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*Review*

# The Importance of Toothbrushing and Oral Hygiene in Maintaining Oral Health

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**Abstract:** This work explores the significance of toothbrushing in maintaining optimal oral health, delving into its benefits, proper techniques, and types of toothbrushes. The primary cause of caries, periodontal diseases, and halitosis is oral biofilm development. One of the most fundamental practices in maintaining oral health is toothbrushing. Studies have confirmed that mechanical procedures for controlling plaque and toothbrushing, in particular, significantly decrease plaque accumulation. The significance of teeth brushing in preventing dental caries has been well-acknowledged for a considerable period. Dentists recommend brushing twice daily for at least two min to ensure thorough cleaning. Unfortunately, precise guidelines from dental associations are often missing. Authors mention that two min of brushing are insufficient for significant plaque removal; plaque removal increases with augmented brushing time, with maximum removal at 180 s. Multiple studies have documented that engaging in the practice of brushing one's teeth twice a day 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. In conclusion, toothbrushing is a simple yet incredibly important practice for maintaining oral health. The benefits extend beyond just a bright smile, encompassing caries, gum disease, halitosis prevention, and the preservation of tooth enamel. Adhering to proper toothbrushing techniques, selecting the right toothbrush, and understanding the connection between oral health and overall well-being can lead to a healthier life. To foster favorable toothbrushing behaviors among the population, dental practitioners and public health experts must know the factors that influence toothbrushing habits.

**Keywords:** oral health; toothbrushing; caries; periodontal diseases; halitosis

## 1. Introduction

The World Dental Federation defines oral health as "multi-faceted", encompassing:

"*The 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]

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Oral diseases are among the most common noncommunicable diseases worldwide. Approximately half of the global population experiences disability due to oral conditions (48.0%). 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 4.1% (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 tissue complications within the oral cavity involves preventing and inhibiting biofilm formation and proliferation [3–14].

Oral diseases are preventable and treatable, particularly in their early stages, 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 significantly impact the quality of life for populations, resulting in pain, sepsis, suffering, discomfort, reduced school attendance, decreased work efficiency, deformities, and, in severe cases, even death [18–20]. Oral health is considered a fundamental human right and is closely interconnected with overall health and well-being. It plays a crucial role in a person's ability to eat, breathe, and speak and 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 among socially disadvantaged groups with limited access to healthcare services, leading to persistent socio-economic inequalities [19,24–26]. In 2021, during the 74th World Health Assembly, a resolution on oral health was adopted, recommending a shift from the traditional curative approach to a preventive promotion approach. This approach promotes oral health within families, schools, and workplaces [27].

Toothbrushing 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, gum disease, and bad breath [34]. This work delves into the significance of toothbrushing in maintaining optimal oral health, exploring its benefits, proper 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 gums. 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 offers a wide range of benefits that extend beyond simply achieving a bright smile. 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 is the primary way individuals can combat plaque and the associated diseases it causes, including dental caries, gingival issues, and periodontal diseases. Consequently, effective plaque control and maintaining good oral hygiene are crucial for oral health preservation and disease prevention [4,9,13].

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The principal aim of toothbrushing, whether or not a fluoride toothpaste is used, is the removal of dental biofilm – a sticky bacterial film that adheres to teeth and gums. Failure to consistently eliminate plaque through proper brushing can lead to cavities and gum 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, thus reducing the risk of caries [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 caries 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. Dental caries occurs from an ecological imbalance within the stable oral microbiome [38–42]. Identifying, intervening, and interrupting the progression of caries while addressing defects remain challenging for current dental practices [41].

Furthermore, it's crucial to emphasize that 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. Gum disease prevention*

Gingivitis and periodontitis are both forms of gum disease triggered by plaque accumulation along the gumline [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 bone, accompanied by decreased bone density. This process leads to gum detachment from the teeth, resulting in the formation of pockets that become infected. Bacterial toxins and the innate immune response to infection initiate the degradation of the osseous and connective structures responsible for tooth retention. If left untreated, the bone, gums, and supportive tissue for the teeth undergo destruction, eventually causing loosening and subsequent tooth extraction [45,46].

Without appropriate intervention, gingivitis can progress into the more severe condition known as periodontitis. Gingivitis is a significant risk factor and an essential precursor for developing periodontitis. Consequently, managing gingivitis is the primary strategy to prevent periodontitis [47]. Effective treatment by a dentist can only halt, or at least slow, the progression of periodontitis if teeth are cleaned properly. Within a few days, plaque buildup can lead to gum inflammation, and plaque can harden into tartar [46]. Regular toothbrushing is instrumental in preventing gum 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 responsible for halitosis. The most commonly employed tools for managing supragingival plaque include mechanical or electric toothbrushing, dental floss and interdental brushes [4,16].

Oral bacteria can lead to halitosis, a frequently observed oral health condition characterized by the persistent release of malodorous and unpleasant breath, irrespective of its underlying cause. 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 prevent the occurrence of foul-smelling breath, which can significantly erode their confidence and self-assurance [48–50].

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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].

## 3. Proper techniques

Regular toothbrushing 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, especially on these surfaces. However, certain anatomical and prosthetic considerations may limit access to interproximal areas and pits and fissures, particularly in the presence of prosthetic devices [34].

While many people brush their teeth, not everyone uses the correct technique. Following proper toothbrushing techniques enhances the effectiveness of the practice.

### *3.1. Brushing duration*

Dentists recommend brushing for at least two min 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]. Unfortunately, precise guidelines from dental associations are often lacking. 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 given toothbrush. Some authors have pointed out that two min of brushing may not be sufficient for significant plaque removal, which increases with extended brushing time, with the maximum removal achieved at 180 s. Clinical studies are needed to potentially update 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 – once in the morning and once before bedtime [31,55] is recommended. Numerous studies have shown that brushing the teeth twice daily has a preventive effect against caries and periodontal disease compared to those who do it less frequently. However, it's worth noting that excessive brushing several times a day can also lead to issues with the teeth and gums [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's advisable to use a toothbrush with soft bristles to prevent damage to tooth enamel and gum irritation [59,60]. Proper 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

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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]. The American Dental Association seal on toothpaste signifies that it meets their criteria for safety and effectiveness [67].

### *3.5. Brushing technique*

Brushing one's teeth is a crucial aspect of the oral hygiene routine. There is a 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 author concludes 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 [68].

While some studies suggest that there is no statistically significant difference between electric and manual toothbrushes [69], systematic reviews, on the other hand, assert that powered toothbrushes are more effective in reducing plaque and gingivitis compared to manual toothbrushing, both in the short and long term [70].

### *3.6. Tongue and palate*

A rough surface on the tongue promotes the accumulation and retention of bacteria and tiny 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 proper tongue and palate dental hygiene is essential for optimal oral health. Bacterial microorganisms are widely recognized as the primary contributors to oral health issues, including halitosis, dental caries, and periodontal disease. Cleaning the tongue removes dead cells, food remnants, and harmful bacteria from the oral cavity, thereby maintaining a healthy balance of beneficial microorganisms [4,71–73].

## 4. Types of Toothbrushes

Several methods exist for removing bacterial plaque from teeth; nevertheless, using a toothbrush is widely regarded as the most effective approach. The manual toothbrush is a simple tool that is widely accepted and economically accessible to most individuals [47]. No single manual toothbrush design demonstrates superiority in terms of plaque removal. Manufacturers in the dental hygiene industry continue to make ongoing modifications to toothbrush designs in order 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 commonly used. Manual toothbrushes are available in various shapes, sizes, and bristle configurations. When using a manual toothbrush, proper brushing technique is crucial to ensure thorough cleaning [68,74,75].

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*4.2. Electric toothbrushes*

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 min. This feature can be especially helpful for individuals who find maintaining the proper 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 [76]. There are various types of electric toothbrushes with different technologies available.

4.2.1. Sonic toothbrushes:

These electric toothbrushes generate rapid vibrations that create microbubbles, enabling a deeper cleaning between teeth and along the gumline. Scientific evidence indicates that sonic toothbrushes have been clinically proven to outperform manual toothbrushes, consistently removing significantly more plaque in a single use [77].

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 [78].

4.2.3. Oscillating-rotating toothbrushes:

A significant milestone occurred in 1991, introducing a groundbreaking toothbrush featuring a prophylaxis-inspired oscillating-rotating mode of action [79]. 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 [77].

## 5. Conclusion

Toothbrushing is a simple yet incredibly important practice for maintaining oral health. Its benefits extend beyond just achieving a bright smile; they encompass caries prevention, gum disease control, halitosis prevention, and the preservation of tooth enamel. Adhering to proper toothbrushing techniques, selecting the right toothbrush, and understanding the connection between oral health and overall well-being can lead to a healthier, happier life. Remember, dedicating a few minutes to your daily oral hygiene routine can make a significant difference in long-term oral health. To promote favorable toothbrushing behaviors among the population, dental practitioners and public health experts must know about the factors that influence toothbrushing habits.

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