



TOOTHBRUSHING AND PREVENTIVE MEASURES: A REVIEW

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ABSTRACT

The present review identifies several factors contributing to the considerable role of toothbrushing in maintaining good oral health, and delves into its benefits, recommended techniques, and types of toothbrushes. Twice-daily brushing with fluoridated toothpaste is accepted as the basic standard of care for at-home plaque removal. Studies have confirmed that mechanical procedures for controlling plaque, as toothbrushing, significantly decrease plaque accumulation. Professional associations recommend brushing twice daily for at least two minutes to ensure thorough cleaning; unfortunately, precise guidelines are often missing. Some authors indicate that two minutes of brushing are insufficient for significant plaque removal; plaque removal increases with augmented brushing time, with maximum removal at 180 s. There is general agreement in multiple studies that brushing twice daily with fluoridated toothpaste has a preventive impact. Various toothbrush designs, including both manual and electric options, have been created to improve the elimination of dental biofilm and reduce the accumulation and persistence of bacteria. Toothbrushing benefits extend beyond cosmetics, encompassing protection against caries, periodontal disease, and halitosis. Adhering to recommended toothbrushing techniques, selecting the right toothbrush, and understanding the connection between oral health and overall well-being can lead to a healthier mouth. To foster favorable toothbrushing behaviors among the population, dental practitioners and public health experts must know the factors that influence brushing habits.



KEYWORDS: Oral health; toothbrushing; caries; periodontal diseases; halitosis.

CEPILLADO DENTAL Y MEDIDAS PREVENTIVAS: UNA REVISIÓN

RESUMEN

La presente revisión identifica varios factores que contribuyen al importante papel del cepillado dental en el mantenimiento de una buena salud bucal y profundiza en sus beneficios, técnicas recomendadas y tipos de cepillos de dientes. Se acepta el cepillado dos veces al día con una pasta dental fluorurada como estándar básico de cuidado para la eliminación de la placa en el hogar. Estudios han confirmado que los procedimientos mecánicos para controlar la placa, como el cepillado dental, disminuyen significativamente la acumulación de placa. Las asociaciones profesionales recomiendan cepillarse los dientes dos veces al día durante al menos dos minutos para garantizar una limpieza profunda, desgraciadamente, a menudo faltan directrices precisas. Algunos autores indican que dos minutos de cepillado son insuficientes para una eliminación significativa de la placa; la eliminación de placa aumenta con el aumento del tiempo de cepillado, con una eliminación máxima a los 180 segundos. Existe un acuerdo general en múltiples estudios de que cepillarse los dientes dos veces al día con pasta dental fluorurada tiene un impacto preventivo. Se han creado varios diseños de cepillos de dientes, tanto manuales como eléctricos, para mejorar la eliminación del biofilm dental y reducir la acumulación y



persistencia de bacterias. Los beneficios del cepillado dental van más allá de los cosméticos y abarcan la protección contra la caries, la enfermedad periodontal y la halitosis. Seguir las técnicas de cepillado recomendadas, seleccionar el cepillo de dientes adecuado y comprender la conexión entre la salud bucal y el bienestar general puede conducir a una boca más sana. Para fomentar conductas favorables de cepillado dental entre la población, los odontólogos y los expertos en salud pública deben conocer los factores que influyen en los hábitos de cepillado.

PALABRAS CLAVE: Salud bucal; cepillado de dientes; caries; enfermedad periodontal; halitosis.

INTRODUCTION

The World Dental Federation defines oral health as “multi-faceted”, encompassing “(t)he ability to speak, smile, smell, taste, touch, chew, swallow and convey a range of emotions through facial expressions with confidence and without pain, discomfort and disease of the craniofacial complex (head, face, and oral cavity). Oral health means the health of the mouth. No matter what the age, oral health is vital to general health and well-being” [1]. Oral diseases are among the

most common noncommunicable diseases worldwide. Approximately half (48.0%) of the global population experiences at least some degree of disability due to oral conditions. The most widespread condition in the Global Burden of Disease study in 2015 was untreated caries in permanent teeth, with an age-standardized prevalence of 34.1%, affecting 2.5 billion people worldwide. The age-standardized prevalence rate of untreated caries in deciduous teeth was 7.8% (573 million), while severe chronic periodontitis



affected 7.4% (538 million), and total tooth loss accounted for in 4.1% of the population (276 million). The prevalence of other oral disorders was 1.8%. Often, oral diseases significantly burden healthcare systems in many countries [2]. The primary cause of caries and periodontal diseases is oral biofilm development. The central strategy for mitigating the occurrence and progression of caries and periodontal pathoses involves preventing and inhibiting biofilm formation and proliferation [3-14], together with adding small yet consistent exposure to fluorides.

Oral diseases are preventable through simple actions like regular toothbrushing using technologies such as fluoride, and applying pit and fissure sealants [3,4,10,11,15-17]. These conditions may advance to become severe enough to significantly impact the quality of life for populations, together with pain, sepsis, suffering, discomfort, school absenteeism, decreased work attendance, deformities, and, in a few severe cases,

even death [18-20]. Oral health is considered a fundamental human right and is touted to be interconnected with overall health and well-being [21]. It plays a crucial role in a person's ability to eat, breathe, and speak; oral health encompasses psychosocial dimensions such as self-confidence, general well-being, and the ability to socialize and work without experiencing pain, discomfort, embarrassment, or difficulty interacting with others [21-23]. Oral diseases are often concentrated in socially disadvantaged groups with limited access to healthcare services, as a part of persistent socio-economic inequalities [19,24-26]. In 2021, the 74th World Health Assembly adopted an oral health resolution, recommending a shift from the traditional curative approach to a preventive promotion approach. This approach promotes oral health within families, schools, and workplaces [27].

Twice-daily brushing with a fluoride toothpaste is accepted as the basic standard of at-home care: it is an effective practice for preserving oral health and



reducing the risk of dental caries and periodontal disorders [4,10,11,13,16,28]. Tooth brushing is widely acknowledged as a significant means of delivering anti-caries agents, such as fluorides. However, many patients struggle to achieve adequate plaque removal through home-based oral hygiene routines. Consequently, most dental professionals advocate brushing one's teeth twice daily to improve plaque management. This recommended practice is followed by most patients who prioritize their oral health, and its effectiveness in promoting oral health maintenance has been demonstrated in various studies [29-33]. Though brushing one's teeth may seem straightforward, it plays a critical role in preventing oral health issues, including caries, periodontal disease, and halitosis [34]. The present review focuses on the significance of toothbrushing in maintaining optimal oral health, outlining its benefits, recommended techniques, and types of toothbrushes.

2. The Benefits of Toothbrushing

Personal oral hygiene involves consistently maintaining oral cleanliness to promote optimal oral health. This includes removing and preventing microbial plaque from both teeth and gingiva. Currently, oral hygiene routines encompass various mechanical tools, such as toothbrushes, dental floss, interdental cleaners, and chewing gums. Additionally, chemotherapeutic substances found in mouth rinses, dentifrices, and chewing gums are employed [34].

Effective toothbrushing with fluoride toothpaste offers a wide range of benefits. Some of the key advantages are described below.

2.1. *Biofilm and bacteria removal*

Numerous studies have provided conclusive evidence that mechanical methods, especially toothbrushing, reduce plaque accumulation [4,5,35]. Regular toothbrushing with fluoridated toothpaste is an important tool to contest plaque and the associated diseases it causes, including dental caries, gingival issues,



and periodontal diseases. Consequently, effective plaque control, judicious use of fluorides, and maintaining good oral hygiene are crucial for oral health preservation and disease prevention [4,9,13].

The principal aim of toothbrushing is the removal of dental biofilm – a sticky bacterial film that adheres to teeth and periodontal tissue. Failure to consistently eliminate plaque through recommended brushing can lead to caries and periodontal disease [5,6,12,14].

2.2. Caries prevention

The role of tooth brushing in preventing caries has long been widely acknowledged. Toothbrushing removes food particles and bacteria from the mouth [4,35-37]. Dental caries occurs when a tooth's enamel is damaged due to acid produced by bacteria within plaque. The development of a carious lesion is influenced by the convergence of three key factors: acidogenic and acidophilic bacteria, dietary carbohydrates, and host-related factors. Moreover, socio-

economic and behavioral factors significantly impact the etiology of the disease. At the individual level dental caries occurs from an ecological imbalance within the stable oral microbiome [38-42]. Identifying, intervening, and interrupting the progression of caries while restoring sequelae remain challenging [41].

Furthermore, tooth brushing should be supplemented with other oral hygiene aids and education to enhance overall oral hygiene. Health education remains a cornerstone of primary prevention, equipping individuals, including schoolchildren, with the knowledge and skills needed to achieve optimal oral and dental health [43,44].

2.3. Periodontal disease prevention

Gingivitis and periodontitis are both forms of periodontal disease triggered by plaque accumulation along the gingiva [4,9,45]. Periodontal disease is widely acknowledged as a prevalent condition within the human population. It is characterized by inflammation of the



gingiva and the subsequent loss of attachment between the gingiva and the underlying hard tissue, accompanied by decreased bone density. This process leads to gingiva detachment from the teeth, which might lead to the formation of pockets, which could easily become an acute condition. Bacterial toxins and the innate immune response to infection initiate the degradation of the osseous and connective structures responsible for tooth retention. Surgical intervention is likely to be needed [45,46].

Without appropriate intervention, gingivitis might progress to the more severe condition, periodontitis. Gingivitis is a significant risk factor and an essential precursor for developing periodontitis; but not all gingivitis progress to periodontitis. Consequently, managing gingivitis is one of the strategies to prevent periodontitis [47]. Effective treatment by a dentist can only halt, or at least slow, the progression of periodontitis if teeth are treated. Plaque buildup can lead to gingival inflammation, and plaque can harden into

tartar [46]. Regular toothbrushing is instrumental in preventing periodontal disease by removing plaque and preventing its accumulation [4,9,30].

2.4. Fresh breath

Effective plaque control is important in suppressing gingivitis, preventing dental caries, and combatting the microorganisms associated with halitosis. The most employed tools for managing supragingival plaque include mechanical or electric toothbrushing, dental floss and interdental brushes [4,16].

Oral bacteria can lead to halitosis, the persistent release of malodorous and unpleasant breath, irrespective of its underlying cause. The primary cause of halitosis is the release of volatile sulfur compounds due to the activity of anaerobic bacteria in the mouth. Brushing eliminates food particles that serve as bacteria's nourishment and reduces the population of oral microbes, resulting in fresher breath [4,48,51-53]. Halitosis has



the potential to hinder interpersonal interactions and contribute to social isolation, particularly among individuals who regularly engage with the public in their professional roles. Hence, it becomes imperative for them to maintain stringent standards of cleanliness and oral hygiene to help prevent the occurrence of foul-smelling breath, which can significantly erode their confidence and self-assurance [48-50].

3. Recommended techniques

Regular toothbrushing with fluoridated toothpaste is crucial in maintaining oral hygiene and minimizing plaque accumulation. This, in turn, reduces the risk of developing dental issues such as dental caries and periodontitis, both of which are commonly associated with plaque buildup [9,54].

For young children it is recommended that an adult takes responsibility for toothbrushing until the child is approximately six years old. At this stage, the child's developing dexterity and cognitive abilities may allow for

supervised brushing, gradually transitioning into independent brushing as the child becomes more capable. In the adult population, toothbrushing is highly effective in removing plaque from smooth surfaces, playing a pivotal role in preventing or resolving gingivitis. However, certain anatomical and prosthetic considerations may limit access to interproximal areas and pits and fissures, particularly in the presence of prosthetic devices [34].

3.1. *Brushing duration*

Dentists recommend brushing for at least two minutes to ensure a thorough cleaning. A helpful approach is to divide the mouth into four quadrants and spend 30 s on each [16,55,56]. Previous studies that examined the relationship between brushing duration and oral hygiene have produced conflicting results [54]. Research has shown that brushing duration is negatively correlated with the remaining plaque on a toothbrush. Some authors have pointed out that two minutes of brushing may not be sufficient for



significant plaque removal, which increases with extended brushing time; maximum removal is achieved at 180 s. Clinical studies are needed to confirm brushing recommendations [6,16,54,56].

3.2. Brushing frequency

Toothbrushing with toothpaste is essential for maintaining good oral hygiene and delivering fluoride [57]. Ideally, brushing should take place after every meal. If this is not feasible, brushing twice daily is recommended – once in the morning and once before bedtime [31,55]. Numerous studies have shown that brushing with fluoridated toothpaste twice daily has a preventive effect against caries and periodontal disease compared to those who do it less frequently. However, it is worth noting that excessive brushing several times a day can also lead to issues with the teeth and periodontium [58].

3.3. Brush selection

Numerous toothbrush designs have been developed to improve the removal of dental biofilm and reduce bacterial

contamination and retention over time [9]. It is advisable to use a toothbrush with soft bristles to prevent damage to tooth enamel and gingival irritation [59,60]. Recommended maintenance and timely toothbrush replacement are crucial to maintaining good oral hygiene. Public awareness regarding toothbrush maintenance is directly related to people's attitudes toward oral hygiene [61]. According to the American Dental Association, it is recommended to switch to a new toothbrush or replace the head of an electric toothbrush every 3 to 4 months [61-63].

3.4. Toothpaste choice

When choosing a toothpaste, it is advisable to prioritize those containing fluoride because it can strengthen enamel and offer protection against dental caries. The inclusion of fluoride in toothpaste has played a significant role in reducing caries rates since the 1970s. Empirical evidence from systematic and Cochrane reviews has consistently supported the effectiveness of fluoride in preventing



dental caries. Furthermore, these reviews have emphasized the advantages of fluoride-containing toothpaste over fluoride-free alternatives in caries prevention. Implementing preventive measures has demonstrated greater economic efficiency compared to treating dental caries. Fluoride's mechanism of action in managing dental caries involves reducing enamel demineralization and facilitating remineralization [64-66]. As far as gingival and periodontal health are concerned, some specially formulated toothpastes (chlorhexidine or triclosan) seem to enhance gingival/periodontal status [67,68]. Recent evidence suggests that toothpaste containing 0.3% triclosan is more effective than regular toothpaste to improving clinical periodontal conditions [69]. However, a systematic review with metanalysis yielded only moderate quality evidence that brushing with an active-ingredient dentifrice with stannous fluoride or triclosan does provide an added clinically relevant effect concerning plaque inhibition capabilities that surpass the effect of a regular sodium

fluoride dentifrice [70]. The American Dental Association seal on toothpaste signifies that it meets their criteria for safety and effectiveness [71].

3.5. Brushing technique

Brushing teeth is a crucial aspect of the oral hygiene routine. There is some lack of consensus among dental professionals, including dentists, oral health therapists, and dental corporations, regarding the recommended approaches for manual toothbrushing. A comprehensive evaluation and analysis of various brushing techniques have revealed that the modified Bass/Bass technique exhibits superior efficacy in reducing plaque and gingivitis compared to the horizontal method. However, the authors concluded that there still exists insufficient evidence to firmly support the proposition that one toothbrushing technique is definitively superior to another in terms of plaque removal and gingivitis reduction. The substantial diversity in multiple aspects of the design and methodology employed in the



selected research presents a significant challenge in arriving at definitive conclusions about the optimal technique for manual toothbrushing [72-74].

3.6. Tongue and palate

The rough surface on the tongue promotes the accumulation and retention of bacteria and tiny food particles. Over time, these substances gradually come together, forming a complex biofilm with multiple layers on the tongue's surface. Plain water cannot alone effectively penetrate this biofilm structure and eliminate the bacteria residing within it. Ensuring recommended tongue and palate dental hygiene is essential for optimal oral health. Cleaning the tongue removes dead cells, food remnants, and harmful bacteria from the oral cavity, thereby maintaining a healthy balance of beneficial microorganisms [4,75-77].

4. Types of Toothbrushes

Several methods exist for removing bacterial plaque from teeth; using a toothbrush is widely regarded as the most effective approach. The manual toothbrush is a simple tool that is widely accepted and accessible to most individuals [47]. No single manual toothbrush design demonstrates superiority in terms of plaque removal. Manufacturers continue to make ongoing modifications to toothbrush designs to gain a competitive edge. Recent advancements include the integration of nylon multi-tufted round-ended bristles to enhance effectiveness, the use of small-sized heads to provide increased accessibility, the implementation of designs that prioritize interproximal access, and the incorporation of longer handles to promote a secure and steady grip [34]. Various types of toothbrushes are available to cater to different preferences and needs.

4.1 Manual toothbrushes



These are the traditional toothbrushes that most people are familiar with, and consequently, they are the ones most used. Manual toothbrushes are available in various shapes, sizes, and bristle configurations. When using a manual toothbrush, recommended brushing technique is crucial to ensure thorough cleaning [68,78,79].

4.2. Electric toothbrushes

While some studies suggest that there is no statistically significant difference between electric and manual toothbrushes [73], some systematic reviews assert that powered toothbrushes are more effective in reducing plaque and gingivitis compared to manual toothbrushing, both in the short and long term [74]. Electric or powered toothbrushes have gained popularity for their ability to provide consistent brushing action. Some models even include built-in timers to ensure brushing for two minutes. This feature can be especially helpful for individuals who find maintaining the recommended brushing technique challenging. Electric

toothbrushes are effective for maintaining good home oral hygiene. Strong clinical evidence supports recommending electric toothbrushing to pediatric patients and patients undergoing orthodontic therapy and treatment or those with special needs [80]. There are various types of electric toothbrushes with different technologies available.

4.2.1. Sonic toothbrushes:

These electric toothbrushes generate rapid vibrations to create microbubbles, enabling a deeper cleaning between teeth and along the gingival margin. Scientific evidence indicates that sonic toothbrushes have been clinically proven to outperform manual toothbrushes, consistently removing significantly more plaque in a single use [81].

4.2.2. Ultrasonic toothbrushes:

These toothbrushes produce ultrasonic waves, which effectively disrupt and dislodge plaque and bacteria to a greater extent. This product is well-known for its ability to offer a thorough and efficient



cleaning process while maintaining a gentle approach. Ultrasonic toothbrushes are more effective than manual toothbrushes in removing plaque and preventing gingivitis in patients without severe periodontal disease [82].

4.2.3. Oscillating-rotating toothbrushes:

A significant milestone occurred in 1991, with the introduction of a toothbrush featuring a prophylaxis-inspired oscillating-rotating mode of action [83]. Oscillating-rotating toothbrushes have demonstrated superior results in promoting oral health, reducing gingivitis, and minimizing plaque compared to manual and sonic brushes. The latest advanced oscillating-rotating models provide even greater efficacy than traditional ones [81].

5. CONCLUSION

Toothbrushing is a simple yet important self-care practice for maintaining oral health. Its benefits extend beyond just

cosmetics; they encompass caries prevention, gingival/periodontal disease risk amelioration, and some halitosis prevention. Adhering to recommended toothbrushing techniques, selecting the right toothbrush, and adhering to a regular schedule with fluoridated toothpaste can make a significant difference in long-term oral health. Dental professionals, health educators, and public health staff should strive to present unified messages to influence toothbrushing habits.

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