteurs de risque communs à de nombreuses maladies non transmissibles, y compris des problèmes de santé bucco-dentaire. Le Programme mondial de santé bucco-dentaire occupe une place privilégiée au sein du Département Prévention des maladies non transmissibles et promotion de la santé (NPH) au Siège, afin de favoriser l'application d'une approche de prévention de la maladie et de promotion de la santé fondée sur des facteurs communs de risque. Si les progrès en matière de santé bucco-dentaire ont été encourageants dans de nombreux pays au cours des dernières décennies, il reste encore beaucoup à faire. Il est donc important de pouvoir s'appuyer sur nos réalisations et sur des stratégies qui ont fait leurs preuves.

Les principes directeurs énoncés dans la Charte d'Ottawa pour la promotion de la santé (adoptée en 1986) constituent un bon point de départ pour cette action, tout en reconnaissant les conditions préalables à la santé et au bien-être. Depuis, un certain nombre de faits nouveaux ont montré l'importance des stratégies de promotion de la santé, et notamment l'importance d'une politique publique favorable à la santé (Conférence d'Adélaïde, 1988) et de milieux favorables à la santé (Sundsvall, 1991). La Conférence de Jakarta de 1997 a réaffirmé les cinq principaux domaines d'action de la Charte comme étant les stratégies d'avenir devant ouvrir la voie à la promotion de la santé au XXI^{e} siècle.

Certains pays devraient réorienter leurs investissements en matière de santé pour tenir compte des besoins différents d'une population diverse. Des politiques publiques favorables à la santé sont fondamentales pour améliorer l'accès aux soins, promouvoir l'équité et créer des environnements propices. La responsabilité de l'Etat en matière de santé peut être la force motrice du changement, et un élément vital dans la promotion de politiques publiques favorables à la santé. Afin de forger des partenariats efficaces pour le développement sanitaire et constituer des alliances, un engagement local, national et mondial est indispensable.

Le présent rapport met en lumière les domaines prioritaires du Programme mondial de santé bucco-dentaire et offre un cadre d'exécution. Les bureaux régionaux jouent un rôle important à cet égard. La contribution spécialisée des centres collaborateurs OMS est essentielle, de même que le soutien des ONG. Une bonne communication et des mesures concertées sont aussi déterminantes. Par son action et moyennant des investissements, le Programme mondial de santé bucco-dentaire contribuera à instaurer l'équité en matière de santé bucco-dentaire et à construire ainsi un avenir meilleur.

BIBLIOGRAPHIE

1. Organisation mondiale de la Santé. Rapport sur la santé dans le monde 2002 – Réduire les risques et promouvoir une vie saine. Genève: Organisation mondiale de la Santé, 2002.

2. Grossi SG, Genco RJ. Periodontal disease and diabetes mellitus: a two-way relationship. Ann Periodontol 1998; 3:51-61.

3. Organisation mondiale de la Santé. Global Oral Health Data Bank. Genève: Organisation mondiale de la Santé, 2002.

4. Organisation mondiale de la Santé. WHO Oral Health Country/Area Profile. (Disponible sur internet à l'adresse suivante: http://www.whocollab.od.mah.se/index.html).

5. Albander JM, Brown LJ, Löe H. Clinical features of early-onset periodontitis. Journal of the American Dental Association 1997; 128: 1393-9.

6. Tomar SL, Asma S. Smoking attributable periodontitis in the United States: findings from NHANES III. Journal of Periodontology 2000; 71: 743-51.

7. U.S. Department of Health and Human Services. Oral Health in America: A Report of the Surgeon General. Rockville, Maryland (Etats-Unis d'Amérique) : U.S. Department of Health and Human Services, National Institute of Dental and Craniofacial Research, National Institute of Health, 2000.

8. Steward BW, Kleihues P. World Cancer Report. Lyon (France): Centre international de Recherche sur le Cancer de l'OMS, 2003.

9. Organisation mondiale de la Santé. Health Situation in the South-East Asia Region 1998-2000. New Delhi: Bureau régional OMS de l'Asie du Sud-Est.

10. Pindborg JJ. Selected and Annotated Bibliography on Oral Manifestations of the HIV Infection 1981-1987. Copenhague (Danemark): WHO Collaborating Centre for Oral Manifestations of the HIV infection, 1990.

11. Andreasen JO, Andreasen FM. Dental trauma. In: Pine C. Community Oral Health. Londres: Elsevier Science Limited, 2002. P. 94-9.

12. Chen M et al. Comparing Oral Health Systems. A Second International Collaborative Study. Genève: Organisation mondiale de la Santé, 1997.

13. Shaw. Dentofacial irregularities. In: Pine C. Community Oral Health. Londres : Elsevier Science Limited, 2002: 104-11.

14. Organisation mondiale de la Santé. Global Strategies to Reduce the Health Care Burden of Craniofacial Anomalies. Genève : Organisation mondiale de la Santé, 2002.

15. Yee R, Sheiham A. The burden of restorative dental treatment for children in third world countries. International Dental Journal 2002; 52: 1-9.

16. Organisation mondiale de la Santé. Enquêtes sur la santé bucco-dentaire : méthodes fondamentales. Quatrième édition. Genève: Organisation mondiale de la Santé, 1998.

17. Fédération dentaire internationale. Organisation mondiale de la Santé. Global goals for oral health in the year 2000. International Dental Journal 1982; 23: 74-7.

18. Cohen L, Gift H. Disease Prevention and Oral Health Promotion. Socio-dental Sciences in Action. Copenhague (Danemark): Munksgaard, 1995.

19. Organisation mondiale de la Santé. Children in the New Millennium. Environmental Impact on Health. Genève: Organisation mondiale de la Santé, 2002.

20. Conférence des Nations Unies sur l'environnement et le développement. Agenda 21. Sommet de Rio, Rio de Janeiro, Brésil, 1992.

21. Organisation mondiale de la Santé. Fluorures et santé bucco-dentaire. Rapport d'un Comité OMS d'experts sur la santé bucco-dentaire et l'utilisation des fluorures. Genève: Organisation mondiale de la Santé, 1994 (OMS, Série de Rapports techniques N° 846).

22. Adyatmaka A et al. School-based Primary Preventive Programme for Children. Affordable Toothpaste as a Component in Primary Oral Health Care. Genève: Organisation mondiale de la Santé, 1998. (Document non publié WHO/NCD/ORH/AFFORDABLE/97.3).

23. Régime alimentaire, nutrition et prévention des maladies chroniques. Rapport d'une Consultation OMS/FAO d'experts. Genève: Organisation mondiale de la Santé, 2003 (OMS, Série de Rapports techniques, N° 916).

24. Machay J, Eriksen M. The Tobacco Atlas. Genève: Organisation mondiale de la Santé, 2002.

25. Johnson NW, Bain C. Tobacco and oral disease. EU-Working Group on Tobacco and Oral Health. British Dental Journal 2000; 189: 200-6.

26. Reibel J. Tobacco and oral diseases: an update on the evidence, with recommendations. Medicine Principle Practices 2003; 12 (suppl 1): 22-32.

27. Organisation mondiale de la Santé. Programmes nationaux de lutte contre le cancer : politiques et principes gestionnaires : résumé d'orientation. Genève: Organisation mondiale de la Santé, 2002.

28. Organisation mondiale de la Santé. The Status of School Health. Genève: Organisation mondiale de la Santé, 1996. (Document non publié WHO/HPR/HEP/96.1).

29. Organisation mondiale de la Santé. Oral Health Promotion Through Schools. WHO Information Series on School Health. Document 11. Genève: Organisation mondiale de la Santé, 2003 (sous presse).

L'hygiène bucco-dentaire, de l'importance de la prévention

Une mauvaise hygiène bucco-dentaire est susceptible d'avoir des conséquences économiques, individuelles ou communautaires, et psychologiques mais aussi, bien évidemment, directement ou indirectement, sur la santé de la personne. D'où l'importance de donner, à l'officine, des conseils de prévention adaptés.

Seul le chirurgien-dentiste peut intervenir à tous les stades de la prévention de l'hygiène bucco-dentaire, notamment au stade tertiaire qui constitue l'élément essentiel de son art. Le stade secondaire de la prévention, qui concerne entre autres les conseils sur la prise de fluor, mais aussi la prévention des effets secondaires de certains médicaments, est du ressort du médecin, du pharmacien et du chirurgien-dentiste chez lequel les autres professionnels de santé doivent, si besoin, diriger leurs patients. Le stade primaire, quant à lui, concerne tout individu.

Un nettoyage régulier des dents permet d'éliminer la plaque dentaire contenant les bactéries responsables des différentes pathologies bucco-dentaires, d'éviter la mauvaise haleine et de garder des dents saines le plus longtemps possible en se protégeant du processus carieux et des maladies parodontales. Un germe se multiplie toutes les 20 minutes. Les bactéries trouvant, dans la bouche, les nutriments nécessaires pour se développer, la plaque dentaire se reforme seulement quelques minutes après la prise alimentaire. Pour cette raison, il est primordial de se brosser les dents après chaque repas.

Une bonne hygiène dentaire nécessite :
– des apports en fluor adéquats ;
– une alimentation de qualité ;
– un nettoyage régulier avec un matériel adapté.

Des apports en fluor adéquats

Les fluorures jouent un rôle essentiel dans la prévention des caries en renforçant l'émail. En effet, ils se fixent sur l'émail et ralentissent sa déminéralisation en consolidant la couche superficielle (qui devient plus résistante à l'attaque acide des aliments). Ils favorisent aussi la reminéralisation de l'émail par précipitation de complexes fluorophosphatés dans les lésions de déminéralisation. Ils peuvent aussi obturer les tubules dentinaires exposés et soulager ainsi l'hypersensibilité dentinaire. De plus, à forte dose, ils possèdent une action bactériostatique. Il ne faut cependant pas ingérer de trop fortes doses de fluor pendant la phase de minéralisation de l'émail des dents car un risque de fluorose avec des altérations de l'émail (apparition de taches blanches et fragilisation de l'émail) existe. La toxicité chronique du fluor se manifeste aussi à plus forte dose, par de l'ostéosclérose, un retard de croissance, des altérations rénales… Il faut surtout rester vigilant face aux cumuls des apports (dentifrices, sels, eaux, supplémentation médicamenteuse).

Une alimentation de qualité

Il existe une corrélation directe entre l'alimentation et les problèmes carieux. L'impact des aliments cariogènes dépend plus de la fréquence de leur consommation que de la quantité totale ingérée pendant le repas. Les aliments riches en sucres accentuent la production d'acides par les bactéries.

La salive favorise, quant à elle, la précipitation de complexes minéraux à la surface amélaire grâce aux ions qu'elle contient. Elle possède, par ailleurs, une action antibactérienne grâce aux enzymes (lysosyme) et aux immunoglobulines salivaires. Son débit assure donc un autonettoyage. Ainsi, si on fait de nombreux petits repas, l'action de la salive est limitée dans le temps. En conclusion, le "grignotage" est à éviter. Il est en revanche conseillé de boire un litre d'eau par jour pour stimuler les glandes salivaires.

Apports de fluor, recommandation de l'Agence française de sécurité sanitaire des produits de santé (Afssaps, 2008)

• **Chez l'enfant de moins de 6 mois :** prescription inutile de fluor systémique.

• **Chez l'enfant de plus de 6 mois :**

– l'usage des fluorures par voie orale doit être modulé en fonction du risque de carie chez l'enfant : grignotage, consommation de boissons sucrées, etc. ;

– quel que soit le risque carieux de l'enfant (bas ou haut risque), le brossage des dents avec un dentifrice fluoré est recommandé au minimum 2 fois/jour. Le dentifrice doit avoir une teneur en fluor adaptée à l'âge de l'enfant ;

– si l'enfant est à haut risque, la supplémentation en fluorures se réalise par voie orale (comprimés ou gouttes) à la posologie de 0,05 mg de fluor/jour/kg sans dépasser 1 mg par jour en raison du risque de fluorose.

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• **Chez l'enfant**

Alimenter l'enfant au sein fait partie de la prévention : le nourrisson se constitue ainsi son capital osseux et dentaire, les muscles faciaux de la mâchoire se développent et ses dents sont mieux alignées. Par ailleurs, mastiquer soigneusement plutôt qu'avaler rapidement favorise le bon développement de l'appareil masticateur et osseux, et évite les malpositions ultérieures des dents qui nécessitent des traitements orthodontiques. La carie étant une maladie infectieuse due à *Streptococcus mutans,* il est conseillé d'éviter de lécher les doigts de l'enfant ou de partager ses couverts pour goûter les aliments. Enfin, il est recommandé d'éviter de laisser aux bébés un biberon de lait ou de jus de fruit au coucher (seule l'eau est sans risque dans ce cas). En effet, ce genre de situation répétée régulièrement peut être à l'origine de caries rampantes des incisives particulièrement difficiles à traiter. Pour la même raison, enduire la sucette de sucre et la remettre en bouche plusieurs fois par jour peut également être à l'origine de productions acides répétées créant des lésions carieuses localisées.

• **Chez l'adulte jeune**

La nature du produit et sa composition chimique préviennent ou accentuent les caries. Ainsi, le chocolat fond dans la bouche, s'élimine rapidement et apporte des tanins, du fluor et des phosphates protecteurs. Le fromage augmente la sécrétion de salive et apporte du calcium et du phosphore utiles à la minéralisation de l'émail. Enfin, la vitamine E, anti-oxydante, renforce la gencive. En revanche, le riz a un effet acidifiant et les aliments trop cuits provoquent une baisse de la mastication. Une consommation trop fréquente de sucre et un temps de contact long avec les dents favorisent également les caries. Les chips, par exemple, riches en sucres métabolisables par les bactéries cariogènes, collent aux dents et prolongent le contact sucre/acide/dent. Certains bonbons combinent un double risque : teneur en sucre importante et acidité très forte provoquant déminéralisation des surfaces amélaires. En cas de vomissements ou de reflux gastro-œsophagien, riches en acide gastrique qui attaque l'émail, il est recommandé de se rincer la bouche avec du bicarbonate et de l'eau et d'éviter un brossage dans les 30 minutes suivant le vomissement.

Choisir les bons aliments

Il faut préférer les aliments complets aux aliments raffinés pauvres en vitamines et sels minéraux.

Un matériel adapté

• **Les brossettes interdentaires** (mieux vaut éviter les cure-dents responsables d'irritations) permettent de déloger les résidus alimentaires coincés et la plaque dentaire accumulée dans les espaces interdentaires. Les brossettes en cônes doivent être préférées au niveau des molaires et les cylindriques au niveau des incisives alors que les triangulaires s'adaptent parfaitement à tous les espaces interdentaires.

• **Le fil dentaire** brut ou ciré, mentholé, voire enrichi en fluor nettoie, en complément du brossage, les surfaces interproximales des dents.

• **Des jets dentaires ou hydropropulseurs** éliminent les résidus alimentaires et massent la gencive.

• **Un dentifrice spécifique**, adapté aux caries (fluoré), gencives (antiseptique/anti-inflammatoire) ou dents sensibles (obturant des tubules ou désensibilisant), doit être utilisé.

• **Une brosse à dents électrique** peut être utilisée à partir de l'âge de six ans mais il ne faut pas oublier qu'hâtivement employée, elle sera moins efficace qu'une brosse à dents manuelle utilisée minutieusement.

• **Une brosse à dents manuelle de qualité** doit être sélectionnée en fonction du degré d'inflammation gingivale, de la sensibilité dentinaire, du type d'espace interdentaire et de la dextérité de l'utilisateur. Elle doit être adaptée à la main de la personne (enfant, adulte). Sa tête, petite de préférence, doit posséder des poils souples ou médium en nylon avec des extrémités arrondies (ou extrémités microfines). Les poils durs sont déconseillés car ils créent des micro-abrasions lors des frottements, abîment la gencive et nettoient moins bien que des poils souples ou médium.

Un nettoyage régulier

Il faut bien comprendre que le brossage a pour objectif d'éliminer la plaque dentaire qui apparaît quelques heures seulement après la fixation de la bactérie sur son support. En effet, après dépôt de glycoprotéines salivaires à la surface dentaire, les premières bactéries dites colonisatrices se fixent quasi immédiatement. Puis, progressivement, d'autres espèces bactériennes adhèrent. Après plusieurs heures, les colonies

bactériennes s'organisent en biofilm bactérien gélatineux et adhésif. Ce biofilm s'enrichit progressivement de bactéries provoquant l'irritation des gencives et peut progresser dans le tissu et créer des poches parodontales entre la gencive et la dent. Grâce aux ions minéraux de la salive, cet enduit gélatineux va se minéraliser au bout de quelques jours et devenir très dur et très fortement fixé à la dent : c'est le tartre.
À ce stade, il est inutile de frotter ou d'appuyer la brosse fortement : seul le dentiste peut éliminer le tartre par nettoyage professionnel ou détartrage (avec ultrasons ou curette spéciale). C'est d'ailleurs la raison pour laquelle on recommande une visite par an (sinon plus) chez son dentiste pour y effectuer un contrôle général et un détartrage. Cela fait partie de la prévention.
Le brossage est un geste de prévention essentiel pour préserver la santé des dents dès le plus jeune âge. Il requiert un certain savoir-faire :
– se laver les mains avant le brossage et prendre uniquement sa brosse à dents (pas d'échange) ;
– ne pas mouiller la brosse pour éviter que le dentifrice déposé sur les brins ne se dilue et perde de son efficacité ;
– prendre en main la brosse à dents selon la méthode "au stylo", entre le pouce et l'index, particulièrement conseillée pour ceux qui appuient fortement sur le manche en écrasant les poils de la brosse et, de ce fait, annulent l'effet recherché. La prise dite "à la paume", comme le font les enfants, permet, quant à elle, de tenir fermement la manche. Elle est conseillée aux personnes qui appuient doucement sur le manche car elle permet une meilleure maîtrise des mouvements ;
– procéder toujours de la même façon afin d'acquérir un automatisme, par exemple brosser d'abord le maxillaire inférieur, puis le supérieur. On nettoie la partie intérieure des dents en partant des molaires de gauche pour aller vers la droite, là où le nettoyage est le plus difficile. Puis, on dirige les mouvements sur la partie externe des dents en revenant de droite à gauche.

• **Le nettoyage des faces occlusales** (les surfaces qui mastiquent) s'effectue avec trois ou quatre mouvements de va-et-vient, de droite à gauche, par groupe de deux dents.

• **Le nettoyage des faces proximales** (côtés des dents) externes ou internes s'opère en brossant les dents de façon douce en respectant les techniques suivantes :
– technique du "rouleau" pour brosser les dents et les gencives. Elle consiste à placer la brosse contre le sillon gingival à 45 degrés et, avec la torsion du poignet, effectuer un mouvement de balayage de la gencive vers la dent, du "rouge vers le blanc", ce qui n'est pas toujours facile ;
– technique de Bass modifiée qui consiste à positionner la tête de la brosse à 45 degrés au niveau du sillon gingivo-dentaire, tête de la brosse inclinée du haut vers le bas (gencive), et à pratiquer quelques petits mouvements en secousses le long de la même dent pendant 10 secondes, puis à déplacer la tête de la brosse vers une dent contiguë ;
– technique de Charter, similaire à la précédente, la tête de la brosse étant positionnée à 45 degré, mais les poils de la tête sont dirigés vers le haut (vers les dents) ; il est également possible d'effectuer de petits mouvements circulaires.

• **Le nettoyage des incisives** s'effectue en plaçant la brosse à dents perpendiculairement derrière les dents de façon à sentir les brins sur le bord de la gencive, ce qui prévient le réflexe nauséeux qui se déclenche si la brosse à dents est trop enfoncée.
Cependant, les spécialistes diront que la technique est moins importante que l'objectif qui est le nettoyage de toutes les surfaces dentaires. Pourtant, certaines techniques sont plus efficaces que d'autres. À chacun, en fonction de sa dextérité, d'adopter celle qui lui permet d'obtenir un résultat optimal et prolongé sans endommager la gencive ni la surface de l'émail. ■

Au comptoir, l'essentiel du conseil bucco-dentaire

• Brosser les dents minutieusement, 3 fois par jour (après chaque repas), avec une brosse à dents souple ou médium et un dentifrice fluoré. Ne pas oublier les espaces interdentaires. Terminer par un rinçage soigneux mais pas forcément abondant.
• Respecter le temps de brossage de 3 minutes, nécessaire pour nettoyer toutes les surfaces dentaires, mais aussi pour permettre aux actifs contenus dans le dentifrice d'agir.
• Renouveler sa brosse à dents au moins tous les 3 mois ou plus souvent si elle est abîmée.
• Si les gencives saignent, utiliser une brosse souple et des dentifrices contenant des antiseptiques/anti-inflammatoires appropriés mais ne jamais stopper les brossages.
• Effectuer une visite annuelle chez le dentiste afin de contrôler denture et gencives, et d'effectuer un détartrage.
• Si des collets sont dénudés, utiliser une brosse à dents souple et un dentifrice peu abrasif pour limiter les risques d'abrasion.
• En cas d'hypersensibilité dentinaire (douleur au chaud ou au froid), utiliser une brosse à dents souple et un dentifrice fluoré ou contenant un désensibilisant (potassium) ou un obturant des tubules dentinaires (strontium, fluorure d'amines).
• Ne pas utiliser quotidiennement des bains de bouche type chlorhexidine, hexetidine, peroxyde d'hydrogène sur une longue période. Préférer des bains de bouche fluorés ou contenant des antiseptiques utilisables au long cours.
• Brosser les dents après la prise de granules homéopathiques, de pastilles, de sirops, notamment le soir avant le coucher.

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L'état buccodentaire comme miroir de la santé : l'enfant pauvre de la médecine de premier recours ?

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La santé buccodentaire (SBD) est indissociable de la santé générale. Plusieurs études ont montré un lien entre la morbi-mortalité, en particulier cardiovasculaire, et la mauvaise SBD, surtout en cas d'édentement. Malheureusement, une partie de la population renonce aux soins dentaires faute de moyens. Le médecin de premier recours (MPR), comme professionnel de santé le plus souvent et intensément en contact avec les patients, joue un rôle important pour renforcer les mesures de prévention, de maintien de la SBD et de dépistage de pathologies buccales. Pour mener à bien cette mission, il se doit de se former à l'examen endobuccal. De plus, tant le MPR que le médecin-dentiste doivent être proactifs dans la construction d'une approche interprofessionnelle de la santé buccodentaire du patient.

Bucco-dental state as the mirror of health : the primary care medicine's poor relative ?
Oral health (OH) is indivisible from general health. Several studies have established the link between morbi-mortality, especially cardiovascular, and bad OH, particularly in the case of edentation. Regrettably, part of the population choses dental care renunciation for financial reasons. The primary care physician (PCP), as the health professionnal with the most frequent and intense contacts with the patients, plays an important role to reinforce prevention measures, OH maintenance and to detect oral pathologies. To fulfill this mission, he has to be trained to endo-buccal examination. Furthermore, both the PCP and the dentist have to proactively build an interprofessional approach to promote patients' OH.

INTRODUCTION

La médecine basée sur les preuves établit un lien toujours plus probant entre la santé buccodentaire (SBD) et la santé en général. Nous allons aborder les aspects de quelques pathologies de la sphère buccale, dont la prise en charge implique tant le médecin de premier recours (MPR) que le médecin-dentiste. Une SBD altérée peut avoir des conséquences locales (figure 1) et systémiques (malnutrition, infections systémiques, problèmes cardiovasculaires, complications obstétricales…) potentiellement sévères. Plusieurs études ont également montré l'importance du dépistage précoce d'un cancer de la cavité buccale.[1] Une étude menée en 2008 et 2009 à Genève montre que 14,5% de la population renonce à des soins pour des raisons économiques, même s'ils en ressentent le besoin ; 75% d'entre eux ont renoncé à des soins dentaires.[2]

Le médecin de premier recours (MPR) est le professionnel de santé le plus en contact avec la population.[3] Il peut donc jouer un rôle primordial pour sensibiliser ses patients à l'application de mesures préventives de SBD, dépister les patients à risque et les inciter à un suivi régulier auprès d'un dentiste. Le présent article a pour objectif d'illustrer ce type d'interventions.

SANTÉ BUCCODENTAIRE, SANTÉ GÉNÉRALE ET STATUT SOCIAL

On ne peut dissocier la santé générale et la SBD. La bouche représente un miroir de la santé ou de la maladie. Véritable sentinelle, c'est un système d'alerte, voire un modèle accessible pour l'étude des autres organes. Elle peut être à la fois une source potentielle et le reflet d'une pathologie systémique.[4]

Plusieurs études prospectives révèlent un lien entre la morbi-mortalité et la mauvaise SBD (tableau 1), notamment une étude prospective suédoise établissant, sur la base du suivi d'une cohorte durant douze ans, une association significative entre un status dentaire caractérisé par un nombre de dents inférieur à dix et une *mortalité augmentée, toutes causes confondues,* comparativement aux personnes ayant plus de vingt dents.[5] Une association similaire a été démontrée au Japon dans une population de personnes âgées.[6]

Figure 1. Atteinte à la santé buccodentaire

Plaque dentaire, tartre, polycarie, parodontite, coexistant dans la même bouche; ici, patient issu d'une population vulnérable (détenu).

L'état buccodentaire, notamment la perte de dents, est corrélé aux *gradients sociaux*. Une étude menée aux Etats-Unis entre 1988 et 1994 met en évidence l'association entre la qualité de la SBD, le revenu, ainsi que le niveau de formation, au même titre que les pathologies cardiovasculaires.[7] En Suisse, un groupe de recherche a démontré que la santé buccale des personnes issues de groupes socio-économiquement défavorisés est plus altérée que celle des groupes favorisés, ceci s'observant dans toutes les tranches d'âges.[8] Or, les personnes se situant au bas de l'échelle sociale sont précisément celles qui renoncent le plus aux soins dentaires pour des raisons financières. Cependant, une étude au Canada, ayant investigué l'association entre le niveau socio-économique et la sévérité des caries dentaires, révèle qu'un accès à une assurance universelle pour les soins dentaires ne gomme pas à elle seule toutes les disparités en termes de status dentaire.[9] En Suède, Wamala démontre que le manque d'accès aux soins dentaires explique 60% des disparités constatées entre personnes défavorisées et favorisées, les facteurs liés au style de vie étant responsables d'environ 29% des disparités.[10]

SANTÉ BUCCODENTAIRE ET RISQUE CARDIO-VASCULAIRE

Il est probable que la *mauvaise hygiène buccale* reflète globalement une mauvaise hygiène de vie. Le simple fait de brosser irrégulièrement ses dents est associé à un doublement du risque d'événements cardiovasculaires (tableau 1) également après correction pour les facteurs de risque traditionnels.[11] Une méta-analyse de 2008 confirme l'*augmentation du risque cardiovasculaire en cas de maladie parodontale*. Le mécanisme possible pourrait être celui d'une inflammation chronique, en particulier en cas de maladie parodontale avec CRP augmentée, ce marqueur étant un facteur prédictif significatif de risque de survenue d'événements cardiovasculaires.[12]

Concernant l'*édentation*, l'étude suédoise précédemment citée a montré une relation entre le nombre de dents manquantes et la mortalité toutes causes confondues; cette relation est aussi significative pour la *mortalité* d'étiologie spécifiquement *cardiaque*, en particulier d'origine coronarienne.[5] Une étude cas-contrôle japonaise montre une association significative entre la perte précoce de dents et la survenue d'un AVC.[13]

PERSONNES ÂGÉES

Les atteintes à la SBD touchent une proportion importante des patients en âge gériatrique. Nombre d'entre eux n'ont pas bénéficié de mesures préventives et ont perdu leurs dents très tôt.

L'Organisation mondiale de la santé a publié en 1986 un rapport indiquant un édentement total de 20-30% des Suisses de plus de 65 ans.[14] Une mauvaise santé buccodentaire au sein de la population âgée a un impact négatif sur la nutritition, contribue à une diminution de la qualité de vie, ainsi qu'à une augmentation de la mortalité et de la morbidité, surtout cardiovasculaire.[15-17]

En institution, les soins sont principalement dispensés par des MPR, des infirmières et des aides-soignantes; les dentistes sont plus rarement impliqués. L'évolution des pathologies dentaires peut être très rapide et les patients gériatriques atteints de troubles cognitifs n'ont souvent plus conscience de l'importance de l'hygiène buccale, utilisent moins les services dentaires et ont de la difficulté à se plaindre de douleurs ou d'impotence dentaire.[17] Au sein de ces populations institutionnalisées, une hygiène buccale déficiente, une dentition négligée, un manque de dextérité et une prescription d'antibiotiques au long cours sont des facteurs favorisant la broncho-aspiration de bactéries de la sphère buccale.[15] Pour cette raison, les soignants doivent être rendus attentifs et instruits à prendre soin de la sphère buccale des résidents.

Tableau 1. Risque cardiovasculaire et santé buccodentaire: associations significatives
SBD: santé buccodentaire; RR: risque relatif; CV: cardiovasculaire.

Paramètre de SBD	RR	IC 95%	p	Critères de jugement	Références
Brossage de dents < 1 x/jour	1,8	1,3-2,4	<0,001	Evénement CV	11
Parodontite	1,24 à 1,34	1,01-1,51 1,10-1,63		Evénement CV	12
Edentation (≤ 10 dents restantes, comparé à > 20 dents)	2,68	1,96-3,67	<0,0001	Mortalité toutes causes confondues	5
Edentation (≤ 10 dents restantes, comparé à > 25 dents)	4,4	2,47-7,85	<0,0001	Mortalité CV	5
Edentation (≤ 10 dents restantes, comparé à > 25 dents)	9,43	4,41-20,17	<0,0001	Mortalité coronarienne	5
Edentation précoce des quinquagénaires et sexagénaires			<0,05	AVC	13

COLLABORATION MÉDECIN DE PREMIER RECOURS ET MÉDECIN-DENTISTE

Plusieurs pathologies justifient une collaboration renforcée entre le médecin-dentiste et le MPR. La parodontite et l'ostéonécrose, associées respectivement au diabète et aux bisphosphonates, en sont des exemples illustratifs, tout comme l'attitude face au tabac.

Le diabète augmente la prévalence et la sévérité de la parodontite, qui est reconnue comme la sixième complication (en fréquence) du diabète. La relation entre ces pathologies est bidirectionnelle, plusieurs études démontrant que le traitement de la parodontite améliore le contrôle des glycémies. La mortalité par néphropathie diabétique est 8,5 fois plus élevée (après ajustement pour l'âge, le sexe et la durée du diabète) chez les diabétiques avec une maladie parodontale sévère, comparativement aux diabétiques au parodonte sain.[18]

L'ostéonécrose du maxillaire et de la mandibule associée à la prescription de bisphosphonates représente l'exemple le plus récent d'une indispensable collaboration entre MPR et professionnels de soins dentaires.[15] Les recommandations découlant d'une enquête auprès des médecins et médecins-dentistes suisses soulignent l'importance de ces mêmes acteurs de santé par leur rôle d'information et de dépistage précoces de cette complication. Le médecin-dentiste doit disposer de compétences qui ne sont pas forcément innées : l'anamnèse médicale doit préciser l'existence d'ostéoporose ou d'antécédent de cancer, l'ostéonécrose pouvant survenir plusieurs années après la prescription du facteur déclencheur. De plus, le terme «bisphosphonate» est rarement connu par le patient qui en bénéficie, les appellations commerciales (Fosamax, Zometa…) ne le laissant pas deviner.[19]

Une enquête menée en Ile-de-France en 2008 auprès de MPR et de chirurgiens-dentistes a révélé que les MPR souhaitent faire évoluer la communication avec leurs collègues dentistes, par exemple par l'intermédiaire d'un dossier médical partagé au sein d'un réseau de santé.[20] Une étude anglaise de 1999, évaluant l'utilité d'un dossier médico-dentaire intégré détenu par le patient, révèle qu'aussi bien les dentistes (87%) que les MPR (68%) soutiennent l'idée d'un tel document.[21]

L'influence négative du tabac sur la SBD est indiscutable et les répercussions incluent perturbations de la cicatrisation, affections parodontales et carcinomes de la cavité buccale. Dans ce contexte, la Société suisse des médecins-dentistes a effectué une campagne de sensibilisation afin de soutenir le rôle actif du médecin-dentiste dans la lutte antitabac.[22]

RÔLE DU MÉDECIN DE PREMIER RECOURS

Dans la gestion de la SBD, le MPR est surtout sollicité par les patients souffrant d'affections stomatologiques avancées et parfois aiguës (par exemple : en cas d'abcès dentaire). Généralement, il conseille à son patient de s'adresser à un dentiste ou stomatologue, après avoir parfois initié un traitement symptomatique et/ou antibiotique.[23]

Au-delà de ces situations, le MPR a un rôle proactif à jouer pour la prévention. La SBD influence le risque cardiovasculaire, le pronostic cognitif, la qualité de vie et la mortalité. Certaines maladies et médicaments l'affectent directement et ces implications doivent être anticipées et dépistées. Le MPR est aussi un témoin privilégié du lien entre niveau socio-économique et renoncement aux soins dentaires pour des raisons financières, et pourrait tenir un rôle pour plaider en faveur d'un accès facilité.

Un examen clinique succinct de la sphère buccodentaire n'est pas suffisant (figures 2 et 3). L'anamnèse ciblée doit être complétée d'un examen endobuccal complet et structuré permettant même le diagnostic précoce d'un cancer de la cavité buccale. Toute lésion suspecte doit être réévaluée après 2-3 semaines et un spécialiste doit être consulté au moindre doute.[24] En effet, le principal facteur de retard diagnostique des cancers de la cavité orale est constitué par la banalisation d'une lésion précoce non seulement par le patient, mais aussi par le médecin traitant et le dentiste.[25]

Des interventions motivationnelles dans l'objectif d'améliorer l'hygiène buccale (brosse à dents et dentifrice adéquats, rôle du rinçage de bouche et du fluor), diminuer le tabac et encourager le suivi par un dentiste (sans qu'un consensus n'existe sur le plan international quant à sa fréquence optimale) sont potentiellement riches en effet.

CONCLUSION

La santé buccodentaire est intimement liée au reste de la santé des patients. Or, l'accès aux soins dentaires en Suisse est moins bien garanti que pour les autres spécialités, en l'absence de participation financière par le système d'assurance-maladie. Pourtant, la proportion de la popula-

Figure 2. Bouche d'un patient vue de face
Plaque dentaire, tartre, gingivite avec récession gingivale.

Figure 3. Bouche de la figure 2, examen endobuccal
Seules les dents antérieures semblent encore saines.

tion affectée par un risque dentaire accru (âge, difficultés socio-économiques, surpoids, diabète, autres comorbidités complexes) augmente.

Pour ces raisons, le MPR a un important rôle à jouer pour renforcer les mesures de prévention et de maintien de la SBD, ainsi que pour dépister les problèmes et encourager les patients à consulter un dentiste pour les pathologies identifiées ainsi que pour un contrôle périodique. L'enjeu est important puisqu'il influence même la mortalité. Les compétences cliniques des MPR doivent également être favorisées par l'enseignement pré- et postgradué, en particulier en ce qui concerne la pratique de l'examen endobuccal, ainsi que dans l'instruction de mesures d'hygiène buccodentaire élémentaires. De plus, tant les MPR que les dentistes se doivent d'être proactifs dans la circulation d'informations de santé concernant leurs patients communs, dans l'intérêt de chacun des trois pôles: patient, médecin-dentiste et MPR.

Pour viser une meilleure prise en charge des pathologies buccodentaires et une amélioration du niveau de soins, plusieurs axes doivent être privilégiés: un accès aux soins dentaires facilité, particulièrement pour les personnes les plus défavorisées, et un renforcement de la formation des professionnels de santé dans ce domaine, qui devrait comporter un volet soulignant l'importance de la communication et de l'interprofessionnalité.

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Implications pratiques

- La précarité est associée à un état buccodentaire déficient ainsi qu'à un renoncement aux soins dentaires
- Le médecin traitant est un témoin privilégié de l'état buccodentaire de la population. L'examen endobuccal par ses soins peut aussi permettre le diagnostic précoce de lésions néoplasiques débutantes
- L'édentation est associée à une mortalité augmentée, principalement d'origine cardiovasculaire
- Le partage d'informations et de connaissances entre médecins de premier recours et médecins-dentistes est primordial

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Bibliographie

1 Sciubba JJ. Oral Cancer: The importance of early diagnosis and treatment. Am J Clin Dermatol 2001;2: 239-51.
2 Wolff H, Gaspoz JM, Guessous I. Health care renunciation for economic reasons in Switzerland. Swiss Med Weekly 2011;141:w13165.
3 Green LA, Fryer GE, Yawn BP, Lanier D, Dovey SM. The ecology of medical care revisited. N Engl J Med 2001;344:2021-5.
4 US Department of Health and Human Services. Oral Health in America: A Report of the surgeon general – Executive summary. Rockville, MD: US Department of health and human services, National institute of dental and craniofacial research, National institutes of health. 2000.
5 Holmlund A, Holm G, Lind L. Number of teeth as a predictor of cardiovascular mortality in a cohort of 7,674 subjects followed for 12 years. J Periodontol 2010; 81:870-6.
6 Ansai T, Takata Y, Soh I, et al. Relationship between tooth loss and mortality in 80-year-old Japanese community-dwelling subjects. BMC Public Health 2010;10: 386.
7 Sabbah W, Tsakos G, Chandola T, Sheiham A, Watt RG. Social gradients in oral and general health. J Dent Res 2007;86:992-6.
8 * Madrid C, Abarca M, Pop S, et al. Santé buccale: déterminants sociaux d'un terrain majeur des inégalités. Rev Med Suisse 2009;5:1946-51.
9 Ismail AI, Sohn W. The impact of universal access to dental care on disparities in caries experience in children. J Am Dent Assoc 2001;132:295-303.
10 Wamala S, Merlo J, Boström G. Inequity in access to dental care services explains current socioeconomic disparities in oral health: The Swedish national surveys of public health 2004-2005. J Epidemiol Community Health 2006;60:1027-33.
11 ** de Oliveira C, Watt R, Hamer M. Toothbrushing, inflammation, and risk of cardiovascular disease: Results from Scottish health survey. BMJ 2010;340:c2451.
12 ** Humphrey LL, Fu R, Buckley DI, Freeman M, Helfand M. Periodontal disease and coronary heart disease incidence: A systematic review and meta-analysis. J Gen Intern Med 2008;23:2079-86.
13 Yoshida M, Murakami T, Yoshimura O, Akagawa Y. The evaluation of oral health in stroke patients. Gerodontology 2011; doi:10.1111/j.1741-2358.2011.00505.
14 OMS. Country profiles on oral health in Europe. Geneva: WHO, 1986.
15 Migliorati CA, Madrid C. The interface between oral and systemic health: The need for more collaboration. Clin Microbiol Infect 2007;13(Suppl. 4):11-6.
16 Holm-Pedersen P, Schultz-Larsen K, Christiansen N, Avlund K. Tooth loss and subsequent disability and mortality in old age. J Am Geriatr Soc 2008;56:429-35.
17 Takata Y, Ansai T, Soh I, et al. Cognitive function and number of teeth in a community-dwelling elderly population without dementia. J Oral Rehabil 2009;36: 808-13.
18 Watanabe K. Periodontitis in diabetics: Is collaboration between physicians and dentists needed? Dis Mon 2011;57:206-13.
19 Hurni V. Collaboration entre médecin et médecin-dentiste: l'exemple des bisphosphonates. Rev Med Suisse 2011;7:198-9.
20 Tenenbaum A, Folliguet M, Berdougo B, Hervé C, Moutel G. Improving the physician-dental surgeon relationship to improve patient care. Presse Med 2008; 37:564-70.
21 Jones R, McConville J, Mason D, et al. Attitudes towards, and utility of, an integrated medical-dental patient-held record in primary care. Br J Gen Pract 1999; 49:368-73.
22 Bornstein M. Altérations de la muqueuse buccale associées au tabagisme. Rev Mens Suisse Odontostomatol 2006:116.
23 * Madrid C, Bouferrache K, Moller P. Pourquoi voir un docteur? C'est un dentiste qu'il vous faut! Santé buccale et médecine de premier recours: quels enjeux? Rev Med Suisse 2006;2:2737-43.
24 Paleri V, Staines K, Sloan P, Douglas A, Wilson J. Evaluation of oral ulceration in primary care. BMJ 2010; 340:c2639.
25 Guggenheimer J. Factors delaying the diagnosis of oral and oropharyngeal carcinomas. Cancer 1989;64: 932-5.

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HABITUDES D'HYGIENE ORALE ET SITUATION DE LA CARIE DENTAIRE DES ETUDIANTS
Enquête auprès de 150 étudiants en résidence universitaire à Dakar - Sénégal

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I - INTRODUCTION

La carie dentaire est une maladie multi-factorielle où interviennent trois facteurs étiologiques la cario-susceptibilité des tissus dentaires, les glucides de l'alimentation et les microorganismes cariogènes (5) ; elle est classée par l'OMS parmi les quatre premiers fléaux mondiaux. Au cours du XXème siècle, la situation épidémiologique de la carie a évolué différemment dans le monde. Dans les pays industrialisés, la prévalence a sensiblement baissé (7) ; l'amélioration de la situation de la carie dentaire dans ces pays est attribuée à l'élévation du niveau de vie, à la généralisation des dentifrices fluorés et des moyens de prévention (4). Dans les pays en développement, de nombreuses études ont montré que la carie est en progression (7) ; en effet, malgré des valeurs absolues plus faibles que celles des pays développés, l'indice CAO est en nette progression. Cependant, ces résultats traduisent une situation globale.

Nous avons réalisé ce travail en milieu universitaire caractérisé par un niveau d'instruction élevé ; nous avons ciblé des étudiants vivant en résidence universitaire où ils bénéficient de conditions de vie favorables comparées à celles de la population globale.

Notre objectif dans ce travail est d'étudier d'une part les habitudes d'hygiène orale (instrument utilisé, fréquence et moment d'utilisation) et d'autre part la situation de la carie dentaire (niveau de risque carieux lié au taux d'accumulation à la plaque dentaire, taux de prévalence de l'atteinte carieuse, indice CAOD).

II - MATERIEL ET METHODES

L'étude a été réalisée à la cité universitaire de l'université Cheikh A. Diop de Dakar entre les mois de janvier et de juin 2000. Cette cité abrite un centre des œuvres universitaires doté d'un service médical et d'un cabinet dentaire.

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II.1. Matériel

II.1.1. Matériel d'étude
Trois fiches de recueil de données (en annexe) ont été confectionnées ; une fiche n°1 a été remise au patient pour recueillir les habitudes d'hygiène orale et deux autres remplies par le praticien au cours de l'examen clinique : une fiche n°2 pour évaluer la plaque accumulée et une fiche n°3 pour enregistrer les données nécessaires à la détermination de l'indice CAOD.

III.1.2. Population d'étude
Il s'agit d'étudiants sénégalais âgés de 18 à 32 ans vivant en résidence universitaire. Nous avons inclus ceux qui ont accepté après un entretien préalable sur les objectifs, de fournir les informations exactes sur le nombre de nettoyage quotidien de la bouche et sur le moyen instrumental utilisé ; ils ont accepté de se soumettre à un examen bucco-dentaire pour évaluer la plaque accumulée et déterminer l'indice CAOD. Afin de comparer les résultats dans les deux sexes et devant la difficulté de recruter plus de 75 étudiantes, nous avons limité le nombre d'étudiants à 150 : 75 hommes et 75 femmes ; le sex-ratio est de 1.

II 2 - Méthodes

II.2.1. Type d'étude
C'est une étude descriptive.

II.2.2 Recueil de données
Les habitudes d'hygiène ont été déterminées par enquête sur 4 jours. L'étudiant précise sur la fiche l'instrument utilisé et y note chaque moment de nettoyage. Les données relatives à la plaque et à l'indice CAO sont notées sur les fiches 2 et 3 par l'examinateur.

II.2.3 Analyse des données

II.2.3.1 Les habitudes de nettoyage de la bouche
Nous avons distingué ceux qui n'utilisent aucun moyen instrumental, ceux qui utilisent le bâtonnet frotte-dents,

ceux qui utilisent la brosse à dents et la pâte dentifrice.
Pour chaque instrument, nous avons calculé la proportion d'étudiants qui l'utilisent et le nombre de nettoyage quotidien. Ceux qui n'ont pas effectué de nettoyage un jour durant avec en moyenne moins d'un nettoyage par jour sont classés « nettoyage irrégulier «.

II.2.3.2 La situation de la carie dentaire
Pour analyser la situation de la carie dentaire, nous avons déterminé : le niveau de risque carieux lié à l'accumulation de la plaque dentaire, le taux de prévalence de la carie dentaire et l'indice CAOD. Ces différents paramètres sont analysés globalement et ensuite selon les habitudes de nettoyage de la bouche.

II.2.3.2.1 Le niveau de risque carieux lié à la plaque.
Le niveau de risque carieux est déterminé après évaluation de la quantité de plaque accumulée. Nous avons suivi la méthode préconisée par DARMOND (2).

a) L'évaluation de la quantité de plaque accumulée
Elle comprend les étapes suivantes :
- Sélection des dents et des faces examinées : l'évaluation se fait sur cinq dents : les quatre premières molaires et une incisive centrale supérieure. Si une molaire est absente, on retient la molaire en distal ou à défaut la dent la plus proche en mésial. Si aucune incisive supérieure n'est présente, une incisive mandibulaire sera retenue. Sur chaque dent sélectionnée, quatre faces sont examinées : mésial, distal, lingual et vestibulaire.
  Les dents sont représentées sur la fiche n°2 d'évaluation par un cercle divisé en quatre secteurs ; chaque secteur représentant une face dentaire à examiner.
- Evaluation de la plaque accumulée. Les 20 faces des 5 dents sont examinées. Avec une sonde parodontale, le praticien balaye chaque face de la dent à environ 1 mm dans le sulcus. La présence de plaque sur la sonde est représentée par un point au niveau du secteur représentant la face sur la fiche.
  L'examen de la face suivante se fera après nettoyage de la sonde avec une compresse stérile désinfectante en présence ou en l'absence de plaque.
  Après avoir évalué toutes les dents, le nombre de faces sans plaque, multiplié par 5 permet d'obtenir le pourcentage de quantité de plaque accumulée.

b) Le niveau de risque carieux lié à la quantité de plaque.
Nous avons adopté la classification décrite par DARMOND (2) qui distingue trois niveaux de risque carieux selon le pourcentage d'accumulation de la plaque :
- Risque carieux faible : la quantité de plaque est inférieure à 20 %, (présence de plaque sur moins de 4 faces),
- Risque carieux moyen : la quantité de plaque est comprise entre 20 et 50 % (présence de plaque sur un nombre de faces compris entre 4 et 10).
- Risque carieux élevé : la quantité de plaque est supérieure à 50 % (présence de plaque sur plus de 10 faces).

II.2.3.2.2. Le taux de prévalence de la carie dentaire
C'est le nombre de personnes porteuses de caries, déterminé par rapport au nombre de personnes examinées. Après avoir déterminé la prévalence globale, nous avons analysé les résultats en fonction du sexe et ensuite en fonction des habitudes de nettoyage de la bouche.

II.2.3.2.3 Détermination de l'indice CAOD
A l'examen de la denture, les dents cariées, absentes ou obturées sont notées sur la fiche n°3. Les résultats ont permis de déterminer l'indice CAOD et son analyse en fonction du sexe et ensuite en fonction des habitudes de nettoyage de la bouche.

III - RESULTATS

III.1 Les habitudes de nettoyage de la bouche

Les étudiants qui n'ont utilisé aucun moyen instrumental représentent 2 % ; le bâtonnet frotte-dents a été utilisé par 1,3 % et la brosse à dents par 96,7 %. Parmi les étudiants qui ont utilisé la brosse à dents, 22,8 % ont effectué un nettoyage quotidien, 42,7 % en ont effectué deux et 31,7 % trois ; 2,8 % ont effectué un brossage irrégulier.

III.2 La situation de la carie dentaire

III.2.1 Le niveau de risque carieux lié à la plaque
Nous avons réparti notre population d'étude selon le niveau de risque carieux lié à la plaque qu'ils ont présenté. Les résultats figurent au tableau I.

Tableau I - Répartition de la population selon le niveau de risque carieux lié à la plaque

Niveau de risque carieux lié à la plaque / Habitudes de brossage	**Faible** (accumulation de plaque 20%)	**Moyen** (accumulation de plaque 20 - 50 %)	**Elévée** (accumulation de plaque 50 %)
Pas de nettoyage (n = 3)	-	-	100 % (n = 3)
Nettoyage avec bâtonnet	-	50 % (n = 1)	50 % (n = 1)
Brossage irrégulier (n = 4)	-	-	100 % (n = 4)
Brossage quotidien unique (n = 33)	-	42,5 % (n = 14)	57,5 % (n = 19)
Deux brossages quotidiens n = 33)	1,6 % (n = 1)	69,3 % (n = 43)	29,1% (n = 18)
Trois brossages quotidiens (n = 46)	2,2% (n = 1)	76 % (n = 35)	21,8 % (n = 10)

III.2.2 La prévalence de la carie dentaire

III.2.2.1 Résultats globaux

90 étudiants ont présenté au moins une carie en bouche. Le taux de prévalence est de 60 %.

III.2.2.2 Résultats selon le sexe

L'analyse des résultats a montré un taux de prévalence de 62,5 % chez les femmes et 57,3 % chez les hommes.

III.2.2.3 Résultats selon le sexe et les habitudes d'hygiène

Tous les étudiants qui n'ont utilisé aucun moyen instrumental ou qui ont utilisé le bâtonnet frotte-dents ont au moins une carie en bouche. La prévalence a varié selon le nombre de nettoyage quotidien pour ceux qui ont utilisé la brosse à dents. Les résultats figurent au tableau II.

Tableau II - Taux de prévalence de carie. Résultats selon le sexe et les habitudes d'hygiène

Sexe / Habitudes de brossage	**Femme**	**Homme**	**Sexes confondus**
Pas de nettoyage (n = 3)	100 % (n = 3)	-	-
Nettoyage avec bâtonnet (n = 2)	-	100 % (n = 2)	-
Brossage irrégulier (n = 4)	-	100 % (n = 4)	-
Brossage quotidien unique (n = 33)	62 % (n = 15)	88,8% (n = 18)	75,8%
Deux brossages quotidiens n = 33)	66,66% (n = 33)	51,72 % (n = 29)	56,5%
Trois brossages quotidiens (n = 46)	50 % (n = 24)	36,36 % (n = 22)	41,4%

III.2.3 L'indice CAOD

III.2.3.1 Résultats globaux

Nous avons enregistré 306 dents cariées, absentes ou obturées, soit un CAOD moyen de 2,04 par étudiant. La composante C (dents cariées) représente 66 % de l'indice global.

III.2.3.2 Résultats selon le sexe

L'analyse des résultats a montré un CAOD moyen de (1,64) chez les femmes et un CAOD moyen de (2,44) chez les hommes.

III.2.3.3 Résultats selon le sexe et les habitudes d'hygiène

Les résultats ont donné un CAOD de 2,6 pour ceux qui ne se nettoient pas la bouche. Ceux qui utilisent la brosse à dents ont un indice CAOD variable selon le nombre de brossage quotidien.

Les résultats figurent au tableau III.

Tableau III - Indice CAOD. Résultats selon le sexe et les habitudes d'hygiène

Sexe / Habitudes de brossage	Femme	Homme	Sexes confondus
Pas de nettoyage (n = 3)	2,6 % (n = 3)	-	-
Nettoyage avec bâtonnet (n = 2)	-	2,5 % (n = 2)	-
Brossage irrégulier (n = 4)	-	4,75 % (n = 4)	-
Brossage quotidien unique (n = 33)	1,66 % (n = 15)	3 % (n = 18)	2,4%
Deux brossages quotidiens n = 33)	1,45 % (n = 33)	2,5 % (n = 29)	1,9 %
Trois brossages quotidiens (n = 46)	1,7 % (n = 24)	1,4 % (n = 22)	1,58 %

IV - DISCUSSION

Dans notre étude, la difficulté majeure a été le recrutement d'un nombre suffisant d'étudiantes : la résidence héberge 3770 étudiants dont 90 étudiantes.

La particularité de notre population d'étude est qu'elle jouit de conditions de vie favorisées dans un contexte de pays en développement : le niveau d'instruction est élevé et les étudiants habitent dans des chambres, dotées d'eau et d'électricité, entretenues et nettoyées quotidiennement. Les étudiants logés régulièrement sont boursiers ou de condition sociale aisée. Cette situation est cependant tempérée par la solidarité qui contraint certains à héberger en surnombre des camarades moins favorisés.

Les habitudes d'hygiène orale
La proportion d'étudiants assurant le nettoyage de la bouche avec un instrument est élevée 98,7 % ; deux instruments sont utilisés : la brosse à dents et le bâtonnet frotte-dents.

Le nettoyage avec le bâtonnet frotte-dents
Cet instrument est supplanté par la brosse à dents dans les deux sexes ; dans la société sénégalaise son utilisation est très répandue (80,8 %) et plus fréquente chez les femmes (87,8 %) que chez les hommes (69,5 %) (10).

Le nettoyage avec la brosse à dents
C'est le principal instrument utilisé par les étudiants 96,7 % la possède. Ce taux est plus élevé que celui de la société en général (16,6 %) (10).

Le nombre de brossage quotidien varie de 1 à 3. Dans la population globale, 10,4 % se brossent les dents 2 à 3 fois par jour (10), chez les étudiants ils sont 71,9 %. Le brossage après le repas est systématique au déjeuner et au dîner mais il est effectué avant le petit déjeuner par 27,9 % ; cette habitude est liée au rinçage traditionnel de la bouche au réveil.

La situation de la carie dentaire
La plaque accumulée et le niveau de risque carieux. La détermination des niveaux de risque carieux liés aux facteurs étiologiques de la carie dentaire permet d'identifier, avec la collaboration du patient, le ou les facteurs intervenant dans son état dentaire. Le Système d'évaluation de la Plaque (SEP) que nous avons utilisé pour déterminer le niveau de risque lié à la plaque est décrit par DARMOND (2). Il est rapide, indolore et esthétique car n'utilise pas de révélateur. Les résultats chiffrés qu'il donne évite de juger l'hygiène du patient dans la gamme du propre au sale. Le SEP fournit une évaluation représentative de l'efficacité du patient à éliminer la plaque et il rend compte indirectement sur le risque constitué par les prises alimentaires non suivies de brossage.

Nos résultats ont montré que tous les étudiants qui ne se nettoient pas la bouche ont un taux d'accumulation de plaque supérieur à 50 %, ce qui correspond d'après la classification de DARMOND (2) à un risque carieux élevé. Ce taux a baissé régulièrement avec l'augmentation du nombre de brossage quotidien chez les étudiants qui utilisent la brosse à dents. Les résultats ont montré que les étudiants qui ont un risque carieux élevé représentent 57,6 % de ceux qui se brossent une fois par jour, 29,1 % de ceux qui se brossent deux fois et 19,6 % de ceux qui se brossent trois fois si on fait le lien entre taux d'accumulation de la plaque et niveau de risque carieux lié à la plaque.

La prévalence de la carie dentaire

La population étudiée présente un taux de prévalence à l'atteinte carieuse de 60 % ; 40 % sont indemnes de carie. Ce résultat montre une progression plus lente de l'atteinte carieuse dans la population scolarisée car plusieurs études en Afrique subsaharienne (1, 3, 6, 8) situent la prévalence de la carie à 12 ans en milieu scolaire entre 40 et 60 % ; en effet dans la population globale THIAM (10) a enregistré 10,6 % de personnes indemnes de carie.

L'indice CAO

Il est faible dans notre étude (2,04) si nous considérons l'âge des étudiants. Selon l'organisation mondiale de la santé (7), dans presque tous les pays africains, les adultes (35 - 44 ans) ont un indice CAO compris entre 5 et 8,9 ; quelques pays ont un indice supérieur compris 9 et 13,9 : Afrique du sud, Madagascar, Maroc et Algérie (7). Le Sénégal a un indice de 14,8 (10). Le bon état dentaire des étudiants, comparé à celui de la population globale, pourrait être en relation avec les avantages liés à la scolarisation ininterrompue; en effet, l'indice CAO est faible chez les élèves en Afrique subsaharienne (9, 3, 6, 8) et au cours des études ils bénéficient du suivi médical et dentaire gratuit au collège et au lycée ; dans ces établissements, ils ont passé leur adolescence, période où ils adoptent facilement les comportements véhiculés dans les médiats par la publicité et surtout ceux qui sont jugés prestigieux tels que l'utilisation de la brosse à dents et des pâtes dentifrice qui sont très souvent fluorées actuellement.

La composante (C) l'indice CAO représente 66 % de l'indice global ; dans une étude chez des enfants de 12 ans en milieu scolaire, MOALIC (5) a trouvé que C représentait 76,8 % de l'indice CAO. Cette situation dénote, malgré la faiblesse de l'indice et la disponibilité d'un cabinet dentaire, un problème dans la prise en charge des étudiants : une démarche préventive incluant les méthodes de promotion de la santé orale n'est pas mise en œuvre et le contact entre le cabinet dentaire et les étudiants est dicté par une urgence de traitement.

CONCLUSION

Cette étude focalisée sur une population favorisée, a montré une intensité de la carie dentaire restée faible jusqu'à l'âge d'adulte jeune. Cette situation contraste avec l'évolution de la carie dans la population générale où l'on note une progression rapide de la carie. Les résultats obtenus montrent l'importance du niveau de vie et du brossage pour améliorer la situation de la carie dentaire. Cependant, l'analyse du CAO a montré que malgré la disponibilité d'un cabinet dentaire, la composante (C) est plus importante : des campagnes de sensibilisation et une démarche plus opérationnelle de la prévention améliorerait davantage cette situation.

RESUME

L'objectif de cette étude est de décrire les habitudes d'hygiène orale et la situation de la carie dentaire de 150 étudiants vivant en résidence universitaire. Les résultats sont les suivants : la brosse à dents a supplanté les moyens traditionnels tels que le rinçage digital à l'eau ou le bâtonnet frotte-dents ; 96,7 % des étudiants l'utilisent. Le taux de prévalence de la carie est élevé (60 %) mais l'indice CAO reste faible (2,04 %). Si nous considérons les étudiants qui se brossent (96 %) nous notons une amélioration de la situation de la carie dentaire avec une diminution du taux d'accumulation de la plaque, une diminution du taux de prévalence de la carie et un indice CAO resté faible jusqu'à l'âge adulte.

SUMMARY

The objective of this study is to describe the oral hygiene habits and the status of the teeth decay of 150 senegalese students living in a university campus. The results showed that the toothbrush as mean of oral hygiene supplanted the traditional means such as « cure dents « or water rinse with finger. Results showed also a high rate decay (60 %) but the CAO indice remained low (2,04 %). We founded an improvement of dental decay status with an increasing daily number of tooth brushing : we noted a decreasing dental plaque deposition rate, a decreasing decay rate and a CAO indice remaining low until adult age.

BIBLIOGRAPHIE

1 - ABELLARD J., DECROIX B., KEREBEL LM.
Enquête épidémiologique sur la santé bucco-dentaire à Fada N'Gourma (Burkina Faso).
Bull. Group. Int. Rech. Sci. Stomatol. Odontol., 1989, 32, 31 -38.
2 - DARMOND
Le système d'évaluation de la plaque.
Information Dentaire, 1965.
3 - DIOMBANA ML., HAIDARA OD., KUSSNER H.
Etude épidémiologique de la carie dentaire en milieu scolaire à Kati. Bilan CAO, co et
fréquence globale.
Med. Afr. Noire, 1998, 45, 47-50.
4. KEREBEL, LM., LE CABELLOC, MT., DACULSI, G.
Report on caries reduction in French school children 3 years after the introduction of a preventive program.
Community Dent. Oral Epidemiol., 1985,13, 201-204.
5. KEYES PH.
The infections and transmissible nature of experimental dental caries.
Arch. Oral Biol., 1962, 1, 304-320.
6 - MOALIC E., ZERILLI A., CAPO-CHICHI S., APOVI G.
Etat bucco-dentaire d'une population d'enfants scolarisés : région de Zou (Bénin) en 1998.
Cahier Santé, 9 (5), 1999, 273-281.
7 - ORGANISATION MONDIALE DE LA SANTE (OMS)
Global data on dental carie level for 12 years and 35-44 years.
WHO/ORW Caries, 1997.
8 - SEMBENE M., KANE A.W., BOURGEOIS D.
Caries prevalence in 12-year-old school children in Senegal.
Int. Dental J., 1999, 49, 73 - 75.
9 - TAPSOBA H., DESCHAMPS JP.
La santé bucco-dentaire dans le système national de santé au Burkina Faso.
Cahier de santé, 1997, 7, 317-321.
10 - THIAM D. A.
Evaluation des besoins en soins dentaires et parodontaux chez l'adulte sénégalais âgé de 35 à 50 ans.
Thèse Chirurgie Dentaire, Dakar, 1997, 33.

30. Organisation mondiale de la Santé. Research to Improve Implementation and Effectiveness of School Health Programmes. Genève: Organisation mondiale de la Santé, 1996. (Document non publié WHO/HPR/HEP/96.3).

31. Organisation mondiale de la Santé. Rapport sur la santé dans le monde 1998 - La vie au 21e siècle. Une perspective pour tous. Rapport du Directeur général. Genève: Organisation mondiale de la Santé, 1998.

32. Organisation mondiale de la Santé. Vieillir en restant actif: cadre d'orientation. Genève: Organisation mondiale de la Santé, 2002. (Document non publié WHO/NMH/NPH/02.8).

33. Centre OMS de Kobe pour le développement de la Santé. Globe Review on Oral Health in Ageing Societies. WHO Ageing and Health Technical Report 3. Kobe: Organisation mondiale de la Santé, 2002.

34. Shay K, Berkey D, Beck J, et al. The First International Conference on rural Ageing: A Global Challenge. Proceedings of the oral health component. Charleston, Virginie occidentale (Etats-Unis d'Amérique), 2000. International Dental Journal 2001; 51: 177-264.

35. Centre OMS de Kobe pour le développement de la Santé. Good Oral Health in Ageing Societies. To Keep Healthy Teeth for Your Healthy Life. Procès-verbal du symposium international de l'OMS, Kobe, Japon, novembre 2001. Kobe: Organisation mondiale de la Santé, 2002.

36. Walls AWG, Steele JG. Geriatric oral health issues in the United Kingdom. International Dental Journal 2001; 51: 183-187.

37. Organisation mondiale de la Santé. The Implications for Training of Embracing a Life Course Approach to Health. Genève: Organisation mondiale de la Santé, 2000.

38. Firatli E. The relationship between clinical periodontal status and insulin-dependent diabetes mellitus. Results after 5 years. Journal of Periodontology 1997; 68: 136-40.

39. Hung HC et al. Oral health and peripheral arterial disease. Circulation 2003; 107: 1152-1157.

40. Morrison HI, Ellison LF, Taylor GW. Periodontal disease and risk of fatal coronary heart and cerebrovascular diseases. Journal of Cardiovascular Risks 1999; 6: 7-11.

41. Slade GD et al. Conference summary: assessing oral health outcomes – measuring health status and quality of life. Community Dental Health 1998; 15: 3-7.

42. Rohr Inglehart M, Bagramian RA. Oral Heath-Related Quality of Life. Chicago, Illinois (Etats-Unis d'Amérique): Quintessence, 2002.

43. Organisation mondiale de la Santé. Formulation de stratégies en vue de l'instauration de la santé pour tous d'ici l'an 2000. Principes directeurs et questions essentielles. Genève: Organisation mondiale de la Santé, 1979 (Série «Santé pour tous», N° 2).

44. WHO Collaborating Centre for Oral Health Care Planning and Future Scenarios. Basic Package for Oral Care. Nijmegen (Pays-Bas): University of Nijmegen, 2002.

45. Organisation mondiale de la Santé. Extending essential care. Integrated management of adolescent and adult illness. Genève: Organisation mondiale de la Santé, 2003. Document WHO/CDS/STB/2003.21.

46. Melnick SL et al. Manifestations buccales de l' infection à VIH: guide des études épidémiologiques. Genève: Organisation mondiale de la Santé, 1994.

47. Organisation mondiale de la Santé. Rapport SuRF 1 (Surveillance of Risk Factors Related to Noncommunicable Diseases). Surveillance des facteurs de risque liés aux maladies non transmisibles: état actuel des données mondiales. Genève: Organisation mondiale de la Santé, 2003.

48. Organisation mondiale de la Santé. Santé 21: la politique-cadre de la Santé pour tous pour la Région européenne de l'OMS. Copenhague: Bureau OMS régional de l'Europe, 1999 (Série européenne de la Santé pour tous, no. 6).

49. Forum Mondiale pour la Recherche en Santé. Rapport 10/90 sur la Recherche en Santé, 2000-2002. Disponible sur internet à l'adresse suivante: http://www.globalforumhealth.org).

BIBLIOGRAPHIE OMS THÉMATIQUE

Organisation mondiale de la Santé. Classification internationale des maladies. Adaptation à l'odontostomatologie.
(CIM-AO), Troisième édition, OMS, 1997 (183 pages).

Organisation mondiale de la Santé. Aspects sanitaires et nutritionnels des oligo-éléments et des éléments en traces.
OMS, 1997 (350 pages).

S.L. Melnick et al. Manifestations bucales de l'infection à VIH: guide des études épidémiologiques.
OMS, 1994 (29 pages).

Organisation mondiale de la Santé. Fluorures et santé bucco-dentaire. Rapport d'un Comité OMS d'experts sur la santé bucco-dentaire et l'utilisation des fluorures. OMS, Série de Rapports techniques N° 846, 1994 (41 pages).

Organisation mondiale de la Santé. Progrès récents en santé bucco-dentaire. Rapport d'un Comité OMS d'experts.
OMS, Série de Rapports techniques N° 826, 1992 (41 pages).

Organisation mondiale de la Santé. Directives de qualité pour l'eau de boisson (Deuxième édition): Volume 1. Recommandations, 1994 (202 pages).

Organisation mondiale de la Santé. Volume 2. Critères d'hygiène et documentation à l'appui, 2000 (1050 pages).

Organisation mondiale de la Santé. Enquêtes sur la santé bucco-dentaire: méthodes fondamentales.
Quatrième édition. OMS, 1998 (67 pages).

Organisation mondiale de la Santé. Régime alimentaire, nutrition et prévention des maladies chroniques.
Rapport d'une Consultation OMS/FAO d'experts.
OMS, Série de Rapports techniques, N° 916. 2003. (149 pages)

Organisation mondiale de la Santé. Fluorides.
Environmental Health Criterias Series, No. 227. OMS, 2002 (288 pages).

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HEALTH POLICY

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Impact of the global burden of periodontal diseases on health, nutrition and wellbeing of mankind: A call for global action

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Abstract

Background: The global burden of periodontal diseases remains high. Population growth trends, changes in risk factors and improved tooth retention will increase the socio-economic burden of periodontitis that is responsible for 3.5 million years lived with disability, 54 billion USD/year in lost productivity and a major portion of the 442 billion USD/year cost for oral diseases.

Methods: In the context of the Milan World Exhibition 2015 "Feeding the Planet, Energy for Life," a green paper was developed and offered for global consultation by the European Federation of Periodontology. The final draft was endorsed by professional organizations around the world and is presented to stakeholders as a call for global action.

Results: Specific actions for the public, policymakers, educators and professional organizations have been identified in the areas of prevention, detection and care. These actions align public interest and knowledge, need for self-care, professional intervention and policies to the best scientific evidence to proactively promote periodontal health and effectively manage the global burden of periodontal diseases, in accordance with WHO/UN priorities and strategies for tackling common non-communicable diseases via the Common Risk Factor Approach.

Conclusions: A strong and coherent body of evidence allows identification of actionable preventive, diagnostic and therapeutic strategies to effectively promote periodontal health and general wellbeing, and better manage the socio-economic consequences. Action requires consideration of the specific national scenarios.

KEYWORDS

diagnosis, periodontal diseases, periodontitis, prevention, public health policy, risk factors, treatment

A draft of this paper has been circulated as a green paper for stakeholder consultation by the European Federation of Periodontology. It has been endorsed by the European Federation of Periodontology, the Asian Pacific Society of Periodontology, the Ibero-Panamerican Society of Periodontics and the International Academy of Periodontology as well as the following national learned societies of Periodontology: Argentinian Society of Periodontology, Australian & New Zealand Academy of Periodontists, Australian Society of Periodontology, Austrian Society of Periodontology, Azerbaijan Society of Periodontology, Belgian Society of Periodontology, Brazilian Society of Periodontology, British Society of Periodontology, Chilean Periodontology Society, Chinese Society of Periodontology, Croatian Society of Periodontology, Danish Society of Periodontology, Dutch Society of Periodontology, Finnish Society of Periodontology, French Society of Periodontology and Implantology, German Society of Periodontology, Hellenic Society of Periodontology, Hong Kong Society of Periodontology and Implant Dentistry, Hungarian Society of Periodontology, Indian Society of Periodontology, Indonesian Society of Periodontology, Irish Society of Periodontology, Israeli Society of Periodontology & Osseointegration, Italian Society of Periodontology and Implant Dentistry, Japanese Academy of Clinical Periodontology, Japanese Society of Periodontology, Korean Academy of Periodontology, Lithuanian Association of Periodontology, Malaysian Society of Periodontology, Moroccan Society of Periodontology, Nepalese Society of Periodontology and Oral Implantology, Norwegian Society of Periodontology, Philippine Society of Periodontology, Polish Society of Periodontology, Portuguese Periodontology and Implants Society, Romanian Society of Periodontology, Russian Association of Periodontists, Serbian Society of Periodontology, Society of Periodontology (Singapore), Slovenian Society of Periodontology, Spanish Society of Periodontology, Swiss Society of Periodontology, Swedish Society of Periodontology, Taiwan Academy of Periodontology, Turkish Society of Periodontology, Ukrainian Society of Periodontists. This paper is supported by The American Academy of Periodontology.

1 | INTRODUCTION

Periodontal diseases, comprising gingivitis and periodontitis, are probably the most common disease of mankind (Guinness World Records 2001). The recent Global Burden of Disease Study (GBD, 1990–2010) indicates that: (i) severe periodontitis is the 6th most prevalent disease worldwide, with an overall prevalence of 11.2% and around 743 million people affected, and (ii) the global burden of periodontal disease increased by 57.3% from 1990 to 2010 (Jin et al., 2016; Kassebaum et al., 2014a; Marcenes et al., 2013; Murray et al., 2012). As periodontitis is the major cause of tooth loss in adult population worldwide, these individuals are at risk of multiple tooth loss, edentulism and masticatory dysfunction, thereby affecting their nutrition, quality of life and self-esteem as well as imposing huge socio-economic impacts and healthcare costs (Chapple, 2014; Chapple et al., 2015; Petersen & Ogawa, 2012; Pihlstrom, Michalowicz, & Johnson, 2005). Periodontal diseases are responsible for 3.5 million years lived with disability (GBD 2015 Disease and Injury Incidence and Prevalence Collaborators, 2016). The global cost of lost productivity from severe periodontitis alone has been estimated to be 54 billion USD/year, while the total economic impact of periodontal diseases accounts for a major component of the 442 billion USD, direct and indirect cost of oral diseases incurred in 2010 (Listl, Galloway, Mossey, & Marcenes, 2015). The overall prevalence of periodontitis increases with age, and the incidence rises steeply in adults aged 30–40 years. Such burden of periodontitis will continue to increase with the growing ageing population also due to increased tooth retention globally (Jepsen et al., 2017; Kassebaum et al., 2014b; Tonetti et al., 2017). Periodontitis disproportionately affects the vulnerable segments of the population and is a source of social inequality (Jepsen et al., 2017; Jin et al., 2011).

Periodontitis is a chronic non-communicable disease (NCD) that shares social determinants and risk factors with the major NCDs that cause around two-thirds of deaths such as heart disease, diabetes, cancer and chronic respiratory disease (Ezzati & Riboli, 2012; FDI 2013a,b; Jin, 2013; Sheiham & Watt, 2000; United Nations 2011). Tobacco smoking, obesity and poor nutrition (both in terms of caloric intake and quality of the nutritional components) and physical inactivity have all been associated with an increased risk of periodontitis (Chapple et al., 2017). Trends in risk factors are likely to impact the burden of periodontitis, and the rise of smoking in developing countries combined with the obesity/diabetes epidemic will further drive incident periodontitis. Besides the shared risk factors with major NCDs, accumulation of dental biofilms consequent to inadequate self-performed oral hygiene procedures, such as tooth brushing and use of inter-dental cleaning aids, accounts for the initiation and progression of periodontal disease in the population. These biofilms, if not well controlled, interact with the unique susceptibility profile of each individual and may become dysbiotic, thereby initiating and sustaining the disease process which is characterized by the inflammatory destruction of the tooth-supporting apparatus and alveolar bone (Darveau, 2010; Hajishengallis et al., 2011; Kornman, 2008; Sanz et al., 2017). The key presentations of periodontitis in the early stages are gingival bleeding, recession of the gingival margin and halitosis. Measurable changes in oral health-related quality of life are present (Buset et al., 2016; Shanbhag, Dahiya, & Croucher, 2012).

Clinical Relevance

Scientific rationale for the study: The global burden of periodontal diseases remains high and trends in risk factors, improved tooth retention and aging population are likely to bear further increases. Associated morbidity, costs and socio-economic impact will continue to rise.

Principal findings: This paper identifies actionable opportunities for prevention, early detection and treatment of periodontal diseases. These have been the subjects of consultation among learned societies in Periodontology worldwide.

Practical implications: We propose specific actions to align public interest and knowledge, need for self-care, professional intervention and policies to the best scientific evidence to proactively promote periodontal health and effectively manage the global burden of periodontal diseases. These actions are in accordance with WHO/UN priorities and strategies for tackling common non-communicable diseases (NCDs) via the Common Risk Factor Approach.

Once a considerable amount of the periodontal attachment has been destroyed by periodontitis both in terms of number of affected teeth and severity, the disease is complicated by an array of signs and symptoms that further impact on the quality of life of the affected individuals. These include tooth migration and drifting, tooth hypermobility, tooth loss and ultimately increasing levels of masticatory dysfunction. Masticatory dysfunction, as the terminal stage of periodontitis, compromises nutrition and general health. However, the early stages of periodontal disease are often symptomless, and a significant number of affected patients do not seek professional care. The relatively "silent" nature of the early stages of the disease, combined with low awareness of periodontal health, leads to many patients seeking "symptom-driven" care for advanced disease through periodontal therapy when available and affordable (Jin, 2015).

Considerable evidence also points to the fact that the effects of periodontitis go beyond the oral cavity and that the body is affected by the haematogenous dissemination of both bacteria and bacterial products originating in the oral biofilms and inflammatory mediators originating in the inflamed periodontium. Through these mechanisms, periodontitis interacts with various systemic diseases, notably diabetes, atherosclerosis, rheumatoid arthritis and pulmonary infections. Loss of masticatory function consequent to periodontal attachment loss and tooth loss due to severe periodontitis impacts on nutrition, as subjects with masticatory dysfunction change their dietary habits usually incorporating more starch and fats and less fresh fruit and vegetables in their diet. The systemic inflammatory burden and poor nutrition consequent to severe periodontitis may contribute to the pathogenesis of chronic NCDs (Tonetti & Kornman, 2013).

Periodontitis can be prevented, easily diagnosed and successfully treated and controlled following appropriate professional care and long-term secondary prevention. Currently, various cultural and socio-economic barriers to professional care prevent the public from applying correct preventive approaches, receiving early diagnosis and seeking treatment, resulting in limited progress in improving periodontal health (Jin et al., 2011). This call for global action aims to draw the attention of oral healthcare professionals, medical practitioners, educators, health officials, payers and the public to opportunities to improve periodontal health and general health. In this document, it is recognized that different countries are at different levels with respect to periodontal health literacy, care and policy. However, even in the most advanced countries, considerable segments of the population continue to present high burdens of disease and have difficulty in accessing health information and professional services.

2 | OPPORTUNITY 1—PREVENTION

Prevention is the key for oral health (Editorial, *Lancet* 2009). Periodontitis is preventable through effective management of gingivitis and promotion of healthy lifestyles at both population and individual levels (Chapple et al., 2015; Jepsen et al., 2017). This can be accomplished through: (i) professional instruction of self-performed effective oral hygiene such as tooth brushing and inter-dental cleaning, and (ii) an integrated and population-based approach in health education based on the Common Risk Factor Approach in the context of the recent UN's resolution for establishment of the 2030 sustainable development goals (GBD 2015 SDG Collaborators, 2016; United Nations, 2015). A critical element is that prevention should be tailored to individual needs through diagnosis and risk profiling. Meanwhile, it is emphasized that each individual should play a proactive role in awareness of oral health, self-care measures, health promotion and disease prevention for optimal oral and general health in the course of life.

Conclusions of the recent European Workshop on Periodontology in primary and secondary prevention of periodontal and peri-implant diseases have helped to identify potential large-scale preventive programmes and highlighted specific actions that may reduce the worldwide prevalence of periodontal diseases (Tonetti, Chapple, Jepsen, & Sanz, 2015). These are the key recommendations.

1. Gingival bleeding is an early sign of periodontal disease and a leading risk marker for existing periodontal inflammation that accounts for the onset and progression of periodontitis. Public health campaigns tailored for different susceptible groups (e.g. adolescents, pregnant women and diabetics), professional information and labelling of oral health care products should highlight the importance of gingival bleeding and encourage professional care whenever it is present and persists.
2. Subject motivation, self-care approaches and detailed instruction on the use of mechanical plaque control aids, such as tooth brushing and inter-dental cleaning, are key in management of gingivitis and prevention of periodontitis.
3. Control of systemic risk factors such as smoking (in the context of the WHO common risk factor approach) is an important component of prevention at both the individual and population levels.
4. An appropriate periodontal diagnosis including an assessment of patient-level factors (e.g. risk factors and life attitudes) should determine the most appropriate professional preventive care and the need for treatment.
5. There is an urgent need for universal implementation of periodontal screening by the oral health care team.
6. Professional mechanical plaque removal is important, but cannot serve as the sole element of professional preventive care. Oral/periodontal health education starting from pre-school period and proactive behaviour change are fundamental to sustained improvements in periodontal health status.
7. Professional preventive care alone is inappropriate in subjects with a clinical diagnosis of periodontitis, as they require effective treatment for their periodontal condition first.
8. The public should be aware that, when gingival bleeding is present, self-medication with chemical plaque control agents may mask more serious underlying periodontal disease and individuals should seek timely professional advice before using anti-gingivitis agents.
9. Long-term success of periodontal therapy requires active participation in a secondary prevention programme specifically designed to meet the needs of these individuals at higher risk of disease recurrence.
10. For optimal long-term tooth retention and oral function, patients participating in secondary prevention programmes require completion of an active phase of periodontal therapy that achieves individually set treatment goals. Secondary prevention is preferably undertaken according to patients' risk profiles with the appropriate frequency of maintenance and patient compliance.

More information is available in the consensus statements of the four workshop working groups (Chapple et al., 2015; Jepsen et al., 2015; Sanz et al., 2015; Tonetti, et al., 2015).

As common oral diseases like periodontitis share risk factors with other NCDs such as heart disease and diabetes, the Common Risk Factor Approach, strongly advocated by the WHO for improving human health, should incorporate self-performed oral hygiene as one of the positive lifestyles. Preventive programmes for NCDs should thus take into account the specific needs to effectively support oral health as one of the fundamental components of general health (United Nations 2011) and include them in large-scale population efforts whenever feasible. Notably, FDI's new definition of oral health recognizes its multidimensional nature and attributes (i.e. disease status, physiological function and psychosocial function), and promotes incorporation of oral health into the mainstream of health and healthcare for effective advocacy of optimal oral and general health (Glick et al., 2016; Lee, Watt, Williams, & Giannobile, 2017).

3 | OPPORTUNITY 2—DIAGNOSIS

Periodontitis is easily diagnosed via a full-mouth comprehensive periodontal evaluation. Periodontal probing should be a key component of regular dental visit. Professional periodontal screening approaches that are both sensitive and inexpensive were introduced in several countries more than a quarter of a century ago. Their routine adoption by all oral healthcare professionals has been an elusive objective, and the burden of undiagnosed disease remains high worldwide. Furthermore, diagnosis is frequently delayed until symptoms of advanced periodontal breakdown emerge. Missed or delayed diagnosis often results in very significant increases in both the burden and cost of disease management, and it indeed represents the leading cause of professional litigation in many industrialized countries (Zinman, 2001). Professional organizations around the world recognize the value of a three-step approach to periodontal diagnosis:

1. Patient self-detection of symptoms and signs of periodontal disease to promote awareness and seek professional examination.
2. Professional periodontal screening to segment the population into periodontal health, gingivitis (planning preventive care for these conditions) and periodontitis.
3. Comprehensive periodontal examination and diagnosis to plan appropriate treatment of periodontitis.

Early diagnosis followed by appropriate treatment and secondary prevention has the potential to improve quality of life, preserve teeth and masticatory function, and reduce the lifelong social and financial burden associated with caring for periodontitis.

Periodontal diagnosis should include an assessment of risk factors for periodontitis. As various systemic conditions (e.g. diabetes) interact with periodontitis or its treatment, their screening is part of a standard periodontal examination. Since the adult population in advanced countries is more likely to see an oral healthcare professional than a medical practitioner, screening for and monitoring of conditions such as diabetes, hypertension and obesity in the dental setting may greatly contribute to detection of undiagnosed medical conditions (Genco et al., 2014; Lalla, Kunzel, Burkett, Cheng, & Lamster, 2011). This reshaped and expanded role of oral healthcare professionals would improve patients' oral and general health, while enhancing their roles in the health workforce team (Glick et al., 2012).

It may be useful to stage the extent and severity of periodontitis and the presence of masticatory dysfunction in a given subject, as treatment needs are likely to be different.

Stage 1: *Mild to Moderate Periodontitis* refers to a condition characterized by gingival inflammation and a degree of destruction of the periodontal attachment compatible with oral function.

Stage 2: *Severe Periodontitis* refers to a condition characterized by gingival inflammation, advanced destruction of the periodontal attachment and presence of vertical bone defects and/or furcation involvement. Oral function may still be preserved but the risk of disease progression leading to tooth loss is high.

Stage 3: *Severe Periodontitis complicated by Masticatory Dysfunction* refers to a condition characterized by gingival inflammation, advanced destruction of the periodontal attachment, presence of vertical bone defects and/or furcation involvement, as well as loss of masticatory function consequent to tooth hypermobility and/or tooth loss.

4 | OPPORTUNITY 3—TREATMENT

Periodontal treatment aims to control gingivitis and periodontitis, avoid disease progression leading to tooth loss, retain a functional dentition for a lifetime, preserve self-esteem and improve quality of life.

Overwhelming evidence indicates that periodontitis can be treated and effectively managed in the majority of subjects. Long-term studies report that, after periodontal therapy, rate of tooth loss averaging 0.1 tooth/patient/year is observed in subjects participating in professional secondary prevention programmes in specialist practice (Trombelli, Franceschetti, & Farina, 2015). This rate is generally compatible with the preservation of the dentition for a lifetime in the majority of subjects. A systematic review reporting tooth survival up to 22 years after periodontal therapy in specialist practice indicates that tooth loss due to periodontal reasons ranges from 1.5% to 9.8%, while 36 to 89% of treated subjects do not experience further tooth loss (Chambrone, Chambrone, Lima, & Chambrone, 2010). Higher rates of tooth loss were observed among older individuals and smokers.

Delivery of appropriate periodontal care to the individual patient requires a full diagnostic and prognostic assessment of the case and access to effective treatments to control inflammation and avoid tooth loss. Periodontal treatment requires delivery by a highly skilled, and sometime highly specialized oral health care professional. Access to such professionals remains a challenge in many health systems.

Scientific evidence indicates that periodontal treatment consisting of a series of sequential phases of care is effective and that the effectiveness is also related to the skill level and experience of the oral health care professional. These phases are:

Phase 1. Control of risk factors (e.g. smoking cessation and diabetes control) and promotion of healthy lifestyles including adequate self-performed oral hygiene combined with control of periodontal inflammation via professional biofilm removal in the supra- and subgingival environments. This is required for all subjects with a diagnosis of periodontitis. Its effectiveness for the individual patient needs to be assessed and can manage to achieve appropriate levels of plaque control, gingival inflammation and residual periodontal pockets. It may be the only phase of treatment necessary for Stage 1 periodontitis.

Phase 2. Subjects who respond well to the first phase of treatment but present with persistent periodontal pockets may benefit

from surgical correction of the anatomical lesions caused by the disease process in order to regain periodontal health, enable adequate self-performed oral hygiene and minimize the risk of recurrence. It is frequently needed for the management of Stage 2 or 3 periodontitis.

Phase 3. Once periodontal health has been achieved, rehabilitation of the masticatory function and/or aesthetics may be indicated in the more advanced cases that have experienced tooth loss, masticatory dysfunction, tooth migration or compromise of aesthetics. It is frequently needed for the management of Stage 3 periodontitis.

Phase 4. Participation in a professional secondary preventive care programme tailored for the periodontitis patient who is at higher risk of recurrence. These patients require more stringent monitoring and a higher level of care. This is necessary for long-term preservation of the dentition after completion of active periodontal therapy (Phases 1–3) of all periodontitis patients.

A classical study with 30-year follow-up indicates that optimal results are obtained with specialist care followed by participation in secondary prevention programmes in specialist clinics. Failure to deliver structured secondary prevention care in a specialist clinic leads to higher rates of recurrence of periodontitis and tooth loss (Axelsson & Lindhe, 1981; Axelsson, Nyström, & Lindhe, 2004).

Periodontal care is being provided in a variety of health systems around the world and, given the global burden of disease, it requires the active engagement of a highly trained and motivated oral health professional team. As the complexity of treatment increases with disease progression (Stages 1–3 periodontitis), it is important to plan appropriate primary and secondary care in national health systems. Appropriate assessment and enhancement could therefore be performed in every country for optimizing the national oral healthcare strategies and services.

In countries with structured dental services, effective primary care is provided in general dental offices through a dentist-led teamwork with dental hygienists and assistants with clearly defined areas of responsibility. While secondary care is delivered in more specialized centres, usually under the guidance of a specialist. In some countries, tertiary care facilities at academic centres may provide support for the management of unusual and challenging forms of disease.

The remit of primary care facilities comprises periodontal health information, health promotion, instruction in self-performed oral hygiene and preventive care for the general population, diagnosis and monitoring to ensure early detection of periodontitis, effective management of mild and moderate forms of disease (Stage 1 periodontitis), early recognition of subjects responding poorly or incompletely to standard treatment in the primary care setting and consideration of referral to a secondary care facility. Access to specialist care is best performed by referral from a primary care facility but patient self-referral is a possibility. The remit of specialized centres includes the management of more advanced (Stages 2 or 3 periodontitis) or non-responding forms of periodontitis as well as periodontitis in patients with complex medical co-morbidities. In many countries periodontitis management in secondary care facilities is provided under the guidance of a periodontist or periodontologist—a trained specialist.

At these centres patients are given comprehensive advice on the full spectrum of treatment options available for the management of their periodontitis, and they should be able to receive the most appropriate form of treatment including control of advanced periodontitis (Stage 2 periodontitis), access flap surgery, osseous resective or regenerative periodontal surgery to manage deep residual pockets, management of ridge deformities consequent to tooth loss, rehabilitation of masticatory dysfunction with dental implants (Stage 3 periodontitis), management of aesthetic concerns with periodontal plastic surgery and, most importantly, the necessary specialized secondary preventive care tailored for high-risk individuals.

Technological advances over the last decades have considerably improved the applicability and predictability of these procedures, and advanced periodontal therapy is based on the largest body of scientific evidence in dentistry, that is, the references of European Federation of Periodontology (EFP) and American Academy of Periodontology (AAP) workshops. Since the science supporting periodontal treatment is strong, specific actions should address at the national level the following priorities to improve access to the available care:

1. Enhance public awareness of the early signs of periodontitis and the need for professional diagnosis to differentiate gingivitis and periodontitis.
2. Improve access to care informing patients that periodontitis can be effectively managed and that management is more cost-effective in the early stages of disease.
3. Enhance public and professional awareness of the standard of care for periodontitis in its different stages of severity.
4. Improve access to evidence-based treatment by addressing the misunderstanding that periodontitis can be effectively managed by self-care or self-medication with dentifrices, mouthrinses, herbal or homeopathic remedies, or by professional tooth cleaning alone.
5. Enhance public and professional awareness of the effect of treatment of periodontitis on improvement of oral health-related quality of life.
6. Enhance public and professional awareness of the possibility of individualized case prognosis based on the specific patient profile and stage of disease.
7. Enhance public and professional awareness of the consequences of incomplete and/or ineffective periodontal treatment, that is, higher risk of periodontitis progression and tooth loss due to incomplete and/or ineffective Phase 1 periodontal treatment as evidenced by persistence of periodontal inflammation with bleeding on probing and residual deep periodontal pockets.
8. Enhance public and professional awareness of the inadequacy of limiting treatment of periodontitis to the delivery of preventive professional care alone.
9. Enhance public and professional awareness of the role of dental implants as a part of the rehabilitation of masticatory dysfunction consequent to Stage 3 periodontitis, but not as a method for the treatment of periodontitis.

10. Enhance public and professional awareness of the need to complete treatment of periodontitis before proceeding with replacement of missing teeth with tooth- or implant-supported restorations.
11. Enhance public and professional awareness of the advances that periodontal treatment has made in the last decades and that consequently periodontal prognosis has changed greatly, and that teeth with advanced disease may be saved, for example, through the application of regenerative periodontal therapy.
12. Enhance public and professional awareness of the interdependence of periodontal health and general health, and the need for specific actions to address common risk factors (e.g. smoking, malnutrition, sedentary lifestyles and overweight/obesity) for both periodontitis and other chronic diseases.
13. Enhance public and professional awareness of the large oral care savings consequent to the delivery of appropriate periodontal care.
14. Enhance public and professional awareness of the potential savings for medical care associated with the delivery of appropriate periodontal care in specific groups like diabetics.

Clarifications of the above priorities, along with the availability of the necessary resources, may improve access to care and contribute to the management of the current burden of disease.

5 | CONCLUSIONS

Periodontology is supported by a strong and coherent body of scientific evidence; that allows identification of appropriate preventive, diagnostic and therapeutic strategies to effectively reduce the enormous global burden of disease represented by periodontitis, promote periodontal health, enhance general wellbeing and better manage socio-economic consequences. This call for global action has summarized reasonable strategies and undertakings whose implementation requires consideration of the specific national scenarios in terms of resources and health system model.

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CONFLICT OF INTEREST

Authors report no conflict of interest.

REFERENCES

Axelsson, P., & Lindhe, J. (1981). Effect of controlled oral hygiene procedures on caries and periodontal disease in adults. Results after 6 years. *Journal of Clinical Periodontology*, *8*, 239–248.

Axelsson, P., Nyström, B., & Lindhe, J. (2004). The long-term effect of a plaque control program on tooth mortality, caries and periodontal disease in adults. Results after 30 years of maintenance. *Journal of Clinical Periodontology*, *31*, 749–757.

Buset, S. L., Walter, C., Friedmann, A., Weiger, R., Borgnakke, W. S., & Zitzmann, N. U. (2016). Are periodontal diseases really silent? A systematic review of their effect on quality of life. *Journal of Clinical Periodontology*, *43*, 333–344.

Chambrone, L., Chambrone, D., Lima, L. A., & Chambrone, L. A. (2010). Predictors of tooth loss during long-term periodontal maintenance: A systematic review of observational studies. *Journal of Clinical Periodontology*, *37*, 675–684.

Chapple, I. L. (2014). Time to take periodontitis seriously. *British Medical Journal*, *348*, g2645.

Chapple, I. L., Van der Weijden, F., Doerfer, C., Herrera, D., Shapira, L., Polak, D., … Graziani, F. (2015). Primary prevention of periodontitis: Managing gingivitis. *Journal of Clinical Periodontology*, *42*(Suppl 16), S71–S76.

Chapple, I. L., Bouchard, P., Cagetti, M. G., Campus, G., Carra, M. C., Cocco, F., … Schulte, A. G. (2017). Interaction of lifestyle, behaviour or systemic diseases with dental caries and periodontal diseases: consensus report of group 2 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *Journal of Clinical Periodontology*, *44*(Suppl 18), S39–S51.

Darveau, R. P. (2010). Periodontitis: A polymicrobial disruption of host homeostasis. *Nature Reviews Microbiology*, *8*, 481–490.

Editorial (2009). Oral health: Prevention is key. *Lancet*, *373*, 1.

Ezzati, M., & Riboli, E. (2012). Can non-communicable diseases be prevented? Lessons from studies of population and individuals. *Science*, *337*, 1482–1487.

FDI World Dental Federation (2013a). FDI policy statement on non-communicable diseases. *International Dental Journal*, *63*, 285–286.

FDI World Dental Federation (2013b). FDI policy statement on oral health and the social determinants of health. *International Dental Journal*, *63*, 287–288.

GBD 2015 Disease and Injury Incidence and Prevalence Collaborators (2016). Global, regional, and national incidence, prevalence, and years lived with disability for 310 diseases and injuries, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*, *388*, 1545–1602.

GBD 2015 SDG Collaborators (2015). Measuring the health-related Sustainable Development Goals in 188 countries: a baseline analysis from the Global Burden of Disease Study 2015. *Lancet*, *388*, 1813–1850.

Genco, R. J., Schifferle, R. E., Dunford, R. G., Falkner, K. L., Hsu, W. C., & Balukjian, J. (2014). Screening for diabetes mellitus in dental practices: A field trial. *The Journal of the American Dental Association*, *145*, 57–64.

Glick, M., Monteiro da Silva, O., Seeberger, G. K., Xu, T., Pucca, G., Williams, D. M., … Séverin, T. (2012). FDI Vision 2020: Shaping the future of oral health. *International Dental Journal*, *62*, 278–291.

Glick, M., Williams, D. M., Kleinman, D. V., Vujicic, M., Watt, R. G., & Weyant, R. J. (2016). A new definition for oral health developed by the FDI World Dental Federation opens the door to a universal definition of oral health. *International Dental Journal*, *66*, 322–324.

Guinness World Records (Eds.) (2001). Gum disease. In: *Guinness World Records* (p. 175). New York: Mint Publishers, Incorporated.

Hajishengallis, G., Liang, S., Payne, M. A., Hashim, A., Jotwani, R., Eskan, M. A., … Curtis, M. A. (2011). Low-abundance biofilm species orchestrates inflammatory periodontal disease through the commensal microbiota and complement. *Cell Host & Microbe*, *10*, 497–506.

Jepsen, S., Berglundh, T., Genco, R., Aass, A. M., Demirel, K., Derks, J., … Zitzmann, N. U. (2015). Primary prevention of peri-implantitis: Managing periimplant mucositis. *Journal of Clinical Periodontology*, *42*(Suppl 16), S152–S157.

Jepsen, S., Blanco, J., Buchalla, W., Carvalho, J. C., Dietrich, T., Dörfer, C., … Machiulskiene, V. (2017). Prevention and control of dental caries and periodontal diseases at individual and population level: consensus report of group 3 of joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *Journal of Clinical Periodontology*, *44*(Suppl 18), S85–S93.

Jin, L. J. (2013). The global call for oral health and general health. *International Dental Journal*, *63*, 281–282.

Jin, L. J. (2015). Interprofessional education and multidisciplinary teamwork for prevention and effective management of periodontal disease. *Journal of the International Academy of Periodontology*, *17*(1 Suppl), 74–79.

Jin, L. J., Armitage, G. C., Klinge, B., Lang, N. P., Tonetti, M., & Williams, R. C. (2011). Global oral health inequalities: Task group-periodontal disease. *Advances in Dental Research*, *23*, 221–226.

Jin, L. J., Lamster, I. B., Greenspan, J. S., Pitts, N. B., Scully, C., & Warnakulasuriya, S. (2016). Global burden of oral diseases: Emerging concepts, management and interplay with systemic health. *Oral Diseases*, *22*, 609–619.

Kassebaum, N. J., Bernabé, E., Dahiya, M., Bhandari, B., Murray, C. J., & Marcenes, W. (2014a). Global burden of severe periodontitis in 1990–2010: A systematic review and meta-regression. *Journal of Dental Research*, *93*, 1045–1053.

Kassebaum, N. J., Bernabé, E., Dahiya, M., Bhandari, B., Murray, C. J., & Marcenes, W. (2014b). Global burden of severe tooth loss: A systematic review and meta-analysis. *Journal of Dental Research*, *93*(7 Suppl), 20S–28S.

Kornman, K. S. (2008). Mapping the pathogenesis of periodontitis: A new look. *Journal of Periodontology*, *79*, 1560–1568.

Lalla, E., Kunzel, C., Burkett, S., Cheng, B., & Lamster, I. B. (2011). Identification of unrecognized diabetes and pre-diabetes in a dental setting. *Journal of Dental Research*, *90*, 855–860.

Lee, J. Y., Watt, R. G., Williams, D. M., & Giannobile, W. V. (2017). A new definition for oral health: Implications for clinical practice, policy, and research. *Journal of Dental Research*, *96*, 125–127.

Listl, S., Galloway, J., Mossey, P. A., & Marcenes, W. (2015). Global economic impact of dental diseases. *Journal of Dental Research*, *94*, 1355–1361.

Marcenes, W., Kassebaum, N. J., Bernabé, E., Flaxman, A., Naghavi, M., Lopez, A., & Murray, C. J. (2013). Global burden of oral conditions in 1990–2010: A systematic analysis. *Journal of Dental Research*, *92*, 592–597.

Murray, C. J., Vos, T., Lozano, R., et al. (2012). Disability-adjusted life years (DALYs) for 291 diseases and injuries in 21 regions, 1990–2010: A systematic analysis for the Global Burden of Disease Study 2010. *Lancet*, *380*, 2197–2223.

Petersen, P. E., & Ogawa, H. (2012). The global burden of periodontal disease: Towards integration with chronic disease prevention and control. *Periodontology 2000*, *60*, 15–39.

Pihlstrom, B. L., Michalowicz, B. S., & Johnson, N. W. (2005). Periodontal diseases. *Lancet*, *366*, 1809–1820.

Sanz, M., Bäumer, A., Buduneli, N., Dommisch, H., Farina, R., Kononen, E., … Winkel, E. (2015). Effect of professional mechanical plaque removal on secondary prevention of periodontitis and the complications of gingival and periodontal preventive measures: Consensus report of group 4 of the 11th European Workshop on Periodontology on effective prevention of periodontal and peri-implant diseases. *Journal of Clinical Periodontology*, *42*(Suppl 16), S214–S220.

Sanz, M., Beighton, D., Curtis, M. A., Cury, J. A., Dige, I., Dommisch, H., … Zaura, E. (2017). Role of microbial biofilms in the maintenance of oral health and in the development of dental caries and periodontal diseases. Consensus report of group 1 of the Joint EFP/ORCA workshop on the boundaries between caries and periodontal disease. *Journal of Clinical Periodontology*, *44*(Suppl 18), S5–S11.

Shanbhag, S., Dahiya, M., & Croucher, R. (2012). The impact of periodontal therapy on oral health-related quality of life in adults: A systematic review. *Journal of Clinical Periodontology*, *39*, 725–735.

Sheiham, A., & Watt, R. G. (2000). The common risk factor approach: A rational basis for promoting oral health. *Community Dentistry and Oral Epidemiology*, *28*, 399–406.

Tonetti, M. S., Chapple, I. L., Jepsen, S., & Sanz, M. (2015). Primary and secondary prevention of periodontal and peri-implant diseases: Introduction to, and objectives of the 11th European Workshop on Periodontology consensus conference. *Journal of Clinical Periodontology*, *42*(Suppl 16), S1–S4.

Tonetti, M. S., Eickholz, P., Loos, B. G., Papapanou, P., van der Velden, U., Armitage, G., … Suvan, J. E. (2015). Principles in prevention of periodontal diseases: Consensus report of group 1 of the 11th European Workshop on Periodontology on effective prevention of periodontal and peri-implant diseases. *Journal of Clinical Periodontology*, *42*(Suppl 16), S5–S11.

Tonetti, M., & Kornman, K. S. (2013). Special Issue: Periodontitis and Systemic Diseases – Proceedings of a workshop jointly held by the European Federation of Periodontology and American Academy of Periodontology. *Journal of Clinical Periodontology*, *40*(Suppl 14), S1–S209.

Tonetti, M. S., Bottenberg, P., Conrads, G., Eickholz, P., Heasman, P., Huysmans, M. C., … Paris, S. (2017). Dental caries and periodontal diseases in the ageing population: call to action to protect and enhance oral health and well-being as an essential component of healthy ageing – Consensus report of group 4 of the joint EFP/ORCA workshop on the boundaries between caries and periodontal diseases. *Journal of Clinical Periodontology*, *44*(Suppl 18), S135–S144.

Trombelli, L., Franceschetti, G., & Farina, R. (2015). Effect of professional mechanical plaque removal performed on a long-term, routine basis in the secondary prevention of periodontitis: A systematic review. *Journal of Clinical Periodontology*, *42*(Suppl 16), S221–S236.

United Nations. *Transforming our world: The 2030 agenda for sustainable development*. New York: United Nations, 2015. https://sustainabledevelopment.un.org/post2015/transformingourworld (accessed December 2, 2016).

United Nations General Assembly. (2011). Political Declaration of the High-level Meeting of the General Assembly on the Prevention and Control of Non-communicable Diseases (16 September 2011) (Clause 19). http://www.un.org/ga/search/view_doc.asp?symbol=A/66/L.1 (accessed December 2, 2016).

Zinman, E. (2001). Dental and legal considerations in periodontal therapy. *Periodontology 2000*, *25*, 114–130.

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Effect of Toothbrushing Frequency on Incidence and Increment of Dental Caries: A Systematic Review and Meta-Analysis

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Abstract

Toothbrushing is considered fundamental self-care behavior for maintenance of oral health, and brushing twice a day has become a social norm, but the evidence base for this frequency is weak. This systematic review and meta-analysis aims to assess the effect of toothbrushing frequency on the incidence and increment of carious lesions. Medline, Embase, Cinahl, and Cochrane databases were searched. Screening and quality assessment were performed by 2 independent reviewers. Three different meta-analyses were conducted: 2 based on the caries outcome reported in the studies (incidence and increment) with subgroup analyses of categories of toothbrushing frequency; another included all studies irrespective of the caries outcome reported with the type of dentition as subgroups. Meta-regression was conducted to assess the influence of sample size, follow-up period, diagnosis level for carious lesions, and methodological quality of the articles on the effect estimate. Searches retrieved 5,494 titles: after removing duplicates, 4,305 remained. Of these, 74 were reviewed in full, but only 33 were eligible for inclusion. Self-reported infrequent brushers demonstrated higher incidence (odds ratio [OR], 1.50; 95% confidence interval [CI], 1.34 to 1.69) and increment (standardized mean difference [SMD], 0.28; 95% CI: 0.13 to 0.44) of carious lesions than frequent brushers. The odds of having carious lesions differed little when subgroup analysis was conducted to compare the incidence between ≥2 times/d vs <2 times/d (OR: 1.45; 95% CI: 1.21 to 1.74) and ≥1 time/d vs <1 time/d brushers (OR: 1.56; 95% CI: 1.37 to 1.78). When meta-analysis was conducted with the type of dentition as subgroups, the effect of infrequent brushing on incidence and increment of carious lesions was higher in deciduous (OR: 1.75; 95% CI: 1.49 to 2.06) than permanent dentition (OR: 1.39; 95% CI: 1.29 to 1.49). Findings from meta-regression indicated that none of the included variables influenced the effect estimate.

Keywords: dentition, home care dental devices, oral hygiene, preventive dentistry, public health, epidemiology

Introduction

Toothbrushing is considered fundamental self-care behavior for maintenance of oral health (Poklepovic et al. 2013), and brushing twice a day is a social norm. It is common practice for dentists and professional organizations to advise this; for example, the Centers for Disease Control and Prevention (CDC) recommends brushing twice a day specifically for preventing dental caries (CDC 2014). Nevertheless, the effect of toothbrushing frequency on prevention of dental caries is unclear: the evidence is inconsistent and conflicting. In 1986, based on conclusions from several workshops on oral hygiene, Addy (1986) stated that other than the delivery of fluoride ions from the toothpaste, brushing frequency by itself has no additional benefit in preventing dental caries. Many studies have found an association between cumulative levels of dental caries and reported toothbrushing frequency, but only 1 published experimental trial could be found that also evaluated the effect of toothbrushing frequency on caries increment: this observed a strong inverse correlation (Chestnutt et al. 1998). A Cochrane review also concludes that brushing twice daily increases the effectiveness of fluoridated toothpaste in decreasing caries increment (Marinho et al. 2003).

Systematic reviews and meta-analyses have been conducted to evaluate the associations between toothbrushing frequency and gingival recession (Rajapakse et al. 2007), head and neck cancer (Zeng et al. 2015), and periodontitis (Zimmermann et al. 2015). However, the evidence for a clear association between toothbrushing frequency per se and dental caries remains ambiguous, and no systematic review could be found that specifically explored this matter.

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A supplemental appendix to this article is published electronically only at http://jdr.sagepub.com/supplemental.

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The present systematic review and meta-analysis aims to assess the effect of toothbrushing frequency on the incidence and increment of carious lesions.

Materials and Methods

Eligibility Criteria

This systematic review conforms to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al. 2009). Case-control, prospective cohort, retrospective cohort, and experimental trials that evaluated the effect of toothbrushing frequency on the incidence or increment of new carious lesions were considered for inclusion. When similar data from the same study population were reported in subsequent published studies, all except the latest record that provided the required data were excluded. Studies reported prior to 1980 and not published in English were excluded. There was no restriction with respect to the characteristics of the study population. Studies with participants of any and all ages were included. As we aimed to observe the effect of the frequency of toothbrushing on the development of dental caries, those studies that analyzed the effect of other caries-related factors such as diet, but not toothbrushing frequency, were excluded. The exposure/intervention variable was toothbrushing frequency, the reported categories of which varied considerably between studies. The outcomes of interest were incidence (proportion of individuals developing new carious lesions) and increment (mean of new carious lesions). The increment was reported in any of the following ways: mean of new decayed teeth or surfaces, mean of new decayed and filled teeth, and mean of new decayed, missing, and filled surfaces. Studies that had tooth loss, tooth pain, or self-reported dental decay as outcome measures were excluded.

Information Sources and Search Strategy

A systematic search for literature was performed in January 2016 in 4 electronic databases: Medline via PubMed, Embase, Cinahl, and Cochrane (for trials and economic assessments). Search filters were used to restrict retrieval to studies in humans, published in English between January 1980 and December 2015, and to journal articles. There were very few longitudinal studies published prior to 1980 on this topic, and it proved difficult to retrieve full texts of these articles and even abstracts in many instances. Books, letters to the editor, and personal opinions were not considered. The search strategy used in PubMed is provided in Appendix Table 1.

Study Selection and Data Extraction

Screening of titles and abstracts was performed by 2 independent reviewers (S.K. and J.T.). Abstracts found relevant were scheduled for full-text review, including those that apparently focused on oral hygiene behavior or oral health–related behavior. There was no discrepancy between the reviewers in study selection. Data extraction from the full texts of the articles was independently performed by 2 reviewers (S.K. and J.T.). Prepiloted forms were used for this purpose and extracted data were rechecked for accuracy by the senior author (N.W.J.). Data on study setting, study design, sample size, follow-up period, dental caries outcome and diagnostic criteria, categories used to record the frequency of toothbrushing, absolute values necessary for meta-analysis, findings, and information on other sources of fluoride were collected. The original corresponding authors were contacted when the data required for meta-analysis were missing: reminders were sent by e-mail twice at 1-wk intervals when a response was not obtained.

Quality Assessment

Studies were assessed for methodological quality by 2 reviewers (S.K. and J.T.) independently. The quality assessment tool for quantitative studies developed by the Effective Public Health Practice Project (EPHPP) was used for this purpose (EPHPP 2003). The level at which a diagnosis of a carious lesion was made was also recorded for every study (i.e., whether at precavity or cavity level). The EPHPP tool has 6 components (selection bias, study design, confounders, blinding, data collection method, and withdrawals and dropouts) with a rating of "strong," "moderate," or "weak" provided for each component, using the criteria described in the EPHPP dictionary itself. A final global rating of strong is given to a study if it does not have weak ratings in any of the 6 components. A study is rated moderate if it has 1 weak rating and weak if it has 2 or more weak ratings.

Data Synthesis

Revman 5.3 (The Cochrane Collaboration, Copenhagen) was used for conducting the meta-analysis. The odds ratio (OR) was the summary estimate reported in most of the studies (16 articles). Seven studies reported continuous data as "mean increment" in carious lesions, along with standard deviations and sample sizes for each toothbrushing category, allowing computing of SMDs and standard errors. Effect estimate of OR = 1 was imputed for 2 studies (Takano et al. 2003; Fure 2004) that did not report any values but stated that the effect of toothbrushing frequency was statistically insignificant; the standard error was imputed as the mean of the reported values in that comparison (Higgins and Green 2011; Schwendicke et al. 2015). Sensitivity analysis excluding these studies was performed using a random-effects model. Unadjusted effect estimates were used in the meta-analysis as the confounding variables, which might have been used for statistical adjustment varied between studies. For 1 study (Mattila et al. 2001), unadjusted data were not available and could not be retrieved by contacting the authors, so adjusted estimates were used.

The categorization of exposure variable (toothbrushing frequency) differed between studies, and some studies had more than 2 categories. In the latter situation, a single effect estimate was generated by comparing the caries increment or incidence in the highest brushing frequency category with the pooled data from the other categories. In 15 studies, frequent brushers

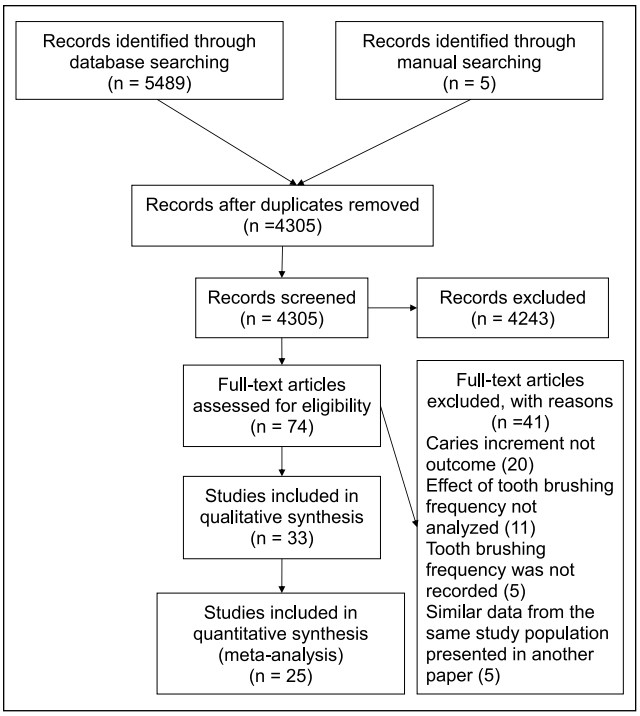

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart depicting the studies identified, included, and excluded with reasons.

were those brushing ≥2/d while in 7 and 1 studies, respectively, they were those brushing ≥1/d and >2/d, respectively.

Heterogeneity was examined using the I^2 statistic. An I^2 value of less than 40% is considered "not important," 30% to 60% is "moderate heterogeneity," and a value between 75% and 100% represents "considerable heterogeneity" (Higgins and Green 2011). Subgroup and meta-regression analyses were conducted to determine the sources of heterogeneity. Two different meta-analyses were conducted based on the caries outcome reported (namely, incidence and increment) with subgroup analyses based on the categories of toothbrushing frequency reported. To report the pooled effect of toothbrushing frequency on incidence or increment of carious lesions, the exposure variable has been categorized as frequent (subjects in highest brushing category in each study) and infrequent brushers (other brushing categories of each study). A third meta-analysis was conducted by pooling the data from all the studies irrespective of the caries outcome reported with the type of dentition as subgroups. For the latter, SMDs were reexpressed as log odds ratios using the formula suggested in the Cochrane handbook (Higgins and Green 2011). A random-effect model was used because study characteristics varied so widely. A general inverse variance method was used for meta-analysis as many studies only provided an overall effect estimate rather than summary data for each exposure group. When the caries assessment in a study was restricted to specific teeth or surfaces, this was included along with the author's name in the forest plots for ease of understanding.

Meta-regression analysis was conducted using Comprehensive Meta-Analysis 3.3.070 (Biostat) to explore the effect of confounding variables that were not considered in subgroup analyses on the effect size. Variables considered were sample size, follow-up period, diagnosis level for the presence of a carious lesion, and methodological quality of the articles. For assessing publication bias, visual inspection of funnel plots was performed, and Egger's regression intercept test was also conducted. For meta-regression, data on each confounding variable were obtained from all the 25 studies included in the meta-analysis. A single funnel plot was constructed to demonstrate publication bias as the number of studies was not sufficient to conduct analyses for caries incidence and caries increment separately (Higgins and Green 2011).

Results

Study Selection

A flowchart describing the selection of records identified, included, and excluded, with reasons, is presented in Figure 1. Searches in Medline, Embase, Cinahl, and Cochrane databases retrieved 3,796, 533, 814, and 346 results, respectively. After removing duplicates, 4,305 remained. Five of these articles were identified by manually searching the references of the included articles and from recently published literature that has not yet been indexed in Medline by reviewing the recent issues of dental epidemiology, public health, and hygiene journals. A total of 74 articles were reviewed in full, of which 33 were considered eligible for inclusion (Appendix Table 2). For quantitative synthesis, data could only be extracted and imputed from 25 articles.

Study Characteristics

Appendix Table 3 presents the characteristics and findings of the included studies. Most were conducted in high-income countries except 4 from Brazil (Lawrence and Sheiham 1997; Rodrigues and Sheiham 2000; Tagliaferro et al. 2006; Rossete Melo et al. 2013) and 1 from China (Zhou et al. 2012). Almost half (16) were conducted on European populations, with 6 and 5 studies each from Finland and Sweden, respectively. There were 7 studies from the United States. Follow-up for the incidence or increment of carious lesions in the studies ranged from 11 mo (Stecksen-Blicks and Gustafsson 1986) to 15 y (Bjertness et al. 1992). Except 8, all studies were on infant or child populations. Eleven of the included studies had caries in the deciduous dentition as an outcome. In 3 articles (Stecksen-Blicks and Gustafsson 1986; Maserejian et al. 2009; Chankanka et al. 2011), cumulative caries in deciduous and permanent dentitions together was the outcome reported, but only one of these (Maserejian et al. 2009) could be included in the meta-analysis. Sample sizes at follow-up in 3 and 7 studies were less than 100 and greater than 1,000 individuals, respectively.

Quality of Studies. Most studies were of strong (13 studies) or moderate quality (14 studies) (Appendix Table 4). Six studies could be rated "weak." Most of the studies diagnosed a carious lesion only when it was cavitated.

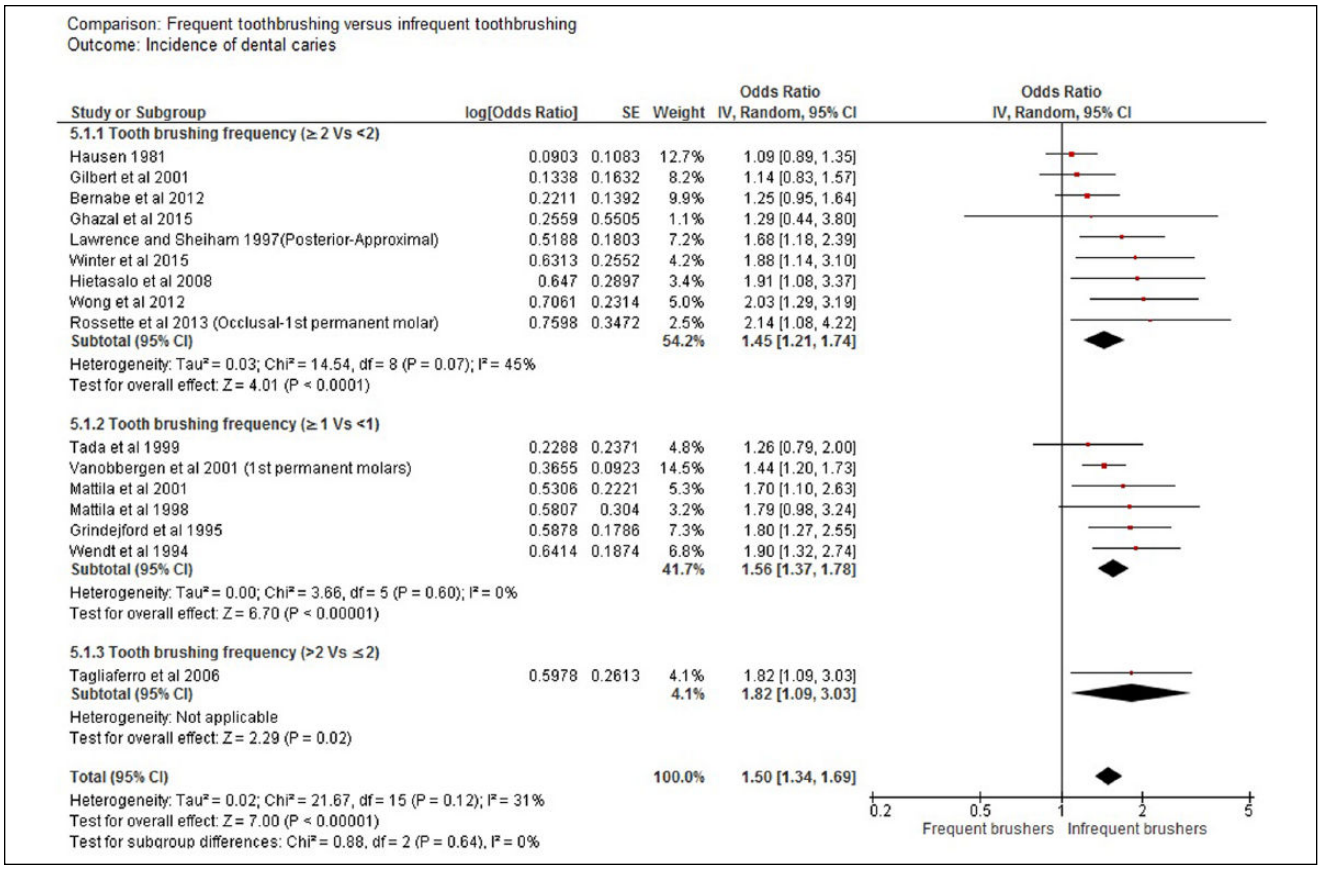

Figure 2. Effect of frequent toothbrushing compared with infrequent brushing on the incidence of dental caries.

Effect of Toothbrushing Frequency on Incidence and Increment of Carious Lesions

Compared with frequent brushers, infrequent brushers demonstrated a higher incidence of carious lesions (OR: 1.50; 95% confidence interval [CI]: 1.34, 1.69). The odds of having carious lesions differed little when subgroup analysis was conducted to compare the incidence between ≥2 times/d vs <2 times/d (OR: 1.45; 95% CI: 1.21 to 1.74) and ≥1 time/d vs <1 time/d brushers (OR: 1.56; 95% CI: 1.37 to 1.78). Only 1 study used the exposure variable, categorized as >2 times/d and ≤2 times/d. No heterogeneity ($I^2 = 0$) was observed between the subgroups (Fig. 2).

Figure 3 demonstrates that brushing <2 times /day significantly caused an increment of carious lesions compared with ≥2/day brushing (standardized mean difference [SMD]: 0.34; 95% CI: 0.18 to 0.49). There were no differences between >2/d and ≤2/d brushers for an increment of carious lesions (SMD: –0.12; 95% CI: –0.38 to 0.15; $P = 0.39$). Overall, infrequent brushing was associated with an increment of carious lesions (SMD: 0.28; 95% CI: 0.13 to 0.44). Considerable heterogeneity was observed between the subgroups of studies with increment as an outcome.

When meta-analysis was conducted with the type of dentition as subgroups, there was an increased chance of incidence or increment of carious lesions among infrequent brushers than those brushing frequently in both the dentitions (Fig. 4). However, the strength of this association was greater in the deciduous dentition (OR: 1.75; 95% CI: 1.49 to 2.06) than that found in the permanent dentition (OR: 1.39; 95% CI: 1.29 to 1.49). Heterogeneity among the studies on deciduous ($I^2 = 0$) and permanent dentitions ($I^2 = 54\%$) was not "considerable."

Sensitivity Analysis, Meta-Regression, and Publication Bias

A sensitivity analysis was performed by excluding 2 studies whose data were imputed; the pooled estimate thus obtained was only minutely different (OR: 1.41; 95% CI: 1.31 to 1.51) from the estimate obtained by including them in the analysis (OR: 1.39; 95% CI: 1.29 to 1.49). Results of the meta-regression analysis (Appendix Table 5) indicate that none of the included variables influenced the effect estimate. There was no evidence of publication bias among the included studies ($t = 1.40$; 95% CI: –0.52 to 2.71; $P = 0.174$): visual inspection of the funnel plot in Figure 5 also demonstrates that no significant asymmetry existed.

Discussion

In this meta-analysis, we aimed to quantify the effect of toothbrushing frequency on incidence and increment of carious

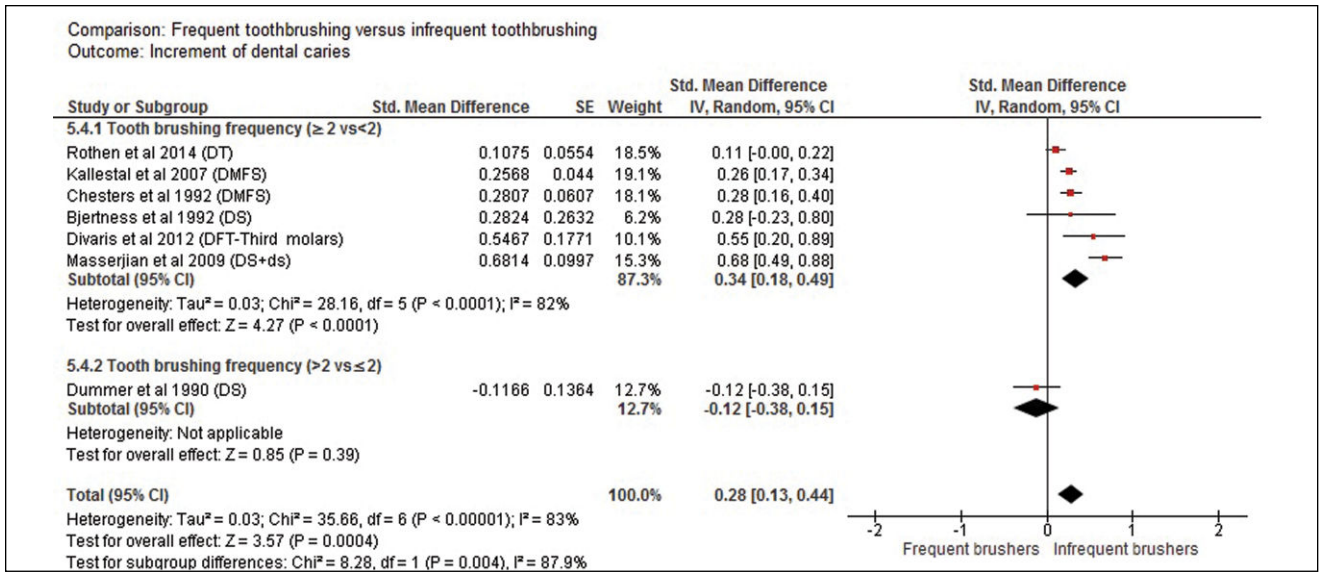

Figure 3. Effect of frequent toothbrushing compared with infrequent brushing on the increment of dental caries.

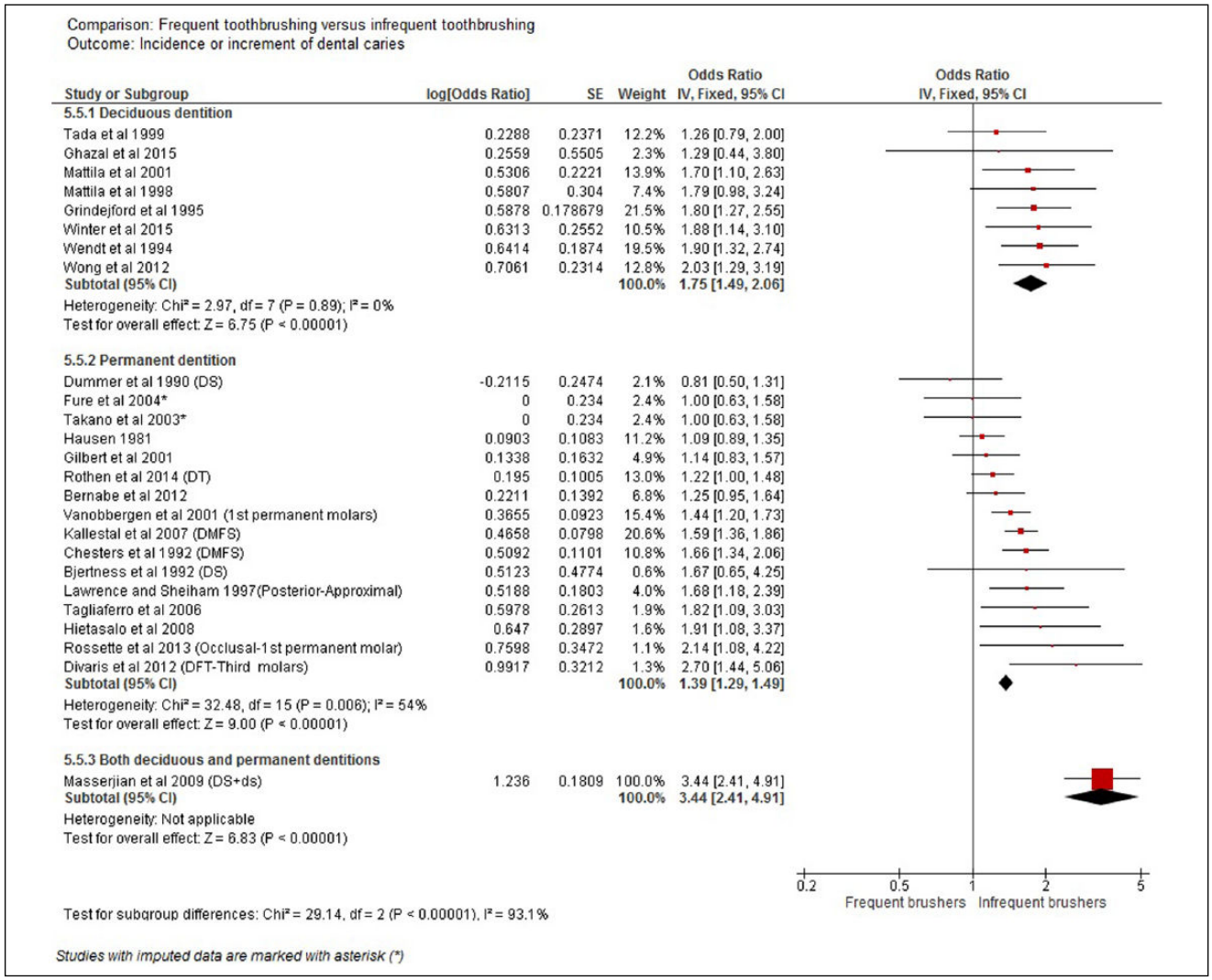

Figure 4. Effect of frequent toothbrushing compared with infrequent brushing: incidence or increment of dental caries is the outcome.

lesions. We have considered only longitudinal studies as we aimed to find if toothbrushing frequency is predictive of the development of carious lesions. To our knowledge, this is the first systematic review and meta-analysis on this topic.

Most of the included studies recorded toothbrushing frequency at baseline and the increment of carious lesions at follow-up. Eight articles could not be included in the data synthesis as the data provided were insufficient.

Although most studies were of moderate or even strong quality, they differed in nature of population, study setting, follow-up period, a method for diagnosis of a carious lesion and caries outcome used. In most of the studies, a lesion was diagnosed as carious only when it was cavitated, although a few studies diagnosed noncavitated lesions also as carious, which would have caused under- and overestimation of dental caries in these studies, respectively. However, results from meta-regression analysis indicated that none of the potential confounding variables had an influence on the effect estimate.

Irrespective of the brushing frequency category used in the studies, those brushing less frequently were at greater risk for the incidence and increment of carious lesions than those brushing frequently. However, the risk for an increment of carious lesions in those brushing >2 times/d did not different significantly from those brushing ≤2 times/d, but this estimate comes from only 1 study and should be considered with caution. Toothbrushing frequency was self-reported, and in the case of children, it was parent/caregiver reported, so the accuracy of information cannot be assumed. There is a likely tendency for subjects to inflate their answers for this type of socially acceptable behavior. This kind of reporting would have caused smaller effect estimates. Toothbrushing frequency was more effective in controlling the incidence or increment in the deciduous dentition than the permanent dentition, possibly because the former has greater susceptibility to dental caries (Lynch 2013).

It is widely believed that effective removal of dental biofilm by toothbrushing can reduce the development of new carious lesions, but the evidence base is weak—especially when it comes to frequency of brushing. It is recognized that most of the population cannot achieve optimal control of biofilm with toothbrushing alone, and fluoride in the toothpaste is considered of major importance in caries prevention (Choo et al. 2001). In this meta-analysis, we could not separate the contribution of fluoride in toothpaste as none of the studies provided data to make this possible. We have established, however, that frequent brushers are at less risk for the incidence of carious lesions independent of fluoride in toothpaste based on the findings from few studies. Three studies (Grindefjord et al. 1995; Leroy et al. 2005; Wong et al. 2012) considered toothbrushing frequency and fluoride in toothpaste as separate variables and found that the effect of the type of toothpaste was insignificant while infrequent toothbrushing frequency was associated with the incidence of carious lesions. Two studies (Wendt et al. 1994; Winter et al. 2015) found both frequent brushing and the presence of fluoride in toothpaste to be associated with decreased incidence of carious lesions.

This study has several limitations. Toothbrushing per se is associated with many factors such as nature and design of the brush and bristles, duration of brushing, brushing method, and the type of dentifrice. These effects cannot be separated in observational studies without diligently collecting comprehensive information on all of these and applying statistical adjustments. None of the studies we found have attempted this. There was also a marked variation between studies in the way toothbrushing frequency was reported. This required us to perform several subgroup analyses based on the categories given. Another limitation of this meta-analysis is that most of the studies had the primary aim of assessing the influence of toothbrushing frequency on dental caries incidence or increment. Different caries diagnosis criteria and methods might have introduced heterogeneity between the studies. Furthermore, we restricted our search to only studies in English that were published after 1980; comparing the findings of older studies with no fluoride in toothpaste with newer studies could have allowed interpreting the relevance of brushing versus fluoridated toothpaste. Last, data on the effectiveness of toothbrushing frequency adjusted for exposure to fluoride dentifrice were not provided in any of the included studies. Most studies were from developed countries. More longitudinal studies from developing and low-income countries might be helpful in assessing the independent effect of toothbrushing frequency on dental caries as it is easier to identify populations not using fluoridated products in some of these countries. Furthermore, it would be helpful for future research if studies can use a uniform protocol for reporting toothbrushing frequency, which could be one of the constituents of a core outcome set for toothbrushing studies. With the likelihood of toothbrushing frequency being considered an indicator of oral health literacy (Parker and Jamieson 2010) and social status (Levin and Currie 2009), using a uniform protocol has wider implications on population oral health research.

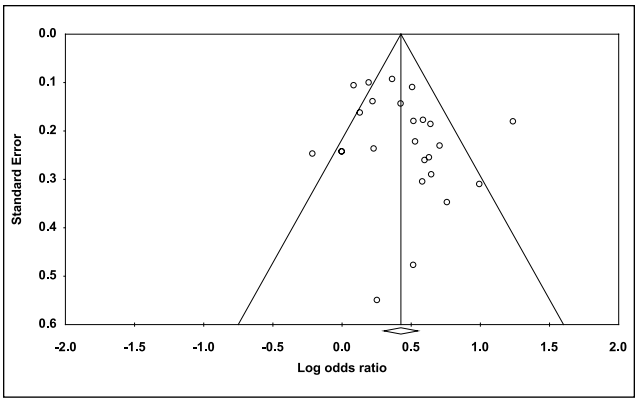

Figure 5. Funnel plot to detect publication bias from all the studies included in the meta-analysis.

Conclusion

Individuals who state that they brush their teeth infrequently are at greater risk for the incidence or increment of new carious lesions than those brushing more frequently. The effect is more

pronounced in the deciduous than in the permanent dentition. A few studies indicate that this effect is independent of the presence of fluoride in toothpaste. It is also possible that other factors in those claiming a higher frequency of brushing, such as greater health awareness and motivation, higher socioeconomic status, and a healthier diet, are responsible for the observed effects.

Author Contributions

S. Kumar, contributed to conception, design, and data acquisition, drafted the manuscript; J. Tadakamadla, contributed to data acquisition, drafted the manuscript; N.W. Johnson, contributed to conception and design, critically revised the manuscript. All authors gave final approval and agree to be accountable for all aspects of the work.

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References

Addy M. 1986. Plaque control as a scientific basis for the prevention of dental caries. J R Soc Med. 79(Suppl 14):6–10.

Bjertness E, Eriksen HM, Hansen BF. 1992. Factors of importance for changes in dental caries among adults: a follow-up study of Oslo citizens from the age of 35 to 50 years. Acta Odontol Scand. 50(4):193–200.

Centers for Disease Control and Prevention (CDC). 2014. Hygiene-related diseases. Atlanta (GA): CDC; [accessed 2016 May 23]. http://www.cdc.gov/healthywater/hygiene/disease/dental_caries.html.

Chankanka O, Cavanaugh JE, Levy SM, Marshall TA, Warren JJ, Broffitt B, Kolker JL. 2011. Longitudinal associations between children's dental caries and risk factors. J Public Health Dent. 71(4):289–300.

Chestnutt IG, Schafer F, Jacobson AP, Stephen KW. 1998. The influence of toothbrushing frequency and post-brushing rinsing on caries experience in a caries clinical trial. Community Dent Oral Epidemiol. 26(6):406–411.

Choo A, Delac DM, Messer LB. 2001. Oral hygiene measures and promotion: review and considerations. Aust Dent J. 46(3):166–173.

Effective Public Health Practice Project (EPHPP). 2003. Qualitative assessment tool for quantitative studies [accessed 2016 May 23]. http://www.ephpp.ca/PDF/Quality%20Assessment%20Tool_2010_2.pdf.

Fure S. 2004. Ten-year cross-sectional and incidence study of coronal and root caries and some related factors in elderly Swedish individuals. Gerodontology. 21(3):130–140.

Grindefjord M, Dahllof G, Modeer T. 1995. Caries development in children from 2.5 to 3.5 years of age: a longitudinal study. Caries Res. 29(6):449–454.

Higgins JP, Green S. 2011. Cochrane handbook for systematic reviews of interventions. Oxford: The Cochrane Collaboration.

Lawrence HP, Sheiham A. 1997. Caries progression in 12- to 16-year-old schoolchildren in fluoridated and fluoride-deficient areas in Brazil. Community Dent Oral Epidemiol. 25(6):402–411.

Leroy R, Bogaerts K, Lesaffre E, Declerck D. 2005. Multivariate survival analysis for the identification of factors associated with cavity formation in permanent first molars. Eur J Oral Sci. 113(2):145–152.

Levin KA, Currie C. 2009. Inequalities in toothbrushing among adolescents in Scotland 1998–2006. Health Educ Res. 24(1):87–97.

Lynch RJ. 2013. The primary and mixed dentition, post-eruptive enamel maturation and dental caries: a review. Int Dent J. 63(Suppl 2):3–13.

Marinho VC, Higgins JP, Sheiham A, Logan S. 2003. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev. 1:CD002278.

Maserejian NN, Tavares MA, Hayes C, Soncini JA, Trachtenberg FL. 2009. Prospective study of 5-year caries increment among children receiving comprehensive dental care in the New England Children's Amalgam Trial. Community Dent Oral Epidemiol. 37(1):9–18.

Mattila ML, Rautava P, Paunio P, Ojanlatva A, Hyssala L, Helenius H, Sillanpaa M. 2001. Caries experience and caries increments at 10 years of age. Caries Res. 35(6):435–441.

Moher D, Liberati A, Tetzlaff J, Altman DG. 2009. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. J Clin Epidemiol. 62(10):1006–1012.

Parker EJ, Jamieson LM. 2010. Associations between indigenous Australian oral health literacy and self-reported oral health outcomes. BMC Oral Health. 10:3.

Poklepovic T, Worthington HV, Johnson TM, Sambunjak D, Imai P, Clarkson JE, Tugwell P. 2013. Interdental brushing for the prevention and control of periodontal diseases and dental caries in adults. Cochrane Database Syst Rev. 12:CD009857.

Rajapakse PS, McCracken GI, Gwynnett E, Steen ND, Guentsch A, Heasman PA. 2007. Does tooth brushing influence the development and progression of non-inflammatory gingival recession? A systematic review. J Clin Periodontol. 34(12):1046–1061.

Rodrigues CS, Sheiham A. 2000. The relationships between dietary guidelines, sugar intake and caries in primary teeth in low income Brazilian 3-year-olds: a longitudinal study. Int J Paediatr Dent. 10(1):47–55.

Rossete Melo R, Rezende JS, Gomes VE, Ferreira EF, Oliveira AC. 2013. Sociodemographic, biological and behavioural risk factors associated with incidence of dental caries in schoolchildren's first permanent molars: a 3-year follow-up study. Eur J Paediatr Dent. 14(1):8–12.

Schwendicke F, Dörfer CE, Schlattmann P, Foster Page L, Thomson WM, Paris S. 2015. Socioeconomic inequality and caries: a systematic review and meta-analysis. J Dent Res. 94(1):10–18.

Stecksen-Blicks C, Gustafsson L. 1986. Impact of oral hygiene and use of fluorides on caries increment in children during one year. Community Dent Oral Epidemiol. 14(4):185–189.

Tagliaferro EP, Pereira AC, Meneghim Mde C, Ambrosano GM. 2006. Assessment of dental caries predictors in a seven-year longitudinal study. J Public Health Dent. 66(3):169–173.

Takano N, Ando Y, Yoshihara A, Miyazaki H. 2003. Factors associated with root caries incidence in an elderly population. Community Dent Health. 20(4):217–222.

Wendt LK, Hallonsten AL, Koch G, Birkhed D. 1994. Oral hygiene in relation to caries development and immigrant status in infants and toddlers. Scand J Dent Res. 102(5):269–273.

Winter J, Glaser M, Heinzel-Gutenbrunner M, Pieper K. 2015. Association of caries increment in preschool children with nutritional and preventive variables. Clin Oral Investig. 19(8):1913–1919.

Wong MC, Lu HX, Lo EC. 2012. Caries increment over 2 years in preschool children: a life course approach. Int J Paediatr Dent. 22(2):77–84.

Zeng XT, Leng WD, Zhang C, Liu J, Cao SY, Huang W. 2015. Meta-analysis on the association between toothbrushing and head and neck cancer. Oral Oncol. 51(5):446–451.

Zhou Y, Yang JY, Lo EC, Lin HC. 2012. The contribution of life course determinants to early childhood caries: a 2-year cohort study. Caries Res. 46(2):87–94.

Zimmermann H, Zimmermann N, Hagenfeld D, Veile A, Kim TS, Becher H. 2015. Is frequency of tooth brushing a risk factor for periodontitis? A systematic review and meta-analysis. Community Dent Oral Epidemiol. 43(2):116–127.

CONCISE REVIEW

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The association between oral hygiene and periodontitis: a systematic review and meta-analysis

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Objective: Dental plaque accumulation and inadequate personal oral hygiene (OH) are known major risk factors of periodontitis. Nevertheless, the magnitude of their effects has not yet been the subject of a meta-analysis. **Material and methods:** The Medline and Scopus databases were searched up to May 2016. Observational studies were eligible if they assessed associations between OH and periodontitis in adult subjects. A multivariate random-effects meta-analysis was used to pool the effects of fair/poor OH *versus* good OH on periodontitis across studies. The associations between oral care habits and periodontitis were also assessed. **Results:** A total of 50 studies were eligible; 15 were used for pooling the effect of fair OH *versus* good OH and poor OH *versus* good OH on periodontitis, with pooled odds ratios (ORs) of 2.04 [95% confidence interval (CI): 1.65–2.53] and 5.01 (95% CI: 3.40–7.39), respectively. Eleven studies examined oral care habits measured according to toothbrushing regularity and dental visit frequency; pooled ORs of 0.66 (95% CI: 0.47–0.94) and 0.68 (95% CI: 0.47–0.98) were obtained, respectively. **Conclusions:** Fair to poor OH increases the risk of periodontitis by two- to five-fold. This risk can be reduced by regular toothbrushing and dental visits.

Key words: *Meta-analysis, oral hygiene, periodontitis, risk factor, systematic review*

INTRODUCTION

Periodontitis is the most common oral disease worldwide, with an age-standardised prevalence of 11.2%[1]. It is a multifactorial disease[2], with risk factors such as diabetes mellitus (DM), smoking and, most commonly, inadequate oral hygiene (OH)[3]. The accumulation of dental plaque and calculus is usually caused by improper toothbrushing techniques, failure to carry out interdental cleaning and irregular dental visits. This accumulation predictably results in gingival inflammation. Persistent gingivitis is a key risk predictor for the breakdown of periodontal attachment. Although poor OH is a well-accepted and important risk factor for periodontitis, the magnitude of the association between OH and periodontitis has not yet been explored in a meta-analysis. Therefore, we conducted a systematic review and meta-analysis aiming to estimate the effects of OH on periodontitis, as measured by the Oral Hygiene Index (OHI), Plaque Index (PI) and plaque score (PSc). A second aim was to pool the magnitudes of association between oral care habits (regular toothbrushing, interdental cleaning and dental visits) and periodontitis.

METHODS

The Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines for conducting a meta-analysis were followed[4]. The checklist is provided in *Appendix S1* (PROSPERO registration number: CRD42015019036).

Search strategy

Relevant studies were identified from Medline and Scopus databases, searched up to May 2016 using standardised methodological filters. Search strategies

were mainly constructed based on the primary objective with three domains (i.e. periodontitis, OH and general aspects for observational studies), as follows: ('periodontitis' OR 'periodontal') AND ('poor oral hygiene' OR 'plaque index' OR 'oral hygiene index' OR 'plaque score') AND ('relation' OR 'association' OR 'risk factor'). The search terms and strategies are described in *Table S1*.

Inclusion criteria

Studies were screened based on titles and abstracts; if a decision could not be made based on this information, full papers were reviewed. Any type of observational study (e.g. cohort, case–control or cross-sectional) published in English was included if it met the following criteria: (i) assessed associations between OH and periodontitis in either general or specific types of adult populations; (ii) had at least two outcome groups, namely periodontitis *versus* non-periodontitis, or mild, moderate and severe periodontitis *versus* normal periodontium; (iii) assessed OH using standard tools, such as the OHI or Simplified Oral Hygiene Index (OHI-S)[5], PI[6], plaque control record/PSc[7] or a questionnaire including the frequency of brushing, interdental cleaning and dental visits; (iv) reported/possibly calculated the mean and standard deviation (SD) of OH scores among periodontitis groups or a contingency table between non-periodontitis/periodontitis and OH groups. Studies were excluded if they had insufficient data for pooling after contacting the authors for additional data.

Two of three reviewers (A.L., S.R. and S.A.) independently evaluated the studies for eligibility, extracted the data and assessed the risk of bias. Any discrepancies between reviewers were discussed and resolved by consensus.

Study factors

The primary study factor was OH, objectively measured using the OHI, PI or PSc. Secondary study factors were oral care habits, which were subjectively assessed using questionnaires assessing the frequency of toothbrushing, interdental cleaning and dental visits.

Outcome

The outcome of interest was periodontitis, which was defined according to the original studies. The definition of periodontitis was based on periodontal probing depth, clinical attachment level or radiographs without a restricted periodontitis definition.

Data extraction

Study characteristics, including study design (cohort, case–control or cross-sectional), population type (general population or specific disease) and study location (community or hospital) were extracted. Subject characteristics (i.e. percentage of male subjects, smoking habits and the presence of DM) and clinical data (i.e. periodontitis definition and details of OH assessments) were also extracted.

Risk of bias assessment

The quality of the studies was assessed using the modified Newcastle–Ottawa Quality Assessment Scale[8] (*Appendix S2*), which considers three domains: the *representativeness* of the studied subjects; the *comparability* between groups; and the ascertainment of *outcome and exposure*. Each domain was graded by assigning stars if there was a low risk of bias. Individual studies were categorised, according to these stars, as having a low, moderate or high risk of bias if the percentage of stars was ≥75%, 50–74% and <50%, respectively.

Statistical analysis

Data were pooled if there were at least two studies reporting the same outcomes and study factors. Data analysis was performed separately according to the type of OH data (i.e. categorical or continuous data), as described below.

For categorical data, the odds ratio (OR) of having periodontitis for fair OH *versus* good OH (OR_1) and poor OH *versus* good OH (OR_2), along with their 95% confidence intervals (95% CIs) were estimated for each study. For studies with two or more OH groups, a multivariate random-effects meta-analysis was applied for pooling ORs. This method considers within-study variation using Riley's method[9,10]. For studies in which OH was divided into more than two groups and ORs were reported without frequency data, the variance-covariance was assumed to be zero.

For continuous data, the mean difference in OH scores between periodontitis and non-periodontitis groups was estimated and pooled using a standardised mean difference (SMD). If logistic model correlation coefficients were reported instead of the mean and SD, the beta coefficients were then pooled using the pooling mean method.

Heterogeneity was assessed using Cochrane's Q test and the I^2 statistic. If heterogeneity was present (Q test <0.1 or $I^2 \geq 25\%$), a random-effects model (DerSimonian and Laird)[11] was used. Otherwise, a fixed-effects model was applied using the inverse variance method.

Sources of heterogeneity were explored using a Galbraith plot to identify outlier studies. Covariables (i.e. population type, age, gender, smoking, DM, index use, periodontitis definition) were then fitted one-by-one into a meta-regression model. If there was a suggested association, a sensitivity analysis excluding the outlier studies and/or a subgroup analysis was performed.

Finally, potential publication bias was explored using the Egger test and a funnel plot. If either of these indicated asymmetry, a contour-enhanced funnel plot was constructed to identify the cause of asymmetry. All analyses were performed using STATA software version 14 (StataCorp, College Station, TX, USA). Two-sided $P < 0.05$ was considered statistically significant except for the heterogeneity test, in which $P < 0.10$ was used.

Grade of evidence

The system from the Grades of Recommendation, Assessment, Development and Evaluation Working Group (GRADE Working Group)[12,13] was used for grading the quality of evidence mainly based on the study design, risk of bias, indirectness of evidence, publication bias, heterogeneity and imprecision of results.

RESULTS

Identifying studies

A total of 2,763 studies were identified from Medline and Scopus, and 1,934 studies remained after removing duplicates. Of these, 1,878 studies were ineligible for reasons described in *Figure 1*, leaving 56[14–69] that were eligible for review. Six studies[14,47,48,51,52,57] were excluded because of insufficient data after contacting the authors. Of the remaining 50 studies, 45[15–18,20–31,33,35–39,42–46,49,50,53–56,58–69] objectively assessed OH using an oral examination. Of these 45 studies, 15[15,17,22,26–29,31,35–39,46,65] analysed OH as categorical data, 31[16,18,20–25,30,33,42–45,49,50,53–56,58–64,66–69] as continuous data and one[22] as both. Eleven studies provided the association between periodontitis and oral care habits measured according to the frequency of brushing[29,32–34,36,37,40,41,44,56], interdental cleaning[29,41,44,56] and dental visits[19,33,34,36,40,56].

Subject characteristics

The characteristics of the 50 included studies are described in *Table 1*. Most study designs were cross-sectional, most studies investigated a general population and 34 were based in hospitals. The mean subject age ranged from 15 to 65 years. The percentages of male subjects, smokers and people with diabetes are also shown in *Table 1*. While the definition of periodontitis varied across the studies, most (92%) used periodontal probing depth and/or clinical attachment level.

Risk of bias assessment

The results of the risk of bias assessments are described in *Table S2*. Most (72%) studies provided inadequate details for sample selection; hence, representativeness was unclear. For example, some authors did not mention their sampling methods or clearly describe their process for selecting cases and controls. Twenty-seven (46%) studies were potentially biased because of improper statistical adjustments for confounding factors. Almost all studies measured periodontitis via an oral examination, which was objective and valid. However, 16 (32%) studies used partial-mouth examination protocols, 16 (32%) studies diagnosed periodontitis without data regarding clinical attachment level and 25 (50%) studies did not provide details about intra/interexaminer agreement. The numbers of studies with low, moderate and high risks of bias were 23, 19 and 8, respectively.

Oral hygiene

Of the 15 studies which reported OH as categorical data, six[15,29,35,38,46,65] categorised OH as good or poor, whereas nine[17,22,26–28,31,36,37,39] categorised OH as good, fair or poor. The criteria for classifying OH are presented in *Table S3*. Pooled ln(ORs) determined using a multivariate meta-analysis (*Figure 2*) were 0.71 (95% CI: 0.50–0.93) and 1.61 (95% CI: 1.22–2.00), which yielded pooled ORs of 2.04 (95% CI: 1.65–2.53) and 5.01 (95% CI: 3.40–7.39), respectively, for fair OH and poor OH. These results indicate that fair OH and poor OH increase the risk of periodontitis by approximately two- and five-fold compared with good OH with an I^2 of 40% and 78%, respectively. The details of each individual study are shown in *Table S4*.

Population type appeared to be a large source of heterogeneity. Subgroup analyses in community-based studies yielded lower heterogeneity levels [i.e. the I^2 values were 4% and 0% for fair and poor *versus* good OH, respectively, with corresponding pooled ORs of 2.23 (95% CI: 1.85–2.69) and 4.78 (95% CI: 4.10–5.58)]. In addition, a sensitivity analysis focussing on 11 studies[15,17,22,26–29,35–37,39] of general populations decreased the degree of heterogeneity to 22% and 49% for fair OH *versus* good OH and poor OH *versus* good OH, with pooled ORs of 2.10 (95% CI: 1.76–2.49) and 4.21 (95% CI: 3.21–5.51), respectively. Moreover, the periodontitis definitions and

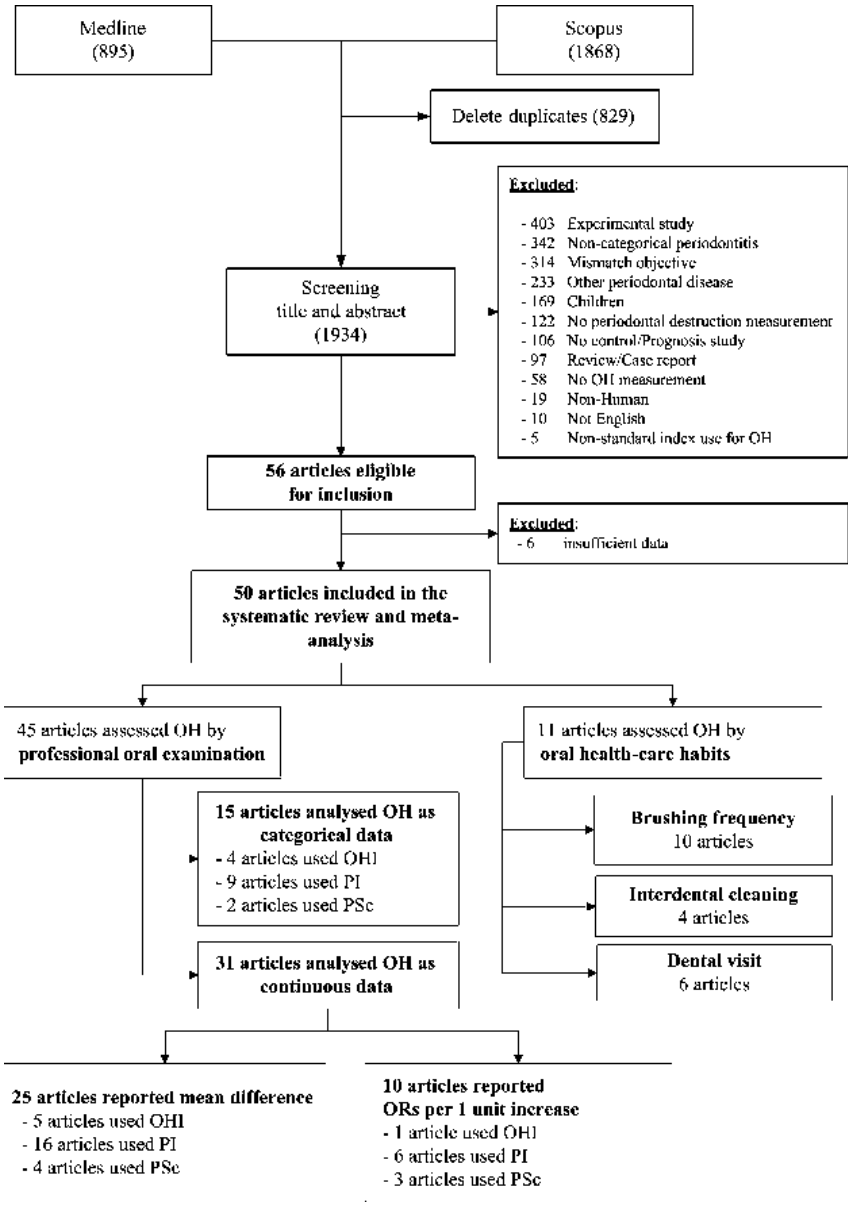

Figure 1. Flow chart of identification and selection of studies. OH, oral hygiene; OHI, Oral Hygiene Index; PI, Plaque Index; PSc, plaque score.

index types used, as well as smoking behaviour, also contributed to heterogeneity (*Table S5*).

Among 31 studies that measured OH on a continuous scale, 25[18,24,25,33,42–45,49,50,53–56,58–64,66–69] compared OH between periodontitis and non-periodontitis groups using the mean scores. The SMDs were highly heterogeneous (I^2 = 95.6%), with a pooled SMD of 2.04 (95% CI: 1.59–2.50) (*Table S6*). From these findings, it could be interpreted that periodontitis subjects had a significantly higher OH score of 2.04 standardised units than did non-periodontitis subjects.

Six[20,22,25,30,33,42] and three[16,21,23] studies reported the effects of PI and PSc on periodontitis as coefficients [i.e. ln(OR)] of logistic regression models. Pooling these corresponding effects yielded pooled ORs of 2.25 (95% CI: 1.43–3.54) and 1.02 (95% CI: 1.01–1.03), and high heterogeneity was found for both (*Figure 3*). These findings could be interpreted to indicate that each one-unit increase in the measures of PI and PSc would increase the odds of having periodontitis by 2.25 and 1.02, respectively.

Oral health-care habits

Ten[29,32–34,36,37,40,41,44,56], four[29,41,44,56] and six[19,33,34,36,40,56] studies assessed the effects of brushing, dental floss and dental visits on periodontitis

Table 1 Characteristics of included studies

Authors	Study type	Study base	Population	OH measurement	Age	Male (%)	Smoking (%)	DM (%)	Periodontitis definition
Imaki[15]	Cross-sectional	Community	General	PI	38.1	100	56.1	N/A	CPITN: 3–4
Norderyd[16]	Cross-sectional	Community	General	PSc	48	48.7	20	4	Radiography: bone loss more than one-third of root length
Wakai[17]	Cross-sectional	Hospital	General	PI	51.1	82.1	34.4	N/A	CPITN: 3–4
Papapanou[18]	Case–control	Hospital	General	PSc	50.9	47.3	32.2	N/A	One site or more with PPD ≥5 mm AND CAL ≥3 mm
Hashim[19]	Cohort	Community	General	OHI, Dental visit	15	54.2	33.3	N/A	One site or more with ≥4 mm increase in CAL
Tezal[20]	Cross-sectional	Community	General	PI	48.7	48.2	61.8	N/A	Mean CAL ≥2 mm
Hugoson[21]	Cross-sectional	Community	General	PSc	65.0	52.7	42.9	N/A	Radiography: bone loss more than one-third of root length
Do[22]	Cross-sectional	Community	General	PI	40	40.3	28.9	N/A	Two or more sites with CAL ≥5 mm AND one site or more with PPD ≥4 mm
Meisel[23]	Cross-sectional	Community	General	PSc	51.0	46.6	49.5	6	4th–5th quintiles of the percentage of sites with CAL >4 mm
Alpagot[24]	Cohort	Hospital	Patients with HIV	PI	34.1	57.9	N/A	0	One site or more with PPD ≥4 mm OR CAL ≥2 mm
Solis[25]	Cross-sectional	Hospital	General	PI	37.4	35.3	23.5	0	Two or more sites with CAL ≥6 mm AND one site or more with PPD ≥5 mm
Wickholm[26]	Cross-sectional	Community	General	PI	36.7	49.2	44.7	N/A	Three or more teeth with PPD ≥5 mm
Natto[27]	Cross-sectional	Community	General	PI	36.4	64.9	70	N/A	≥10 sites with PPD ≥5 mm
Torrungruang[28]	Cross-sectional	Community	General	PSc	60	74.4	14.3	15.8	Mean CAL >2.5 mm
de Macêdo[29]	Cross-sectional	Community	General	PSc, Flossing, Brushing	N/A	33.8	31.4	N/A	Four or more teeth with PPD ≥4 mm AND CAL ≥3 mm at the same site
Khader[30]	Cross-sectional	Hospital	General	PI	39.4	44.8	N/A	N/A	Khader's risk score
Vandana[31]	Cross-sectional	Hospital	Dental fluorosis	OHI	25.36	68.6	N/A	0	CPITN: 3–4
Wang[32]	Cross-sectional	Community	General	Brushing	N/A	45.7	27.7	0	Mean CAL ≥3 mm
Akhter[33]	Case–control	Hospital	General	PI, Brushing, Dental visit	38.5	50	45.7	N/A	Two or more sites with CAL ≥6 AND one site or more with PPD ≥5 mm
Kumar[34]	Cross-sectional	Community	General	Brushing, Dental visit	33.9	100	N/A	N/A	CPITN: 3–4
Benguigui[35]	Cross-sectional	Community	General	PI	58	54.9	19.2	6.7	CDC/AAP
Saxlin[36]	Cohort	Community	General	PI, Brushing, Dental visit	41.86	27	0	0	New teeth with PPD ≥4 mm
Bawadi[37]	Cross-sectional	Hospital	General	PI, Brushing	36.4	49.4	20.3	17.9	Four or more teeth with PPD ≥4 mm AND CAL ≥3 mm at the same site
Carrilho Neto[38]	Cross-sectional	Hospital	Inpatients	OHI	45.7	59.7	42.7	N/A	One site or more with PPD >4 mm
Mathur[39]	Cross-sectional	Hospital	General	OHI	N/A	57.3	N/A	N/A	N/A
Teng[40]	Cross-sectional	Hospital	Psychiatric inpatients	Brushing, Dental visit	41	62.5	42.5	N/A	CPITN: 3–4
Crocombe[41]	Cross-sectional	Community	General	Brushing, Flossing	N/A	50	15	4.3	One site or more with CAL ≥4 mm
Mannem[42]	Cross-sectional	Hospital	General	PI	52.5	44.1	34.2	N/A	Four or more teeth with PPD ≥4 mm AND CAL ≥3 mm at the same site
Raja[43]	Cross-sectional	Hospital	General	PI	36.5	53.3	96.7	0	Four or more sites with CAL ≥4 mm
Vogt[44]	Cross-sectional	Hospital	Pregnancy	PSc, Flossing, Brushing	27.2	0	15.87	0	Four or more teeth with PPD ≥4 mm AND CAL ≥4 mm at the same site
Fiyaz[45]	Case–control	Hospital	General	OHI	N/A	N/A	0	0	One site or more with PPD >4 mm OR CAL >1.5 mm
Palle[46]	Cross-sectional	Hospital	CVD	OHI	57.2	84.1	32.3	52.2	Five or more sites with CAL ≥5 mm
Cakmak[49]	Case–control	Hospital	General	PI	38.3	49.1	0	0	One site or more with PPD ≥5 mm AND CAL ≥4 mm
Develioglu[50]	Case–control	Hospital	General	PI	46.7	N/A	0	33.3	≥30% sites with PPD ≥5 mm AND CAL ≥3 mm

(continued)

Table 1 continued

Authors	Study type	Study base	Population	OH measurement	Age	Male (%)	Smoking (%)	DM (%)	Periodontitis definition
Jacob[53]	Case–control	Hospital	General	PI	37.3	75.6	33.3	0	CDC/AAP
Kaur[54]	Case–control	Hospital	General	PI	N/A	66.7	25	0	N/A
Koseoglu[55]	Case–control	Hospital	General	PI	34.0	50	0	0	Four or more teeth with PPD ≥5 mm AND CAL ≥4 mm in each jaw
Kovačević[56]	Cross-sectional	Hospital	General	OHI, Brushing, Flossing, Dental visit	38.9	77.2	31.7	N/A	CPITN: 3–4
Lavu[58]	Case–control	Hospital	General	OHI	33.6	50.4	0	0	CAL >1 mm at least 30% sites
Lutfioglu[59]	Case–control	Hospital	General	PI	33.1	53.3	51.1	0	One site or more with PPD ≥5 mm with radiographic evidence of bone loss
Meenawat[60]	Case–control	Hospital	General	PI	43.2	100	41.4	0	Four or more teeth with PPD >4 mm AND CAL >2 mm
Mesa[61]	Case–control	Hospital	General	PSc	46.3	40.3	46.8	N/A	Four or more teeth with PPD ≥4 mm AND CAL ≥3 mm at the same sites
Perayil[62]	Case–control	Hospital	General	OHI	43.1	43.3	0	0	Five or more teeth with PPD ≥5 mm AND CAL ≥3 mm
Pereira[63]	Case–control	Hospital	General	PSc	38.4	33.7	0	0	Four or more teeth with PPD ≥4 mm AND CAL ≥3 mm
Petrović[64]	Case–control	Hospital	General	PI	36.1	38.8	22.4	0	Thre or more quadrants with three or more sites with PPD ≥3 mm AND CAL ≥2 mm
Pranckeviciene[65]	Cross-sectional	Hospital	Type I and type II DM	PI	43.86	N/A	25.9	100	One site or more with CAL >5 mm
Puri[66]	Case–control	Hospital	General	OHI	39.78	N/A	0	0	AAP 1999
Singh[67]	Case–control	Hospital	General	PI	43.5	52.5	0	0	One site or more with PPD ≥5 mm AND CAL ≥2 mm
Toyman[68]	Case–control	Hospital	General	PI	34.6	51.2	0	0	Six teeth or more with PPD ≥5 mm with radiographic evidence of bone loss
Varghese[69]	Case–control	Hospital	General	PI	N/A	65.3	0	0	≥30% sites with PPD ≥6 mm AND CAL ≥5 mm

CAL, clinical attachment level; CDC/AAP, periodontitis definition of the Centers for Disease Control and Prevention in collaboration with the American Academy of Periodontology; CPITN, the Community Periodontal Index of Treatment Needs; CVD, cardiovascular disease; DM, diabetes mellitus; HIV, human immunodeficiency virus; N/A, not available; OH, oral hygiene; OHI, oral hygiene index; PI, plaque index; PPD, periodontal pocket depth; PSc, plaque score.

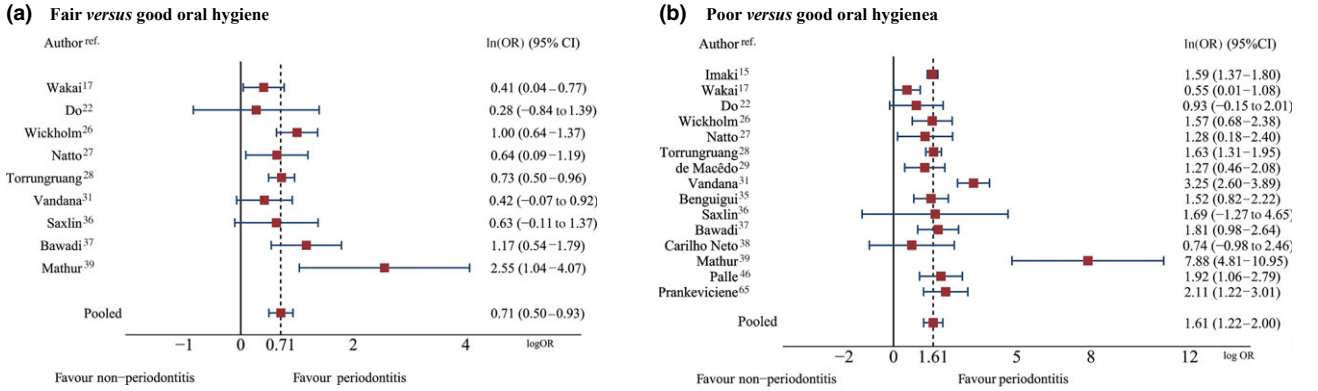

Figure 2. Pooling effects of fair oral hygiene (OH) *versus* good OH (a) and poor OH *versus* good OH (b) on periodontitis. 95% CI, 95% confidence interval; OR, odds ratio.

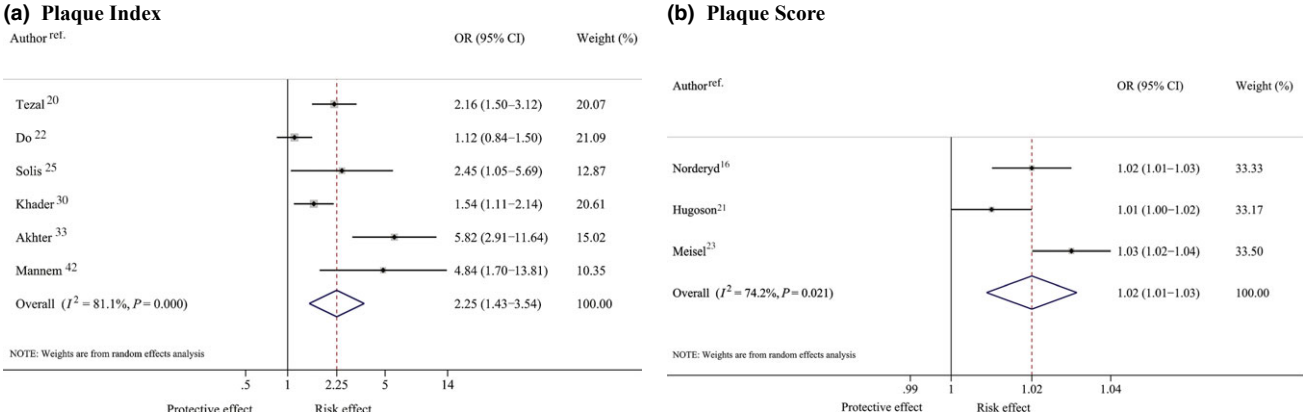

Figure 3. Pooling odds ratios (ORs) of plaque index (a) and plaque score (b) on periodontitis.

(*Table S7*). The pooled ORs (*Figure 4*) suggested that toothbrushing and dental visits were significantly associated with periodontitis, although the I^2 values showed high heterogeneity, at 94.5% and 60.4%, respectively. Subjects who brushed their teeth regularly had approximately 34% significantly lower odds of having periodontitis (pooled OR = 0.66; 95% CI: 0.47–0.94). Smoking, the definition of regular brushing and periodontitis were potential sources of heterogeneity (*Table S8*).

For dental visits, the sensitivity analysis was performed by considering four of six studies that had clearly defined a regular dental visit as at least one visit per year[19,33,36,56]. This yielded a significant effect size of 0.56 (95% CI: 0.37–0.83) with an I^2 of 0%, indicating that subjects who regularly visited dentists at least once a year had a 44% lower risk of periodontitis than those who did not. The effects of interdental cleaning with dental floss on periodontitis showed little heterogeneity (I^2 = 5.1%), but the pooled OR was borderline significant (OR = 0.87; 95% CI: 0.75–1.00).

Publication bias

Publication bias was assessed for all pooled estimates using funnel plots (*Figure S1*) and Egger tests (*Table S9*). The results suggested symmetry except for the mean differences in OH score, PSc and dental visits. Contour-enhanced funnel plots were further constructed (*Figure S2*), and these indicated that the asymmetry of the funnels might be caused by both heterogeneity and publication bias.

Quality of evidence

The scoring using the GRADE framework is shown in *Table 2* and *Appendix S3*. Based on observational studies, all pooled estimates were graded as low quality[13]. For the effects of fair OH and poor OH on periodontitis, this was upgraded to moderate quality because of large effect sizes and strong dose–response relationships. The effects of brushing and dental visits were downgraded to very low quality caused by heterogeneity and publication bias, respectively.

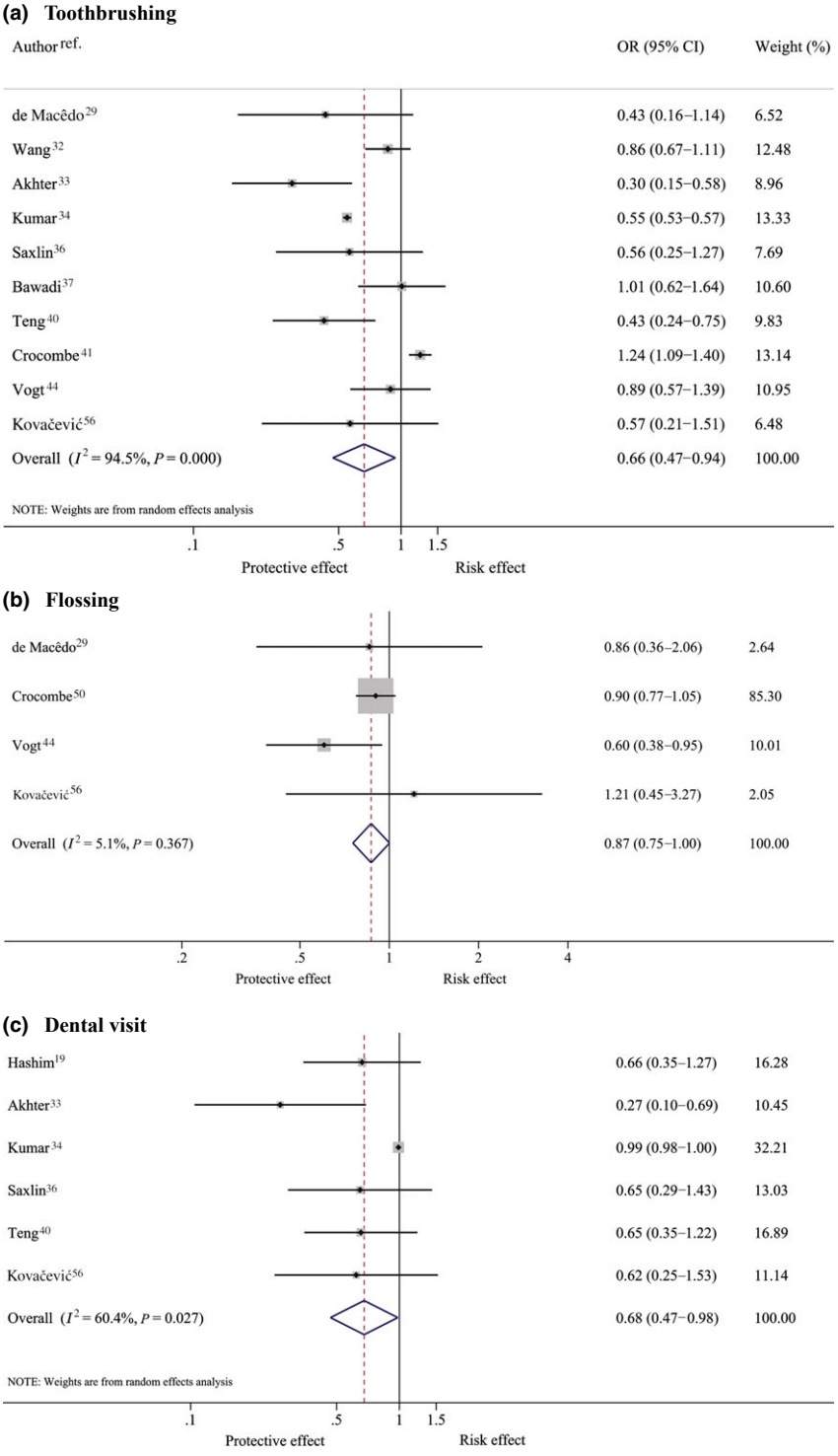

Figure 4. Pooling effect of oral care habits – toothbrushing (a), flossing (b) and dental visits (c) –on periodontitis.

DISCUSSION

We conducted a systematic review and meta-analysis of the effects of OH on periodontitis. The results suggest a dose–response relationship between OH and periodontitis, with fair and poor OH significantly increasing the risk of having periodontitis by two- and five-fold, respectively, compared with good OH. In contrast, regular toothbrushing and dentist visits could reduce periodontitis by 34% and 32%, respectively. These pooled OH effects and oral care habits are summarised in *Table 2* and *Figure 5*.

The effect of OH on periodontitis was stronger than those of other risk factors, such as DM[70] (OR = 2.6; 95% CI: 1.0–6.6), smoking[71] (OR = 2.82; 95% CI: 2.36–3.39) or obesity[72] (OR = 2.13; 95% CI: 1.40–3.26). Our results also showed protective effects of regular toothbrushing, which were consistent with the findings of a previous meta-analysis[73] that reported a significant risk for severe periodontitis caused by infrequent brushing (OR = 1.44; 95% CI: 1.21–1.71). However, our study could only identify a small effect of interdental cleaning with dental floss (i.e. a non-significant reduction of 13% in the risk of periodontitis). This result was also consistent with a previous meta-analysis[74], which found little benefit from self-performed flossing on plaque or periodontal parameters.

Table 2 Overview of the meta-analysis

Risk factor	No. of studies	Pooled OR (95% CI)	I^2 (%)	Quality of evidence*
OH				
Categorical data				
Fair OH *versus* Good OH	9	2.04 (1.65–2.53)	40	
Poor OH *versus* Good OH	15	5.01 (3.40–7.39)	78	
Continuous data				Moderate
PI: 1-unit increase	6	2.25 (1.43–3.54)	81.1	
PSc: 1-unit increase	3	1.02 (1.01–1.03)	74.2	
OH score	25	2.04 (1.59–2.50)†	95.6	
Oral health-care habits				
Toothbrushing	10	0.66 (0.47–0.94)	94.5	Very low
Interdental cleaning	4	0.87 (0.75–1.00)	5.1	Low
Dental visits	6	0.68 (0.47–0.98)	60.4	Very low

OH, oral hygiene; PI, plaque index; PSc, plaque score.
*Quality of evidence: The Grades of Recommendation, Assessment, Development and Evaluation Working Group (GRADE Working Group).
†Pooled standard mean difference (SMD).

Although the use of OH assessments varied between the included studies, approximately half commonly used the PI with similar cut-off points. OH was defined as *poor* for a PI of >2 or if the patient had a moderate accumulation of soft deposits visible by the naked eye; and OH was defined as *fair* for PI values ranging from 1 to 2 or if the patient had a film of plaque adhering to the tooth as detected by disclosing solution or probe.

To address concerns about the varying quality of the individual studies, a sensitivity analysis was also performed, including only studies with a low risk of bias[22,26–29,35–37,46,65]. The results showed little difference compared with those of the main analysis, but heterogeneity was much lower.

Good OH and oral care habits should be encouraged and promoted in public health campaigns. Dentists and dental hygienists should regularly educate, motivate and assess patients' perceptions for improving oral health behaviours. Additionally, dental nurses or assistants should encourage and provide general, useful information. Repeated and individually tailored OH instructions are key elements in achieving gingival health. Goal setting, self-monitoring and planning are effective interventions for improving OH-related behaviours in patients with periodontitis. Recognising the benefits of behaviour changes, their own susceptibility and the deleterious effects of periodontitis are important messages in periodontitis prevention[75].

Patients should be able to access dental care regularly for professional cleaning together with tailoring and monitoring their OH[75]. They should also be taught how to perform plaque removal efficiently. Generally, mechanical plaque controlled by twice-

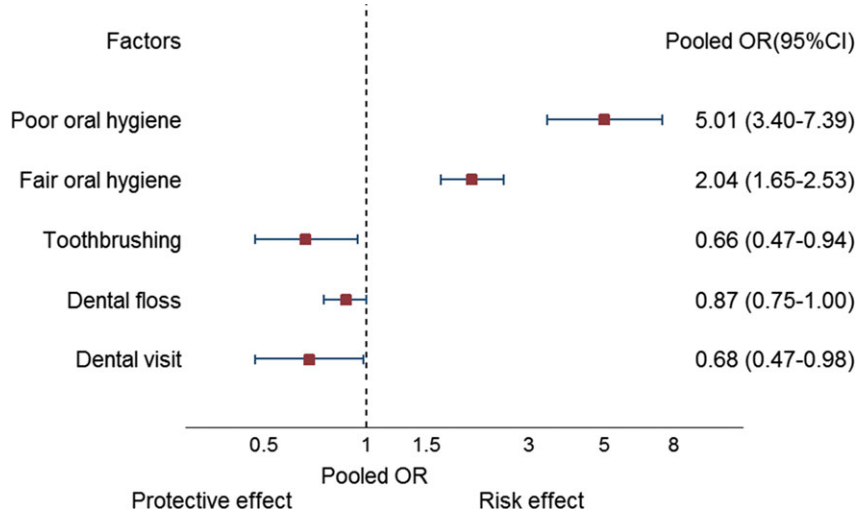

Figure 5. Summary of pooled effect of oral hygiene (OH) and oral care habits on periodontitis. OR, odds ratio.

daily toothbrushing with a fluoride-containing dentifrice is an accepted recommendation. The proper duration of toothbrushing is also mentioned as an important determinant of plaque removal; therefore, it should be stressed during toothbrushing instruction[76]. The current scientific data show that dental floss is not effective as a tool for removal of interdental plaque. It requires the user to be instructed about specific skills in order to be more effective. Interdental brushes have been shown to be the most effective method for removal of interdental plaque[77]; however, the selection of interdental aids must be at the clinician's discretion based on a patient's needs and dexterity and the characteristics of a patient's interdental spaces.

This study has some strengths. It includes studies of the effects of OH using both objective and subjective assessments. The magnitudes of the effects were pooled and reported. The results of subgroup analyses (i.e. population type, study base, periodontitis definition and smoking) were also explored. We used rigorous pooling methods (multivariate random-effects meta-analysis), which considered the variance-covariance between the studies.

However, this study also has some limitations. Our pooled ORs were based on summary data of observational studies. Some data were reported without adjusting for potential confounders; thus, the pooled results might be prone to bias. Moreover, the definition of periodontitis varied among studies, which resulted in high heterogeneity, although the subgroup analyses did reduce this effect. Furthermore, the assessments of publication bias using funnel plots and Egger tests with the low numbers of included studies in some meta-analyses may not be valid. Failure to detect asymmetry cannot rule out a reporting bias or vice versa.

In conclusion, poor OH increases the risk of periodontitis by approximately two- to five-fold compared with good OH. Oral care habits, including regular brushing and dental visits, can decrease the risk of periodontitis and should thus be promoted as a public health intervention.

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Conflicts of interest

The authors declare no conflicts of interest. This study received no external funding, apart from the support of the authors' institution.

SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Figure S1. Funnel plots of publication bias assessment.

Figure S2. Contour-enhanced funnel plots.

Table S1. Search terms and search strategy.

Table S2. Risk of bias assessment.

Table S3. Categorisation of OH level.

Table S4. Pooling effects of fair and poor *versus* good OH on periodontitis.

Table S5. Subgroup and sensitivity analysis according to sources of heterogeneity of fair and poor *versus* good OH.

Table S6. Pooling SMD of OH scores between periodontitis and non-periodontitis.

Table S7. Pooled effect size of oral care habits on periodontitis.

Table S8. Sources of heterogeneity of tooth brushing meta-analysis.

Table S9. Publication bias assessment by Egger test.

Appendix S1. PRISMA checklist.

Appendix S2. Modified Newcastle-Ottawa Quality Assessment Scale.

Appendix S3. GRADE approach.

REFERENCES

1. Kassebaum NJ, Bernabe E, Dahiya M *et al.* Global burden of severe periodontitis in 1990–2010: a systematic review and meta-regression. *J Dent Res* 2014 93: 1045–1053.
2. Van Dyke TE, Sheilesh D. Risk factors for periodontitis. *J Int Acad Periodontol* 2005 7: 3–7.
3. Bakdash B. Oral hygiene and compliance as risk factors in periodontitis. *J Periodontol* 1994 65(5 Suppl): 539–544.
4. Moher D, Liberati A, Tetzlaff J *et al.* Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009 6: e1000097.
5. Greene JC, Vermillion JR. The simplified oral hygiene index. *J Am Dent Assoc* 1964 68: 7–13.
6. Silness J, Loe H. Periodontal disease in pregnancy. II. Correlation between oral hygiene and periodontal condition. *Acta Odontol Scand* 1964 22: 121–135.
7. O'Leary TJ, Drake RB, Naylor JE. The plaque control record. *J Periodontol* 1972 43: 38.
8. Wells GA, Shea B, O'Connell D *et al.* The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses. Available from: http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp. Accessed 22 August 2016.
9. White IR. Multivariate random-effects meta-regression: updates to mvmeta. *Stata J* 2011 11: 255–270.
10. Riley RD, Thompson JR, Abrams KR. An alternative model for bivariate random-effects meta-analysis when the within-study correlations are unknown. *Biostatistics* 2008 9: 172–186.
11. DerSimonian R, Laird N. Meta-analysis in clinical trials. *Control CliniTrials* 1986 7: 177–188.
12. Atkins D, Best D, Briss PA *et al.* Grading quality of evidence and strength of recommendations. *BMJ* 2004 328: 1490.

13. Guyatt G, Oxman AD, Akl EA *et al.* GRADE guidelines: 1. Introduction-GRADE evidence profiles and summary of findings tables. *J Clin Epidemiol* 2011 64: 383–394.
14. Bagramian RA, Farghaly MM, Lopatin D *et al.* A comparison of periodontal disease among rural Amish and non-Amish adults. *J Clin Periodontol* 1994 21: 386–390.
15. Imaki M, Yoshida Y, Tanada S. Relation between smoking and periodontal disease by oral hygiene status in Japanese factory workers. *Appl Human Sci* 1997 16: 77–81.
16. Norderyd O, Hugoson A. Risk of severe periodontal disease in a Swedish adult population. A cross-sectional study. *J Clin Periodontol* 1998 25: 1022–1028.
17. Wakai K, Kawamura T, Umemura O *et al.* Associations of medical status and physical fitness with periodontal disease. *J Clin Periodontol* 1999 26: 664–672.
18. Papapanou PN, Neiderud AM, Papadimitriou A *et al.* "Checkerboard" assessments of periodontal microbiota and serum antibody responses: a case-control study. *J Periodontol* 2000 71: 885–897.
19. Hashim R, Thomson WM, Pack ARC. Smoking in adolescence as a predictor of early loss of periodontal attachment. *Community Dent Oral Epidemiol* 2001 29: 130–135.
20. Tezal M, Grossi SG, Ho AW *et al.* The effect of alcohol consumption on periodontal disease. *J Periodontol* 2001 72: 183–189.
21. Hugoson A, Ljungquist B, Breivik T. The relationship of some negative events and psychological factors to periodontal disease in an adult Swedish population 50 to 80 years of age. *J Clin Periodontol* 2002 29: 247–253.
22. Do GL, Spencer AJ, Roberts-Thomson K *et al.* Smoking as a risk indicator for periodontal disease in the middle-aged Vietnamese population. *Community Dent Oral Epidemiol* 2003 31: 437–446.
23. Meisel P, Siegemund A, Grimm R *et al.* The interleukin-1 polymorphism, smoking, and the risk of periodontal disease in the population-based SHIP study. *J Dent Res* 2003 82: 189–193.
24. Alpagot T, Duzgunes N, Wolff LF *et al.* Risk factors for periodontitis in HIV+ patients. *J Periodontal Res* 2004 39: 149–157.
25. Solis ACO, Lotufo RFM, Pannuti CM *et al.* Association of periodontal disease to anxiety and depression symptoms, and psychosocial stress factors. *J Clin Periodontol* 2004 31: 633–638.
26. Wickholm S, Söder PÖ, Galanti MR *et al.* Periodontal disease in a group of Swedish adult snuff and cigarette users. *Acta Odontol Scand* 2004 62: 333–338.
27. Natto S, Baljoon M, Bergstrom J. Tobacco smoking and periodontal health in a Saudi Arabian population. *J Periodontol* 2005 76: 1919–1926.
28. Torrungruang K, Tamsailom S, Rojanasomsith K *et al.* Risk indicators of periodontal disease in older Thai adults. *J Periodontol* 2005 76: 558–565.
29. de Macêdo TCN, Costa MdCN, Gomes-Filho IS *et al.* Factors related to periodontal disease in a rural population. *Braz Oral Res* 2006 20: 257–262.
30. Khader YS. Factors associated with periodontal diseases in Jordan: principal component and factor analysis approach. *J Oral Sci* 2006 48: 77–84.
31. Vandana KL, Sesha Reddy M. Assessment of periodontal status in dental fluorosis subjects using community periodontal index of treatment needs. *Indian J Dent Res* 2007 18: 67–71.
32. Wang QT, Wu ZF, Wu YF *et al.* Epidemiology and preventive direction of periodontology in China. *J Clin Periodontol* 2007 34: 946–951.
33. Akhter R, Hassan NMM, Aida J *et al.* Relationship between betel quid additives and established periodontitis among Bangladeshi subjects. *J Clin Periodontol* 2008 35: 9–15.
34. Kumar TS, Dagli RJ, Mathur A *et al.* Oral health status and practices of dentate Bhil adult tribes of southern Rajasthan, India. *Int Dent J* 2009 59: 133–140.
35. Benguigui C, Bongard V, Ruidavets JB *et al.* Metabolic syndrome, insulin resistance, and periodontitis: a cross-sectional study in a middle-aged French population. *J Clin Periodontol* 2010 37: 601–608.
36. Saxlin T, Ylostalo P, Suominen-Taipale L *et al.* Overweight and obesity weakly predict the development of periodontal infection. *J Clin Periodontol* 2010 37: 1059–1067.
37. Bawadi HA, Khader YS, Haroun TF *et al.* The association between periodontal disease, physical activity and healthy diet among adults in Jordan. *J Periodontal Res* 2011 46: 74–81.
38. Carrilho Neto A, De Paula Ramos S, Sant'ana AC *et al.* Oral health status among hospitalized patients. *Int J Dent Hyg* 2011 9: 21–29.
39. Mathur LK, Manohar B, Shankarapillai R *et al.* Obesity and periodontitis: a clinical study. *J Indian Soc Periodontol* 2011 15: 240–244.
40. Teng PR, Su JM, Chang WH *et al.* Oral health of psychiatric inpatients: a survey of central Taiwan hospitals. *Gen Hosp Psychiatry* 2011 33: 253–259.
41. Crocombe LA, Brennan DS, Slade GD *et al.* Is self interdental cleaning associated with dental plaque levels, dental calculus, gingivitis and periodontal disease? *J Periodontal Res* 2012 47: 188–197.
42. Mannem S, Chava VK. The effect of stress on periodontitis: a clinicobiochemical study. *J Indian Soc Periodontol* 2012 16: 365–369.
43. Raja S, Joshi V, Shirahatti R *et al.* "Is the periodontium an index of your mind?" A crossectional study to evaluate the relationship between life events and periodontitis. *Int J Clin Dent* 2012 5: 39–48.
44. Vogt M, Sallum AW, Cecatti JG *et al.* Factors associated with the prevalence of periodontal disease in low-risk pregnant women. *Reprod Health* 2012 9: 3.
45. Fiyaz M, Ramesh A, Ramalingam K *et al.* Association of salivary calcium, phosphate, pH and flow rate on oral health: a study on 90 subjects. *J Indian Soc Periodontol* 2013 17: 454–460.
46. Palle AR, Reddy CMSK, Shankar BS *et al.* Association between obesity and chronic periodontitis: a cross-sectional study. *J Contemp Dent Pract* 2013 14: 168–173.
47. Alhabashneh R, Khader Y, Herra Z *et al.* The association between periodontal disease and metabolic syndrome among outpatients with diabetes in Jordan. *J Diabetes Metab Disord* 2015 14: 67–73.
48. Bhat M, Roberts-Thomson K, Do LG. Clustering of risk indicators for periodontal disease: a population-based study. *Community Dent Health* 2015 32: 158–162.
49. Cakmak O, Alkan BA, Ozsoy S *et al.* Association of gingival crevicular fluid cortisol/dehydroepiandrosterone levels with periodontal status. *J Periodontol* 2014 85: e287–e294.
50. Develioglu H, Ozdemir H, Bostanci V. Comparative analysis of the blood flow values of patients with type 2 diabetes mellitus presenting with chronic periodontitis, patients with chronic periodontitis only and healthy individuals. *West Indian Med J* 2014 63: 359–363.
51. Hsiao CN, Ko EC, Shieh TY *et al.* Relationship between areca nut chewing and periodontal status of people in a typical aboriginal community in Southern Taiwan. *J Dent Sci* 2015 10: 300–308.
52. Ismail FB, Ismail G, Dumitriu AS *et al.* Identification of subgingival periodontal pathogens and association with the severity of periodontitis in patients with chronic kidney diseases: a cross-sectional study. *Biomed Res Int* 2015 2015.
53. Jacob PS, Nath S, Patel RP. Evaluation of interleukin-1β and 8 in gutka chewers with periodontitis among a rural Indian population. *J Periodontal Implant Sci* 2014 44: 126–133.

54. Kaur S, Narayanswamy S, Ramesh AV. Comparative evaluation of salivary soluble CD44 levels in periodontal health and disease. *J Indian Soc Periodontol* 2014 18: 734–738.
55. Köseoğlu S, Saylam M, Pekbaşriyanik T *et al.* Level of interleukin-35 in gingival crevicular fluid, saliva, and plasma in periodontal disease and health. *J Periodontol* 2015 86: 964–971.
56. Kovačević V, Milosavljević M, Rančić N *et al.* Assessment of the periodontal health and community periodontal index in the Army of Serbia. *Vojnosanit Pregl* 2015 72: 953–960.
57. Kvarnvik C, Soljegard E, Charalampakis G *et al.* Periodontal disease in a remote Asian population: association between clinical and microbiological parameters. *J Investig Clin Dent* 2016 7: 246–253.
58. Lavu V, Venkatesan V, Bhaskar LV *et al.* Polymorphic regions in Fcgr and Tnf alpha genes and susceptibility to chronic periodontitis in a cohort from South India. *J Periodontol* 2016 87: 914–922.
59. Lütfioğlu M, Aydoğdu A, Sakallioğlu EE *et al.* Gingival crevicular fluid interleukin-8 and lipoxin A4 levels of smokers and nonsmokers with different periodontal status: a cross-sectional study. *J Periodontal Res* 2015 51: 471–480.
60. Meenawat A, Govila V, Goel S *et al.* Evaluation of the effect of nicotine and metabolites on the periodontal status and the mRNA expression of interleukin-1β in smokers with chronic periodontitis. *J Indian Soc Periodontol* 2015 19: 381–387.
61. Mesa F, Magán-Fernández A, Muñoz R *et al.* Catecholamine metabolites in Urine, as chronic stress biomarkers, are associated with higher risk of chronic periodontitis in adults. *J Periodontol* 2014 85: 1755–1762.
62. Perayil J, Suresh N, Fenol A *et al.* Comparison of glycated hemoglobin levels in individuals without diabetes and with and without periodontitis before and after non-surgical periodontal therapy. *J Periodontol* 2014 85: 1658–1666.
63. Pereira AL, Franco GC, Cortelli SC *et al.* Influence of periodontal status and periodontopathogens on levels of oral human β-defensin-2 in saliva. *J Periodontol* 2013 84: 1445–1453.
64. Petrović SM, Zelić K, Milašin J *et al.* Detection of herpes simplex virus type 1 in gingival crevicular fluid of gingival sulcus/periodontal pocket using polymerase chain reaction. *Srp Arh Celok Lek* 2014 142: 296–300.
65. Pranckeviciene A, Siudikiene J, Ostrauskas R *et al.* Severity of periodontal disease in adult patients with diabetes mellitus in relation to the type of diabetes. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub* 2014 158: 117–123.
66. Puri K, Chhokra M, Dodwad V *et al.* Association of interleukin-1 α (-889) gene polymorphism in patients with generalized aggressive and chronic periodontitis. *Dent Res J (Isfahan)* 2015 12: 76–82.
67. Singh P, Gupta ND, Bey A *et al.* Salivary TNF-alpha: a potential marker of periodontal destruction. *J Indian Soc Periodontol* 2014 18: 306–310.
68. Toyman U, Tüter G, Kurtiş B *et al.* Evaluation of gingival crevicular fluid levels of tissue plasminogen activator, plasminogen activator inhibitor 2, matrix metalloproteinase-3 and interleukin 1-β in patients with different periodontal diseases. *J Periodontal Res* 2015 50: 44–51.
69. Varghese SS, Thomas H, Jayakumar ND *et al.* Estimation of salivary tumor necrosis factor-alpha in chronic and aggressive periodontitis patients. *Contemp Clin Dent* 2015 6: S152–S156.
70. Nelson RG, Shlossman M, Budding LM *et al.* Periodontal disease and NIDDM in Pima Indians. *Diabetes Care* 1990 13: 836–840.
71. Papapanou PN. Periodontal diseases: epidemiology. *Ann Periodontol* 1996 1: 1–36.
72. Suvan J, D'Aiuto F, Moles DR *et al.* Association between overweight/obesity and periodontitis in adults. A systematic review. *Obes Rev* 2011 12: e381–e404.
73. Zimmermann H, Zimmermann N, Hagenfeld D *et al.* Is frequency of tooth brushing a risk factor for periodontitis? A systematic review and meta-analysis. *Community Dent Oral Epidemiol* 2015 43: 116–127.
74. Berchier CE, Slot DE, Haps S *et al.* The efficacy of dental floss in addition to a toothbrush on plaque and parameters of gingival inflammation: a systematic review. *Int J Dent Hyg* 2008 6: 265–279.
75. Tonetti MS, Eickholz P, Loos BG *et al.* Principles in prevention of periodontal diseases: consensus report of group 1 of the 11th European Workshop on Periodontology on effective prevention of periodontal and peri-implant diseases. *J Clin Periodontol* 2015 42(Suppl 16): S5–S11.
76. Slot DE, Van der Weijden FA. Group A. Initiator paper. Plaque control: home remedies practiced in developing countries. *J Int Acad Periodontol* 2015 1(Suppl): 4–15.
77. Salzer S, Slot DE, Van der Weijden FA *et al.* Efficacy of inter-dental mechanical plaque control in managing gingivitis–a meta-review. *J Clin Periodontol* 2015 42(Suppl 16): S92–S105.

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Further caries decline in Swiss recruits from 1996 to 2006

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Summary Swiss army recruits (N=606) from the army base at Thun were dentally examined with a standardized method in the year 2006. The results were compared with those of previous surveys (1985 and 1996). The mean DM6FT-value in the year 2006 was 3.11, whereas in 1996 it had been clearly higher (4.95). This corresponds to a caries decline of 37%. The observed caries decline can only partly be explained. Recruits, who were smokers, showed an increased caries experience.
Recruits of the German-speaking part of Switzerland who had profited from oral health lessons by oral health instructors in Kindergarten and primary schools did not differ in caries experience from recruits of the French-speaking part of Switzerland.

Introduction

Dental examinations have been carried out on recruits in Switzerland since 1970 (Curilovic et al. 1972, Curilovic et al. 1980, Menghini et al. 1991, Menghini et al. 2001). Previous investigations showed a steady decline of the caries experience. The purpose of this study was to determine the caries experience of Swiss recruits in 2006 and to compare it to that of 1985 and 1996.

The results of a parallel investigation which dealt with the periodontal health of the same recruits have already been published (Röthlisberger et al. 2007).

Investigations on recruits in 1970 (Curilovic et al. 1972) and 1974 (Curilovic et al. 1980) used another methodology. Therefore, they were not included here for comparison.

Materials and methods

Site and date of the survey

The dental survey took place on the military base in Thun over 7 days in July 2006.

Sample

In Switzerland there is general conscription for men. 20% of those who were called up were recognized as *un*fit for military service with the old recruitment criteria (Swiss army 1995). From 2003 on, more extensive medical investigations were carried out in the recruitment centers. Therefore, in 2006 notably more recruits (35%) were recognized as *un*fit for service (Report of the Swiss Federal Council 2007).

As in the earlier surveys (1985, 1996) recruits were from all parts of the country. All Swiss cantons were represented. Like-

wise, all levels of education were represented (Röthlisberger et al. 2007).

All recruits available at the Thun recruit school during the 7 study days (tank and logistics troops) were included. 606 recruits were examined clinically and radiologically. The average age of these recruits was 20.4 years and matched that of the 1985 and 1996 investigations.

Methods

The caries experience was determined, as in 1985 and 1996, by means of a standardized method (Marthaler 1966) in 28 teeth (without third molars). Details of how the examinations were carried out have already been described (Menghini et al. 1991, Menghini et al. 2001).

The recruits brushed teeth before the examination on their own initiative.

Questionnaire

In 2006 37 questions were presented to the recruits on personal details, oral hygiene behavior, eating behavior, drinking customs, smoking habits and drug consumption. Most questions were aimed at identifying risk indicators for erosion. Nine questions were also of interest for identifying caries risk indicators.

Investigators

In 1985 and 1996 the clinical assessment was carried out by two investigators (TM and GM). Both investigators agreed well (intraclass-correlation coefficient for DM6FT and DFS was 0.98 and 0.95). In 2006 the clinical investigation was carried out by only one investigator (GM). The assessment of the X-ray images was carried out in all 3 investigations by one and the same investigator (MS) (intraclass-correlation coefficient for DFS and $D_{1-2}S$ in approximal surfaces of molars and premolars was 0.93 and 0.88).

Caries indices

The following indices were used to describe the caries experience:

DT	Sum of carious teeth
MT	Sum of missing teeth
FT	Sum of filled teeth
DMFT	Sum of carious, missing and filled teeth
DM6FT	Sum of carious, missing (first molars only) and filled teeth
DS	Sum of carious predilection sites
FS	Sum of filled predilection sites
DFS	Sum of carious and filled predilection sites
$D_{1-2}S$	in pits and fissures of molars and premolars Sum of stained pits and fissures
$D_{1-2}S$	in approximal surfaces of molars and premolars Sum of surfaces with radiolucencies confined to enamel
$D_{1-2}S$	in free smooth surfaces of molars Sum of surfaces with white spots
$D_{1-2}S$	in surfaces of anterior teeth Sum of surfaces with white spots

Statistical analyses

Changes in caries experience were tested using the Mann-Whitney test.

Caries risk indicators were identified using the Mann-Whitney test or the Kruskal-Wallis test. Because 9 variables were examined (multiple test situation), the significance level was corrected according to Bonferroni: $P<0.05/9 = P<0.006$. This ensures that the probability of a type 1 error is less than 0.05.

Results

Changes in caries experience from 1985 to 1996

Changes in caries experience from 1985 to 1996 can be seen in Table I. This has been described previously (Menghini et al. 2001).

Changes in caries experience from 1996 to 2006

Changes in caries experience from 1996 to 2006 are given in Table I. The DM6FT-value in 1996 was 4.95 on average; in 2006 it was still 3.11. This indicates a caries decline of 37%. Roughly three quarters of the DM6F-teeth were filled (FT).

The DFS-value in 1996 was 8.48 on average; in 2006 it was still 4.61. This gives a caries decline of 46%. According to predilection site, the decline amounted to between 41% (approximal surfaces of molars and premolars) and 74% (free smooth surfaces of molars). Most predilection sites (DFS) were filled (FS).

Caries-free recruits

The percentage of recruits who were free of caries (DM6FT = 0) increased from 15.6% in 1996 on 27.9% in 2006.

Sealed pits and fissures

In 1996 0.74 of pits and fissures were sealed on average; in 2006 it was 1.61 (Tab. I). Only very few sealed premolars were found.

Caries risk indicators

Only one single risk indicator could be determined (Tab. II). Recruits who smoked had significantly ($P<0.006$) more caries than non-smokers (DM6FT 3.9 versus 2.8; DFS 5.9 versus 4.0; DFS approx Mol & PM 2.5 versus 1.4).

The 8 remaining variables were not associated with caries experience ($P>0.006$).

Estimation of the caries increment between the ages of 15 and 20

Among the recruits examined was a group which had graduated from compulsory education in the Canton of Zurich. The mean caries experience of the 20-year-old recruits from the Canton of Zurich was compared with the mean caries experience of 15-year-old schoolchildren from the Canton of Zurich who had been examined 5 years earlier (Tab. III). The difference between these values was used to estimate the caries increment between ages 15 and 20. The estimated increment (DFS) amounted to 7.62 in the 1980s, 6.52 in the 1990s and only 2.24 in the first decade of the twenty-first century. In each case the increment was highest in the approximal surfaces of molars and premolars. The majority of the lesions was filled (FS).

Discussion

Samples

The recruits examined in 1985, in 1996 and 2006 were from all areas (cantons) and all educational levels in Switzerland.

Tab.I Caries experience (means) of Thun recruits in the years 1985, 1996 and 2006

	1985[1] (N=753)	1996 (N=416)	2006 (N=606)	1996–2006 Change
Teeth (28)				
MT first molars	0.09	0.03	0.02	
MT other teeth	0.44	0.39	0.45	
DT	4.16	1.24	0.73	
FT	5.44	3.68	2.36	
DMFT	10.14	5.34	3.56	
DM6FT[2]	9.70	4.95	3.11	–37%***
All predilection sites (92)				
DS	4.99	1.52	0.83	
FS	13.82	6.95	3.78	
DFS	18.81	8.48	4.61	–46%***
Pits and fissures of molars and premolars (22)				
DS	0.50	0.23	0.09	
FS	8.34	4.53	2.53	
DFS	8.83	4.76	2.62	–45%***
$D_{1-2}S$	5.53	6.83	4.20	
Sealed	0.16	0.74	1.61	+118%***
Approximal surfaces of molars and premolars (24)				
DS	4.14	0.94	0.66	
FS	4.26	2.10	1.13	
DFS	8.40	3.04	1.79	–41%***
$D_{1-2}S$	8.98	3.75	2.30	
Free smooth surfaces of molars (16)				
DS	0.16	0.17	0.03	
FS	0.47	0.17	0.06	
DFS	0.63	0.34	0.09	–74%***
$D_{1-2}S$	3.08	2.10	0.59	
Surfaces of anterior teeth (30)				
DS	0.19	0.19	0.06	
FS	0.76	0.15	0.06	
DFS	0.95	0.34	0.12	–65%***
$D_{1-2}S$	0.92	0.92	0.44	

[1] Only the right side was examined. The mean values were doubled.
[2] In the DM6FT Index "M" counts only the missing first molars.
*** P<0.001

Nevertheless, the samples were not drawn at random and it is not certain that the Thun recruits represent 20-year-old Swiss men with regard to caries experience. It is conceivable, that 1.) those who qualified for conscription differed from those who were deemed unfit for military service and/or that 2.) those serving on the military base in Thun differed from those serving elsewhere in the Swiss army.

Changes in caries experience from 1996 to 2006

From 1996 to 2006 there was a clear caries decline. The cause for the decline is not known but two possible reasons may be put forward:

– More sealants were found in 2006 than in 1996. This may be a cause for the caries reduction in pits and fissures. However this does not explain the caries reduction in other predilection sites.
– The recruits examined in 1996 (born in 1976) were first exposed to fluoridated domestic salt (introduced in 1983) at age 7. The recruits examined in 2006 were exposed all their life to fluoridated salt (250 ppm F). With the latter a pre-eruptive fluoridation effect may have contributed to the caries decline. However, up until now this effect has only been observed in areas with fluoridated drinking water (Marthaler 1960, Groeneveld et al. 1990, Singh et al. 2007).

Other reasons for the caries decline which were taken into account:

– Improved oral hygiene does not seem to be a likely cause. Röthlisberger et al. (2007) found slightly higher plaque and gingivitis indices with the recruits examined in 2006 compared to those examined in 1996.
– In 2006 35% of those called up were found to be unfit for service. In previous years it was only 20% (Report of the Swiss Federal Council 2007). This could mean that selectively more "healthy" recruits were examined in 2006 compared to 1996. However, this is contradicted by the periodontal findings

Tab. II Caries risk indicators in Thun recruits examined in 2006

		DM6FT[1]		DFS		DFS Approximal Mol & PM	
	N	Mean	Median	Mean	Median	Mean	Median
School in French-speaking Switzerland	141	3.1	2.0	4.4	2.0	1.6	0.0
School in German-speaking Switzerland	458	3.1	2.0	4.7	2.0	1.9	0.0
		P=0.820		P=0.931		P=0.341	
Direct foreign ancestors	76	3.9	3.0	5.8	3.5	2.3	1.0
No direct foreign ancestors	527	3.0	2.0	4.5	2.0	1.7	0.0
		P=0.013		P=0.009		P=0.058	
Smoker	195	3.9	3.0	5.9	3.0	2.5	1.0
Non-smoker	410	2.8	2.0	4.0	2.0	1.4	0.0
		P=0.002*		**P=0.001***		**P=0.000***	
TB < 2× daily	53	4.2	3.0	6.9	3.0	3.2	1.0
TB ⩾ 2× daily	551	3.0	2.0	4.4	2.0	1.7	2.0
		P=0.084		P=0.095		P=0.012	
TB within 15 minutes after eating	214	2.8	2.0	3.8	2.0	1.4	0.0
TB later	371	3.3	2.0	5.0	2.0	2.0	0.0
		P=0.211		P=0.158		P=0.081	
Different TB movements	273	3.0	2.0	4.4	2.0	1.6	0.0
Horizontal TB movements	45	2.9	2.0	4.6	2.0	2.1	0.0
Vertical TB movements	68	3.2	2.0	4.8	3.0	2.0	0.0
Circular TB movements	216	3.3	2.0	4.9	2.0	1.9	0.0
		P=0.804		P=0.821		P=0.762	
Use of dental floss	202	3.1	2.0	4.9	2.0	1.8	0.0
Does not use dental floss	402	3.1	2.0	4.5	2.0	1.8	0.0
		P=0.802		P=0.488		P=0.597	
Chewing gum use	423	3.2	2.0	4.8	2.0	1.9	0.0
Does not use chewing gum	176	2.9	2.0	4.2	2.0	1.6	0.0
		P=0.414		P=0.446		P=0.372	
Softdrinks ⩽ 2× daily	321	2.8	2.0	4.1	2.0	1.5	0.0
Softdrinks > 2× daily	281	3.5	2.0	5.3	3.0	2.1	0.0
		P=0.314		P=0.301		P=0.476	

[1] In DM6FT Index "M" counts only the missing first molars.
* Only these differences are significant after Bonferroni correction (P<0.006).
TB=Toothbrushing

of Röthlisberger et al. (2007). These authors found no improvement in periodontal conditions between 1996 and 2006.

– It is also possible that the examination was less strict in 2006 compared to 1996 ("examiner drift"). On the other hand, both the clinical and the radiological findings showed a caries decline. These findings were recorded by different examiners. Besides, a clear decline was seen in filled surfaces (FS) (Tab. I). This component is unlikely to be influenced much by the investigator.
– Further factors unknown to us may play a role.
– The caries decline in the approximal surfaces of molars and premolars is worth mentioning. In 1996 an average of 3.0 surfaces were carious or filled; in 2006 it was just 1.8 surfaces. The reduction in lesions in these surfaces is also important, because the class II composite fillings common today have a lower life span than the amalgam fillings, which were used previously (Sjögren & Halling 2002).

Risk indicators for caries

A significantly higher caries experience was found in smokers. One possible explanation is that smokers are less health-conscious than non-smokers. Smokers reported brushing their teeth less frequently and consuming soft drinks more frequently. Additionally, smokers had untreated caries more often (40%) than non-smokers (27%)(results not shown). Smokers were also less highly educated (Röthlisberger et al. 2007). In the literature it has been pointed out that smokers consume more sugar (Bennett et al. 1970).

The rest of the variables were – in part surprisingly – *not* associated with caries experience:

The recruits who completed compulsory education in the German-speaking part of Switzerland had been looked after, as a rule, during kindergarten and primary school by a dense network of oral health instructors; this in contrast to the recruits who graduated from compulsory education in the French-speaking part of Switzerland. However, no difference in caries experience was found.

Tab. III Estimation of the caries increment between the ages of 15 and 20

	Caries experience 15-year-old Zurich Schoolchildren 1979/80	Caries experience 20-year-old Zurich Recruits 1985	Caries "Increment" 15 to 20	Caries experience 15-year-old Zurich Schoolchildren 1991/92	Caries experience 20-year-old Zurich Recruits 1996	Caries "Increment" 15 to 20	Caries experience 15-year-old Zurich Schoolchildren 2000	Caries experience 20-year-old Zurich Recruits 2006	Caries "Increment" 15 to 20
Number of subjects	283	92		136	56		103	62	
Mean age	15.5	20.4		15.5	20.6		15.5	20.4	
DFS	9.71	17.33	**7.62**	2.87	9.39	**6.52**	1.71	3.95	**2.24**
DFS pits and fissures Mol & PM	6.06	8.30	2.24	2.21	4.84	2.63	1.33	2.32	0.99
DFS approximal surfaces Mol & PM	3.18	7.65	4.47	0.49	3.52	3.03	0.35	1.44	1.09
DFS free smooth surfaces Mol	0.13	0.52	0.39	0.07	0.43	0.36	0.02	0.10	0.08
DFS surfaces of anterior teeth	0.35	0.85	0.50	0.10	0.61	0.51	0.01	0.10	0.09
FS	7.04	13.14	6.10	2.58	7.57	4.99	1.36	3.34	1.98
DS	2.68	4.20	1.52	0.28	1.82	1.54	0.35	0.61	0.26

Recruits with foreign roots showed a tendency (not significant) for more caries.

In the recommendations for caries prophylaxis, brushing the teeth immediately after eating is often recommended. No advantage could be shown here for following this advice. The caries experience was not significantly lower in recruits, who reported brushing their teeth within 15 minutes after eating.

The advantages of one or other tooth brushing technique are often argued vehemently. No advantage with regard to caries could be shown here for any particular technique. Recruits using horizontal vertical or circular brushing techniques did not differ significantly in caries experience.

In the same way, lower caries experience could not be shown for the following behavior patterns: Frequent tooth brushing ($\geqslant 2\times$ daily), use of dental floss, using chewing gum and moderate consumption of soft drinks ($\leqslant 2\times$ daily).

Estimation of the caries increment between the ages of 15 and 20

The caries increment was not measured longitudinally, but calculated from the difference in cross-sectional data. The estimated caries increment of 2.24 lesions for the first decade of the twenty-first century was well below the increment in the 1990s (6.52). But because these are not real longitudinal data, the results must be interpreted with care.

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Résumé

606 recrues ont été soumises à un contrôle dentaire lors d'une enquête épidemiologique qui s'est déroulée à Thoune en 2006. Les résultats ont été comparés avec ceux de deux enquêtes préalables (1985 et 1996).

L'indice de carie CA6OD moyen était de 3,11; en 1996, cette valeur était sensiblement plus élevée (4,95). Cela correspond à une réduction de la carie de 37%. Cette réduction n'a pu être expliquée que partiellement.

Les recrues qui fumaient avaient davantage de caries.

Au niveau de la carie, aucune différence n'a été constatée entre les recrues provenant de la Suisse alémanique, qui à l'école maternelle et à l'école primaire ont été prises en charge par les operatrices de prévention dentaire, et celles de la Romandie.

References

Bennett A E, Doll R, Howell R W: Sugar consumption and cigarette smoking. Lancet 295: 1011–1014 (1970)

Bericht des Bundesrates zur Wehrhaftigkeit in Erfüllung des Postulats 05.3526 von Ständerat Franz Wicki vom 29. September 2005 (2007)

Curilovic Z, Renggli H H, Saxer U P, Germann M A: Parodontalzustand bei einer Gruppe von Schweizer Rekruten. Schweiz Monatsschr Zahnheilkd 82: 437–451 (1972)

Curilovic C, Helfenstein U, Renggli H H, Saxer U P, Schmid M O, Lutz F: Klinische Parodontalbefunde bei einer Gruppe Schweizer Jugendlicher. Soz Präv Med 25: 139–148 (1980)

Groeneveld A, van Eck A A M J, Backer Dirks O: Fluoride in caries prevention: is the effect pre- or post-eruptive? J Dent Res 69: 751–755 (1990)

Marthaler T M: Kariesstatistische Resultate der Trinkwasserfluoridierung im bleibenden Gebiss und was sie von der Salzfluoridierung erwarten lassen. Schweiz Monatsschr Zahnheilk 70: 315–332 (1960)

Marthaler T M: A standardized system of recording dental conditions. Helv Odont Acta 10: 1–18 (1966)

Menghini G D, Marthaler T M, Steiner M, Bandi A, Schürch E: Kariesprävalenz und gingivale Entzündung bei Rekruten im Jahre 1985: Einfluss der Vorbeugung. Schweiz Monatsschr Zahnmed 101: 1119–1126 (1991)

Menghini G D, Steiner M, Marthaler T M, Weber R M: Rückgang der Kariesprävalenz bei Schweizer Rekruten von 1970 bis 1996. Schweiz Monatsschr Zahnmed 111: 409–416 (2001)

Röthlisberger B, Kuonen P, Salvi G E, Gerber J, Pjetursson B E, Attström R, Joss A, Lang N P: Periodontal conditions in Swiss army recruits: a comparative study between the years 1985, 1996 and 2006. J Clin Periodontol 34: 860–866 (2007)

Singh K A, Spencer A J, Brennan D S: Effects of water fluoride exposure at crown completion and maturation on caries of permanent first molars. Caries Res 41: 34–42 (2007)

Sjögren P, Halling A: Survival time of class II molar restorations in relation to patient and dental health insurance costs for treatment. Swed Dent J 26: 59–66 (2002)

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IMPORTANCE OF ORAL HYGIENE DURING CHILDHOOD

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Read before Session on Child Hygiene, American Public Health Association, at San Francisco, Cal., September 16, 1920.

Civilization is robbing the human race of its teeth and toothless man seems not far distant. The possibility of education to a coarser diet appears to be most remote, so the most hopeful coarse lies in prophylactic measures. The field is the child and the woman Dental Hygienist is the most promising missionary of preventive dentistry.

BEFORE taking up the field investigations in mouth hygiene under the Child Hygiene Section of the United States Public Health Service, the writer, realizing that the work would be principally among children, took advantage of the opportunity to examine several hundreds of children's skulls found in the National Museum. The skulls would average 200 to 300 years old. The field from which they had been collected ranged from the Aleutian Islands, down our Pacific coast, through Honduras and Yucatan, into Peru and across to the South Sea Islands. It was astonishing to discover among this entire collection but a single tooth which showed dental caries.

The investigations carried on during the last year show findings which, compared with the above, become alarming. Out of 7,059 children examined in the State of West Virginia some 16,151 cavities were found exclusive of those containing fillings. Another surprising item was that of underdeveloped jaws and irregular teeth, there being 1,759 of these cases out of 5,935 examined. None of these cases were found in the examination of the skulls referred to.

Among the interesting points of information gained by this study is that the teeth of the Eskimo, due to the hard usage given them, are in a process of evolution, becoming larger and more firmly set in the bony structures supporting them. In some instances this amounted to the formation of actual buttresses about the roots of these teeth.

The conclusion to be drawn bears out the statement of one scientist, that it is but a matter of few generations before civilized man will be edentulous or without teeth. The possibility of persuading the people of today to subsist upon a

coarser diet is most remote and it will be at once seen that our only hope in this direction lies in some prophylactic measure.

A point of great interest is noted in the case of children who show retardation or are under weight. Particularly interesting is a group of 33 retarded children brought for examination. Among these 29 were found to have malocclusion of varying degree and 28 had some pathological gum condition. The examination of 270 underweight children showed 33 percent of them to have from one to four cavities, 46 percent to have from four to eight cavities and a number showed nine, ten and eleven. A marked relation between dental defects and ill health cannot be denied.

Much valuable information may be gained by the study of the reports of the draft boards during the recent war. The greatest number of rejections for any one cause was that for defective vision and the second greatest was for dental defects and it must be here stated that the requirements in this particular were not stringent. Thus again is shown the fact that the conditions existing in the country today are more serious than generally considered and we can but be impressed with the necessity of adopting some definite preventive measures in the immediate future.

Already in England there is under way a program tending toward the improvement of dental conditions for all the people[1] and the most recent country to adopt measures of national magnitude in this line is New Zealand. A letter from the consul general at Aukland states that there has been appointed a national director of mouth hygiene, with a competent corps of assistants who will, at government expense, care for the teeth of all the school children. New York state has a state bureau of mouth hygiene. Among the later states to adopt similar measures is Tennessee, and West Virginia has a similar movement well under way.

The greatest step in this direction is found in America, where we have the dental hygienist, a woman specialist who confines her activities to preventive measures and who exceeds in skill in this particular, the dental man. The dental hygienist solves more than one of our greatest problems for us. There has always been an almost instinctive fear of the dental chair upon the part of children and in overcoming this fear the hygienist serves us well. She has an instinct which enables her to get on well with these little ones and is as far ahead of the average dental man in this particular as is the trained nurse ahead of the male nurse, and for the very same reasons.

A very serious problem confronts us in the matter of the first or six year molar. Out of 7,059 examinations some 1,822 of these teeth were found to be missing and it must be borne in mind that some of these had been erupted but a very short time. These teeth seem to have been lost for one of two reasons; either because of the fear which the child had, or else the parent has failed to recognize this tooth as a permanent tooth. In her work among the school children the hygienist solves this problem in either case. The dental hygienist is the real foundation upon which we must build the structure of preventive dentistry, and some 12 states, realizing this, have enacted legislation which legalizes the practice of dental prophylaxis by these women.

As stated before, our only hope of reducing dental caries lies in some prophylactic measure. The question at once arises, can satisfactory results be obtained by this means? In Bridgeport, Conn., this work has been in progress for a period of five years and the records show a reduction in caries of over 50%.

Dr. Fones, in whose charge this work has been carried on,[2] states that in his opinion this can be further reduced to at least 70 or 80%.

It has never seemed to the writer, however, that the main objective of mouth

hygiene was the prevention of dental caries. It is a health measure rather than a dental measure. In communities where rational mouth hygiene has been accepted and put into practice there has been reported a reduction in the percentage of cases of illness among school children that seems at first glance to be beyond possibility. In the work at Bridgeport we find that diphtheria has been reduced from 36.6% to 18.7%, measles from 20% to 4.1%, and scarlet fever from 14.1% to 0.5%. Similar results appear wherever careful records have been kept.

Recently the matter of focal infection as related to the mouth has been given much prominence due to the advent of the X-ray. It is not to be denied that abcesses at the apices of roots constitute a constant menace to general health. Before an individual can show symptoms of most of the diseases of which we have definite knowledge, it is necessary that bacteria, or their products, enter the blood stream. This takes place in the areas surrounding the apex of a tooth root which becomes infected from the putrescent pulp of a tooth, but an equally if not more dangerous source of infection is the area surrounding the neck of the tooth, at the border of the gums. It does not require a radiograph to reveal this, but the fascination of radiography has called attention to the apex of the root and in a measure obscured our vision of gingival lesions.

If any of these abscesses* or ulcers existed in any other part of the body or in any other part of the digestive tract, serious results would be anticipated. Then why tolerate them in the body's main gateway? It is at least inconsistent to demand pure water and pure food and to then pollute them at the moment of their being taken into the digestive tract!

Were our sustenance taken into the body through an orifice in the chest wall direct, this orifice would be kept carefully covered and not the slightest sepsis would for one moment be tolerated there. The location of the mouth and its varied functions in no way lessens the inconsistency of demanding pure food and allowing the mouth to contain chronic ulcers, pus and decomposed filth. Yet this is revealed every time a group of children is examined and for the greater part it has been allowed to go unnoticed.

The improvement in mentality and in school work that always follows the introduction of a system of mouth hygiene into a school system is so marked that it is difficult to get the average thinking man to believe the very result that he sees. In Bridgeport retardation cost the city 47% of the entire budget. This was reduced to 17%, meaning a reduction of 30% in the housing required, 30% less teachers, a reduction of 30% in the entire school budget.

At Trenton, N. J., there is a state hospital for the insane. The superintendent, Dr. Henry A. Cotton, claims to be discharging 70% of those admitted to his institution through means of cleaning up mouth sepsis and its sequellæ, the infected tonsil and the gastro-intestinal ulcer. This work is not new to Dr. Cotton; he has been doing it for a period of ten years. The bacteria found in the mouth, or their products, selecting the brain as their field of activity, become the direct cause of abnormal mentality. Toxins must be regarded as vegetable poisons, as is alcohol, and it should not be hard to realize that some of these affect the brain as does alcohol. Psychiatrists have long recognized a type of insanity referred to as the toxic cases.

Much adverse criticism has appeared in relation to Dr. Cotton's claims. One point frequently noted is that many cases of *dementia præcox* and of the maniac-depressive type clear up and are discharged without having received treatment along the lines mentioned. It would seem that this but strengthened, rather than refuted, Dr. Cotton's claims. These patients, given a period of pro-

*The paper was illustrated by a number of beautiful illustrations in color of actual cases, which it is not practicable to present here.

longed rest and furnished with a well-balanced diet, have their resistance raised and overcome the bacteria by their own vitality. But the fact that the discharges of recovered patients at Trenton continues cannot be denied.[3]

A definition of insanity which meets all tests[4] is "The inability of an individual to accommodate himself to his circumstances." Now if the bacteria of the mouth, or their toxins, will cause an adult so to conduct himself as to be legally adjudged insane and committed to an institution for these unfortunates, is it surprising that these same organisms in a child, whose susceptibility is much greater, should cause him so to conduct himself that he fails to harmonize with his teacher and the general plan of school work?

It is not claimed for a moment that all the bacteria found in the mouth are brain selective as far as their toxic effects are concerned, but it is true of some at times. Again they may form the bacterial overload which results in mental unbalance in borderline cases. They may exist as harmless saprophytes in a normal mouth, but given the media of food debris or of blood serum from abnormal gums upon which to grow and they at once assume entirely different characteristics.

W. H. Burnham states,[5] "Educators are beginning to realize that the knowledge acquired in the schools amounts to little, but that the habits formed and the attitude formed toward life, society and the work, are of vital importance. Most important of all, perhaps, is the problem of obtaining the right attitude between pupil and teacher." We cannot expect this attitude to be formed if the child is suffering from even a slight degree of auto-intoxication from his oral condition.

Psychologists agree[6] that the future of an individual depends very largely upon his life during his pre-school age, and that the future of a child can be successfully predicted by observing him during his sixth year. During this early period of life there occurs a fixation of mental trends that largely determines the attitude toward life as a whole. Is it possible that the best attitude can be formed unless the child be in the best of health? The benefits of all hygienic measures at this period of life are more necessary than at any other period.

Little attention is given to the mouths of these little ones on the assumption that, since the deciduous teeth will be replaced by the permanent set, no particular attention to them is necessary, and in this the average dentist is the chief offender. Putrescent pulps, abcesses and endless colonies of pathological organisms are allowed to remain and the responsibility is thrown upon nature. Modern dentistry is more deficient along this line than any other. The normal absorption of roots takes place only when the physiological integrity of the pulp is preserved, and the life of the pulp is essential to normal dentition.[7] Much of the malocclusion in the adult is traceable to the death of the pulp in a deciduous tooth.

Medicine and dentistry have long been practiced as separate professions. The medical man has left the mouth entirely to the dentist and the dentist has worked along mechanical lines to the exclusion of pathology, and in this both professions are at fault. The greatest benefit of the X-ray to mankind is the closer relationship of the medical and dental men. The problem of caring for the mouths of the little ones is an exceedingly important one and it must be met, faced and solved by the best efforts of both medicine and dentistry.

Just as in preventive medicine lies the greatest good in all medical science, so, too, in dental prophylaxis is to be found the nearest solution of this problem. The establishment of a dental clinic in a school and the employment of competent persons to care for the mouths of the younger children comes nearest to the requirements.

Among the other important measures that may be instituted is the toothbrush

drill. This feature of mouth hygiene must not be underestimated in its value. All will admit the difficulty of getting the average child habitually to brush his or her teeth. But in children we find herd instinct to be very strong. As soon as the first boy appears at school in the springtime with his marbles, all sewing, cooking and other domestic activities in the homes of the other boys must cease until the last year's marbles are located. Children will give various amusing excuses to avoid the brushing of their teeth. However, given the idea that it is a perfectly proper procedure and one practiced by the other children, the acceptance of the mouth toilet as a part of the regular daily routine becomes another matter. In this lies the greatest value of the toothbrush drill and not in the actual brushing at the time. Let us by all means have these drills, but let us see that proper methods of brushing be adopted and let us use reason in carrying them out.

We teach the use of the individual cup; we urge the children to refrain from putting pencils in their mouths; and at length do we speak of that greatest of dangerous habits, coughing and sneezing without protecting our neighbors. Let us hold these drills out of doors. Wet your toothbrush and rub the end of your thumb over the bristles and note the spray that flies from it. In these toothbrush drills let us not so proceed that we create a worse condition than would be created by promiscuous coughing and sneezing.

Were there no other benefit to be derived from the use of the toothbrush than that of the psychological effect produced it would still be well worth our while. Booker T. Washington noted a marked relation between oral hygiene and mentality. He stated that as soon as he could get a colored man to use a toothbrush that he could make a man of him.

Every hygienic measure adopted strengthens the position of others that may be in practice, but in the whole field of hygiene there is no single part that can approach the hygiene of the mouth in importance. In preventive medicine there is no measure which is as far-reaching, and in the matter of expenditure of time or of money in carrying out a mouth hygiene program the returns in each and every case stamp it as much more than a measure of economy.

REFERENCES.

1. Report of the Committee on Dentists act. London, Eng., 1919.

2. Report of Five Years' Mouth Hygiene in the Public Schools of Bridgeport, Conn. A. C. Fones, 1919.

3. The Role of Focal Infection in the Psychoses. Dr. Henry A. Cotton, N. Y. Med. Journal, Mar. 8, 1919.

4. Numerous medico-legal cases in New York State. Dr. Paul G. Taddiken.

5. W. H. Burnham, Jour. A. M. A. Mar. 24, 1917.

6. Psychoanalysis, Jones. Page 403.
Human Motives. Putnam. Page 95, 109.
Mental Hygiene of Childhood. White. Page 18, 44, 52.

7. Resorption Radicylaire des Dents de Lait. Luciani. Bulletin de l'Acad. of Méd., May 15, 1917.

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The papers of the Symposium on Mental Hygiene presented at the San Francisco meeting of the Association are scheduled for the May issue of the JOURNAL.

kaiser commission on KEY FACTS
medicaid and the uninsured
THE HENRY J. KAISER FAMILY FOUNDATION

June 2012

Oral Health in the US: Key Facts

Oral health is an integral dimension of overall physical health and well-being. For that reason, the high rates of untreated tooth decay and other oral health problems among Americans, and the fact that millions of children and adults lack access to preventive and primary oral health care and needed dental treatment, are urgent concerns. The consequences of poor oral health access and care include complications of major chronic conditions, pain, impacts on children's growth and social development, nutrition problems, late detection of oral cancers, loss of teeth, missed school days and work, and expensive emergency room use for preventable dental conditions. Tragically, untreated oral disease occasionally leads to death.

Currently, 15% of the U.S. population lives in dental Health Professional Shortage Areas, and nearly half the states do not meet federal targets for fluoridation of drinking water, a highly effective measure to prevent tooth decay. The nation has made great strides to help ensure dental coverage and care for all children, most recently in the Affordable Care Act. Still, major access and affordability challenges remain, and progress for adults has been particularly elusive, affecting those with low income and people of color most adversely.

The data and facts highlighted here (see over, too) illustrate the scope and contours of the oral health gaps facing the U.S. today:

Children

- Tooth decay is the most common chronic illness among school-age children. It is almost entirely preventable.
- About 1 in 4 children have untreated tooth decay. The rate among low-income children is more than twice that for children with more income (31% versus 14%). African American and Hispanic children also have elevated rates compared to White children (28% and 29% versus 19%).
- Medicaid and CHIP cover comprehensive dental benefits for children, but 30% of children with private health insurance are uninsured for dental care.
- In 2010, more than 80% of low-income children with health insurance – whether Medicaid or private insurance – had a dental visit within the past 12 months, compared to half of low-income, uninsured children.

Nonelderly adults

- About 1 in 4 nonelderly adults have untreated tooth decay. The rate among low-income adults is twice that for adults with more income (41% versus 19%).
- Employed adults lose over 164 million hours of work a year related to oral health problems or dental visits.
- For every adult without health insurance, an estimated three lack dental insurance.
- Dental benefits are mandatory for children in Medicaid, but adult dental services are covered at state option. Most states provide some adult dental benefits, but half restrict their coverage to emergency services, and adult dental benefits are frequently cut or eliminated when states face budget pressures.
- In 2010, 22% of low-income adults had gone five years or more without a dental visit, or had never had a visit.

Medicare beneficiaries

- Medicare does not provide coverage for routine dental care. Some beneficiaries have dental coverage through private plans, or through Medicaid, but the scope of coverage varies widely.
- One in four Medicare beneficiaries have no natural teeth. This condition can often lead to other health issues, including nutritional deficiencies.
- Nearly half (44%) of all Medicare beneficiaries report no dentist visit in the past year, and 22% report they have not seen a dental provider in the last five years. Among lower-income beneficiaries, one in three have not visited a dental provider in five years.
- Medicare beneficiaries who used any dental services in 2008 spent, on average, $672 out-of-pocket for dental care.

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Oral Health Access in the States: Selected Measures

	Percent of Population Living in a Dental HPSA[1]	Percent of Adults Age 18+ with a Dental Visit within the Past Year[2]	Percent of Adults Age 65+ Who Have All Natural Teeth Extracted[3]
United States	15.4%	69.7%	17.0%
Alabama	31.8%	64.7%	25.5%
Alaska	20.7%	69.4%	16.2%
Arizona	21.4%	70.1%	13.4%
Arkansas	7.9%	61.1%	23.3%
California	6.7%	69.6%	10.6%
Colorado	9.8%	68.0%	13.4%
Connecticut	12.9%	81.6%	9.2%
Delaware	30.1%	74.2%	16.4%
District of Columbia	5.5%	75.3%	11.2%
Florida	20.1%	66.4%	13.3%
Georgia	14.5%	70.2%	21.0%
Hawaii	24.7%	72.6%	7.4%
Idaho	24.8%	69.3%	15.7%
Illinois	18.2%	69.7%	15.2%
Indiana	4.2%	68.8%	21.3%
Iowa	14.1%	76.0%	16.9%
Kansas	22.7%	72.9%	17.9%
Kentucky	8.4%	63.2%	27.4%
Louisiana	50.6%	63.9%	25.6%
Maine	21.2%	68.7%	20.7%
Maryland	8.2%	75.5%	13.6%
Massachusetts	15.4%	81.7%	15.2%
Michigan	12.6%	72.5%	13.1%
Minnesota	10.5%	78.9%	11.2%
Mississippi	57.8%	58.1%	27.1%
Missouri	21.6%	64.3%	19.5%
Montana	33.7%	61.1%	17.6%
Nebraska	0.8%	69.5%	15.2%
Nevada	13.1%	67.2%	17.2%
New Hampshire	4.5%	76.7%	17.2%
New Jersey	1.2%	76.0%	14.1%
New Mexico	38.3%	67.2%	18.5%
New York	10.8%	72.5%	14.7%
North Carolina	18.0%	68.4%	21.5%
North Dakota	10.2%	72.6%	18.8%
Ohio	11.2%	71.5%	19.8%
Oklahoma	3.8%	57.2%	24.6%
Oregon	22.9%	70.4%	13.7%
Pennsylvania	14.2%	72.3%	18.0%
Rhode Island	15.1%	78.1%	16.5%
South Carolina	32.5%	63.4%	21.6%
South Dakota	14.1%	73.5%	18.2%
Tennessee	27.1%	66.3%	33.7%
Texas	19.3%	61.7%	14.1%
Utah	19.3%	74.3%	12.8%
Vermont	3.8%	75.6%	17.5%
Virginia	14.3%	78.4%	15.0%
Washington	13.6%	72.1%	12.0%
West Virginia	14.5%	60.5%	36.0%
Wisconsin	11.1%	75.1%	16.3%
Wyoming	12.2%	69.0%	18.6%

[1] Designated Health Professional Shortage Areas (HPSA) Statistics, Health Resources and Services Administration (HRSA), February 2012. Percentages calculated using 2010 population data from U.S. Census Bureau, available at http://2010.census.gov/2010census/data/

[2] Centers for Disease Control and Prevention (CDC), based on the Behavioral Risk Factor Surveillance System (BRFSS), 2010. Data available at http://apps.nccd.cdc.gov/brfss/list.asp?cat=OH&yr=2010&qkey=6610&state=All

[3] Centers for Disease Control and Prevention (CDC), based on the Behavioral Risk Factor Surveillance System (BRFSS), 2010. Data available at http://apps.nccd.cdc.gov/brfss/list.asp?cat=OH&yr=2010&qkey=6606&state=All

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Research Article

Prevalence of Dental Caries in relation to Body Mass Index, Daily Sugar Intake, and Oral Hygiene Status in 12-Year-Old School Children in Mathura City: A Pilot Study

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Aim. To correlate the prevalence of dental caries to body mass index, daily sugar intake, and oral hygiene status of 12-year-old school children of Mathura city. *Material and Methods*. The study design was cross-sectional and included 100 school children aged 12 years ($n = 50$ boys and $n = 50$ girls) who were randomly selected from two schools based upon inclusion and exclusion criteria. Body weight/height was recorded and BMI was calculated and plotted on CDC-BMI for age growth charts/curves for boys and girls to obtain percentile ranking. Dental caries was recorded using WHO criteria. Oral hygiene status of the study subjects was assessed using oral hygiene index-simplified. Data regarding the daily sugar intake was recorded using 24-hour recall diet frequency chart. The data obtained was analysed using SPSS version 11.5 for windows. *Result*. Only 27 subjects were affected by caries. The mean DMFT/dmft was 0.37 ± 0.79 and 0.12 ± 0.60, respectively. Statistical analysis by means of a logistic regression model revealed that only oral hygiene status had a significant effect on caries prevalence (OR = 5.061, $P = 0.004$), whereas daily sugar intake and body mass index had no significant effect. *Conclusion*. From the analysis, it was concluded that oral hygiene status had a significant effect on caries prevalence of 12-year-old school children of Mathura city.

1. Introduction

Dental Caries is a chronic disease which can affect us at any age. If untreated, it can lead to pain and discomfort and finally loss of teeth. Caries is one of the most common diseases of childhood. The disease is not self-limiting and without adequate intervention, the process can continue until the tooth is destroyed. The term "caries" denotes both the disease process and its consequences, that is, the damage caused by the disease process [1]. The World Health Organization's report on oral health in 2003 and Global Oral Data Bank of WHO confirm the international distribution of dental caries and stated that by the age of 12 only 15 to 30% of the population were caries-free with a global DMFT of 1.74 [2–4]. The global distribution of dental caries presents a varied picture; countries with low caries prevalence are experiencing an unprecedented increase in caries prevalence and severity of dental caries. On the other hand, in developed countries a reduction of dental caries incidence and improvement of gingival health care are evident. This decline in dental caries was mainly due to appropriate use of fluorides and preventive oral health care measures. The scenario in India is not different from developing countries [5].

Dental caries has a multifactorial aetiology in which there is interplay of three principal factors: the host (saliva and teeth), the microflora (plaque), and the substrate (diet) and a fourth factor: time. There is no single test that takes into consideration all these factors and can accurately predict an individual's susceptibility to caries. The risk of dental caries can be evaluated by analysing and integrating several causative factors such as fluoride, microbial plaque, diet, bacterial and salivary activity, and social and life style related behavioural factors [1].

Excessive body weight in children is a major public health problem. According to National Family Health Survey (NFHS), obesity has reached epidemic proportions in India,

affecting 5% of the country's population. India is following a trend of other developing countries that are steadily becoming more obese [6, 7]. Obesity status in children is measured by assessment of body mass index (BMI) corresponding to gender and age [6]. Consumption of soft drinks and fast foods together with less activity and exercise contributed to the increasing number of overweight people worldwide [8]. High sugar intake, for example, sugar containing snacks and soft drinks, is reported to be more common among overweight and obese children/adolescents than those with normal weight. Frequent sugar intake is also a recognized risk factor for dental caries. Thus, the eating pattern among overweight or obese children may be a common risk factor in overweight children and dental caries [9]. Given that the strong evidence supporting the relation between dental caries with indiscriminate dietary intake has been linked to the development of obesity at a young age, a link between dental caries and weight is biologically possible [6]. The role of sugar (and other fermentable carbohydrates such as highly refined flour) as a risk factor in the initiation and progression of dental caries is overwhelming. Sugar acts as a favoured substrate for the cariogenic bacteria that reside in dental plaque, particularly the mutans streptococci, and the acid by-products of this metabolic process induce demineralization of the enamel surface. Whether this initial demineralization proceeds to clinically detectable caries or whether the lesion is remineralized by plaque minerals depends on a number of factors, of which the amount and frequency of further sugars consumption are of utmost importance [10]. Another risk factor for development of caries is the existence of bacterial plaque on the teeth. Caries can be reduced by mechanical removal of plaque from tooth surfaces; however, most children do not remove it effectively which means the deficiency of maintenance of good oral hygiene. Several studies have shown that, in countries where proper oral hygiene is followed, caries prevalence has decreased despite increases in sugar consumption, thus marking the importance of oral hygiene in caries etiology [11, 12].

Dental caries is a multifactorial disorder and it is difficult to assess all the associated risk factors simultaneously. There have been no studies documented in literature in this part of India assessing the prevalence of dental caries in relation to body mass index, daily sugar intake, and oral hygiene. So an attempt was made to assess the prevalence of dental caries in relation to body mass index, daily sugar intake, and oral hygiene status in 12-year-old school children in Mathura city. Cross-sectional study was designed to evaluate the daily sugar intake, oral hygiene status, and body mass index and to correlate each of them with the prevalence of dental caries among 12-year-old school children in Mathura city.

2. Material and Method

Ethical permission from institutions ethical committee was taken before the commencement of study. Consent from subjects, parents, and school was also taken.

Sample size was determined by the formula based on the study population:

$$n = \frac{4pqn}{e^2 (N - 1) + 4pq}, \quad (1)$$

where p = prevalence 27% (prevalence of dental caries obtained from previous study), $q = (1 - p) = 100 - 27 = 73$, e = permissible error in estimation of prevalence 10%, N = study population 5000 (Department of Education Mathura), and n = sample size.

The estimated sample size for the study based on the prevalence of the dental caries came out to be 860.10% of sample size; that is, 86 was included in pilot study, but to avoid any error slightly higher sample of 100 was taken for study.

This study was planned to be conducted in high schools of Mathura city in 12-year-old children. There are 141 primary schools and 37 high schools as per the record in the District Education Departments of Mathura. Out of 37 high schools, 16 are government aided and the rest are all private institutions. Government institutions had children with similar socioeconomic and cultural background. Children do not have any specific habit such as tobacco chewing and smoking, but they were very fond of having sugar candies.

Level of fluoride ion concentration in drinking water in Mathura city is in optimum range and subjects maintained their oral hygiene by using fluoridated toothpaste.

Out of 16 government aided high schools, 2 schools were randomly selected to obtain the sample size of 100 study subjects having similar socioeconomic and cultural background. Subjects who were willing to participate, have completed 12 years of age, and were continuously residing in Mathura city right from their birth were included in the study whereas subjects who were suffering from any acute or chronic diseases and were under medication, were below 12 years of age and above 13 years of age, and did not obtain parental consent were excluded from the study. A proforma was used for collection of data in the study.

2.1. Anthropometric Measurements. Body weight of study subjects was measured using standardized digital weighing machine. The fractional weight below 500 grams and above 500 grams was rounded to the nearest whole number. Height of study subjects was measured using a measuring tape and recorded in meters. Measurement of weight and height was taken without shoes and with their school dress. From the above data, BMI was calculated and plotted on CDC-BMI for age growth charts/curves for boys and girls to obtain a percentile ranking and subjects were categorized as follows [13].

Underweight: less than 5th percentile.

Healthy weight: 5th percentile to less than 85th percentile.

At risk of overweight: 85th to less than the 95th percentile.

Overweight: equal to or greater than the 95th percentile.

Table 1

Form	Frequency	Points
Liquid: soft drinks, fruit drinks, cocoa, sugar and honey in beverages, nondairy creamers, ice cream, sherbet, gelatine desert, flavoured yoghurt, pudding, custard, popsicles	— × 5 =	
Solid and sticky: cake, cupcakes, donuts, sweet rolls, pastry, canned fruit in syrup, bananas, cookies, chocolate candy, caramel, toffee, jelly beans, other chewy candies, chewing gum, dried fruit, marshmallows, jelly, jam	— × 10 =	
Slowly dissolving: hard candies, breath mints, antacid tablets, cough drops	— × 15 =	
Total sweet score: —		
Interpretation sweet score: 5 or less: excellent 10: good 15 or more: "watch out" zone		

Total sweet score: —
Interpretation sweet score: 5 or less: excellent; 10: good; and 15 or more: "watch out" zone.

2.2. Dental Caries. Dental caries status was collected using Dentition Status of WHO criteria mentioned in Basic Oral Health Survey Methodology (1997) [14] and from the above data DMFT/dmft was calculated.

2.3. Oral Hygiene Status. Oral hygiene of study subjects was determined using oral hygiene index-simplified (OHI-S) by Greene and Vermilion [15]. This index is based upon two parameters: Debris and Calculus and it has been validated by other authors in 12-year-old children of different geographic region.

2.4. Daily Sugar Intake. Data regarding the daily sugar intake was recorded using 24-hour recall diet frequency chart and the subjects were grouped into excellent, good, and watch out zone based upon sugar sweet score (see Table 1) [16].

All examinations and data collection were done by a single examiner and proforma was filled by a recording assistant after standardization. The examination of study subjects was carried out in their school premises using natural light, ordinary chair, plain mouth mirror and CPI probe for dental caries, and explorer no. 5 (Shepard's hook) for OHI-S. Presterilized armamentarium was used to carry out the examinations.

2.5. Statistical Analysis. The data obtained was analysed using SPSS version 11.5 for windows. Mean and standard deviations were calculated for each clinical parameter. Differences between means were tested with one-way ANOVA followed by post hoc tukey's test. Independent effects of BMI, oral hygiene status, and daily sugar intake on caries prevalence were tested using linear multiple regression analysis. Significance for all statistical tests was predetermined at a probability (P) value of 0.05 or less.

Table 2: Distribution of various characteristics of study population.

Sociodemographic characteristics	Study subjects (n = 100)	
	Male (n = 50)	Female (n = 50)
Diet		
Vegetarian	41 (82%)	44 (88%)
Mixed	9 (18%)	6 (12%)
Oral hygiene means		
Toothbrush with toothpaste	45 (90%)	50 (100%)
Toothbrush with toothpowder	4 (8%)	0 (0%)
Indigenous (chewing stick)	1 (2%)	0 (0%)
Oral hygiene frequency		
Once	38 (76%)	31 (62%)
Twice	12 (24%)	19 (38%)
Body mass index categories		
Underweight**	4 (8%)	23 (46%)
Healthy weight**	40 (80%)	24 (48%)
At risk of overweight	5 (10%)	3 (6%)
Overweight**	1 (2%)	0 (0%)
Daily sugar intake		
Excellent	8 (16%)	3 (6%)
Good	12 (24%)	17 (34%)
Watch out	30 (60%)	30 (60%)
Oral hygiene status		
Good*	12 (24%)	19 (38%)
Fair	34 (68%)	31 (62%)
Poor*	4 (8%)	0 (%)

**represents that values obtained are highly statistically significant ($P < 0.001$).
*represents that values obtained are statistically significant ($P < 0.05$).

3. Results

An epidemiological survey conducted showed that the study population consisted of 100 school children, out of which 50 (50%) were males and 50 (50%) were females. Table 2 shows sex-wise distribution of various characteristics of study population collected by survey. One-way ANOVA was applied

Table 3: Multiple linear regression analysis of oral hygiene status, body mass index, and daily sugar intake on caries prevalence in 12-year-old school children.

Independent variables	Dependent variable (caries affected at 12 years of age)				
	Odd ratio	95% CI		SE	*P* value
		Lower	Upper		
Body mass index	0.742	0.365	1.511	0.363	0.411
Daily sugar intake	1.214	0.613	2.407	0.349	0.578
Oral hygiene status	5.061	1.669	15.347	0.566	**0.004**

to determine the association between mean DMFT and BMI categories of study population (underweight, health weight, at risk of overweight and overweight) but no significant association was found ($F = 1.145$, $P = 0.335$, N.S.) but when it was applied to determine the association between mean dmft and BMI Categories of study population (underweight, health weight, at risk of overweight and overweight), significant association was found ($F = 7.783$, $P = 0.000$, S). Similarly, one-way ANOVA was applied to determine the association between mean DMFT/dmft and daily sugar intake categories of study population (excellent, good, and watch out); no significant associations were found ($F = 1.348$, $P = 0.265$, N.S., and $F = 0.489$, $P = 0.615$, N.S.), respectively. When one-way ANOVA was applied to determine the association between mean DMFT/dmft and oral hygiene status of study population (good, fair, and poor), no significant associations were found ($F = 2.563$, $P = 0.082$, N.S., and $F = 1.051$, $P = 0.354$, N.S.). Multiple linear regression analysis was done to determine the independent effects of BMI, oral hygiene status, and daily sugar intake on caries prevalence. It was found that oral hygiene status had a significant effect on caries prevalence (OR = 5.061, $P = 0.004$, S). However, body mass index and daily sugar intake had no significant effect on caries prevalence (Table 3).

4. Discussion

The main objective of the present study was to determine the prevalence of dental caries in relation to body mass index, daily sugar intake, and oral hygiene status of 12-year-old school children of the Mathura city. Our study found a low caries prevalence (27%) with a mean DMFT of 0.37 and mean dmft of 0.12, respectively, when compared with the global DMFT for 12-year-olds [4]. Similar results were obtained in a study by David et al. (2005) [17] who reported 27% prevalence of dental caries with a mean DMFT of 0.5. Our study found no statistically significant association between DMFT and BMI ($F = 1.145$, $P = 0.335$, N.S.). Similarly, Tramini et al. [18] found no significant association between DMFT and BMI. This finding is consistent with the results from the prospective study by Pinto et al. [6], where no correlation between dental decay and BMI was detected in a multiple regression analysis. Kopycka-Kedzierawski et al. [9] even found an inverse association between BMI and caries experience: overweight children were less likely to have caries experience than normal weight children aged 6–11 years. After having performed a systematic review of obesity and dental caries, Kantovitz et al. [19] concluded that only one study with high level of evidence showed direct association between obesity and dental caries.

Recent systematic review and meta-analysis conducted by Hayedn et al. [20] showed that, overall, there was a significant relationship between childhood obesity and dental caries. However, this relationship was not significant for newly industrialized countries similar to present study conducted in Mathura, India [20]. This might be attributed to the fact that both obesity and dental caries are multifactorial in aetiology and various genetic and environmental factors have an impact on them. Another risk factor common to both obesity and dental caries is high sugar intake. Ludwig et al. [21], in a longitudinal study, found that the increasing prevalence of obesity in children was linked to the consumption of sugar-sweetened drinks. However, our study found no significant association between dental caries (DMFT/dmft) and daily sugar intake. Even with increased consumption or high intake of sugar there was decrease in dental caries. This might be attributed to the widespread exposure to fluoride not only through drinking water but also through toothpaste, professional applications, and through fluoride's presence in processed foods and drinks [11]. This result is consistent with the findings of systematic review by Burt and Pai [11] which concluded that the relationship between sugar consumption is much weaker in modern age of fluoride exposure. Another study by Loveren [22] concluded that if good oral hygiene is maintained and fluoride is supplied frequently, teeth will remain intact even if the carbohydrate-containing food is frequently eaten. Local oral factors such as retention around the teeth and salivary functions may be factors strongly modifying caries activity [22]. Oral hygiene is a basic factor for oral health. Poor oral hygiene leads to accumulation of dental plaque which has an important role in the aetiology of dental caries [23]. The overall oral hygiene status among study population was recorded as fair in 65% and good in 31% and only 4% of the study population showed poor oral hygiene status. There was significant difference between oral hygiene status of males and females ($P = 0.037$). The OHI-S and its components showed a high mean value for males as compared to females. The probable reason for lower mean scores of OHI-S and its components in females was perhaps the increased grooming habits of girls in this age group. These findings are in accordance with the study by Sogi and Bhaskar [24]. Even though oral hygiene status of majority of the study population was between fair and good, 27% of

the study subjects were affected by caries in the present study but no statistically significant difference was seen between DMFT/dmft and oral hygiene status (DMFT, $P = 0.082$; dmft, $P = 0.354$). However, multiple linear regression analysis found that oral hygiene status had a significant effect on caries prevalence (OR = 5.061, $P = 0.004$, S).

5. Conclusion

Oral hygiene status had an intricate relationship with caries prevalence whereas body mass index and daily sugar intake did not reveal any significant association in 12-year-old school children of Mathura city. The relationship between dental caries and obesity should be further explored by longitudinal studies as they both have common risk determinants.

Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

[1] E. Reich, A. Lussi, and E. Newbrun, "Caries-risk assessment," *International Dental Journal*, vol. 49, no. 1, pp. 15–26, 1999.

[2] B. L. Edelstein, "The dental caries pandemic and disparities problem," *BMC Oral Health*, vol. 6, no. 1, article no. S2, 2006.

[3] P. C. Baehni and B. Guggenheim, "Potential of diagnostic microbiology for treatment and prognosis of dental caries and periodontal diseases," *Critical Reviews in Oral Biology and Medicine*, vol. 7, no. 3, pp. 259–277, 1996.

[4] Caries for 12-Year-Olds by Country/Area, 2010, http://www.whocollab.od.mah.se/countriesalphab.html.

[5] J. K. Dash, P. K. Sahoo, S. K. Bhuyan, and S. K. Sahoo, "Prevalence of dental caries and treatment needs among children of Cuttack (Orissa)," *Journal of the Indian Society of Pedodontics and Preventive Dentistry*, vol. 20, no. 4, pp. 139–143, 2002.

[6] A. Pinto, S. Kim, R. Wadenya, and H. Rosenberg, "Is there an association between weight and dental caries among pediatric patients in an urban dental school? A correlation study," *Journal of Dental Education*, vol. 71, no. 11, pp. 1435–1440, 2007.

[7] Obesity in India, 2010, http://en.wikipedia.org/wiki//Obesity_in_India.

[8] M. Sadeghi and F. Alizadeh, "Association between dental caries and body mass index-for-age among 6-11-year-old children in Isfahan in 2007," *Journal of Dental Research, Dental Clinics, Dental Prospects*, vol. 1, no. 3, pp. 119–124, 2007.

[9] D. T. Kopycka-Kedzierawski, P. Auinger, R. J. Billings, and M. Weitzman, "Caries status and overweight in 2- to 18-year-old US children: Findings from national surveys," *Community Dentistry and Oral Epidemiology*, vol. 36, no. 2, pp. 157–167, 2008.

[10] E. W. Gerdin, M. Angbratt, K. Aronsson, E. Eriksson, and I. Johansson, "Dental caries and body mass index by socioeconomic status in Swedish children," *Community Dentistry and Oral Epidemiology*, vol. 36, no. 5, pp. 459–465, 2008.

[11] B. A. Burt and S. Pai, "Sugar consumption and caries risk: a systematic review," *Journal of dental education*, vol. 65, no. 10, pp. 1017–1023, 2001.

[12] S. Petti, G. Tarsitani, P. Panfili, and A. S. D'Arca, "Oral hygiene, sucrose consumption and dental caries prevalence in adolescent systemic fluoride non-users," *Community Dentistry and Oral Epidemiology*, vol. 25, no. 4, pp. 334–336, 1997.

[13] R. J. Kuczmarski, C. L. Ogden, S. S. Guo et al., "2000 CDC Growth Charts for the United States: methods and development," *National Center for Health Statistics*, vol. 11, no. 246, pp. 1–201, 2002.

[14] World Health Organization, *Oral Health Surveys—Basic Methods*, WHO, Geneva, Switzerland, 4 edition, 1997.

[15] J. C. Greene and J. R. Vermillion, "The simplified oral hygiene index," *Journal of the American Dental Association*, vol. 68, pp. 7–13, 1964.

[16] M. L. Darby and M. M. Walsh, "Nutritional counseling," in *Dental Hygiene Theory and Practice*, pp. 567–568, Saunders, 2nd edition, 2003.

[17] J. David, N. J. Wang, A. N. Åstrøm, and S. Kuriakose, "Dental caries and associated factors in 12-year-old schoolchildren in Thiruvananthapuram, Kerala, India," *International Journal of Paediatric Dentistry*, vol. 15, no. 6, pp. 420–428, 2005.

[18] P. Tramini, N. Molinari, M. Tentscher, C. Demattei, and A. G. Schulte, "Association between caries experience and body mass index in 12-year-old French children," *Caries Research*, vol. 43, no. 6, pp. 468–473, 2009.

[19] K. R. Kantovitz, F. M. Pascon, R. M. P. Rontani, and M. B. D. Gavião, "Obesity and dental caries—a systematic review," *Oral Health & Preventive Dentistry*, vol. 4, no. 2, pp. 137–144, 2006.

[20] C. Hayedn, J. O. Bowler, S. Chambers et al., "Obesity and Dental caries in children: a systematic review and meta-analysis," *Community Dentistry and Oral Epidemiology*, vol. 41, no. 4, pp. 289–308, 2013.

[21] D. S. Ludwig, K. E. Peterson, and S. L. Gortmaker, "Relation between consumption of sugar-sweetened drinks and childhood obesity: a prospective, observational analysis," *The Lancet*, vol. 357, no. 9255, pp. 505–508, 2001.

[22] C. Loveren, "Diet and dental caries: cariogenicity may depend more on oral hygiene using fluorides than on diet or type of carbohydrates," *European Journal of Paediatric Dentistry*, vol. 1, pp. 55–62, 2000.

[23] Oral Hygiene Indices. Introduction, 2010, http://www.whocollab.od.mah.se/expl/ohiintrod.html.

[24] G. Sogi and D. J. Bhaskar, "Dental caries and oral hygiene status of 13-14 year old school children of Davangere," *Journal of the Indian Society of Pedodontics and Preventive Dentistry*, vol. 19, no. 3, pp. 113–117, 2001.

National Governors Association

NGA Paper

The Role of Dental Hygienists in Providing Access to Oral Health Care

Executive Summary

Basic oral health care is an important determinant of overall health, yet access to it remains a challenge for millions of Americans. To address barriers to access, particularly in underserved and vulnerable populations, states are considering expanding the oral health care workforce, especially dental hygienists, who typically perform preventive oral health services, including fluoride and sealant applications and prophylaxis (cleanings). These services prevent cavities and gum disease, which, when left untreated, can result in more serious health conditions. Although the curriculum and training requirements for dental hygienists are based on national accreditation standards, the policies and regulations affecting dental hygienists vary widely among states. To increase access to basic oral health care, some states have explored deploying dental hygienists outside of dentists' offices. States also have explored altering supervision or reimbursement rules for existing dental hygienists as well as creating new professional certifications for advanced-practice dental hygienists. Although limited domestic research exists on the safety and efficacy of an expanded scope of practice for dental hygienists, studies of pilot programs have shown safe and effective outcomes. International research provides stronger evidence that advanced-practice dental hygienists deliver safe, high-quality care. As states face more demand for oral health, they should examine the role that dental hygienists can play in increasing access to care by allowing them to practice to the full extent of their education and training.

This issue brief summarizes variations in policies affecting dental hygienists and describes some of the alternative provider models and legislation that states have enacted to leverage dental hygienists in an expanded capacity.

Background

Oral health is an important component of physical health and well-being. Oral diseases, which range from dental carries (cavities) to more widespread infections, are problematic for millions of Americans and lead to serious consequences, including complications of major chronic conditions, debilitating pain, absenteeism from work and school, nutrition issues, loss of teeth, impacts on children's growth and social development, adverse pregnancy outcomes, inefficient use of emergency department services, and even death.[1] Fortunately, dental disease and poor oral health can be easily prevented with regular access to dental care and effective patient education. Professional prophylaxis and fluoride or sealant application are proven interventions that prevent cavities and gum disease. Without treatment, gum disease may ultimately destroy bone, connective tissue, and teeth, requiring surgery.[2]

Despite being almost entirely preventable, Americans

[1] Institute of Medicine and National Research Council, *Improving Access to Oral Health Care for Vulnerable and Underserved Populations* (Washington, DC: The National Academies Press, 2011), http://www.hrsa.gov/publichealth/clinical/oralhealth/improvingaccess.pdf (accessed October 1, 2013): 51; and Pew Center on the States, "A Costly Dental Destination: Hospital Care Means States Pay Dearly" (February 2012), http://www.pewtrusts.org/our_work_report_detail.aspx?id=85899372468 (accessed October 1, 2013)

[2] Centers for Disease Control and Prevention, "Oral Health: Preventing Cavities, Gum Disease, Tooth Loss, and Oral Cancers: At a Glance 2011," http://www.cdc.gov/chronicdisease/resources/publications/aag/doh.htm (accessed October 1, 2013); and Valeria C. C. Marinho, Stuart Logan, Julian P. T. Higgins, and Aubrey Sheiham, "Systematic Review of Controlled Trials on the Effectiveness of Fluoride Gels for the Prevention of Dental Caries in Children," *Journal of Dental Education* 67 no. 4 (2003): 448–458, http://www.ncbi.nlm.nih.gov/pubmed/12749574 (accessed October 1, 2013).

have high rates of untreated tooth decay and other oral health problems. Approximately 25 percent of nonelderly Americans have untreated tooth decay, which is also the most common chronic illness among school-aged children.[3] Low-income people of any age, including children, are more likely to have had cavities and are more than twice as likely to go without treatment.[4] Furthermore, the rate of tooth decay is higher for minority ethnic groups and low-income Americans.[5] Data show that African Americans, Hispanics, American Indians, and Alaskan Natives generally have the poorest oral health among U.S. racial and ethnic groups and face the greatest barriers to receiving care.[6]

Factors Contributing to Oral Health Problems

The reasons some Americans fail to receive adequate oral health care are complex. One important factor limiting access to dental services is income. Approximately 22 percent of people earning up to 200 percent of the federal poverty level had forgone a needed dentist visit in 2010 because they could not afford the service.[7] In contrast, only 13 percent of people earning between 200 percent and 399 percent of the poverty level and about 6 percent of people earning 400 percent of the poverty level reported the same (see Table 1).[8]

Individuals who have dental coverage are significantly more likely to receive dental services than individuals without such coverage; therefore, access to dental health insurance can be another important factor affecting access to basic dental services.[9] The most recent data available from the Medical Expenditure Panel Survey found that 57 percent of people with private insurance had visited a dental provider over the past year. In contrast, only 27 percent of people without coverage and 32 percent of people with public coverage had a dental visit over the past year.[10]

Table 1. Percent Forgoing Needed Dental Care in 2010 by Percent of the Federal Poverty Level

Earnings up to Federal Poverty Level, by Percent	Percent Forgoing Needed Dental Care
Up to 200	22
200–399	13
400 and over	6

Source: American Dental Association.[11]

Moreover, states are not required to offer dental services through Medicaid for adults, and fewer than half of states choose to cover preventive oral health care services through their Medicaid program.[12] Medicare, which covers both the elderly and people who have disabilities, does not cover dental procedures outside of tooth extractions, some oral examinations performed by surgeons before surgery (but not treatment for any oral health problems the physician uncovers), and oral surgeries that are needed because of a medical problem originating elsewhere.[13] In 2012, the Kaiser Family Foundation reported that 44 percent of Medicare beneficiaries reported no dental visit in the previous year.

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[3] Henry J. Kaiser Foundation, Oral Health in the U.S.: Key Facts (June 2012), http://www.kff.org/uninsured/upload/8324.pdf (accessed October 1, 2013).
[4] Institute of Medicine and National Research Council, 51.
[5] Ibid.
[6] Ibid, 57–59.
[7] Ibid.
[8] Ibid.
[9] Ibid, 10.
[10] American Dental Association, Breaking Down Barriers to Oral Health for All Americans: The Role of Finance (April 2012), http://www.ada.org/sections/advocacy/pdfs/7170_Breaking_Down_Barriers_Role_of_Finance-FINAL4-26-12.pdf (accessed October 1, 2013).
[11] Ibid.
[12] Medicaid.gov, "Dental Care," http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Benefits/Dental-Care.html (accessed October 1, 2013).
[13] Institute of Medicine and National Research Council, 210.

Oral Health Coverage for Children in the Patient Protection and Affordable Care Act

The Patient Protection and Affordable Care Act (ACA) included provisions to address the lack of dental coverage for children. Two provisions in the ACA aim to expand dental coverage in public and private health insurance plans for children in 2014. Section 1302 (b)(1)(J) of the ACA requires pediatric dental coverage as part of the essential health benefits offered in each qualified health plan, which can be included in the medical plan or as a stand-alone pediatric dental plan. Although the U.S. Supreme Court ruled that ACA-mandated Medicaid expansion for adults was optional for states, it left standing a section of the law that requires states to set Medicaid eligibility for those between age 6 and 19 at no lower than 133 percent of the federal poverty level (effectively 138 percent of the federal poverty level with income disregards in place). The 20 states that currently set eligibility below this threshold must make such children eligible for Medicaid by 2014, thereby qualifying them for Medicaid's mandatory children's dental coverage.[14]

Other factors beyond dental insurance significantly affect the likelihood that individuals will access dental services. For example, one recent study showed that children on Medicaid who had access to a dental care coordinator and whose caregivers were educated about dental benefits increased their use of these services.[15] Low health literacy is also associated with reduced use of dental care. One study found that 44 percent of individuals who have low overall health literacy reported visiting a dentist in the prior year, while 77 percent of people who have high health literacy visited dentists during the same period.[16]

Importantly, some Americans are unable to access care because they cannot find an available dentist; for instance, individuals on public insurance can find it hard to locate dentists who accept their coverage. Federal guidelines require pediatric dental coverage in state Medicaid and Children's Health Insurance Program (CHIP) programs, but small numbers of children enrolled in those programs receive oral health care, and research indicates that a likely contributing factor is that many dentists do not accept such insurance.[17] In fact, according to fiscal year 2011 Medicaid Early and Periodic Screening, Diagnostic, and Treatment program data, less than 40 percent of Medicaid enrollees 1 to 5 years old received any dental services, and even fewer received preventive dental services.[18] Dentists often cite low reimbursement rates and high administrative burdens as barriers to accepting Medicaid patients. One 2000 study estimated that only about 20 percent of private-practice dentists had billed Medicaid significantly

[14] National Conference of State Legislatures, "2011 Webinar: Oral Health and the Affordable Care Act: State Roles" (May 18, 2012), http://www.ncsl.org/issues-research/health/webinar-oral-health-and-the-affordable-care-act.aspx (accessed October 1, 2013).
[15] Catherine J. Binkley, Brent Garrett, and Knowlton W. Johnson, "Increasing Dental Care Utilization by Medicaid-Eligible Children: A Dental Care Coordinator Intervention," Journal of Public Health Dentistry 70 no. 1 (Winter 2010): 78–84.
[16] Sheida White, Jing Chen, and Ruth Atchison, "Relationship of Preventive Health Practices and Health Literacy: A National Study," American Journal of Health Behavior 32 no. 3 (2008): 227–342, http://www.ncbi.nlm.nih.gov/pubmed/19765202 (accessed October 1, 2013).
[17] U.S. Government Accountability Office, "Efforts Under Way to Improve Children's Access to Dental Services, but Sustained Attention Needed to Address Ongoing Concerns," Report to Congressional Committees, GAO-11-96 (2010), http://www.gao.gov/new.items/d1196.pdf (accessed October 1, 2013).
[18] Medicaid–CHIP State Dental Association and Centers for Medicare and Medicaid Services, Engaging More General Dentists to Care for Young Children: Access to Baby and Child Dentistry (ABCD) in Washington and South Dakota (May 8, 2013), 9, 10, http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Benefits/Downloads/LearningLabSlides4.pdf (accessed October 1, 2013).

(more than $10,000).[19] Research suggests that both increasing payments and streamlining Medicaid participation processes would modestly increase use of oral care and decrease the distance patients have to travel to get it.[20]

Like several other health professions, dentists are not distributed optimally across the country. The Health Resources and Services Administration (HRSA) designates dental health professional shortage areas (HPSAs) based on geography and population groups as well as within facilities.[21] Currently, the United States has about 4,600 dental HPSAs, and every state has at least one. Nationally, HRSA estimates that about 10 percent of the population is underserved. (See Appendix B for a state-by-state breakdown of dental HPSAs.) The number of dentists is projected to decline in coming years from a peak of 60 per 100,000 in 1994 to 55 per 100,000 in 2020.[22] The American Dental Association (ADA) posits that substantial increases in dentists' productivity resulting from increases in the employment of allied dental professionals will mitigate this decline.[23]

Expanding the Role of Dental Hygienists

Expanding the provision of affordable preventive services outside of dentists' offices might reduce the most serious consequences of limited access to dentists, and dental hygienists are potentially well suited to play an important role in expanding affordable access. The scope of practice of dental hygienists is established by state law and includes the procedures hygienists can perform, supervision levels, and locations in which dental hygienists can provide services. The services that are most effective in preventing serious dental disease are tasks that fall within dental hygienists' normal scope of practice—professional prophylaxis, the application of fluoride, and the application of sealants. In addition, the Bureau of Labor Statistics (BLS) reports that approximately 20 percent more dental hygienists are employed in the United States than dentists.[24]

One significant barrier to the increased use of dental hygienists is scope of practice and supervision requirements mandating that hygienists work directly with dentists to provide prophylactic services. Advocates for decreasing these mandatory supervision levels argue that dental hygienists are more likely to practice in shortage areas and provide more affordable services to high-need populations. To provide hygienists incentives to practice in those communities, some state proposals for expanding dental hygienist practice limit such expansion to hygienists practicing in shortage areas or underserved populations.

Scope of Practice and Education

Dental hygienists' scope of practice is determined by state laws and state regulatory boards. The majority of dental hygienists work in dentists' offices.[25] Dentists often hire hygienists for just a few days a week and so many hygienists work part time or for multiple dentists. Hygienists typically provide prophylaxis, take x-rays, and apply sealants or fluoride in dental practices. Other common tasks include applying local or topical anesthesia and placing or removing periodontal dress-

[19] Institute of Medicine and National Research Council, 206–207; and Burton Edelstein, "The Dental Safety Net, Its Workforce, and Policy Recommendations for Its Enhancement," Journal of Public Health Dentistry 70(Suppl. 1): S32–S39, http://www.ncbi.nlm.nih.gov/pubmed/20806473 (accessed October 1, 2013).
[20] Burton Edelstein, "The Dental Safety Net"; and Institute of Medicine and National Research Council, 206–209.
[21] U.S. Department of Health and Human Services, Health Resources and Service Administration, "Dental HPSA Designation Overview," http://bhpr.hrsa.gov/shortage/hpsas/designationcriteria/dentalhpsaoverview.html (accessed October 1, 2013).
[22] American Dental Association, Survey Center, Dental Workforce Model 2001–2025, www.adea.org/publications/tde/documents/dentistryslides.pdf (accessed November 15, 2013).
[23] Ibid.
[24] The Bureau of Labor Statistics reports that there are about 150,000 dentists and about 180,000 dental hygienists; U.S. Department of Labor, Bureau of Labor Statistics, "Dental Hygienists," Occupational Outlook Handbook, 2012–2013 Edition (March 29, 2012), http://www.bls.gov/ooh/Healthcare/Dental-hygienists.htm (accessed October 1, 2013); and U.S. Department of Labor, Bureau of Labor Statistics. Also see "Dentists," Occupational Outlook Handbook, 2012–2013 Edition (March 29, 2012), http://www.bls.gov/ooh/Healthcare/Dentists.htm (accessed October 1, 2013).
[25] Ibid.

ings. State law and regulations vary widely with regard to the level of supervision required for common tasks. For example, although all dental hygienists are trained to provide prophylactic services, some states require a dentist's presence or specific authorization from a dentist before a hygienist can actually provide those services.

Dental hygienist training programs are widely available. There are 332 accredited certificate or associate's degree programs in dental hygiene across the nation, and programs exist in every state.[26] Most dental hygienists in the workforce have an associate's degree, which requires an average of 2,860 hours of instruction including an average of 535 hours of supervised clinical instruction.[27] Some proposals advocating the expansion of dental hygienist practice suggest that hygienists should receive additional training (certification, continuing education, or a more advanced degree) before practicing with less supervision. Only 58 programs provide a bachelor's degree in dental hygiene,[28] which requires on average 3,073 hours of instruction. It is much less costly to open and operate new dental hygiene programs than dental schools (which, on average, are more costly to open and operate than medical schools).[29]

Current Supervision Requirements Vary Widely

Supervision requirements for dental hygienists are central to their ability to practice in expanded roles. Throughout the country, a great deal of variation exists in state law and regulations defining those supervision requirements in both public and private settings. Supervision requirements are commonly categorized into three levels: direct supervision, general supervision, and direct access. *Direct access* is an umbrella term denoting a practice that has less supervision and more access to patients.[30] Other categories of supervision that states use are *public health supervision* and *collaborative practice.* Most states also differentiate among supervision requirements for dental hygienists based on whether services are provided in private practice or a public setting (e.g., schools and nursing homes). Typically, states require more supervision in private settings than in public settings. No state requires more stringent oversight in public settings than in private settings.

Direct Supervision

Dental hygienists operating under direct supervision requirements can provide services only when a dentist is physically present. Seven states require direct supervision for all three major preventive tasks—prophylaxis, application of fluoride, and sealants—although some make an exception for at least one of those tasks in public settings with a dentist's authorization; one other state requires direct supervision for sealants only (see Appendix A).

General Supervision

Unlike direct supervision requirements, dental hygienists operating under general supervision requirements must receive authorization from a dentist to perform services for specific patients; however, dentists are not required to be physically present to provide such authorization. In some states, that requirement also includes an examination by a dentist before a hygienist is allowed to provide services. Other states allow the dentist to authorize services for a specific patient without an exam. Six states require general supervision for prophylaxis, fluoride, and sealants in all settings (see Appendix A).

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[26] American Dental Hygienists' Association, "Number of Dental Hygienist Education Programs Offered by State" (August 2, 2013), http://www.adha.org/resources-docs/7525_Map_of_DH_Programs_Per_State.pdf (accessed November 7, 2013).
[27] Ibid.
[28] Ibid.
[29] Karen Fox, "Special Report: An In-depth Look at New Dental Schools," American Dental Asociation (September 5, 2011), http://www.ada.org/news/6173.aspx (accessed October 1, 2013).
[30] American Dental Hygienist's Association, "Direct Access States" (October 2012), http://www.adha.org/resources-docs/7513_Direct_Access_to_Care_from_DH.pdf (accessed October 1, 2013).

More commonly, in private practices, states require general supervision for all three tasks but allow less supervision in at least one public setting—for example, residences of the homebound, schools, and residential facilities. That is the case for 28 states across all three tasks (see Appendix A).

Direct Access

Dental hygienists operating under direct-access requirements have the greatest autonomy. They are allowed to initiate treatment based on their assessment of a patient's needs without the specific authorization of dentists, treat the patient without the presence of a dentist, and maintain a "provider–patient relationship." In most states, to provide direct-access services, hygienists are required to complete additional continuing education courses or demonstrate specific levels of experience. In addition, some states require formal, written agreements between hygienists and dentists or require that dental hygienists carry their own liability insurance. In total, 36 states allow direct access for at least one of the three preventive tasks in at least one setting, which is most commonly the public setting (see Appendix A).

In **Oregon**, for example, dental hygienists can work without supervision or authorization in a broad range of public settings, including nursing homes, adult foster homes, residential care facilities, adult congregate living facilities, mental health residential programs, correctional and juvenile detention facilities, nursery schools, day care programs, Job Corps, primary and secondary schools, public and nonprofit community health clinics, in the homes of homebound adults, and directly for people eligible for Women, Infants, and Children programs. These hygienists must complete 2,500 hours of supervised experience, meet additional continuing education requirements, and carry their own liability insurance.

Supervision Levels Defined

- **Direct Supervision.** The dentist is physically present.
- **General Supervision.** The dentist has seen the patient or specifically authorized the hygienist to provide service to that patient.
- **Direct Access.** The hygienist initiates the service without authorization from the dentist. In some cases, the hygienist is required to have a relationship with the dentist; in two states, he or she can practice independently.

States vary greatly in the number of public settings in which they allow dental hygienists to provide services on a direct-access basis. Some states allow direct access in only one or two settings. Of particular importance for children is that not all direct-access states allow it in public schools, which prevents dental hygienists from independently participating in school-based efforts to increase access to dental care. The Pew Center on the States examined sealant programs in schools and found that in 19 states, dentists must examine students before hygienists are allowed to apply sealants. They concluded that those policies limit the number of students who can be served through such programs.[31]

Two states, **Colorado** and **Maine**, allow for an independent scope of practice for hygienists, with no requirements for oversight by dentists. In Colorado, for example, hygienists are authorized to open their own

[31] Pew Center on the States, "A Costly Dental Destination."

practices and provide a set of basic services, including prophylaxis treatments, administering fluoride, taking x-rays, and applying sealants.[32] There is no requirement that those hygienists form a relationship with or receive supervision from dentists, and they are not required to undergo additional training or demonstrate additional clinical experience. Hygienists in Colorado also are allowed to purchase dental equipment but not to provide restorative dental services (see the description of the Maine model below).[33]

State-Specific Examples of Innovations in Supervision Requirements

As described above, several states have taken innovative actions to provide greater autonomy to dental hygienists. Many states that allow such autonomy place extra education requirements on hygienists. In addition, hygienists may undergo a lengthier licensure process and often receive a new, professional title. The remainder of this section describes the models being employed to expand the autonomy of dental hygienists in **California**, **Maine**, **Massachusetts**, and **Minnesota** (also summarized in Table 2 on page 14). Most of those models have not undergone rigorous evaluation and are being implemented on a small scale.

California

In 1986, the California Office of Statewide Health Policy and Development created the registered dental hygienist in alternative practice (RDHAP).[34] Legislation passed in 1993 made the professional designation permanent.[35] RDHAPs must be licensed as dental hygienists and have a bachelor's degree. They also must complete 150 hours of additional education courses (approved by the Dental Hygiene Committee of California) and pass a written examination in the California Dental Practice and ethics by the Dental Hygiene Committee of California.[36] RDHAPs are allowed to perform the same tasks as dental hygienists but without supervision or prior examination by dentists. They are permitted to practice only in underserved settings, such as dental HPSAs, nursing homes, or residential care facilities. They also are required to have a dentist of record for referral, consultation, and emergency services. In addition, California requires that patients obtain a prescription for services from a dentist or physician within 18 months of a visit with an RDHAP to be eligible to continue to receive basic services from an RDHAP.

By 2012, 294 RDHAPs were licensed in the state.[37] A 2009 survey of California RDHAPs found that more than two-thirds of their patients had no other source of oral health care.[38] Most of the RDHAP practices used mobile equipment to serve patients in nursing homes or who are homebound. Survey data indicate that RDHAPs charged lower fees than dentists.[39] Importantly, the data also indicate that RDHAPs struggled to find referrals to dentists for patients in need of more advanced restorative care.

Maine

Since 2008, Maine has licensed a new category of dental hygienists who practice independently in all public and private settings and can provide most services within traditional dental hygienists' scope

[32] Colorado Revised Statutes, Title 12, Professions and Occupations Health Care, Article 35, Dentists and Dental Hygienists, Part 1, General Provisions, C.R.S. 12–35–124(2013).
[33] Colorado Revised Statutes.
[34] Elizabeth Mertz and Paul Glassman, "Alternative Practice Dental Hygiene in California: Past, Present, and Future," Journal of the California Dental Association 39 no. 1 (2011): 37–46.
[35] Ibid.
[36] California Department of Consumer Affairs, Dental Hygiene Committee of CA, "How to Become a Licensed Dental Auxiliary Registered Dental Hygienist in Alternative Practice," http://www.dhcc.ca.gov/applicants/becomelicensed_rdhap_appinst.shtml (accessed October 1, 2013).
[37] Elizabeth Mertz and Paul Glassman, "Alternative Practice Dental Hygiene in California."
[38] Ibid.
[39] Ibid.

of practice.[40] Requisites for that license include either an associate's degree and 5,000 hours of clinical experience or a bachelor's degree and 2,000 hours of experience.[41] Maine also allows those hygienists to open their own practice and employ other independent-practice dental hygienists. As of 2013, the state reported that 58 dental hygienists have been licensed as independent practitioners but that fewer than 20 actually practice independently.[42]

Massachusetts

In 2009, in response to the difficulty MassHealth (Medicaid) and CHIP enrollees encountered in obtaining dental services, the Massachusetts legislature created public health dental hygienists (PHDHs).[43] PHDHs are authorized to deliver preventive dental care without direct supervision or direction from a dentist in a number of public settings, including schools, long-term care facilities, and community health centers.[44] PHDHs must have at least three years of full-time clinical experience and must meet training requirements as determined by the Board of Registration in Dentistry. They also are required to hold collaborative agreements with dentists. PHDHs are allowed to perform any task the state allows under general supervision for dental hygienists. PHDHs also are allowed to bill Medicaid for their work but cannot bill commercial insurers. Thirty-one PHDHs have been authorized under this program, and in fiscal year 2012, PHDHs treated 6,900 Medicaid enrollees.[45]

Minnesota

From 1993 to 2000, Minnesota had the lowest dentist-to-patient ratio in the nation.[46] To address this shortage, the state established in 2009 dental therapists as a new category of oral health care provider. Dental therapists can earn either a bachelor's degree or a master's degree from a dental therapy education program. A master's degree and completion of additional clinical practice hours allows for certification as an advanced dental therapist and the ability to practice with less supervision.[47] Dental therapists and advanced dental therapists provide restorative services beyond the scope of preventive services traditionally provided by dental hygienists. For dental therapists, those restorative services are provided under what the state calls "indirect supervision," in which the dentist is onsite and specifically has authorized the service. Advanced dental therapists provide the same services under general supervision. In order to practice, dental therapists must have a collaborative management agreement in place with a supervising dentist.

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[40] Independent practice hygienists licensed in Maine can perform the following duties without dentist supervision: (1) Interview patients and record complete medical and dental histories; (2) take and record the vital signs (blood pressure, pulse, and temperature); (3) perform oral inspections, recording all conditions that should be called to the attention of a dentist; (4) perform complete periodontal and dental restorative charting; (5) perform all procedures necessary for a complete prophylaxis, including root planning; (6) apply fluoride to control caries; (7) apply desensitizing agents to teeth; (8) apply topical anesthetics; (9) apply sealants; (10) smooth and polish amalgam restorations, limited to slow-speed application only; (11) cement pontics and facings outside the mouth; (12) take impressions for athletic mouth guards and custom fluoride trays; (13) place and remove rubber dams; (14) place temporary restorations in compliance with the protocol adopted by the board; and (15) apply topical antimicrobials—excluding antibiotics and including fluoride—for the purposes of bacterial reduction, caries control, and desensitization in the oral cavity. The independent practice dental hygienist must follow current manufacturers' instructions in the use of these medicaments.

[41] Laws and Rules Relating to the Practice of Dentistry, Dental Hygiene, and Denturism, Maine Revised Statutes, Title 32, Chapter 16, Subchapter 3 B: Independent Practice Dental Hygienists, http://www.mainedental.org/forms/DentalPracticeAct.pdf (accessed October 15, 2013).

[42] Paul Koenig, "Gardiner Hygienist Sees Dental-Care Expansion Bill as Key to His Future," Kennepec Journal (June 17, 2013), http://www.kjonline.com/news/Gardiner-hygienist-sees-dental-care-expansion-bill-as-key-to-his-future.html?pagenum=full (accessed October 1, 2013).

[43] Massachusetts Department of Health and Human Services, "Public Health Dental Hygienist Overview," http://www.mass.gov/eohhs/gov/departments/dph/programs/community-health/primarycare-healthaccess/healthcare-workforce-center/oral-workforce-dev/dental-hygienist/public-health-dental-hygienist-overview.html (accessed October 1, 2013).

[44] Chelsea Conaboy, "Program Brings Dental Care to Children Without Dentists," The Boston Globe (January 28, 2013), http://www.bostonglobe.com/lifestyle/health-wellness/2013/01/28/dental/Q50fxo2b7SPqYSdPdVb5kK/story.html (accessed October 1, 2013).

[45] Ibid.

[46] National Governors Association, "Minnesota's Dental Therapy Program," http://statepolicyoptions.nga.org/casestudy/minnesota's-dental-therapy-program (accessed October 1, 2013).

[47] Minnesota Statute 150A.106, "Advanced Dental Therapist" https://www.revisor.mn.gov/statutes/?id=150A.106&year=2009 (accessed December 5, 2013).

The law does not require a dental hygienist's license prior to becoming a dental therapist, but one of two dental therapy master's programs does require applicants to have the license.[48] Similar to dental hygienists who have collaborative agreements, dental therapists are authorized to work in nursing homes, community health centers, Head Start programs, and U.S. Department of Veterans Affairs clinics.[49] They can also work in other settings, including private practices, as long as more than 50 percent of patients are low-income, disabled, chronically ill, or uninsured.

Advanced Dental Hygiene Practitioner

In 2008, the American Dental Hygienists' Association (ADHA) promulgated standards for an Advanced Dental Hygiene Practitioner (ADHP) curriculum to prepare dental hygienists to practice at an advanced level.[50] The curriculum provides master's level training and builds on the existing foundation of dental hygiene education at the bachelor's level.[51] Under the ADHA proposal, ADHPs would not be permitted to work independently. Instead, they would be required to work in partnership with dentists to provide diagnostic, preventive, therapeutic, and restorative services to underserved populations in a variety of settings. They also are intended to serve as liaisons to dentists and oral specialists for patients who require a higher level of expertise. Using this collaborative, multidisciplinary framework, ADHA posits that ADHPs would be able to serve populations in settings where there is a shortage of dentists.

Alaska Dental Health Aide Therapist

In 2003, tribal governments in Alaska collaborated to create a new dental provider category—the dental health aide therapist (DHAT)—that does not require initial training as a dental hygienist.[52] This provider model is part of the Alaskan Dental Health Aide Initiative, developed by tribal governments in the Alaska Native Tribal Health Consortium. DHATs provide preventive and restorative dental services with remote or in-person supervision by dentists. The DHATs are certified by the Community Health Aide Certification Board, whose members are appointed by the Indian Health Service. To be certified, DHAT candidates must have a high school diploma and complete a two year training program that includes 3,160 training hours and field work. The certification must be renewed every two years. The federal government and private foundations provided funding to develop the program.

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[48] Metropolitan State University, "Master of Science in Advanced Dental Therapy," http://www.metrostate.edu/applications/drep/files/MSOHCP_Fact_Sheet.pdf (accessed December 3, 2013).

[49] Like other states discussed in this report, Minnesota has allowed dental hygienists to practice in community settings outside of a traditional dental office since 2001, although this option is not widely used.

[50] American Dental Hygienists' Association, "Competencies for the Advanced Dental Hygiene Practitioner" (2008): 8, http://www.adha.org/resources-docs/72612_ADHP_Competencies.pdf, (accessed October 1, 2013).
(accessed May 29, 2013)

[51] Ibid.

[52] National Governors Association, "Alaskan Dental Health Aide Initiative," http://statepolicyoptions.nga.org/sites/default/files/casestudy/pdf/Alaska Dental Health Aide Program.pdf (accessed October 4, 2013); and Scott Wetterhall et al., "Evaluation of the Dental Health Therapist Workforce Model in Alaska: Final Report" (October 2010), W. K. Kellogg Foundation, http://www.wkkf.org/knowledge-center/resources/2010/10/alaska-dental-therapist-program-rti-evaluation-report.aspx (accessed October 16, 2013).

Barriers Limiting Dental Hygienist Practices

Reimbursement Policies

Reimbursement policies can create significant barriers to direct-access and independent dental hygienist practices. For example, state laws delineating the scope of practice of dental hygienists are not always aligned with state Medicaid reimbursement policies. In such instances, even though the state may allow dental hygienists to provide preventive services on a direct-access or independent basis, the hygienist might not be able to bill Medicaid directly for those services. In turn, that lack of reimbursement affects the likelihood that dental hygienists will be able to provide access in low-income settings. For example, one hygienist interviewed from such a state began her own direct-access practice, traveling to different nursing homes to provide prophylaxis to nursing home patients, but until the state changed its Medicaid billing rules, her only form of reimbursement for those services was directly from nursing home patients or through donations.[53]

Only 15 states have adopted explicit statutory or regulatory language to permit Medicaid to reimburse hygienists directly (see Appendix A). For example, **Minnesota** adopted a policy in 2002 to permit dental hygienists who have a collaborative practice agreement with dentists to apply for Medicaid provider coverage and bill directly for their services.[54] Hygienists in **Connecticut** are authorized to receive reimbursement by the Medicaid program only in specific settings, including nursing homes, group homes, schools, hospitals, and community health centers without dental clinics.[55] **Colorado** law generally prohibits hygienists employed by dentists to file individual claims but permits reimbursement for employed hygienists who provide direct services to children.[56] Those hygienists can bill for preventive services such as fluoride, sealants, oral hygiene instructions, and other prophylactic treatments. The other states that have adopted policies allowing direct Medicaid reimbursement to dental hygienists also impose varying conditions on hygienists when billing for services.[57]

Implications of Placing Dental Hygienists in Underserved Areas

Some experts question the equity of limiting the work of hygienists based on practice settings and argue that expanding their practice areas will help hygienists fulfill unmet oral health care needs for underserved populations. More than half the states allow direct-access hygienists to work with underserved populations in some public settings but explicitly bar them from practicing in private settings.

The rationale that state dental boards most commonly use for restricting hygienists from practicing in unsupervised settings focuses on concerns about quality and safety, even though no clear evidence exists to support such restrictions. Furthermore, if the basis for restricting the expanded scope of practice is a concern about safety and efficacy (as unfounded as this concern may be), these concerns should apply regardless of the income level of the recipient or the site of care.

Some also argue that barring dental hygienists from providing direct-access services for subsets of patients can be considered an unfair trade restriction.[58] For example, the Federal Trade Commission (FTC) provided comments on a proposal by the Georgia dentistry

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[53] Deb Astroth, private correspondence, February 20, 2013.

[54] Minnesota Department of Human Services, "Critical Access Dental Program—Results and Recommendations" (2008), http://www.health.state.mn.us/healthreform/oralhealth/dhsreportmay08.pdf (accessed October 1, 2013).

[55] American Dental Hygienists' Association, "States Which Directly Reimburse Dental Hygienists for Services Under the Medicaid Program," http://www.adha.org/resources-docs/7519_Direct_Reimbursement_Medicaid_by_State.pdf (accessed October 1, 2013).

[56] Ibid.

[57] Ibid.

[58] Susan S. DeSanti, Richard A. Feinstein, and Joseph Farrell, Federal Trade Commission Office of Policy Planning, Bureaus of Competition and Economics, letter to Randall Vaughn, Division Director, Georgia Secretary of State, Professional Licensing Boards Division, Georgia Board of Dentistry, December 30, 2010, http://www.ftc.gov/os/2010/12/101230gaboarddentistryletter.pdf (accessed October 1, 2013).

Business and Administrative Barriers

Hygienists who can legally start their own practices have reported a need for more business and financial management training and cited administrative functions as top barriers to independent practice.[59] They typically face many of the same challenges as small business owners and require strong business acumen in addition to clinical education to maintain those practices over time. Business skill deficits most frequently cited by hygienist are insurance billing, marketing and outreach, general business planning, and financial practice management.[60]

An important first step for hygienists opening an independent practice is to create a comprehensive business plan. An effective plan contains a market analysis with segmentation of potential customers; outlines the services that will be provided, with a fee schedule; details a marketing strategy to reach the target customer base; and defines practice financials, including income forecasts and cash flow projections. In addition, office systems must be in place, including billing and accounting systems and customer service processes that ensure high-quality care.[61] A key challenge to billing is prohibitive state laws that limit direct reimbursement by Medicaid for services that dental hygienists provide. Even when hygienists are able to bill directly for their services, they still need to establish and manage an administrative process for obtaining billing and vendor numbers as well as processing claims.

Another challenge for hygienists practicing independently is the money required to open a new practice. Although start-up costs are significantly lower than those required to start a dental practice, hygienists typically need to secure a loan for the cost of equipment. Those who do can confront lenders who, unfamiliar with a new, independent practice model, may not be willing to provide such capital.[62] To reduce the need for start-up capital, some hygienists rent space from dentists who work either part time or with alternate schedules. Other hygienists choose to operate mobile practices that provide on-site services in settings such as nursing homes, long-term care facilities, or schools. Regardless of the model, it remains clear that if independently practicing hygienists are to be successful, they must be comfortable functioning as both clinician and business owner.

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[59] Cynthia Wades, Tim Bates, and Elizabeth Mertz, "Registered Dental Hygienists in Alternatives Practice in California, 2009 Descriptive Report," Center for Health Professions (December 2011), http://futurehealth.ucsf.edu/Content/11660/2011_12_Registered_Dental_Hygienists_In_Alternative_Practice_in_California.pdf (accessed October 21, 2013).

[60] Ibid.

[61] Esther Andrews, Practice Management for Dental Hygienists (Philadelphia: Lippincott Williams & Wilkins, 2007).

[62] Elizabeth Mertz, "Registered Dental Hygienists in Alternative Practice: Increasing Access to Dental Care in California" (San Francisco: Center for Health Professions, University of California, San Franciso, 2008).

board to bar hygienists from providing preventive services in public settings without direct supervision.[63] The FTC argued that there was no evidence that allowing hygienists to provide preventive services without supervision was a safety issue.[64] The FTC further argued that restricting the practice without evidence that the restriction limits public safety unnecessarily reduces competition.[65]

In addition, although there are indications that independently practicing dental hygienists are more likely to provide services to underserved populations, it remains uncertain whether independent-practice dental hygienists will address the shortage of oral health care workers.[66] Dental hygienists practicing independently could face the same economic disincentives as dentists, whose professional boards argue that low reimbursement levels, high administrative burdens, and the expensive nature of the equipment and insurance required to run a dental office are the main barriers to treating low-income or uninsured populations.[67] In some instances, those same barriers could apply to dental hygienists.

Dental Therapists

Dental therapists, also known in some countries as dental nurses, have been prevalent in New Zealand and Australia since the early 20th century and have spread to more than 40 countries around the world.[68] Those providers are required to have additional training and education above that of a dental hygienist. They also operate under an expanded scope of practice that includes the ability to diagnose and perform restorative services. International studies find that these therapists provide safe, quality dental care.[69]

Research and Evaluation

Experts suggest that dental hygienists have the ability to provide safe preventive services and can increase access to care for low-income populations. However, U.S. studies examining the impact of expanded roles for dental hygienist on quality, cost, and access to care are limited. International studies provide stronger evidence that advanced-level dental hygienists provide safe, high-quality care.[70]

A 2001 study examining the quality and efficiency of dental hygiene care in the United States focused on a school-based program in **Oregon** in which hygienists provided sealants without supervision.[71] The study found that the hygienists' services met all quality

[63] Ibid.
[64] Ibid.
[65] Ibid.
[66] Elizabeth Mertz and Paul Glassman, "Alternative Practice Dental Hygiene in California."; MCD Public Health, "Oral Health Care in Maine: Report in Response to Resolves 2011 Chapter 92 (LD1105)" (December 2012), http://www.maine.gov/legis/opla/oralhealthcareMCDreport.pdf (accessed October 21, 2013); L. Jackson Brown, Donald R. House, and Kent D. Nash, "The Economic Aspects of Unsupervised Private Hygiene Practice and Its Impact on Access to Care," American Dental Association Dental Health Policy Analysis Series (2005), http://www.ada.org/sections/professionalResources/pdfs/report_hygiene.pdf (accessed October 21, 2013); and Matthew Stone, "Bill to Allow Hyginists to Open Clinics Wins Bipartisan Support, but Dentists Question the Strategy," BDN Maine (April 10, 2013), http://bangordailynews.com/2013/04/10/news/state/bill-to-allow-hygienists-to-open-clinics-wins-bipartisan-support-but-dentists-question-the-strategy (accessed October 21, 2013).
[67] Institute of Medicine and National Research Council, 206–209.
[68] Institute of Medicine and National Research Council, 133.
[69] Ibid.
[70] J. Timothy Wright, et. al., "A systematic review of oral health outcomes produced by dental teams incorporating midlevel providers," T*he Journal of the American Dental Association*, (January 1, 2013) 144 no. 1: 75-91.
[71] Susan Sanzi-Schaedal, Bonnie Bruerd, and Gordon Empry, "Building Community Support for a Dental Sealant Program," *Journal of Dental Hygiene* 75 no. 4 (2001): 305–309, http://www.ncbi.nlm.nih.gov/pubmed/11813677 (accessed October 1, 2013). In 2001, Oregon required a dentist to screen a patient before a hygienist could place sealants. This requirement was removed in 2007.

standards.[72] Another, older study evaluated the effect of hygienists in a 1986 **California** demonstration project that allowed dental hygienists to open independent practices and provide prophylaxis, examinations, fluoride, and deep cleaning (i.e., root planning).[73] Researchers compared the seven independent dental hygienist practices to six dentist-owned practices and found that hygienists provided the same or better quality of care than dentists in most areas, including infection control.[74] In addition, the hygienists' offices kept more accurate medical records (including following up on important findings in a patient's medical history with the patient or his or her physician) and more completely recorded patients' periodontal status and the results of soft-tissue examinations.[75] The hygienists also performed better at removing tartar from patients' teeth. Finally, the study found that the hygienists provided services to more Medicaid patients than dentists provided.[76]

Conclusion

Lack of access to adequate oral health care services is an ongoing problem in the United States, and complex barriers to accessing those services exist for many populations. Dental hygienists often are at the center of proposed strategies to increase access to oral health care. Such strategies include changing supervision rules and reimbursement policies so that dental hygienists are able to provide preventive services outside of dentists' offices or creating advanced-provider models that involve training hygienists to perform under new titles with an expanded scope of practice and less supervision. Some of the barriers to access for underserved populations will be the same, regardless of whether services are provided by a dentist or a dental hygienist. Those barriers include low health literacy, low reimbursement rates for the publicly insured, and high administrative burdens for reimbursement from public payers.

Innovative state programs are showing that increased use of dental hygienists can promote access to oral health care, particularly for underserved populations, including children. Such access can reduce the incidence of serious tooth decay and other dental disease in vulnerable populations, which suffer disproportionally from untreated dental problems. There is evidence indicating that these practices can be both safe and effective.

As demand for oral health services rises—in part due to changing demographics and expanded access to dental insurance—states can consider doing more to allow dental hygienists to fulfill these needs by freeing them to practice to the full extent of their education and training.

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[72] Ibid.

[73] James R. Freed , Dorothy A. Perry, and John E. Kushman, "Aspects of Quality of Dental Hygiene Care in Supervised and Unsupervised Practices," *Journal of Public Health Dentistry* 57 no. 2 (1997): 68–75, http://www.ncbi.nlm.nih.gov/pubmed/9195498 (accessed October 1, 2013). Prior to opening an independent practice, hygienists received 118 hours of training in management, business, and updates to hygiene practice; 300 hours of supervised residency; and 52 hours of in-service management practice; and E. Mertz and P. Glassman, "Alternative Practice Dental Hygiene in California."

[74] James R. Freed et al., "Aspects of Quality of Dental Hygiene Care."

[75] Ibid.

[76] Ibid.

Table 2. Innovations in Providing Oral Health Care Services

Title	State or Sponsor	Practice Settings	Supervision Requirements	Educational and Licensing Requirements
Registered Dental Hygienist in Alternative Practice	California	**Public:** Residences of the homebound, schools, residential facilities and other institutions, and dental health professional shortage areas (HPSAs) as certified by the California Office of Statewide Planning and Development (OSHPD).[a] **Private:** Includes dental health professional shortage areas certified by OSHPD.	Can own a practice and practice without supervision.[b] No prior exam by a dentist is required, but patients must get a prescription for services from a dentist or physician every 18 months after initial services are provided. Must have documentation of an existing relationship with at least one dentist for referral, consultation, and emergency services.[c]	A bachelor's degree and completion of a Dental Hygiene Committee of California–approved continuing education course and a written exam prescribed by the Dental Hygiene Committee of California.
Independent Practice Dental Hygienist	Maine	All public and private settings.[d]	Can own a practice and provide services encompassing most of a dental hygienist's scope of practice without supervision.[e] No referral from a dentist or documented relationship with a dentist is required. Must provide a referral to a dentist for patients indicating needed services.	A bachelor's degree and 2,000 clinical hours or an associate's degree plus 5,000 clinical hours.
Public Health Dental Hygienist	Massachusetts	**Public:** Include residences of the homebound, schools, nursing homes, community health centers, and Head Start programs, with reimbursement limited to Medicaid or other state insurance programs.[f] **Private:** None.	Cannot own a practice. No supervision or prior examination by a dentist is required.[g] Must provide a written recommendation that the patient visit a dentist within 90 days.[h] Must have a collaborative practice agreement with a dentist, local or state agency, or institution.[i]	Associate's degree as part of initial dental hygienist licensure. At least 3 years of experience and training in a public health setting.[j]

Title	State or Sponsor	Practice Settings	Supervision Requirements	Educational and Licensing Requirements
Dental Therapist (DT)	Minnesota	**Public:** Include residences of the homebound, U.S. Department of Veterans Affairs hospitals, and dental HPSAs as designated by the U.S. Department of Health and Human Services.[k] **Private:** May practice in any setting as long as more than 50 percent of patients served by the dental therapist are enrolled in a state insurance program, have a disability or chronic condition that creates a barrier to care, or have no dental health coverage.[l]	Cannot own a practice. Can provide restorative services under indirect supervision. Advanced dental therapists can provide restorative services under general supervision. Must have a collaborative practice agreement with a dentist describing practice settings and populations.[m]	Bachelor's degree. Master's degree allows certification as an advanced dental therapist. The Central Regional Dental Testing Services examination is taken as a licensure requirement towards completion of the program.
Advanced Dental Hygiene Practitioner	Model curriculum developed by the American Dental Hygienists' Association	Public and private settings are determined by states adopting the model.[n]	Ability to own a practice depends on state law. General supervision is required for an expanded list of services (including some restorative services). States adopting the model would impose other requirements.	Minimum of a master's degree, with other requirements set by the states adopting the model.

[a] California State Statutes, Business and Professions Code, Section 1926.
[b] California State Statutes, Business and Professions Code, Section 1925.
[c] California State Statutes, Business and Professions Code, Section 1930; and California State Statutes, Business and Professions Code, Section 1930(a,1).
[d] Maine Revised Statutes, Title 32, Chapter 16, Subchapter 3 B.
[e] Ibid.
[f] Commonwealth of Massachusetts, General Laws, Part I, Title XVI, Chapter 112, Section 51, https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXVI/Chapter112/Section51 (accessed October 15, 2013).
[g] Ibid.
[h] Ibid.
[i] Ibid.
[j] "Public Health Dental Hygienist: A New Category of Dental Professional," http://www.mass.gov/eohhs/docs/dph/com-health/oral-health/phdh-fact-sheet.pdf (accessed October 15, 2013).
[k] 2013 Minnesota Statutes, Chapter 150A, Section 105 Dental Therapist, https://www.revisor.mn.gov/statutes/?id=150a.105 (accessed October 15, 2013).
[l] Ibid.
[m] Ibid.
[n] American Dental Hygienist's Association, "Competencies for the Advanced Dental Hygiene Practitioner (ADHP)" (2008), http://www.adha.org/resources-docs/72612_ADHP_Competencies.pdf (accessed November 20, 2013).

Appendix A. Current State Dental Hygienist Scope-of-Practice Rules

Methodology. State legislation and regulations were reviewed to determine whether state Medicaid rules explicitly authorized hygienists to be eligible for reimbursement under Medicaid. The American Dental Hygienists' Association provided scope-of-practice information.[a] When more than one supervision level is provided, the two levels refer to private or public. *Private settings* refer to privately owned and operated dental offices. *Public settings* refer to public health clinics, public schools, nursing homes, or correctional facilities.

Symbol	Definition
Y	The condition as established by state legislative or regulatory guidelines has been met.
N	The criteria have not been met.
A	The dental hygienist can provide services as he or she determines appropriate without specific authorization or direct dentist supervision (direct access) in at least one setting.
G	A dentist must authorize the dental hygienist's practice but need not be present.
D	Direct dentist supervision of the dental hygienist practice is required.

State	Percentage of Residents Underserved[b]	Can Be Directly Reimbursed by Medicaid[c]	Prophylaxis (Cleanings)	Fluoride	Pit/Fissure Sealants
Alabama	24	N	D	D	D
Alaska	10	N	G/A	G/A	G/A
Arizona	15	Y	G/A	G/A	G/A
Arkansas	5	N	G/A	G/A	G/A
California	3	Y	G/A	G/A	G/A
Colorado	7	Y	A	A	A
Connecticut	10	Y	G/A	G/A	G/A
Delaware	22	N	G	G	G
Florida	18	N	G/A	G/A	G/A
Georgia	11	N	D	D	D
Hawaii	11	N	D/G	D/G	D/G
Idaho	18	N	G/A	G/A	G/A
Illinois	13	N	G	G	G
Indiana	4	N	D/G	D/G	D
Iowa	7	N	G/A	G/A	G/A
Kansas	17	N	G/A	G/A	G/A

[a] American Dental Hygienists' Association, "Dental Hygiene Practice Act Overview: Permitted Functions and Supervision Levels by State," https://www.adha.org/resources-docs/7511_Permitted_Services_Supervision_Levels_by_State.pdf (accessed November 12, 2013); and American Dental Hygienist's Association, "Direct Access States."

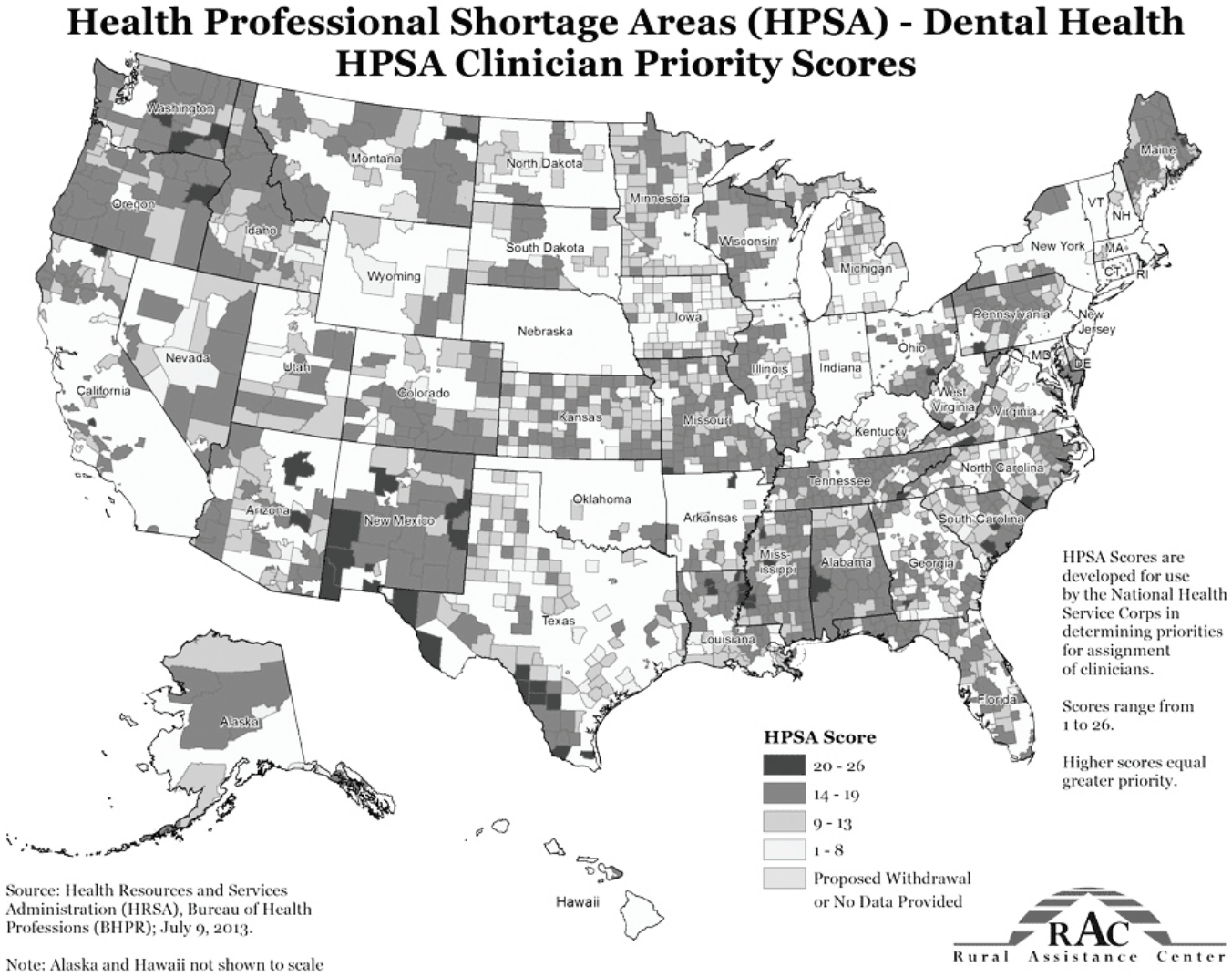
[b] The total state population divided by estimated underserved population in each state. Data provided by the Health Resources and Services Administration (HRSA), April 2013.This data is continually updated by HRSA and can be accessed here: http://datawarehouse.hrsa.gov/.

[c] State Medicaid dental hygienist reimbursement policies were obtained from the study, "States Which Directly Reimburse Dental Hygienists for Services under the Medicaid Program," conducted by the American Dental Hygienists' Association (2010).

State	Percentage of Residents Underserved[b]	Can Be Directly Reimbursed by Medicaid[c]	Prophylaxis (Cleanings)	Fluoride	Pit/Fissure Sealants
Kentucky	5	N	G/A	G/A	G/A
Louisiana	24	N	D/G	D/G	D/G
Maine	15	Y	G/A	G/A	G/A
Maryland	5	N	G	G	G
Massachusetts	5	Y	G/A	G/A	G/A
Michigan	5	N	G/A	G/A	G/A
Minnesota	7	Y	G/A	G/A	G/A
Mississippi	36	N	D	D/G	D
Missouri	18	Y	G/A	G/A	G/A
Montana	15	Y	G/A	G/A	G/A
Nebraska	0	Y	G/A	G/A	G/A
Nevada	11	Y	G/A	G/A	G/A
New Hampshire	1	N	G/A	G/A	G/A
New Jersey	0	N	G	G	G
New Mexico	26	Y	G/A	G/A	G
New York	5	N	A	A	A
North Carolina	13	N	D/G	D/G	D/G
North Dakota	8	N	G	G	G
Ohio	8	N	G/A	G/A	G/A
Oklahoma	2	N	A	A	A
Oregon	17	Y	G/A	G/A	G/A
Pennsylvania	10	N	G/A	G	G/A
Rhode Island	10	N	G/A	G/A	G/A
South Carolina	21	N	G/A	G/A	G/A
South Dakota	13	N	G/A	G/A	G/A
Tennessee	20	N	G	G/A	G/A
Texas	9	N	G/A	G/A	G/A
Utah	13	N	G	G	G
Vermont	0	N	G/A	G/A	G/A
Virginia	8	N	G/A	G/A	G/A
Washington	10	Y	G/A	G/A	G/A
West Virginia	11	N	G/A	A	G
Wisconsin	9	Y	G/A	G	G/A
Wyoming	7	N	G	G	D
Totals		**Y=15**	**D=3**	**D=2**	**D=5**
		N=35	**G=8**	**G=9**	**G=8**
			A=3	**A=4**	**A=3**
			G/A=32	**G/A=30**	**G/A=31**
			D/G=4	**D/G=5**	**D/G=3**

Appendix B. National Health Service Corps Dental Health HPSA Priority Scores

The Rural Assistance Center created the map below depicting health professional shortage area scores for dental providers.[a] The scores are used by the U.S. Department of Health and Human Services to set priorities for the assignment of recipients of the National Health Service Corps loan repayment assistance and are an indication of the geographic areas with the highest needs for more dental providers, according to federal criteria.



[a] Available at http://www.raconline.org/racmaps/mapfiles/hpsa_dentalscore.png.

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Toothbrushing frequently reduces tooth decay

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Posted by Derek Richards

Regular toothbrushing is important for the maintenance of oral health and the prevention of caries and periodontal disease. Brushing effectively twice a day with a fluoridated toothpaste has been a key recommendation from dental organisations for many years. While in 2003 a Cochrane review (Marinho *et al*) noted that the effectiveness of fluoridated toothpaste was increased by greater frequency of use.

The aim of this review was to assess the effect of toothbrushing frequency on the incidence and increment of carious lesions.

Methods

Searches were conducted in the Medline, Embase, CINHAL, and Cochrane databases. Case-control, prospective cohort, retrospective cohort, and experimental trials that evaluated the effect of toothbrushing frequency on the incidence or increment of new carious lesions were considered for inclusion.

Two reviewers independently selected studies, extracted data and assessed study quality. The quality assessment tool for quantitative studies developed by the Effective Public Health Practice Project (EPHPP) was used. Meta-analysis of caries outcomes and meta-regressions to assess the influence of sample size, follow-up period, diagnosis level for carious lesions, and methodological quality of the articles were conducted.

Results

- 33 studies were eligible for inclusion with 25 contributing to the quantitative analysis.
- Of the 33 studies the quality of 13 was considered to be strong, 14

moderate and 6 weak.

- Compared with frequent brushers, self-reported infrequent brushers demonstrated a higher incidence of carious lesions, OR=1.50 (95%CI: 1.34 -1.69).
- The odds of having carious lesions differed little when subgroup analysis was conducted to compare the incidence between
    - ≥2 times/d vs <2 times/d, OR= 1.45 (95%CI; 1.21 – 1.74). and
    - ≥1 time/d vs <1 time/d brushers =OR 1.56; (95%CI; 1.37 – 1.78).
- Brushing <2 times /day significantly caused an increment of carious lesions compared with ≥2/day brushing, standardized mean difference [SMD] =0.34; (95%CI; 0.18 – 0.49).
- Overall, infrequent brushing was associated with an increment of carious lesions, SMD= 0.28; (95%CI; 0.13 – 0.44).
- Meta-analysis conducted with the type of dentition as subgroups, found the effect of infrequent brushing on incidence and increment of carious lesions was higher in deciduous, OR=1.75; (95%CI; 1.49 – 2.06) than permanent dentition OR=1.39; (95% CI: 1.29 -1.49).
- Meta-regression indicated that none of the included variables influenced the effect estimate.

Conclusions

The authors concluded

> Individuals who state that they brush their teeth infrequently are at greater risk for the incidence or increment of new carious lesions than those brushing more frequently. The effect is more pronounced in the deciduous than in the permanent dentition. A few studies indicate that this effect is independent of the presence of fluoride in toothpaste. It is also possible that other factors in those claiming a higher frequency of brushing, such as greater health awareness and motivation, higher socioeconomic status, and a healthier diet, are responsible for the observed effects.

Comments

A good range of databases were searched although the searches were restricted to those published in English and performed after 1980, which could possibly impact on the findings. A range of studies designs was included and they were assessed for quality using the EPHPP tool. Details of the overall quality assessment for each of the studies is presented in an appendix to the main study. As the authors highlight, the included studies are longitudinal observational studies and an important issue is the method by which the frequency of toothbrushing is reported. Typically in these studies it is self-reported and the measurements are coarse (e.g, less than once a day, once a day, twice a day, more than twice a day), rather than specific numbers of brushing episodes per day and the authors rightly call for a uniform protocol for reporting toothbrushing frequency in future studies.

As the included studies are observational in nature the quality of the evidence is not high but is does provide support the professional recommendation to brush twice a day. However, there are many potential factors associated with effective toothbrushing, design of brush and bristles, duration and frequency of brushing as well as type for toothpaste and brushing method. While much has been written on these aspects the quality of the evidence to support these factors are limited and more clarification is needed.

Links

Primary paper

Kumar S, Tadakamadla J, Johnson NW. Effect of Toothbrushing Frequency on Incidence and Increment of Dental Caries: A Systematic Review and Meta-Analysis. J Dent Res. 2016 Jun 22. pii: 0022034516655315. [Epub ahead of print] Review. PubMed PMID: 27334438.

Other references

Marinho VC, Higgins JP, Sheiham A, Logan S. Fluoride toothpastes for preventing dental caries in children and adolescents. Cochrane Database Syst Rev. 2003;(1):CD002278. Review. PubMed PMID: 12535435.

EPHPP – Effective Public Health Practice Project

Dental Elf – 27th May 2015

Toothbrushing, plaque removal and gingivitis

Dental Elf – 11th Aug 2014

How should I brush my teeth?

Dental Elf – 8th Oct 2013

Teaching toothbrushing with fluoride toothpaste – are we doing it well?

Tagged with: brushing technique, caries, fluoride, incidence, oral health, toothbrushing

Derek Richards

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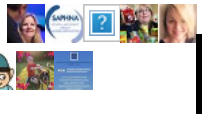

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