
CLINICAL PRACTICE GUIDELINES

LIGNES DIRECTRICES DE PRATIQUE CLINIQUE

Periodic health examination, 1993 update: 3. Periodontal diseases: classification, diagnosis, risk factors and prevention

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with the Canadian Task Force on the Periodic Health Examination***

Objective: To review the 1979 Canadian Task Force on the Periodic Health Examination recommendations on the diagnosis and prevention of periodontal disease.

Options: Self-care at home, professional care, treatment with antimicrobial agents and management of patients at high risk.

Outcomes: Maintaining the gingiva, alveolar bone and periodontal ligament in a healthy state (absence of gingival bleeding and no loss of epithelial attachment).

Evidence: A literature search for articles published from 1980 to 1993 was conducted. Selected studies published before 1980 were also reviewed if there were no recent updates. Evidence was evaluated and classified as good, fair or poor according to the criteria of the task force.

Values: The task force's evidence-based rules for recommendations were used. In addition, whenever feasible, and on the basis of advice from the reviewers and experts, recommendations were modified in the interest of maintaining oral health (e.g., dental flossing in children).

Benefits, harms and costs: The recommendations are not expected to increase the costs of preventing periodontal diseases for the general population. They could benefit dental patients and reduce costs because they are based on the periodontal needs of patients rather than on the current universal application approach.

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Copies of this and other task force reports are available from the Health Services Directorate, Health Services and Promotion Branch, Health Canada, Tunney's Pasture, Ottawa, ON K1A 1B4.

Recommendations: There is good evidence to recommend personal toothbrushing and flossing to prevent gingivitis in adults. In children there is good evidence to support toothbrushing only; however, flossing is recommended to develop the necessary skills and establish a habit. There is weak scientific evidence to recommend oral hygiene for the prevention of periodontitis; however, brushing and flossing are strongly recommended to prevent gingival inflammation and reduce the level of supragingival bacteria. There is fair evidence to recommend professional scaling and plaque removal in periodontally healthy individuals. There is good evidence to recommend professional scaling every 3 to 4 months in patients with periodontitis or after periodontal surgery. There is also good evidence to recommend the use of chlorhexidine oral rinse as an adjunct to self-care in the prevention of gingivitis. Listerine is less effective than chlorhexidine. There are no long-term studies of the effectiveness of other antimicrobial rinses marketed for home use. Anticalculus dentifrices are recommended for people with high levels of calculus formation to reduce the accumulation of supragingival calculus. Antibiotics are not recommended for the prevention of gingivitis or periodontitis. There is fair evidence to recommend smoking cessation to reduce the risk of developing periodontitis.

Validation: The report was reviewed by members of the task force and three external reviewers selected to represent different areas of expertise in the management of periodontal disease. Changes recommended by the experts were incorporated if there was published scientific evidence.

Sponsor: These guidelines were developed and endorsed by the task force. Funding was provided by the Faculty of Dentistry, Dalhousie University, and the Faculty of Dentistry, University of Toronto.

Objectif : Réviser les recommandations sur le diagnostic et la prévention de la parodontopathie, faites en 1979 par le Groupe de travail canadien sur l'examen médical périodique.

Options : Soins personnels à la maison, soins professionnels, traitement à l'aide d'agents antimicrobiens et prise de médicaments à risque élevé.

Résultats : Maintenir la gencive, l'os alvéolaire et le desmodonte dans un état sain (absence de saignement gingival et de perte de l'attache épithéliale).

Preuve : On a passé en revue les articles publiés de 1980 à 1993. On a sélectionné et consulté des études publiées avant 1980 si elles n'avaient pas été mises à jour récemment. Les preuves ont été évaluées et classées selon les critères du Groupe de travail : bonnes, passables ou peu abondantes.

Valeurs : Les règles du Groupe de travail, fondées sur les preuves, ont servi à formuler les recommandations. De plus, chaque fois que cela était possible, et tel que les réviseurs et les experts l'ont conseillé, on a modifié les recommandations en fonction du maintien d'une bonne hygiène buccale (p. ex., l'usage de la soie dentaire chez les enfants).

Avantages, préjudices et coûts : Les recommandations ne devraient pas donner lieu à une augmentation des coûts de prévention de la parodontopathie chez la population en général. Elles pourraient par ailleurs s'avérer avantageuses pour les patients des soins dentaires et réduire les coûts parce qu'elles sont fondées sur les besoins parodontiques des patients plutôt que sur l'approche universelle actuelle.

Recommandations : Il y a de bonnes preuves pour recommander le brossage de dents et l'usage de la soie dentaire dans le but de prévenir la gingivite chez les adultes. Chez les enfants, il y a de bonnes preuves pour appuyer le recours au brossage de dents uniquement; cependant, l'usage de la soie dentaire est recommandé pour développer l'habileté nécessaire et établir une habitude. Il y a peu de preuves scientifiques pour recommander l'hygiène buccale afin de prévenir la parodontite; cependant, le brossage et la soie dentaire sont fortement recommandés pour prévenir l'inflammation gingivale et réduire la concentration de bactéries sus-gingivales. Il y a des preuves passables pour recommander le détartrage et l'enlèvement de la plaque dentaire par un professionnel chez les personnes qui n'ont pas de problème parodontique. Il y a de bonnes preuves pour recommander que le détartrage soit fait par un professionnel tous les 3 à 4 mois chez les patients atteints de parodontite ou ayant subi une chirurgie parodontique. Il y a aussi de bonnes preuves pour recommander l'usage d'un rinçage-bouche à la chlorhexidine en adjonction aux soins personnels pour prévenir la gingivite. Le Listerine est moins efficace que la chlorhexidine. Il n'y a pas d'étude à long terme évaluant l'efficacité des autres rinçage-bouche antimicrobiens mis sur le marché pour les soins personnels. Les dentifrices prévenant l'accumulation de tartre sont recommandés à ceux dont le taux de formation de tartre est élevé afin de réduire l'accumulation de tartre sus-gingivale. Les antibiotiques ne sont pas recommandés pour la prévention de la gingivite ou de la paro-

dontite. Il y a des preuves passables pour recommander de cesser de fumer afin de réduire le risque de développer une parodontite.

Validation : Le rapport a été révisé par les membres du Groupe de travail et par trois réviseurs externes choisis pour représenter leurs différents domaines de compétence dans le traitement de la parodontopathie. Les modifications recommandées par les experts ont été incorporées si les preuves scientifiques avaient été publiées.

Commanditaires : Ces lignes directrices ont été développées et approuvées par le Groupe de travail. Le financement provient des facultés de médecine dentaire de l'Université Dalhousie et de l'Université de Toronto.

The periodontium is a complex, highly specialized, shock-absorbing and pressure-sensing system consisting of four interrelated tissues supporting the teeth: cementum, periodontal ligament, alveolar bone, and junctional and sulcular epithelia (Fig. 1'). The periodontal ligament connects the teeth to the alveolar bone² and is a dynamic tissue with a high rate of remodelling and turnover.

The purpose of this review of clinical practice guidelines is to provide practising dentists and physicians with up-to-date information and scientifically based recommendations for the prevention of the most common forms of periodontal disease. A discussion of treatment is beyond the scope of this paper. An extensive review of treatments is available in the proceedings of the World Workshop in Clinical Periodontics, held in Princeton, NJ, in 1989.³

Review methods

Periodontal diseases are the most prevalent chronic diseases, accounting for over 95% of cases in children, adolescents, adults and elderly people. Prevention of periodontal diseases is based on three approaches: self-care, professional care by a dentist or dental hygienist and use of antimicrobial agents. The scientific basis for each of these alternatives was reviewed and classified as good, fair or poor according to the criteria developed by the Canadian Task Force on the Periodic Health Examination. The scientific evidence was gathered and reviewed from several searches of MEDLINE for articles published from 1980 to 1993. Selected studies published before 1980 were also reviewed if there were no recent updates. Studies were selected and evaluated to determine whether interventions being evaluated (e.g., tooth-brushing) were effective. The external and internal validity of the studies was also evaluated. The report was critically reviewed twice by the task force and by three national and international experts. All decisions on outcome were made by the authors (A.I.I. and D.W.L.), who relied on published research findings and comments by three experts.

Overview

There are many types of periodontal disease, the most common being gingivitis — inflammation of the

gingival tissue surrounding a tooth (Fig. 2). The most common form of gingivitis is chronic plaque-associated inflammation⁴ — a polymicrobial infection with no single associated bacterial agent. Less prevalent forms of gingivitis are aggravated by systemic conditions (e.g., an increase in sex hormones [prepubertal gingivitis]), certain drugs (phenytoin, cyclosporine and steroids) and systemic diseases (e.g., insulin-dependent diabetes mellitus and leukemia). Non-plaque-associated gingivitis secondary to dermatologic diseases or to HIV infection is less common. The review of risk factors, burden of suffering and prevention is limited to chronic plaque-associated gingivitis.

Gingivitis is often a precursor to periodontitis — inflammation of the periodontal ligament, junctional epithelia, cementum and gingiva (Fig. 2). The pathognomonic sign of periodontitis is loss of alveolar bone and the subsequent formation around the tooth of a pocket, which varies in depth depending on host responses and the severity and duration of the inflammation. The pocket acts as a reservoir favouring the growth of anaerobic bacteria.

The most common form of periodontitis, chronic adult periodontitis, results from a polymicrobial infection characterized by continuous and slowly progressing loss of alveolar bone. Although chronic adult periodontitis is generalized, some tooth sites experience more advanced bone loss than others. This form of periodontitis

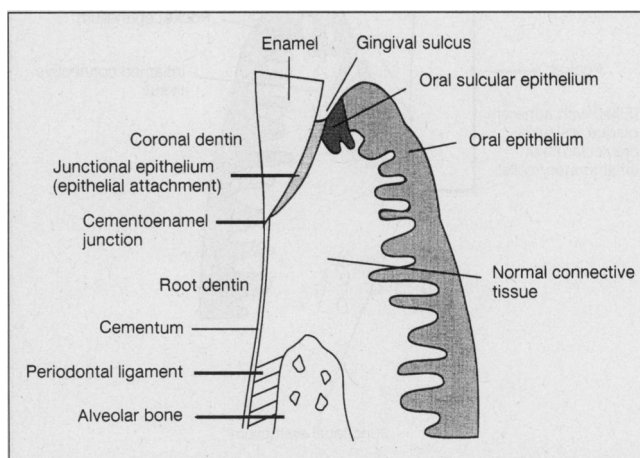


Fig. 1: Schematic longitudinal section of the dentogingival area of a healthy tooth and periodontium. Reprinted with minor modifications from Gillet et al' with permission of Munksgaard International Publishers Ltd., Copenhagen.

is not associated with any clinically manifested host dysfunction.⁴

Another form, localized juvenile periodontitis, is characterized by its early onset in adolescents or young adults and by severe bone loss around the first permanent molars and sometimes the incisors.⁵ In this disease there are no severe clinical signs of gingivitis,⁶ the lesions are bilaterally symmetrical,⁷ and the patients usually have good oral hygiene. This type of periodontitis affects girls and women three times more often than boys and men⁸ and black people more often than white people.⁹ A recent study, however, showed no female preponderance of juvenile periodontitis after correction for ascertainment bias.¹⁰ Juvenile periodontitis may have a genetic basis¹¹ and could be associated with a neutrophil functional abnormality (GP-110 deficiency).⁴ A number of subgingival organisms are found in juvenile periodontitis.^{12,13}

Diagnostic criteria

Gingivitis

Gingival bleeding is a valid and reliable indicator of gingivitis.^{14,15} It may occur spontaneously during or after eating, toothbrushing or gentle probing during dental examination. Redness and swelling are other clinical signs of gingivitis,¹⁶ but they are less valid indicators than gingival bleeding in detecting early inflammatory changes.¹⁵ About 38% of tooth sites evaluated visually and with the use of bleeding indices for the presence of gingival inflammation exhibited bleeding in the absence of redness and swelling.¹⁵ The reliability of gingival bleeding and visual signs of inflammation in measuring gingivitis has been estimated at about 90%.¹⁵

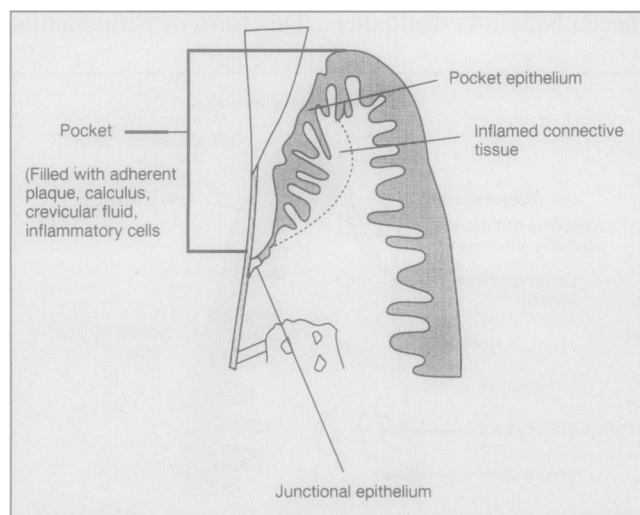


Fig. 2: Schematic longitudinal section of the dentogingival area of a tooth with periodontitis. Reprinted with minor modifications from Gillet et al' with permission of Munksgaard International Publishers Ltd., Copenhagen.

Periodontitis

Periodontal pocket formation (Fig. 2) provides a historical record of periodontal disease around a tooth. Pockets form as inflammation of gingival tissue extends into the junctional epithelium (periodontal attachment level) and surrounding connective tissue and the junctional epithelium subsequently detaches and recedes from the root of the tooth. The depth of the pocket depends on the severity and duration of the inflammatory destruction.

The periodontal (epithelial) attachment level can be detected with a periodontal probe and estimated through measurement of the distance from the cemento-enamel junction to the base of the periodontal pocket (Figs. 1 and 2). Another clinical measurement widely used by dentists is pocket depth — the distance from the gingival margin to the base of the periodontal pocket. In a healthy periodontium, there is no loss of epithelial attachment or pocket formation, and the gingival crevice is less than 2 mm deep (Fig. 1).

The presence of periodontal pocketing does not mean that periodontitis is progressing.¹⁷ Unfortunately, the decision to treat a diseased periodontium is still based primarily on the depth of the pocket, without determination of whether the disease is active. New advances in risk assessment, if validated, may allow clinicians to diagnose progressing sites better. Tools now on the market include DNA probes¹⁸ for detecting periodontopathogens or enzymes produced by pathogenic bacteria.¹⁹ The validity of these tools will be discussed later.

A critical problem associated with diagnosis of periodontitis is the reliability of the periodontal probe used to measure pocket depth or attachment level. The pressure applied to the probe when inserted into the periodontal pocket is significant in determining the depth of penetration.²⁰ In addition, the probing depth increases with more severe gingival inflammation.²¹ As a result, examiners can reach 95% agreement only within a wide range (2 mm) in their measurements of pocket depth.²²

A number of automated periodontal probes have been developed to reduce variability in examinations.²³⁻²⁵ One probe, which electronically detects the cemento-enamel junction, is accurate within 0.04 mm.²⁵ However, these automated periodontal probes have not been widely marketed and are not used by private practitioners. Their high price and general lack of availability for testing have hampered independent evaluations of their reliability.

Conventional radiographs are unsuitable for diagnosing early periodontitis,^{26,27} because extensive bone loss must occur before it becomes visible.²⁸ Moreover, alveolar bone height, as visualized in radiographs, cannot be used to predict accurately future bone loss.^{27,29} Further research would be needed to define the optimal healthy bone level for different age, sex and ethnic groups.

Periodontal disease activity

There are no adequately sensitive or specific methods for detecting periodontal disease activity. The positive predictive value of bleeding during probing in predicting the progression of periodontitis is about 30% and the negative predictive value about 98%.³⁰ Similarly, the presence of gingival bleeding is an invalid indicator of periodontal disease activity.³¹ However, tooth sites that do not bleed are not likely undergoing active periodontal destruction. New biologic markers are being developed and tested, but no recommendations can be made regarding the predictive ability of these new tests until they have been studied.

Burden of suffering

Gingivitis

Recent epidemiologic studies have relied on measuring gingival bleeding, the most objective sign of early gingivitis.^{32,33} In the most recent survey conducted by the National Institute for Dental Research, Bhat³⁴ reported that 60% of US children and adolescents examined had at least one tooth site with gingival bleeding and that less than 6% of the tooth sites per child, on average, had gingival bleeding. Beck and associates,³⁵ in Iowa, found that the prevalence of gingival bleeding increased significantly with age, reaching a plateau at 34 years. Overall, the prevalence of gingivitis in Iowa was about 55%.³⁵ In the United States 47% of adults studied had at least one tooth site with gingival bleeding.^{32,36}

Although gingivitis is not serious and its importance has been questioned, it should be prevented and treated because it affects quality of life and social functioning, especially by causing bleeding during eating or toothbrushing. Traditionally, it was believed that gingivitis inevitably led to periodontitis,^{37,38} but recent epidemiologic findings have questioned this observation.³⁹ Gingival inflammation is a necessary but not sufficient prerequisite for periodontitis.⁴⁰

Periodontitis

Periodontitis is considered one of the most prevalent chronic diseases in humans.⁴¹ According to a 1981 estimate, the treatment time to manage all patients with gingivitis and periodontitis in the United States over 4 years was 120 to 133 million hours, at a cost of \$5 to \$6 billion annually. Preventive management (oral prophylaxis) accounted for 89% of the estimated cost and periodontal surgery for the remaining 11%.³⁶

Although periodontitis affects a large proportion of the US population, from 53% of adults aged 18 and 19 years to 98% of adults aged over 60, advanced periodontitis (defined by a pocket depth of 6 mm or more) occurs in only 8% of adults and 34% of elderly people.³² The

prevalence of advanced periodontitis has been reported to be 21% in Japan,⁴² 27% in Finland,⁴³ 8% in US adults in 1981,⁴⁴ 3% in Switzerland⁴⁵ and 12% in elderly Ontarians.⁴⁶ The low prevalence of advanced periodontal destruction has been confirmed by several recent epidemiologic studies.^{39,47,48} In most people, advanced periodontitis is site specific, affecting relatively few teeth in the mouth.^{32,39}

Several studies have described the natural history of periodontitis.^{39,49-53} All indicate that only 3% to 13% of the population is susceptible to rapid and advanced loss of periodontal attachment, whereas about 80% of adults experience slow or moderate periodontitis progression. Less than 10% of adults experience minimal loss of periodontal attachment. The presence of plaque, calculus and gingivitis is highest in the high-risk group,^{39,51} but the presence of these factors does not account for 90% of the variability.⁴⁷ Certain systemic factors, such as non-insulin-dependent diabetes, are associated with a rapid progression of periodontitis.^{54,55} The identification and prediction of those at high risk are major challenges for future research.

Several cross-sectional⁵⁶⁻⁵⁹ and longitudinal^{60,61} studies have found that, contrary to popular belief, periodontitis is not the main reason for tooth extraction in adults. Rather, dental caries⁶⁰ and social, cultural and cost factors⁶¹ are often reasons for tooth loss.

Risk factors

Dental plaque

Dental plaque is the bacterial mass that adheres to and builds up on a tooth surface.⁶² There is strong evidence supporting supragingival plaque (above the gingival line) as a cause of gingivitis.⁶³ A unique uncontrolled longitudinal study followed gingivitis and periodontitis development in adults over 15 years.⁶⁴ All 375 participants underwent scaling and root planing of tooth surfaces to remove calculus every 2 to 3 months during the first 9 years of the study and twice annually during the following 6 years. The participants were instructed on how to maintain oral hygiene practices at home. After 15 years the participants had no clinically detectable loss of periodontal attachment. Therefore, if plaque is completely removed, chronic gingivitis and periodontitis can be prevented. However, the costs and commitment of such an intensive program may make this approach impractical for the general population.

There is a weak correlation between plaque mass and attachment loss;⁶⁵ however, there is an association between the presence of *Actinobacillus actinomycetemcomitans*, *Prevotella (Bacteroides) intermedius* and *Porphyromonas gingivalis* in dental plaque and attachment loss.^{66,67} Other studies have identified people who are not susceptible to severe periodontitis despite their poor oral hygiene.^{49,68} These results suggest that, although an in-

crease in plaque mass can lead to the growth of some bacteria and an increase in the threshold of toxins produced by these bacteria, the association between plaque and periodontitis is still not specifically defined.

In the past 5 years considerable progress has been made in developing more specific bacterial identification methods, such as DNA probes,¹⁸ to identify a group of periodontopathogens in order to aid dental practitioners in predicting active periodontal disease. Although these advances are significant, further research is needed to define risk models for different profiles of periodontal diseases. Listgarten and collaborators⁶⁹ showed that the mere presence or absence of a certain bacterial species (*A. actinomycetemcomitans* and *P. intermedius*) cannot, on its own, serve as a reliable predictor of recurrence of periodontal destruction. This study, however, included only patients who had received periodontal treatment, and therefore the results cannot be generalized. Wilton and colleagues,⁷⁰ in a recent review of specific antibody response to subgingival plaque bacteria, concluded that antibody response to *A. actinomycetemcomitans* and *P. gingivalis* does not allow diagnosis or prediction of periodontal disease because antibodies to these bacteria are also found in healthy people. Recent identification of unique virulent antigens or enzymes of *P. gingivalis*, which could cause destruction of connective tissues and disruption of host defence mechanisms, provides a promising tool for prediction and risk assessment of periodontitis.⁷¹

Calculus

Calculus, calcified dental plaque,⁷² acts as a retention web for bacteria and toxins and, consequently, contributes to attachment loss.⁷³ A longitudinal study conducted in Sri Lanka and Norway between 1970 and 1985⁷³ showed that among Sri Lankan tea labourers calculus was highly prevalent and was associated with higher loss of periodontal attachment than among Norwegian adults. In the Norwegian adults, who had regular dental care throughout their lives, 70% of the interdental surfaces were calculus free; no association was detected between subgingival calculus and loss of periodontal attachment. These results appear to indicate that calculus is associated with periodontitis and that the presence of some calculus, in patients receiving regular dental care, does not lead to significant periodontal attachment loss. However, the findings are confounded by differences between Sri Lankan and Norwegian samples in availability of dental care and personal oral hygiene habits. In a case-control study conducted by Carlos and coworkers⁶⁷ involving Navajo Indian adolescents aged 14–19 years, the presence of calculus increased the odds of attachment loss by 5 times, and gingival bleeding increased the odds by 16.5 times.

Dental calculus is associated with loss of attachment in patients with poor oral hygiene and limited ac-

cess to professional dental care but not in those with excellent oral hygiene.⁷³ Although there is no scientific evidence that calculus directly causes the initiation of gingivitis or periodontitis, it is an important contributor to the chronicity of these diseases.⁷² To achieve periodontal health, however, absolute removal of all calculus is not necessary^{73,74} and, despite meticulous instrumentation, cannot always be achieved in clinical practice.⁷⁵ This finding does not suggest that the goal of professional cleaning should be less than total removal of all accessible calculus.

Age

Aging is a consistent risk factor for periodontitis.^{39,50} However, loss of periodontal attachment and alveolar bone support with age is not inevitable.⁷⁶ With efficient elimination of plaque and calculus, there is no clinically detectable loss of attachment.⁶⁴ This status can only be achieved in highly motivated patients who receive regular and meticulous professional care.

Smoking

A consistent association between cigarette smoking and periodontitis has been confirmed in both cross-sectional and longitudinal studies.^{77–80} Use of smokeless (chewing) tobacco has been associated with localized loss of periodontal attachment and oral leukoplakia but not with severe periodontal destruction.^{81,82}

Diabetes

A recent study of periodontitis in Pima Indians⁵⁵ with non-insulin-dependent diabetes showed that the odds ratio of alveolar bone loss was 2.6 times higher among the diabetic patients than among those without diabetes. However, after accounting for other risk factors the researchers concluded that periodontitis is a nonspecific complication of non-insulin-dependent diabetes. Even after differences in oral hygiene were accounted for, gingivitis was found to be more prevalent in patients with insulin-dependent diabetes than in nondiabetic people.⁸³ After a thorough critical review of the literature Katz and associates⁵⁴ concluded that periodontal disease is more prevalent and more severe in diabetic patients than in nondiabetic people.

Malocclusion

A 20-year follow-up study involving adolescents with different malocclusal conditions showed that orthodontic treatment is not needed to prevent periodontal disease in patients with these problems but that special oral hygiene education and maintenance are.⁸⁴ Occlusal trauma does not cause periodontitis.⁸⁵ Crowded teeth may be more prone to accumulate dental plaque; there-

fore, patients with such teeth should be taught how to maintain gingival health.

Host defences

There is no direct scientific evidence that host defences play a role in preventing chronic gingivitis and adult periodontitis; however, rapidly progressing periodontitis, especially in a child, adolescent or young adult may suggest a defect in host defence. Nishimura and collaborators⁸⁶ found that a mother and a daughter with early-onset periodontitis had been infected with *P. gingivalis* and that, although they had normal humoral response to other anaerobic bacteria associated with periodontitis, both showed depressed neutrophil chemotaxis and reduced superoxide production. The daughter also had depressed neutrophil phagocytosis. Mediators of host response, such as interleukins and tumour necrosis factors, may be associated with advanced and progressive periodontitis.⁸⁷

Prevention

Prevention of gingivitis and periodontitis is achieved primarily by controlling plaque and calculus around the teeth. Nonspecific control of plaque and calculus requires their frequent removal from all accessible tooth surfaces, which consequently disturbs dental plaque ecology. Although this approach is most widely recommended, the use of antimicrobial agents is also recommended in some patients. This section will review the evidence supporting personal toothbrushing, flossing, professional scaling and root planing, and the use of antimicrobials and anticalculus toothpastes. There have been no studies of the effectiveness of physician counselling (screening or referral) on the prevention of gingivitis and periodontitis.

We followed the task force's rules for evaluating the scientific evidence supporting recommendations on preventive intervention and management.⁸⁸

Toothbrushing and flossing

As discussed previously, the accumulation of dental plaque leads to the development of gingivitis. Loe, Theilade and Jensen⁶³ (level II-2 evidence) showed that gingivitis develops in healthy adults after 10 to 21 days in the absence of personal plaque removal. This study, while providing strong evidence for recommending at least daily toothbrushing, does not address the long-term consequence of plaque accumulation and the different reactions among patients to qualitative and quantitative changes in dental plaque.

Although cross-sectional epidemiologic studies have shown a negative correlation between periodontal disease and the frequency of toothbrushing, periodontal diseases were measured with indices that do not allow

evaluation of the separate effect of toothbrushing on gingivitis and periodontitis. Cohort studies have shown an association between good oral hygiene and a low prevalence of periodontitis.^{49,51} Addy and coworkers⁸⁹ found only a weak correlation between toothbrushing frequency and gingival health. They also found that social class and sex were more important indicators of gingival health than toothbrushing frequency. On the contrary, a clinical trial⁹⁰ (level I evidence) confirmed that effective plaque removal every 48 hours was associated with gingival health; however, the external validity of this study is limited because the participants cleaned their teeth under supervision and "a dental hygienist ensured that no plaque remained following the performance of oral hygiene."^{91,92} Although supervised toothbrushing in the classroom was effective, participants reported that the daily routine of the procedure was "very boring."⁹¹

Two studies conducted in dental offices showed that oral hygiene instructions were not based on the principles of effective instruction,⁹³ were not intensive or detailed and, unexpectedly, were more intensively directed toward patients with low levels of dental plaque and at low risk of periodontal disease because hygienists perceived these patients as more likely to follow instructions.⁹⁴

Studies of the effectiveness of dental floss aid in removing plaque between the teeth have been inconclusive.^{95,96} However, a recent 2-week clinical trial (level I evidence) involving adults showed that toothbrushing twice daily alone reduced gingival bleeding by 35% and that toothbrushing and flossing at home resulted in a 67% reduction.⁹⁷ No differences between waxed and unwaxed floss were found in reducing gingival bleeding. Again, this study cannot be generalized to unsupervised flossing at home because the participants were checked daily by the research team to ensure effective toothbrushing and flossing. A recent clinical trial (level I evidence) involving third-grade schoolchildren demonstrated that toothbrushing was as effective as combined toothbrushing and flossing.⁹⁸ Therefore, for children without gingivitis, there is no additional benefit from flossing because spaces between primary teeth are wider than those between permanent teeth. Nevertheless, flossing should be part of an oral hygiene program for children to teach the skill and establish the habit.

Daily supervised toothbrushing in children was found to be associated with effective removal of plaque and prevention of gingivitis.⁹⁹ There is no scientific evidence to support the superiority of any of the techniques or styles of toothbrushing; however, physicians and dentists should be aware of and advise their patients concerning the damaging effects of some toothbrushing techniques (e.g., horizontal scrubbing). Toothbrushing too frequently has been associated with gingival recession followed by root exposure and hypersensitivity to cold and hot stimuli.¹⁰⁰ Vigorous horizontal toothbrushing has been shown to cause abrasion of the tooth struc-

ture.¹⁰¹ Also, this style of toothbrushing can cause development of systemic bacteremia in patients susceptible to infectious endocarditis.¹⁰²

There is no consistent scientific evidence to support the superiority of electric toothbrushes over manual ones.¹⁰³⁻¹⁰⁶ A manual toothbrush, if used efficiently, is as effective as an electric one.¹⁰⁴ New electric toothbrushes may help some patients to increase the frequency of toothbrushing and are very helpful in maintaining good

oral hygiene in patients with physical disabilities who cannot manage a manual toothbrush properly; however, the additional benefits of electric toothbrushes should be weighed against the higher cost.

Professional care

The most common form of professional preventive care for gingivitis and periodontitis is scaling and pol-

Table 1: Summary of manoeuvres, effectiveness, levels of evidence and recommendations for the prevention of periodontal diseases

Manoeuvre	Effectiveness	Level of evidence*	Recommendation*
Toothbrushing and flossing	Toothbrushing is effective in preventing gingivitis	Uncontrolled cohort study ⁶³ (II-2) and clinical trial ⁹⁰ (I)	Fair evidence to recommend toothbrushing for prevention of gingivitis (B). Patients who are not motivated or dextrous may not comply
	Flossing is ineffective in preventing gingivitis in children	Clinical trials ^{91,92,98} (I)	Flossing is recommended to develop the skill and establish a habit (C)
	Flossing is effective in preventing gingivitis in adults	Clinical trial ⁹⁷ (I)	Good evidence to recommend flossing in adults (A)
	Brushing and flossing may prevent periodontitis	Cohort studies ^{49,51} (II-2)	Brushing and flossing are recommended to prevent gingival inflammation (C)
	There is no evidence that brushing or flossing is effective in high-risk groups (e.g., patients with malocclusion, diabetes or HIV infection)	—	Supervised toothbrushing and flossing is recommended (C)
Use of electrically powered toothbrush	Electric toothbrushes are not superior to manual toothbrushes; the benefit to those with limited dexterity or motivation must be weighed against the cost	Clinical trials ¹⁰³⁻¹⁰⁶ (I)	Fair evidence not to recommend (D). Recommended for patients with limited dexterity (C)
Professional scaling and prophylaxis	In periodontally healthy patients: Intensive professional oral hygiene prophylaxis prevents chronic gingivitis and periodontitis. However, annual scaling provides no additional benefit in periodontally healthy patients who maintain good oral hygiene. Frequency of scaling should be based on each patient's oral hygiene and on clinical signs of periodontitis	Clinical trials ¹⁰⁷⁻¹¹¹ (I)	Fair evidence to recommend professional scaling depending on the periodontal disease status of the patient (B)

*For descriptions of the other levels of evidence and classification of recommendations see Appendix 1 in part 1 of the 1992 update (*Can Med Assoc J* 1992; 147: 443).

†Not marketed for dental use in Canada, but dentists and physicians can prescribe it if indicated.

ishing of teeth. Scaling removes calculus and bacteria either above the gingiva or inside the gingival crevice or pocket. After scaling, an abrasive is applied via a small rubber cup or a brush to remove stains and plaque and to smooth the scaled areas. In another preventive procedure, root planing, calculus is removed from the root surface using scalers, with or without surgical exposure of the root by opening a gingival flap. The choice of procedure is determined by the depth of

the periodontal pocket and accessibility of the area.

Studies by Axelsson and associates^{64,107,108} have been used to support the contention that regular professional care is necessary for periodontal health. However, these studies lack external validity. The frequency and techniques used for scaling (especially interproximal scaling) in these studies differ from those used regularly by Canadian and US dentists and dental hygienists. Other studies have shown that in adults with healthy periodon-

Manoeuvre	Effectiveness	Level of evidence*	Recommendation*
	In patients who have periodontitis or who have undergone periodontal surgery: Scaling and prophylaxis are crucial for maintaining periodontal health after treatment	Clinical trials ¹¹⁴⁻¹¹⁶ (I)	Good evidence to recommend scaling and prophylaxis every 3 to 4 months (A)
Use of chlorhexidine oral rinse	Effective in preventing gingivitis and as an antimicrobial. Reduces supragingival plaque level. Side effects include increased supragingival calculus formation, bad taste and staining of teeth	Clinical trials ¹¹⁷⁻¹¹⁹ (I)	Good evidence to recommend twice daily use of 0.12% chlorhexidine rinse† (A)
Use of Listerine oral rinse	Less effective than chlorhexidine. Effective in preventing gingivitis with long-term use (6 months or more). Side effects include poor taste and burning sensation in the mouth	Clinical trials ^{120,121} (I)	Fair evidence to recommend use by patients with severe gingivitis (B)
Use of other over-the-counter oral rinses	No long-term studies of effectiveness in preventing gingivitis and periodontitis	—	No evidence to recommend use (D)
Toothbrushing with anticalculus dentifrices	Effectiveness in preventing gingivitis is not documented Effective in reducing supragingival calculus. Long-term benefits not evaluated	— Clinical trials ¹²⁶⁻¹²⁸ (I)	No evidence to recommend for gingivitis (C) Fair evidence to recommend for patients at risk of calculus formation (B)
Antibiotic prophylaxis	No evidence of effectiveness in preventing gingivitis or periodontitis in the general population	—	Antibiotics are not recommended for preventive use because of side effects (E)
Smoking cessation	Eliminates increased risk of periodontal diseases due to smoking	Cross-sectional and cohort studies ⁷⁷⁻⁸² (II-2)	Fair evidence to recommend smoking cessation for patients with periodontal disease (B)
Screening for periodontal disease by physicians (reports of gingival bleeding during toothbrushing)	Not evaluated	—	Recommended in areas with no dental services (C)

tium annual scaling was as effective as more frequent scaling in maintaining gingival health.¹⁰⁹⁻¹¹¹ The Axelsson studies^{64,107,108} also demonstrated that "traditional dental care" (scaling and prophylaxis carried out once a year in a dental office) did not prevent periodontitis in adults.

A study by Suomi and collaborators¹¹² is also used to support professional prophylaxis, but it too lacks external validity. This study, during which adults received 11 professional preventive treatments during 3 years, cannot be used to support biannual dental prophylaxis. It is not that the conventional frequency of dental prophylaxis is harmful or not recommended but, rather, that the scientific evidence supporting its effectiveness is weak.

No recent clinical trial has tested the optimal frequency and efficiency of scaling in periodontally healthy patients with excellent home maintenance methods and in patients who cannot maintain their periodontal health at home. The traditional biannual scaling provided to regular patients who do not suffer from moderate or severe periodontal destruction cannot be supported unequivocally.¹¹³ Patients with little or no periodontal disease may require less frequent scaling. The recall interval should differ among patients on the basis of oral hygiene status and severity of gingivitis and periodontitis.

The scientific evidence strongly supports the need for recalls every 3 or 4 months for scaling and root planing in patients with progressive advanced periodontitis. This regimen should be continued until periodontal health is restored and the patient can maintain good personal oral hygiene.¹¹³⁻¹¹⁶

Antimicrobial prophylaxis

An oral rinse with chlorhexidine (0.12% or 2%), an antibacterial agent, is effective in reducing supragingival plaque and gingivitis (level I evidence).¹¹⁷⁻¹¹⁹ Unsupervised use of a chlorhexidine oral rinse for 6 months was more effective than use of a sanguinarine rinse or Listerine (Warner-Lambert Canada Inc., Scarborough, Ont.; active ingredients eucalyptol, menthol and thymol) in reducing plaque and gingival bleeding (level I evidence).¹¹⁷

A recent Canadian trial revealed that rinsing twice daily with 0.12% chlorhexidine over 2 years significantly reduced supragingival plaque and gingival bleeding.¹¹⁸ In addition, there is evidence to support chlorhexidine use as an adjunct to scaling and root planing in periodontal patients under professional maintenance care.¹¹⁹

Side effects associated with chlorhexidine use include increased calculus formation, bad taste and staining of teeth.¹¹⁹ Although it is not marketed for dental use in Canada, dentists and physicians can prescribe it (0.1%, 0.15% or 0.2%) if indicated.

Short-term studies (6 to 9 months) have documented the effectiveness of Listerine in preventing gingivitis when compared to a placebo.^{120,121} The most

common side effects of Listerine are poor taste and a burning sensation in the mouth.¹²²

No long-term studies have documented the clinical effectiveness of unsupervised use of other over-the-counter oral rinses such as Plax (Pfizer Canada Inc., Kirkland, Que.), Scope (Procter and Gamble, Toronto, Ont.) and Cepacol (Merrell Dow Pharmaceutical Inc., Richmond Hill, Ont.) in preventing gingivitis.

The use of antibiotics (tetracyclines) to prevent gingivitis and periodontitis in the general population has not been tested because of possible side effects, the potential development of resistant bacterial strains and patient hypersensitivity. Moreover, gingivitis and periodontitis are polymicrobial infections. However, systemic antibiotics have been used successfully in clinical trials involving patients with juvenile periodontitis and patients with recurrent or uncontrolled periodontitis after treatment (refractory periodontitis).^{123,124}

Anticalculus toothpastes

Although calculus is not an important cause of gingivitis and periodontitis, many over-the-counter dentifrices are marketed with the claim that they prevent the formation of calculus and gum disease. In 1988 the US Food and Drug Administration warned toothpaste manufacturers to stop claiming that their products could prevent plaque and gingivitis (*The Washington Post*, Oct. 8, 1988: A2). The "antitartar" toothpastes contain soluble pyrophosphates, which prevent calcification of plaque and have been found to reduce the amount of supragingival (but not subgingival) calculus by 32%^{125,126} and 45%.¹²⁷ However, there are case reports of cheilitis and mucosal erythema associated with the use of these toothpastes.¹²⁸ The long-term value of these products in preventing gingivitis and periodontitis has not been established; however, all of these toothpastes contain fluoride, which has a highly active remineralizing effect on tooth decay.

Recommendations (Table 1)

Gingivitis

Absence of gingival bleeding is a highly specific indicator of the lack of periodontal disease activity. Gingival inflammation should be managed with toothbrushing (level II-2 evidence, recommendation B) and flossing (adults, level I evidence, recommendation A; children, ineffective [level I evidence], recommendation C) or professional mechanical cleaning (level I evidence, recommendation B). In patients who have difficulty cleaning their teeth due to a mental handicap, cancer or a physical disability, rinsing with chlorhexidine is recommended as an adjunct to toothcleaning (level I evidence, recommendation A).

Although the presence of gingivitis cannot be used

to predict periodontitis, management of gingivitis is recommended.¹¹⁵ Therefore, the assessment of gingivitis in a periodic dental examination is recommended (recommendation C).

Physicians, in assessing health status, should ask their patients about the presence of gingival bleeding during eating and toothbrushing and, if present, should refer them to a dentist for a more detailed examination and management program.

Periodontitis

During a regular dental examination the presence of periodontal pockets and loss of periodontal attachment should be recorded for all teeth. Progressive periodontitis (any increase in pocket depth from baseline scores) can be successfully controlled by personal oral hygiene (level II-2 evidence, recommendation C) and professional scaling and root planing (level I evidence, recommendation B). However, evidence to support an optimal frequency of professional care to prevent periodontitis development or progression is not available for the general population. The frequency of professional scaling should be based on each patient's periodontal health status. In addition, there is fair evidence (level II-2 evidence, recommendation B) to recommend smoking cessation for patients with periodontitis.

Physicians should ask patients during a periodic health examination whether they experience gingival bleeding, especially when eating or toothbrushing, and, if present, refer them to a dentist (recommendation C). They should also refer patients who have any systemic condition (e.g., diabetes or HIV infection) that may lead to a reduction in immune response or an increase in collagen tissue breakdown. Patients with cancer scheduled to receive chemotherapy or radiation therapy should also be seen by a dentist or periodontist for a thorough examination and a preventive management program.

The current practice of advising a regular biannual or annual scaling for all patients is costly and cannot be supported by the current scientific evidence. Proper diagnosis and risk assessment are prerequisites for prevention. The recommendations, if followed, would reduce the cost of care for periodontal disease and shift more professional time and health care funds to patients who need more intensive and frequent professional management because of severe periodontal destruction.

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- opment. *J Clin Periodontol* 1989; 16: 311-315
122. Overholser CD Jr: Longitudinal clinical studies with antimicrobial mouthrinses. *J Clin Periodontol* 1988; 15: 517-519
 123. Papli R, Lewis JM: Refractory chronic periodontitis: effect of oral tetracycline, hydrochloride and root planing. *Aust Dent J* 1989; 34: 60-68
 124. Novak MJ, Polson AM, Adair SM: Tetracycline therapy in patients with early juvenile periodontitis. *J Periodontol* 1988; 59: 366-372
 125. Zacherl WA, Pfeiffer HJ, Swancar JR: The effect of soluble pyrophosphates on dental calculus in adults. *J Am Dent Assoc* 1985; 110: 737-738
 126. Lobene RR: A study to compare the effects of two dentifrices on adult calculus formation. *J Clin Dent* 1989; 1: 67-69
 127. Rugg-Gunn AJ: A double blind clinical trial of an anticalculus toothpaste containing pyrophosphate and sodium monofluorophosphate. *Br Dent J* 1988; 165: 133-136
 128. Beacham BE, Kurgansky D, Gould WM: Circumoral dermatitis and cheilitis caused by tartar control dentifrices. *J Am Acad Dermatol* 1990; 22: 1029-1032

Conferences continued from page 1407

Apr. 21-24, 1994: Women's Health: Key Research and Health Care Issues — a National Multidisciplinary Conference

Hamilton, Ont.

Abstract deadline: Nov. 30, 1993

Keynote address: Dr. Judith Kazimerski

Child care available during the conference.

I. Ellis, conference coordinator, Faculty of Health Sciences, Rm. 1M10, McMaster University, 1200 Main St. W, Hamilton, ON L8N 3Z5; tel (416) 525-9140, ext. 2182; fax (416) 521-2100

Apr. 24, 1994: Association of Canadian Medical Colleges 6th Conference on Physician Manpower

Vancouver

Abstract deadline: Dec. 3, 1993

Eva Ryten, Association of Canadian Medical Colleges, 1006-151 Slater St., Ottawa, ON K1P 5N1; fax (613) 594-3364

Le 24 avr. 1994 : Association des facultés de médecine du Canada 6^e conférence sur la main-d'oeuvre médicale canadienne

Vancouver

Date d'échéance pour les résumés : le 3 déc. 1993

Eva Ryten, l'Association des facultés de médecine du Canada, 1006-151, rue Slater, Ottawa, ON K1P 5N1; fax (613) 594-3364

Apr. 25-26, 1994: International Symposium on Inherited Epidermolysis Bullosa (cosponsored by the Office of Continuing Medical Education, University of North Carolina School of Medicine, and by the National Epidermolysis Bullosa Registry; precedes the annual meetings of the Society for Investigative Dermatology and the American Federation for Clinical Research)

Chapel Hill, NC

Dr. Jo-David Fine, Department of Dermatology, University of North Carolina at Chapel Hill, 137 NCMH, CB 7600, Chapel Hill, NC 27514; tel (919) 966-3321

Les 26 et 27 avr. 1994 : Immunologie et leucémies — Symposium international

Nancy, France

Langues officielles : le français et l'anglais

Date d'échéance pour les résumés : le 15 janv. 1994

Laboratoire d'immunologie, Faculté de médecine, BP 184, 54500 Vandoeuvre-Lès-Nancy, France; tél 011-33-83-59-28-56, fax 011-33-83-44-60-22

Apr. 26-27, 1994: Immunology and Leukemia — International Symposium

Nancy, France

Official languages: English and French

Abstract deadline: Jan. 15, 1994

Immunology Laboratory, Faculty of Medicine, PO Box 184, 54500 Vandoeuvre-Lès-Nancy, France; tel 011-33-83-59-28-56, fax 011-33-83-44-60-22

Apr. 27-30, 1994: The Post-Polio Syndrome: Advances in the Pathogenesis and Treatment

Bethesda, Md.

Geraldine Busacco, conference director, New York Academy of Sciences, 2 E 63rd St., New York, NY 10021; tel (212) 838-0230, fax (212) 838-5640

Apr. 28-May 1, 1994: American Association for the History of Medicine Annual Meeting

New York

Dr. J.M. Duffin, History of Medicine, Queen's University, Kingston, ON K7L 3N6

Apr. 29-30, 1994: The Critical Path — a Multiprofessional Approach to the Care of the Trauma Patient

Toronto

Ms. C. Stolarchuk, conference coordinator, Sunnybrook Health Science Centre, Rm. H109, 2075 Bayview Ave., North York, ON M4N 3M5; tel (416) 480-6100, ext. 5904

May 8-11, 1994: Canadian Long Term Care Association Annual National Conference (cosponsored by the Newfoundland Hospital and Nursing Home Association)

St. John's

Canadian Long Term Care Association, 302-260 St. Patrick St., Ottawa, ON K1N 5K5; tel (613) 237-9837, fax (613) 237-6592

May 11-14, 1994: North American Society of Pacing and Electrophysiology 15th Annual Scientific Sessions

Nashville, Tenn.

Abstract deadline: Dec. 1, 1993

Abstract deadline (Young Investigator Awards Competition):

Jan. 3, 1994

NASPE, 377 Elliot St., Newton Upper Falls, MA 02164-1126; tel (617) 244-7300, fax (617) 244-3920

continued on page 1451