

Plaque control and oral hygiene methods

Introduction

The experimental gingivitis study of Loe *et al.*¹ demonstrated a cause and effect relationship between plaque accumulation and gingival inflammation, and helped to establish plaque/biofilm as the primary risk factor for gingivitis. When healthy individuals withdrew oral hygiene efforts, gingival inflammation ensued within 21 days in all subjects. Once effective plaque removal was recommenced, clinical gingival health was quickly re-established – indicating that plaque-associated inflammation is modifiable by plaque control. As current consensus confirms that gingivitis and periodontitis may be viewed as a continuum of disease,² the rationale for achieving effective plaque control is clear.

However, despite this knowledge and the wide range of marketed oral hygiene products, much of the dental literature remains somewhat equivocal on the relative benefits of different oral hygiene tools and techniques. Interpretation of the research literature is limited by factors including short duration, industry involvement and heterogeneity of study designs and assessment parameters. Furthermore, the majority of studies have been conducted in healthy individuals, while the presence of confounders and ethical concerns limits the practicality of withdrawal plaque removal in diseased/susceptible patients.

This clinical feature addresses some of the key concepts, tools and techniques that may be used by dental professionals in providing effective oral hygiene (OH) advice to their patients. Many of the concepts and statements that follow reflect the consensus recommendations of the 11th European Workshop in Periodontology,² which addressed prevention of periodontal and peri-implant diseases.

Oral dysbiosis

Current thinking indicates that only certain microbial species within plaque are pathogenic, and indeed much of the time, the oral environment exhibits a state of symbiosis, or relative harmony, between the body and the oral microbiome. A threshold of bacterial burden may exist below which the oral tissues remain unaffected; if this is overcome, the state of balance is disturbed (dysbiosis) and periodontal destruction may ensue. This microbial threshold might differ between individuals, or at different times within an individual, potentially explaining the often-episodic nature of periodontal disease and its uneven pattern of distribution in the population. Maintenance of gingival health would consequently focus on altering the volume and/or pathogenicity of plaque and/or risk factors contributing to susceptibility at host sites. In this context, regular plaque removal maintains an immature biofilm, containing fewer pathogenic species. The modifiable nature of plaque accumulation makes it a rational target to address to prevent dysbiosis.



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Epidemiology

Gingivitis is ubiquitous in child and adult populations. Epidemiological studies suggest that the majority of adolescents and adults exhibit gingival bleeding.³ Periodontal examinations conducted as part of the US National Health and Nutritional Examination Survey (NHANES) between 2009 and 2012 – using full-mouth charting – indicated periodontal disease prevalence of 45.9% of the US adult population. All ethnic groups were affected; disease prevalence was elevated among smokers and those over 65 years, as well as individuals with lower educational attainment and lower socioeconomic status.⁴

Severe periodontitis alone has been estimated to affect approximately 11% of the population, rendering it the sixth most common chronic disease worldwide.⁵ Plaque is identified as a key causative factor in peri-implant inflammation. A recent meta-analysis estimated that peri-implant mucositis affects approximately 63% of patients and 30% of implants. In the same study, the estimated prevalence of peri-implantitis approximated 19% of patients and 10% of implants.⁶

Practical importance of plaque control

Prevention

Plaque control is an effective method for the prevention of gingivitis. Based on the accepted gingivitis–periodontitis continuum, plaque control is also indicated for periodontal disease prevention. Prevention may be considered in terms of:

- primary prevention – advice and care in healthy individuals focused on prevention of plaque and gingivitis; and,
- secondary prevention – advice and care in patients previously treated for periodontal disease.

Non-surgical therapy

Improved plaque control alone can reduce gingival inflammation. However, when combined with non-surgical instrumentation, the clinical benefit seen is greater, with most of the evidenced reduction in pocket depth being attributable to the effects of the instrumentation itself.⁷ Where effective OH does not support non-surgical instrumentation, recolonisation of treated sites occurs within weeks and clinical benefits are reduced.⁸

Surgical therapy

Healthy gingival tissues present a more favourable environment for periodontal surgery. A plaque-free environment may also reduce the possibility of wound contamination/poor wound healing/postoperative infections.

Periodontal maintenance

A preventive programme including well-performed OH and professional maintenance care may provide effective long-term management of periodontal disease, resulting in low tooth mortality and low incidence of disease progression.⁹

Discussions with your patient

Start by listening

Patients may be unaware of the association between poor plaque control and



FIGURE 1: Bass tooth brushing technique (sulcular brushing).

This technique concentrates on cleaning cervical tooth areas and the area beneath the adjacent gingival margin.

A mannequin may be used to demonstrate how brush head angulation influences the interproximal extension of bristles (a, b). The patient is instructed to use a pea-sized amount of toothpaste (c). The brush head is positioned obliquely towards the tooth so that the toothbrush bristles are pointed at approximately 45° to the gingival margin and extend into the sulcus (d). The brush is moved in a back-and-forth direction, without removing the bristle tips from the sulcus. The patient should focus on short strokes, working on one to two teeth at a time (e). The same technique is applied for palatal/lingual surfaces (f). On lingual surfaces of anterior teeth, the brush head is kept vertical to allow access (g, h). Occlusal surfaces are brushed using a back-and-forth scrubbing motion (i). This technique may also be used for powered brushes (j-l)

Patients are advised to follow the same brushing sequence each time, cleaning all tooth surfaces and areas of the mouth.

Note: The modified Bass technique incorporates an additional step. Following brushing at the sulcus region, the brush head is rolled over the gingiva and tooth in an occlusal direction. This allows the brush bristles to flex interproximally and enhances plaque removal in these areas.

periodontal diseases and may be motivated towards good OH primarily by the idea of a healthy appearance and avoidance of halitosis.

Dental professionals should question patients to understand their rationale for achieving OH, as this may provide a valuable insight into how to frame and deliver preventive advice.

Delivery of OH instruction

- Include a simple explanation of the role of plaque deposits in the initiation and progression of periodontal diseases.
- Explain that plaque accumulates daily; consequently, there is an ongoing requirement for prevention, in which the patient (through home care) and



FIGURE 2: Interproximal plaque deposits demonstrated by use of disclosing agent (a). As this patient has healthy gingival tissues that fill the entire embrasure space, interdental brush use may be traumatic. Consequently, flossing is demonstrated for interproximal care (b). Floss sticks may be used to address compliance or dexterity concerns in such instances (c).

dental professionals (through preventive/supportive instrumentation) must work together. Some patients may be motivated by understanding their personal role in prevention.

- Enable the patient to recognise plaque and signs of gingivitis. Practically, this can be achieved through in-office demonstration and periodic home use of disclosing aids by the patient.
- Demonstrate appropriate hygiene aids and their use to the patient and evaluate this use.
- Patients with dental implants should also be made aware that implants are also susceptible to disease and require patient and professional care.
- Potential issues of patient compliance should be considered when designing an OH regimen and evaluated periodically.
- Plan to reinforce concepts, adapting to changes in patient systemic and dental health, compliance and dexterity.

Mechanical oral hygiene

Overview

Personalise: patients should receive a personalised OH regimen that reflects their disease state, intra-oral local anatomic factors, likely compliance and manual dexterity. This may need to be adapted over time.

Brushing: manual or powered brushing may be recommended as the primary means of reducing plaque and gingivitis. Where plaque control remains inadequate, rechargeable power brushes should be recommended.

Interdental: interdental hygiene should be recommended. Selection of interdental aids should be based on the interdental anatomy, specifically the size/shape of the interdental embrasure space.

Reinforce: evidence suggests that reinforcement of OH instruction (OHI) provides further benefit in plaque and gingivitis reduction.¹⁰

Practical steps

In new patients, it may be advisable to simplify the regimen initially, to reduce the scope and time of new technique aspects to which the patient must commit. On this basis, begin with effective tooth brushing and one method of interproximal hygiene.

In compliant patients who demonstrate good cleaning efficiency, additional tools or techniques may be added as indicated. The patient's existing oral hygiene technique should be evaluated. Where brushing is atraumatic and provides relatively effective plaque removal, subtle modifications of technique may be more effective than teaching a new brushing method.

When a new brushing method is advised, the dental professional should

demonstrate the technique (**Figure 1**) and review the patient's attempt to replicate, providing feedback as indicated. The patient should be able to observe their own technique in a mirror. The use of a mannequin for demonstration, as well as the use of a disclosing agent to highlight plaque deposits (**Figure 2**) may prove helpful. Current recommendations on tooth brushing frequency and duration are primarily based around fluoride delivery to the dentition and maximising patient compliance:

- brushing – twice daily brushing for two minutes is advocated;
- interproximal hygiene – should be advocated at least once daily as this reduces the time/compliance requirement for this 'additional' hygiene step; the patient should be encouraged to choose a time that facilitates compliance and for some patients, this may not be simultaneous to brushing; and,
- mouthwashes – where indicated, most manufacturers suggest rinsing twice daily for 30 seconds (some chlorhexidine formulations advocate a 60-second rinse cycle).

Tooth brushing

Manual brushing

There is no clear evidence of the superiority of any particular bristle design in terms of plaque reduction or gingival inflammation. Therefore, a simple flat-trim brush design may be satisfactory to recommend to patients during OHI. Soft bristle brushes should be recommended, as they reduce the potential for tissue trauma and tooth abrasion but maintain effective plaque removal. A compact brush head design may facilitate greater access and control.

Powered brushing

Rechargeable powered brushes appear to achieve greater plaque reductions than those with replaceable batteries. Short-term studies indicate that powered brushes with a rotation-oscillation motion provide greater plaque reduction than those employing side-to-side action. However, differences appear small and their clinical significance is questionable.¹¹

Powered v manual brushing

In controlled studies using standardised brushing times, powered brushes give statistically significant additional short-term and long-term (greater than three months) reductions in plaque indices (in the order of 10-20%). Findings for reductions in gingival inflammation are broadly similar (in the range 5-10%). The clinical significance of these improvements may be questioned.

Reasons for the slightly improved effectiveness of powered brushing have not



FIGURE 3: In large, open interdental embrasure spaces, interdental brushes are the hygiene aid of choice (a). Dental woodsticks are cheap and may be selected by patients for this purpose also. The flat base of the triangular woodstick should face the gingival tissue during use (b). Single-tuft brushes may help to address local anatomic factors such as surfaces approximating an edentulous space (c).

Table 1: Selection of adjunctive mechanical aids for various clinical situations.

Clinical consideration	Adjunctive OH aid(s)/technique(s)
Tooth crowding	Single-tuft brush to improve access Floss/picks interproximally
Tooth spacing	Compact-head/single-tuft brush for routine hygiene Large IDB interproximally
Interproximal restoration overhang	Remove overhang Size-appropriate IDB
Distal surface of most posterior tooth	Single-tuft brush/large IDB
Edentulous space adjoins tooth (proximal tooth surface)	Use of gauze strips (“flossing motion”) at proximal surface
Gingival recession (buccal/lingual site)	Establish contributing factors Single-tuft brush ± modify recommended brushing technique
Exposed furcation	Single-tuft brush
Root concavity	IDB
Halitosis	Establish contributing factors Tongue brushing/tongue scraper ± mouthwash
Food trapping	Oral irrigation device
Lacking dexterity for use of interproximal aids	
Fixed partial denture (pontic area and proximal surfaces)	Specialised floss Small IDBs/use of floss threader where access is poor
Removable denture	Daily removal of denture for tissue health and denture brush/toothbrush for denture hygiene
Implant restoration	Single-tuft brush at: <ul style="list-style-type: none"> ▶ cervical area of single-implant crowns (emergence often creates plaque retentive area); ▶ exposed implant surfaces; and, ▶ overdenture abutments. IDB at proximal sites Fixed multi-unit restorations – OH as for fixed partial denture (above) If mucositis – add mouthwash/ chlorhexidine gel

been definitively established. Design features such as small brush-head design, the use of a timing device to encourage increased brushing time and sensors to detect excessive pressure may contribute to the results obtained.

Interproximal hygiene

Overview

Tooth brushing is generally unable to clean interproximal sites effectively. Interproximal cleaning is therefore required to maintain interproximal health, particularly for secondary prevention. A wide array of products is available. Interproximal sites may be more vulnerable to periodontal tissue destruction due to the more complicated nature of interdental anatomy and the lack of a keratinised barrier mucosa in the region of the interdental col. Interdental brushes (IDBs) may be considered the device of choice in most cases and are particularly indicated for open embrasure spaces (Figure 3). Flossing may be preferred at healthy sites where IDBs will not pass through the interproximal space atraumatically.

For plaque removal, there is moderate evidence that adjunctive use of IDBs provides greater plaque removal than brushing alone. Evidence for the efficacy of other aids is inconsistent or lacking. In cases of gingival inflammation, there is limited evidence that interproximal cleaning, even with IDBs, reduces inflammation. This may be due to methodological limitations in the research in this area. Interproximal aids include:

- IDBs;
- floss – dental floss, dental tape, floss holders, specialised floss and floss threaders;
- single-tufted brushes;
- dental woodsticks;
- interdental stimulators; and,
- oral irrigators.

Interdental brushes

These are recommended as the most effective method interproximally. IDBs may achieve greater plaque removal compared to tooth brushing alone, or tooth brushing and flossing.¹² They are relatively easy to use and may therefore gain high acceptance among patients.

Brush bristles should meet gentle resistance when inserted interproximally but should not have to be forced into a site. Selecting an appropriately sized brush allows bristles to adapt to even complex interproximal anatomy.

IDBs are flexible and may be bent to facilitate access in posterior regions. In the maxillary molar region, IDB insertion from the palatal aspect may be easier due



FIGURE 4: Interdental brushing.

Simulation of interdental brush concepts on dental mannequin (a to f), and demonstration by the patient intra-orally (g to i). Different IDBs may be tried in each interdental space to determine the appropriate size for use. Brush bristles should meet gentle resistance when inserted interproximally (a, b). IDBs may be pre-placed to facilitate access (c). In the posterior maxilla, a palatal approach may present easier access for the patient (d). During insertion, the IDB may be angled towards the mesial and distal to maximise contact with the tooth surfaces (e, f).

Patients are advised to hold the brush between their thumb and index finger. Partial mouth opening is sufficient, as with wide opening, the tension from the oral musculature may limit access for IDB placement (g). The IDB is inserted at approximately 90° to the teeth, ensuring the tip does not traumatise the papilla.

Patients should slide the brush in and out of the space to facilitate plaque removal; using gentle pressure of the brush against the gums will allow bristles to penetrate slightly subgingivally (h, i). IDB bristles should be rinsed after each use and allowed to dry. Patients should expect to replace IDBs after approximately one week of use.

to the interproximal tooth anatomy of this area (**Figure 4**).

IDBs are generally colour coded by size. However, this is not standardised among manufacturers, so recommendations to patients need to be very clear.

Patients may require several different brush sizes for optimal cleaning in all areas, based on the size of individual interdental spaces. However, it's reasonable to commence with a single size initially to encourage adoption of interproximal cleaning. Localised anatomical features or patient factors may complicate mechanical oral hygiene, particularly interdental hygiene. **Table 1** addresses selection of appropriate mechanical aids for various clinical situations.

Chemical plaque control

Overview

This is delivered primarily through two methods – toothpastes and mouthwashes. These agents may improve subjective feeling of cleanliness and halitosis control. Product selection should be based on patients' individual

caries and periodontal risk profile. Patients may select products based on convenience factors such as price and taste; therefore, review details of product use with each patient periodically.

Toothpastes

Use of fluoridated toothpaste is advocated. Herbal and cosmetic products may not contain fluoride and may also have a higher abrasive content. Additional active ingredients vary among marketed products but include anti-plaque, anti-calculus, anti-gingivitis and anti-sensitivity agents. Toothpastes represent an efficient method to deliver active agents as they are widely accepted by patients as a routine part of their oral hygiene regimen.

Mouthwashes

Mechanical cleaning remains the mainstay of preventive treatment. Mouthwashes require an additional step in the mechanical OH regime and this

Table 2: Principal mouthwashes used for control of plaque and gingival inflammation

Mouthwash type	Active agent(s)	Plaque reduction	Gingivitis reduction	Consider
Bis-biguanide	Chlorhexidine 0.2% for specialised short-term use 0.06% for “daily” use (over limited period)	Greatest	Greatest	Staining Taste disturbance Local side effects limit suitability for longer-term use
Essential oil	Thymol Eucalyptol Menthol Methyl salicylate	Good	Good (approaches chlorhexidine levels in some studies)	Additional actives in some formulations High alcohol content of some formulations
Quaternary ammonium compound	Cetylpyridinium chloride (CPC) Various concentrations across several product ranges – usually 0.05%/0.075% Often combined with sodium fluoride	Good	Equivocal	Staining may occur with some formulations This is the formulation used by many “store brand” products and all-purpose rinses.

may impact on patient compliance. When mechanical plaque control is insufficient, or hygiene is ineffective in preventing gingival inflammation, mouthwashes may be advocated.

The anti-plaque action of mouthwashes may depend on prolonged persistence of antimicrobial action in the mouth (substantivity). It may be prudent to use mouthwashes following tooth brushing and avoid rinsing after use to maximise the beneficial effects. Evidence for interaction of mouthwash agents with sodium lauryl sulphate in toothpastes, which might purportedly reduce mouthwash adherence/substantivity, is inconsistent. Local side effects such as extrinsic tooth staining, taste disturbance and discomfort from high alcohol content may reduce acceptability to patients. **Table 2** overviews the principal mouthwashes used for control of plaque and gingival inflammation.

Summary

- Gingivitis and periodontitis represent a continuum of disease and mechanical disturbance of plaque is paramount in achieving plaque control. Professional OHI should be provided (and reinforced) to reduce plaque and gingivitis, while manual or powered brushing may also be advocated. Powered brushes may be beneficial where plaque control is insufficient.
- IDBs may be considered the interproximal device of choice in most cases. However, in healthy tissues with intact papillae, IDB use may be traumatic and flossing is advocated. A wide array of adjunctive mechanical hygiene aids is available.
- Mouthwashes may be viewed as adjuncts to mechanical cleaning. The cumulative literature suggests that chlorhexidine mouthwash products may offer superior benefits in terms of plaque inhibition and control of gingival inflammation. However, due to local side effects, short-term use is generally advocated. Where longer-term mouthwash use is recommended, products based on an essential oils formulation may represent the option of choice.

Acknowledgment

The author expresses his gratitude to Yvonne Howell RDH and Yvonne O’Sullivan RDH for their assistance with the photographic demonstration of the oral hygiene techniques used in this article.

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