Contemporary practices for mechanical oral hygiene to prevent periodontal disease

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1 | THE EFFECT OF PLAQUE CONTROL ON PERIODONTAL HEALTH

It is well established that the accumulation of dental plaque on teeth leads to gingivitis,¹ which in some cases leads to chronic periodontitis.² Consequently, the prevention and treatment of gingivitis also serves to prevent periodontitis.³ There is substantial evidence that several mechanical and chemical methods of plaque control can prevent gingivitis.⁴ Provided that cleaning is sufficiently thorough and performed at appropriate time intervals, toothbrushing and interdental mechanical cleansing procedures can reliably control plaque.³,⁵

According to long-term cohort studies, adequate oral hygiene practices in the population correlates with a decreased prevalence of periodontitis.⁶-⁸ These long-term cohort studies from Sweden and Norway demonstrated a reduction of plaque and gingivitis over the last 30 years. Concomitantly, the prevalence of periodontitis decreased, as well as the amount of alveolar bone loss. Furthermore, the number of retained molars increased in all age groups between 20 and 80 years.⁶-⁸ Although these long-term studies presume a correlation between good oral hygiene and stable oral conditions, studies with a control group without any preventive measures enabling an assessment of the true significance of daily and professional oral care are lacking. Long-term randomized controlled trials are needed to assess the effect of plaque removal on prevention of periodontal diseases compared with subjects without oral hygiene as a negative control, to truly test the presumption that adequate oral hygiene leads to a decreased prevalence of periodontitis. Such studies, however, would be regarded as unethical. The best long-term evidence suggests that self-reported toothbrushing twice or more a day is correlated with fewer periodontal pocket depths ≥4 mm developed over an 11-year time frame.⁹

Besides the observation that good oral hygiene is correlated with stable oral conditions, it has been demonstrated that in adults with gingivitis the quality of self-performed mechanical plaque removal is not always completely effective and could be improved.¹⁰ To date, no alternative methods for mechanical plaque control have proven to be effective in daily practice because of economic and safety reasons. However, chemical adjuncts in dentifrices and mouthrinses have been demonstrated to provide additional benefits in the prevention of gingivitis.¹¹,¹²

Natural physiologic forces and masticatory patterns can influence plaque development in human dentition.¹³ This effect is, however, mainly limited to regions less at risk of periodontal diseases such as incisal and occlusal areas. Tongue movement, especially the contact of its rough dorsum on the lingual surfaces, and to a lesser extent on the buccal aspects of the posterior teeth, appears to limit plaque development.¹¹ The cheeks also help to limit plaque growth on the buccal surfaces of the posterior teeth.

Saliva does not appear to be as effective in removing and/or washing out plaque and has a limited effect on removing debris from interproximal spaces and occlusal pits.¹⁴ However, saliva contains antibacterial, antiviral, and antifungal protein components that modulate the oral microbial flora.¹⁵ For example, changes in the quantity and quality of the saliva caused by medication may have a substantial impact on saliva composition.¹⁶,¹⁷ While chewing fibrous foods (eg,
raw carrots) has an effect on plaque development, effective plaque control has not been supported by the outcome of clinical studies. As these physiologic cleaning mechanisms are insufficient with respect to the prevention of inflammation, periodontal health seems to be primarily influenced by the quality and precision of mechanical plaque control.

In daily practice, complete removal of the microbial biofilm by mechanical means remains limited for various reasons. Biofilm removal might be incomplete because of limitations in the patient’s dexterity and precision. In addition, oral hygiene devices allow only limited access when anatomic and morphologic conditions such as tooth crowding and root irregularities exist. To date, how much plaque has to be removed for periodontal health, in particular for primary prevention, has not been established. However, in patients with a history of inflammation of the periodontal tissues, it is obvious that improvement in plaque removal has to be achieved for secondary prevention to avoid further disease progression. A major goal of manufacturers of oral hygiene products is to make daily oral hygiene more efficacious, but also more time-efficient and comfortable for the patient. In order to improve daily oral care, modifications of oral hygiene devices are frequently and strenuously marketed. However, long-term clinical evaluation of these products is often missing.

In daily practice, every dental professional must provide well-considered, evidence-based advice for each of their patients. Apart from scientific evidence, clinical experience, as well as patient values, experiences and preferences, and available instruments, must be taken into consideration to make well-informed decisions. The aim of the current review is to summarize and synthesize the available scientific evidence-supporting practices for mechanical oral hygiene preventing periodontal diseases.

### 2 | SOURCES OF EVIDENCE

Systematic reviews can be used to identify evidence to inform the clinical decision process. The choice and recommendation of oral hygiene devices should be based on the current best available evidence. In order to easily provide evidence-based findings to the clinician, a synthesis (systematic review) of all original clinical studies on the area under investigation is valuable. Summarizing the results from different trials provides a sophisticated information service on the topic of concern. Furthermore, the findings of high-quality systematic reviews can be summarized in a meta-review.

This helps the clinician to find, in a timesaving manner, high-quality information. Wherever possible, meta-reviews were used as the basis for the current paper. In the case of information gaps, other published papers were added.

### 3 | THE EVIDENCE FOR MECHANICAL ORAL HYGIENE

Two meta-reviews emerged from a PubMed-Medline search, along with one network meta-analysis. Additionally, two systematic reviews were available, neither of which had been included in the two meta-reviews. The effects of different oral hygiene devices and the mechanical plaque-removing effect of a dentifrice were evaluated compared with manual brushing (Table 1). Furthermore, the effect of brushing with an antiplaque/antigingivitis dentifrice was compared with the mechanical effect of brushing with a standard manual toothbrush and fluoride dentifrice.

| TABLE 1 | Evidence of additional plaque removal compared with manual toothbrushing alone |
|-----------------------------------------------|
| **Reference** | **Magnitude of the effect** | **Quality of evidence grade** |
| **Power toothbrush** | | |
| Rotating-oscillating | Sicilia et al, 2002 | No meta-analysis |
| Not specified | Yaacob et al, 2014 | Short term: small longer term: moderate |
| High-frequency, high-amplitude, sonic-powered | De Jager et al, 2017 | Moderate |
| **Dentifrice** | | |
| Mechanical effect (pre- and postbrushing) | Valkenburg et al, 2016 | No additional effect on plaque removal |
| **Interdental cleaning** | | |
| Floss | Sälzer et al, 2015 | Small |
| Woodstick | Unclear |
| Interdental brush | Large |
| Oral irrigator | Unclear |
The information in support of the use of a power toothbrush comes from one meta-review and five systematic reviews. Manual toothbrushes are available in different designs, varying in the shape of their handles, brush heads, arrangement of bristles, and filament shapes. Handles are ergonomically designed and their shapes tailored to suit a particular brushing technique. For instance, variation in the bristle tuft arrangement has been demonstrated to influence brushing efficiency. The use of manual toothbrushes has been shown to achieve an average plaque score reduction in a single brushing exercise of 42% (30%-53%). Cross-angled bristle tuft designs appear to work better than flat or multilevel tuft designs. There is no firm evidence regarding the superiority of tapered compared with end-rounded toothbrush filaments.

With power toothbrushes, an average plaque score reduction of 46% (36%-65%) has been reported. Data support the superiority of rechargeable, oscillating-rotating power toothbrushes over those that had changeable batteries. Considering that these data emerged from single brushing studies, the translation of this information to real-life situations appears inappropriate. For instance, the Hawthorne effect and the novelty effect contribute to patient performance. In order to minimize the impact of the Hawthorne effect, long-term randomized controlled studies are needed.

A meta-analysis by the Cochrane Collaboration demonstrated a superior reduction in the plaque index score in short-term studies (1-3 months) of 11%, and in long-term studies (>3 months) of 21%, for oscillating-rotating toothbrushes compared with manual toothbrushes. Similar results were demonstrated for parameters of gingivitis, which improved by 6% in short-term and by 11% in long-term studies. However, the authors point out that there is a possible risk of bias. Instructions are often not given to the same extent in test and control groups, or for particularly difficult techniques for manual toothbrushes (eg, according to Bass). Furthermore, there is great heterogeneity between the studies concerning brushing duration and frequency as well as instruction. A more recent comparison of manual with side-to-side (sonic) toothbrushes demonstrated statistically significant greater reductions in plaque (standardized mean difference = -0.89, 95% confidence interval = [-1.27, -0.51]) and gingivitis (Δ0.67, [-1.01, -0.32]) for the side-to-side brushes compared with manual brushes. However, the clinical relevance in relation to periodontal patients or progression of the disease remains unclear.

A recent prospective cohort study of 2819 participants over 11 years reported that the use of power toothbrushes was associated with statistically significant and clinically relevant reductions in clinical attachment loss and probing pocket depths as well as higher numbers of remaining teeth. Based on performance and user-friendly practicability, power toothbrushes are becoming increasingly popular. However, only limited evidence is available on the efficacy of power toothbrushes in certain age groups. For children and adolescents (aged 4-17 years), some studies found power toothbrushing to be superior to manual brushing, while other studies did not find any difference. For specific tooth surfaces, for example, lingual surfaces of the mandibular incisors or posterior teeth, cleaning with electric toothbrushes was found to be more effective in general. It should be noted that many uncertainties remain, especially in younger children. For example, it is unclear if oral hygiene is improved in orthodontic patients with fixed appliances, where existing evidence is too heterogeneous to demonstrate a beneficial effect of power toothbrushes. For patients with an intellectual disability, a randomized clinical trial found that the use of a power toothbrush was as effective and safe as a manual toothbrush.

The application of power toothbrushes is frequently combined with user-friendly wireless remote displays in order to structure and improve the duration of the brushing procedure, which might help to further improve efficacy. As the theoretical cleaning efficacy of power toothbrushes is high, less than ideal results have been attributed to limitations in patient performance. Newer technologies such as positioning detection and behavioral analysis may help improve outcomes using these devices.

Proposed methods for toothbrushing vary among professionals, different dental associations, and companies that manufacture oral hygiene products. Based on the current lack of evidence in support of different brushing techniques, especially in younger age groups, habitual routines in the use of toothbrushes should not be modified radically in favor of a certain brushing technique. Toothbrushing performance should be analyzed for each patient and deficits addressed to improve shortcomings. Proper instructions should be provided for every toothbrush, including powered ones, in order to prevent injury to both hard and soft oral tissues. However, most subjects maintain their same habitual motion patterns regardless if they brush with a manual or a powered toothbrush. Hence, a one-size-fits-all instruction routine should never be adopted. Instead, the needs of the individual patient should be addressed.

Additional approaches for the use of a specific toothbrushing method should be considered, for instance, self-performance feedback. Such a monitoring system can lead to a prolonged learning effect resulting in improved oral hygiene. Such feedback systems are now available to track the areas being brushed and the pressure applied by use of video recognition and a motion sensor. The use of such a device allows the patient to receive twice-daily feedback on their brushing performance. Repeated oral hygiene instructions over a series of visits with regular feedback and reinforcement of the home care activities have been proposed by Rylander and Lindhe.

An individually tailored oral health educational program has been found to be efficacious in improving long-term adherence to oral hygiene in periodontal treatment.
6 | HOW OFTEN AND FOR HOW LONG SHOULD WE BRUSH?

How often teeth have to be brushed for and how much plaque should be eliminated to prevent periodontal disease is controversial.6 In daily dental practice, it is generally recommended to brush twice daily with a fluoride-containing toothpaste for 2 minutes52 in order to eliminate plaque, to prevent caries and gingivitis, and also to give a feeling of oral freshness.19 Self-reported infrequent brushers demonstrated higher incidence and increment of carious lesions than frequent brushers.53 With respect to toothbrushing duration, it has been shown that a 2-minute brushing time is more effective than 1 minute.27 Increasing the brushing time to 3 minutes or longer does not appear to improve the effectiveness of plaque reduction and will most likely demotivate most users.54 More frequent and shorter brushing times may increase the risk of adverse effects.55 Hence, oral hygiene instruction should not primarily focus on a fixed brushing time because of strong interindividual differences, for example, anatomic conditions, individual performance at home, and the patient’s dexterity. For instance, patients with periodontitis are likely to need more than 2 minutes for oral hygiene,3 with additional time for the use of other devices, for example, interdental brushes. Instead of adhering to an exact duration for oral hygiene, the focus of the instruction should be on educating the patient to use a systematic approach to access difficult to reach areas.

7 | WHAT IS THE ADDITIONAL EFFECT OF DENTIFRICE TO MECHANICAL TOOTHBRUSHING?

Toothbrushing with dentifrice does not appear to have an additional mechanical effect on plaque removal compared with brushing alone.25 Plaque scores are reduced by approximately 50% following a toothbrushing exercise either with or without the use of dentifrice. Dentifrice is, however, of major importance for the delivery of fluoride in order to prevent the development of caries,56 or to deliver anti-inflammatory agents.4,11,12,57 That fluoride is crucial for prevention4,11,12,57 has been reinforced in a recent systematic review, which showed that in the absence of fluoride the preventive effect of personal oral hygiene is questionable.60 Only dentifrices containing additional anti-inflammatory agents such as triclosan or stannous fluoride have been found to provide additional effects on plaque removal and gingival health, but not a standard fluoride dentifrice.4,11,12,57 However, because the impact of triclosan in dentifrices may be negligible because of the small amount of triclosan incorporated, and concerns regarding the theoretical environmental effects resulting from widespread use of this antimicrobial,61 its use has recently diminished. For stannous fluoride-containing dentifrices, discoloration of the teeth is a possible side effect, which can be reduced by adding sodium hexametaphosphate.57 Furthermore, baking soda seems to provide an additional effect on plaque reduction and may also improve gingival parameters.62 Independent of specific ingredients, dentifrices have a weak inhibitory effect on plaque regrowth when used daily.63

Besides active plaque and gingivitis control agents, tooth-whitening ingredients have also been added to dentifrices and have been shown to significantly reduce extrinsic tooth discoloration.64 No studies have reported significant adverse effects following the use of whitening dentifrices. However, none of the included studies have considered abrasion of the dental hard tissues. Clinical evidence on the abrasive effect of dentifrice is limited and merits further evaluation. Dentifrice with high abrasivity might be harmful to enamel and dentine, but this effect is largely dependent on boundary conditions such as the presence and the quality of the acquired pellicle.65 In addition, protocols for the determination of the abrasiveness of dentifrices lack validity and reproducibility.66,67 In general, most dentifrice ingredients are softer than enamel and hence abrasion caused by dentifrice is negligible over the lifetime of the patient.68 Baking soda crystals are notably large but soft and potentially less damaging to tooth minerals than conventional dentifrice abrasives.69 A major complaint from patients when brushing with a baking soda containing-dentifrice was the unpleasant taste.62

8 | WHAT ARE THE EFFECTS OF DIFFERENT INTERDENTAL CLEANING DEVICES?

This section is based on one meta-review,23 including six systematic reviews,70-75 and another, more recent, network meta-analysis.24 Interdental surfaces of molars and premolars are the primary sites for plaque accumulation. As these surfaces cannot be efficiently reached by toothbrush filaments and are not easily visible, caries and periodontitis develop on these tooth surfaces more often than on facial sites.76,77 Thoroush interdental cleaning must therefore be a principle goal of daily oral care as it helps to reduce the extension and severity of both caries and periodontal disease.29 Evaluation of the effect of interdental cleaning aids is generally performed by assessing visual clinical indices. Because the interdental space is not easily accessible for visual inspection, the usefulness of these indices is limited. The presence or absence of interdental or subgingival plaque cannot be precisely evaluated. Furthermore, as mentioned above, it is still unclear how much plaque has to be eliminated to prevent periodontal disease.

Many devices are used for interdental cleaning, including dental floss, interdental brushes, and woodsticks. The great variety of products makes it difficult for the patient and the dental care professional to choose the most appropriate device. The choice of interdental cleaning product is usually made individually depending on patient preference. The size and shape of the interdental space, contour of the gingiva, tooth alignment, dexterity, and motivation of the patient all influence the type of interdental device to use. Good interdental oral hygiene will require a device that can comfortably penetrate between adjacent teeth and that will be well accepted by the patient without resulting in injury to soft or hard tissues.5,23 Furthermore, the choice should depend on the latest and best available evidence.
The use of interdental cleaning devices is still low. In Germany, the consumption of dental floss was stable during recent years, but an increase has been noted for interdental brushes. The following interdental cleaning devices were evaluated in a meta-review, a summary of existing systematic reviews, and their efficacy was compared in a network meta-analysis.

### 8.1 Dental floss

The use of dental floss is demanding for the patient, requiring a high level of tactile and fine motor skills together with a good knowledge of anatomic conditions. Dental floss is typically manufactured as monofilament made up of expanded polytetrafluoroethylene and polyfil made up of twisted single filaments of varying numbers, in which the diameter, degree, and orientation of the filaments depend on the product, or pseudopolyfil when the single filaments are embedded in a matrix. Furthermore, waxed dental floss is available to facilitate placement between tightly opposed teeth, to which flavoring agents can be added, as well as preventive agents such as fluoride.

The type of dental floss (waxed/unwaxed, impregnated/unimpregnated) that is the most effective remains uncertain. A more lubricious dental floss can be passed over the approximal contact with less pressure to reduce the risk of papillary trauma. According to a meta-review (including two systematic reviews), the evidence in favor of the use of dental floss in addition to toothbrushing preventing gingivitis is weak, and the magnitude of the effect is small. Most studies could not demonstrate that flossing is effective in plaque removal. Correspondingly, a network meta-analysis concluded that unsupervised flossing does not yield a substantial reduction in gingival inflammation. This observation has met a lot of opposition, particularly as it resulted in news organizations reporting that flossing does not work what contradicts the recommendations made over many years. However, the lack of evidence does not imply that flossing is not effective. On the other hand, given that this product has been on the market for over two centuries, it is not unreasonable to presume that appropriate studies to test the efficacy of flossing should have been conducted by now. Until such studies are performed, the use of dental floss should be recommended, because it is still useful for interdental cleaning, especially when anatomic considerations preclude the use of more effective interdental cleaning devices that will not pass through the interproximal area without trauma. Practitioners should customize their recommendations to accommodate the available interdental space. To date, no evidence has been established to help make a choice between different types of dental floss with respect to efficacy. However, huge differences in use-related properties have been reported, and may direct the individual advice for each patient.

### 8.2 Interdental brushes

Interdental brushes are built of helically aligned filaments fixed to a twisted central wire. Their structures can differ in shape, for example, cylindrical or conical, angled or straight, and they vary with respect to the stiffness of filaments. Areas that are not accessible by a toothbrush, like the central part of the interdental space and the embrasure, can be reached effectively by interdental brushes. Especially in teeth with attachment loss, the concavities in the apical root surfaces are not accessible for plaque removal using dental floss or woodsticks. Interdental brushes have been shown to remove plaque as far as 2-2.5 mm below the gingival margin.

According to the meta-review (including two systematic reviews) there is evidence of a moderate quality for interdental brushes with respect to reduction of plaque and gingivitis, and the effect is large. Interdental brushes seem to be the most effective method for removing interdental plaque and improving gingival health. No systematic evaluation of the different designs of interdental brushes emerged from our PubMed search. However, it has been shown that interdental brush design might influence effectiveness, for example, cylindrical-shaped interdental brushes seem to be more effective than conical-shaped brushes, and straight ones more than angled ones. Although interdental brushes appear to be superior to other interdental cleaning devices, additional reduction of gingivitis and plaque scores of approximately 30% can be expected when they are used as adjuncts to toothbrushing compared with toothbrushing alone. Few studies have investigated the effectiveness of the more recently introduced rubber bristle interdental cleaners. Compared with interdental brushes in patients with gingivitis, the devices seem to be equally effective, but interdental rubber brushes are better received by patients. A recent randomized trial demonstrated a significantly greater reduction in interdental plaque score by using interdental brushes or rubber picks compared with toothbrushing alone, but not by flossing.

### 8.3 Dental woodsticks

Dental woodsticks have a trapezoidal profile and are slightly curved along their length. They are manufactured from long fiber, shatterproof wood, and are available in different sizes. Their application is similar to interdental brushes. However, they have limitations with respect to cleaning root concavities and insertion at a correct angle in the most posterior interdental spaces. One systematic review has evaluated the effect of triangular woodsticks. The evidence for the use of woodsticks in addition to toothbrushing is weak and of unclear magnitude with regard to gingival index, and the evidence in support of plaque reduction is inconclusive. However, gingival bleeding can be reduced significantly by woodsticks compared with toothbrushing alone. This might be a consequence of the physical stimulation of the swollen papilla by the woodstick. Regarding their efficacy in the removal of interproximal dental plaque, no statistically significant differences were found between the use of triangular woodsticks and round toothpicks in the removal of supragingival plaque.

The occurrence of gingival bleeding following the use of woodsticks can be used to increase patient motivation and awareness of
gingival health. Gingival self-assessment has been demonstrated to be an effective method. The presence of bleeding provides immediate feedback on the level of gingival health. The dental care professional can therefore easily demonstrate the gingival condition to the patient, using an interdental bleeding index to quantitate the clinical manifestation. This monitoring could encourage patients to include woodsticks as part of their oral hygiene regimen.

8.4 | Oral irrigators

Oral irrigators are designed to flush away loosely adherent plaque through the mechanical action (shear forces) of a stream of water. The evidence for using an oral irrigator is weak and of unclear magnitude, as evaluated in one systematic review. The oral irrigator has been demonstrated to improve gingival health when compared with toothbrushing alone but does not concomitantly appear to reduce visible plaque. Applying chlorhexidine by an oral irrigator seems to be more effective than water with regard to plaque and gingivitis. A systematic review did not evaluate the specially designed blunt-ended subgingival irrigation tip (Pik Pocket, Water Pik), nor did it include an assessment of the recently developed Sonicare Air Floss (Philips Healthcare). A direct comparison of an oral irrigator vs an interdental brush, both in conjunction with manual toothbrushing, showed that the oral irrigator removed significantly more plaque from tooth surfaces than interdental brushes after a single use, and were more effective in reducing gingival bleeding over 2 weeks.

A commonly discussed adverse event of the oral irrigator is its potential to cause bacteremia. This risk is, however, comparable with that found after toothbrushing. Daily marginal irrigation for 3 months did not increase the risk of developing a bacteremia during a maintenance program following periodontal therapy. But, for patients at risk of endocarditis, no specific information is available, and caution should be given regarding instructions.

9 | Advice concerning the use of oral hygiene devices

According to the principles of evidence-based medicine, not only the science, but also individual patient preferences and denticilies, as well as the clinician’s experience, should be taken into account when providing advice concerning the use of oral hygiene devices. Based on the outcomes of a meta-review, the European Federation of Periodontology concluded in a recent guideline that daily interproximal cleaning “is essential for maintaining interproximal gingival health, but there is no evidence to support the use of dental floss for interproximal cleaning in periodontitis patients. Interdental brushes are the most effective method and the method of choice where spaces will accommodate their atraumatic use. However, caution is advised in their use at healthy sites where interproximal spaces may be too narrow to safely accommodate them.” Consequently, instructions should be given individually according to contour and consistency of the gingival tissues, the size and morphologies of the interproximal embrasures, tooth position and alignment, and the ability and motivation of the patient. Furthermore, to achieve maximum effectiveness, the interdental oral hygiene instructions as advised to the patient should provide enough information to enable the patient to identify each site and the appropriate device to be able to clean all interproximal surfaces effectively.

Patients must be aware that bleeding per se is not a reason for cessation of interdental cleaning but is an indicator of inflammation that needs to be treated by interdental cleaning.

10 | What are the adverse events of toothbrushing?

A commonly discussed concern related to toothbrushing is the development of gingival recessions as a negative side effect. Although gingival recessions are associated with different etiologic/risk factors, other factors like gingival biotype and alveolar dehiscence and secondary factors like orthodontic treatment, piercings, and the incorrect use of a toothbrush are likely causes. Toothbrushing factors that might be associated with gingival recession are toothbrushing frequency, a horizontal or scrub toothbrushing method, bristle hardness, toothbrushing duration, and the frequency of changing a toothbrush.

A large body of published research has consistently shown oscillating-rotating toothbrushes to be as safe as manual toothbrushes, demonstrating that these power toothbrushes do not pose a clinically relevant concern regarding hard or soft tissues. Even in patients with pre-existing gingival recessions, which are more susceptible to the development of further recessions, there were no differences between manual and power toothbrush groups when evaluated for 1-3 years. Factors influencing the application, such as contact pressure, and the frequency and duration of toothbrushing, cannot be assessed reliably because of the heterogeneity of the studies. Long-term data, however, are scarce. In two long-term studies, it was found that a substantial amount of recessions showed a reduction after 1-3 years without any additional therapy. This indicates that the toothbrush itself may not play a major role in the development of gingival recessions, rather than the force with which it is used. The effect of pressure control feedback systems on gingival recessions has not yet been evaluated.

Besides the development of hard and soft tissue lesions caused by toothbrushing, there might be further serious adverse effects, such as isolated cases of ingestion, aspiration, or traumatic injury to soft tissues in and out of the oral cavity, as a result of careless use.

It is also well established that oral biofilms in the presence of gingival inflammation significantly increase the incidence of temporary bacteremia after brushing. When no gingival inflammation is present, this risk is negligible. Currently, there are no evidence-based
recommendations on how to deal with the risk of bacteremia, in particular for high-risk patients (seriously ill patients), inpatients, or patients in nursing homes.

11 | CONCLUSIONS

No direct information from well-powered, randomized controlled trials concerning the clinical effect of oral hygiene on the prevention of periodontitis is available, although it has been shown in periodontitis patients that weekly professional supragingival plaque removal significantly diminished counts of both supragingival and subgingival species creating a microbial profile comparable with that observed in periodontal health. Conducting randomized controlled clinical trials evaluating the role of oral hygiene is challenging because assessing clinical parameters related to periodontitis requires a study duration of several years. Hence, to date, we have had to rely on information gained by observational studies or data from studies mostly conducted using gingivitis patients.

The choice of toothbrush type should take into consideration the individual situation of the patient. If plaque removal is to be improved, eg, is caused by the presence of deficits in combination with biofilm-associated pathologic processes, a power toothbrush (oscillating-rotating or sonic technology) appears to be the best choice. Plaque control in patients with periodontitis is more demanding because of the present attachment loss. However, data from clinical studies are sparse. A randomized controlled clinical study lasting more than 3 years failed to demonstrate superior clinical and microbiologic effects of powered toothbrush and triclosan dentifrice compared with manual toothbrush and standard fluoride-dentifrice in periodontitis-susceptible patients on regular maintenance therapy.

With respect to interdental cleaning, the interdental brush is the most effective for the periodontitis patient. There is also room for dental floss, woodsticks, or rubber interdental cleaners in case the interdental brush does not appropriately fit without trauma. The oral irrigator mainly relies on shear forces, which cannot be induced in wide, open interdental spaces in periodontitis patients, although some effects may be expected by using one along the gum line with the intention to clean the subgingival area.

Evidence related to contemporary practices for mechanical oral hygiene to prevent periodontal disease mainly relies on studies with gingivitis patients. General recommendations concerning the ideal oral hygiene devices and procedures are still inconclusive. However, generally established recommendations should be maintained, as these are anchored in patients’ minds. In order to improve the level of oral hygiene the primary approach most likely remains an individually tailored instruction to a systematic oral hygiene procedure.

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