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REVIEW ARTICLE

Tooth brushing: An effective oral hygiene measure

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ABSTRACT

Many people adopt tooth brushing as their primary method of oral hygiene. Tooth brushing is a mechanical means of eliminating microbial biofilm (dental plaque) from the oral cavity. Pieces of evidence have shown that dental plaque is implicated in the initiation and progression of the commonest oral diseases – dental caries and periodontal disease. If dental plaque is actively eliminated from the oral cavity, the incidence of common oral diseases will be reduced. Dental authorities posit that using the 'ideal' toothbrush, supplemented with fluoride-containing toothpaste, at least, 2 times a day for about 2-3 minutes per session, with the right technique, will effectively eliminate material alba and dental plaque from the mouth. This review was intended to take a brief look at the concept of tooth brushing as an effective oral hygiene method. The review was carried out by taking a look at journal articles and related researches and reviews. It began with an introduction and proceeded to discuss thematic issues on tooth brushing in oral hygiene before drawing a conclusion that buttresses the strategic role of tooth brushing as an oral hygiene method in the control of dental plaque

INTRODUCTION

Dental caries and periodontal disease have historically been considered the most important part of the global burden of oral disease (Peterson, 2005). The bacterial biofilm (plaque) is commonly held responsible as one main reason for the formation of both dental caries and inflammatory periodontal diseases (Attina & Hornecker, 2005). The onset of these diseases might be prevented by regular and effective plaque removal in the form of primary prevention (Suhasini & Valiathan, 2020).

Tooth brushing is one of the modern recommended oral hygiene measures adopted as the primary oral hygiene material (Adamu et al., 2020). It is considered a primary mechanical means of removing substantial amounts of plaque to prevent oral diseases, while also maintaining dental aesthetics and preventing halitosis (Asadoorian, 2006).

Effective plaque removal depends not only on the type of toothbrush but also on the proper tooth brushing technique (Damle et al., 2014). Many different tooth brushing techniques have been recommended over the past 20-30 years and they include the bass method, Stillman's method, charters method, scrub method, fones' method, and the roll method (Janakiram et al., 2018;

Rajwani et al, 2020). Manual dexterity, toothbrush design, brushing duration, parental involvement, brushing method, manipulative skills, and motivation of an individual are of paramount importance in maintaining oral hygiene (Damle et al., 2014; Suhasini & Valiathan, 2020).

Tooth brushing is mostly recommended to be performed after meals to eliminate both bacterial plaque and food impaction. The American Dental Association [ADA] (2009) has modified this position by the use of the statement that patients should brush "regularly." Research has indicated that if plaque is completely removed every other day, there will be no deleterious effects in the oral cavity. On the other hand, because few individuals completely remove plaque, daily brushing is still extremely important to maximize sulcular cleaning as a periodontal disease control measure, as well as to allow using fluoride dentifrices more often in dental caries control (Attina & Hornecker, 2005; Baruah et al., 2017).

It is on this premise that this review became necessary to identify and assess the quality of evidence in the existing literature on the effectiveness of tooth brushing as an oral hygiene measure.

CONCEPT OF ORAL HYGIENE

In most low- and middle-income countries, with increasing urbanization and changes in living conditions, the prevalence of oral diseases continues to increase. This is primarily due to poor oral hygiene, lack of access to oral health care services, inadequate exposure to fluoride, consumption of beverages high in sugar, alcohol consumption, and tobacco use (Lalitha et al., 2014; World Health Organization [WHO], 2020).

Oral hygiene is the practice of keeping the mouth clean and free of diseases and other problems by regular brushing of the teeth and cleaning between the teeth. It is important to practice oral hygiene to prevent oral health conditions such as dental caries and periodontal disease, which contribute to the global burden of oral disease that affects close to 3.5 billion people worldwide, with caries of permanent teeth being the most common condition (Menezes et al., 2020; WHO, 2020)

The purpose of oral hygiene is to prevent the building of plaque, the sticky film of bacteria, and food that forms on the teeth. Plaque adheres to the crevices and fissures of the teeth and generates acids that when not removed regularly, slowly eat away or decay the protective enamel surface of the teeth resulting in cavities. Plaque also irritates gums and can lead to gum disease, periodontal disease, and eventual tooth loss (WHO, 2020).

Mechanical and chemotherapeutic approaches to oral hygiene are important in promoting healthy periodontal and dental tissues. Mechanical disruption and removal of plaque are simple and effective; tooth brushing and flossing are the most common oral hygiene measures used today. Chemotherapeutic supplementation of mechanical measures using dentifrices, mouth rinses, gels, and chewing gum as delivery vehicles can improve oral hygiene (Choo et al, 2001).

Poverty, poor education, and inequality not only result in poor oral health but also affect how people think about their oral health. Despite excellent oral health care, oral diseases are prevalent. This suggests that improving healthcare services merely will not address the issue, oral health promotion needs to be implemented (Niranjan et al, 2017)

ORAL HYGIENE MEASURES

Current oral hygiene measures include mechanical aids (toothbrushes, floss, interdental cleaners, and chewing gums) and chemotherapeutic agents (mouth rinses, dentifrices, and chewing gums). The benefits derived from oral hygiene depend on the manual dexterity, lifestyle, motivation, and oral condition of individuals (Choo et al, 2001).

Toothbrushes

The toothbrush is the most common method of removing plaque from the oral cavity (Sasan et al., 2006; Hughes & Dean, 2016). A toothbrush could be manual or powered. The manual toothbrush (MTB) was invented in China between 618 to 907 A.D. and was composed of hog hair for bristles. In 1780, England resident, William Addis manufactured the “first modern toothbrush,” and this brush had a bone handle and holes for placement of natural hog bristles. In the early 1900s, celluloid began replacing the bone handle - this change came about during World War I, when bone and hog bristles were in short supply. Similarly, as a result of deficit supply, nylon bristles were introduced. Initially, nylon bristles were copies of natural bristles in length and thickness, however, they were stiffer than the natural bristles. They did not

have the hollow stem of natural bristle, so they did not allow water absorption. Other advantages of nylon bristles were the ability to form the bristles in various diameters and shapes, and to round, the bristle ends to be gentler on gingival tissues (Voelker et al., 2013).

Powered toothbrushes were first developed in Switzerland after the Second World War and were powered by electricity. Introduced to the United States market in 1960, powered toothbrushes were an immediate success, but these early versions were not superior to manual toothbrushes and suffered from mechanical failure. These first powered toothbrushes were designed simply to mimic the manual tooth-brushing motions, some up and down and others side to side. Continuous developments have occurred since these initial models. However, the second generation of powered toothbrushes did not emerge until the 1990s and they have increasingly become a household item ever since (Asadoorian, 2006).

Toothbrushes are divided into 2 parts: the toe, located at the end of the head, and the heel end closest to the handle. Toothbrush heads are composed of tufts, which are individual bundles of filaments secured in a hole in the toothbrush head. Filaments within the tufts are known as bristles. The number and length of the filaments in a tuft, the number of tufts, and the arrangement of tufts vary with toothbrush designs. A brushing plane may be flat with all filaments the same length, bilevel, multilevel, rippled, or crisscrossed with tufts angled in at least 2 different directions (Sasan et al, 2006; Voelker et al., 2013; Hughes & Dean, 2016).

An ideal toothbrush is therefore defined as a toothbrush that removes plaque effectively (Sasan et al, 2006). It has the following specifications as pointed out by the ADA (2019):

i. Brushing surface (length): 1-1.25 inches long (25.4-35.8mm)
ii. Width: 5/16-3/8 inches wide (7.9-9.5mm)
iii. Number of rows: 2-4 rows of bristles
iv. Tufts per row: 5-12 tufts
v. Number of bristles: 80-85 bristles per tuft

The diameter of bristles are

a) Soft: 0.007 inch (0.2mm)
b) Medium: 0.012 inch (0.3mm)
c) Hard: 0.014 inch (0.4mm)

Dental floss

Dental floss is the most effective means for removing food trapped between the teeth and interdental plaque. Toothbrush bristles alone cannot effectively clean between these tight spaces of the teeth. Should those tight spaces be left untidied, plaque forms which eventually hardens into tartar, a hard mineral deposit that forms on teeth and can only be removed through professional cleaning by a dental professional. 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 (ADA, 2019, Salzer et al., 2020).

Interdental cleaning aids

Interdental cleaning agents (small brushes, special wooden sticks, plastic picks, or water flossers) are easier to use than floss and can be used to clean proximal tooth surfaces, wide interdental spaces, exposed root surfaces, concavities, and furca in periodontally involved dentitions. These aids can remove plaque and accumulated food debris from areas inaccessible to toothbrushes, deliver chemotherapeutic agents and reduce interdental gingivitis. Interdental brushes with diameters slightly larger than the gingival embrasure can exert pressure on tooth surfaces in wide interproximal spaces and achieve better plaque removal than floss or sticks (Choo et al., 2001; ADA, 2019)

Dentifrices

As pastes or gels, modern dentifrices are adjuncts to tooth brushing and vehicles for agents to inhibit calculus, reduce plaque, prevent caries, whiten enamel and desensitize exposed root surfaces. Mild abrasives and detergent components promote plaque removal, although the abrasive can damage exposed root surfaces. Dentifrice is, however, of major importance for the delivery of fluoride to prevent the development of caries or to deliver anti-inflammatory agents. Fluoride is crucial for prevention and 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 (Choo et al., 2001; Agrawal & Gupta, 2020; Salzer et al., 2020).

Mouth-rinses and gels

Mechanical plaque control shortfalls can be redressed by antibacterial and cariostatic mouth rinses and gels. They can be classified into three main types: Antiseptic, plaque-

inhibiting, and preventive. Antiseptic mouthwash includes chlorhexidine. Plaque-inhibiting mouthwashes include a variety of active ingredients, ranging from antimicrobials (e.g. cetylpyridinium chloride) and agents to prevent bacteria adhering to tooth surfaces (e.g. the amine alcohol delmopinol hydrochloride) to essential oils (e.g. thymol, eucalyptol, and menthol together with methyl salicylate) and preventive mouthwashes are those that contain fluoride for the reversal of early lesions of dental caries (Agrawal & Gupta, 2020)

Chewing gums

Chewing gums serve as mechanical and chemotherapeutic agents. Chemotherapeutically, gums promote salivation and require hydration to release the agent, which can then be effective for longer periods than rinses or dentifrices. The use of sugar-free chewing gum as a mechanical salivary stimulant after eating can accelerate the clearance of dietary substances and microorganisms, promote buffers to neutralize plaque acids and provide antibacterial substances. Chewing sugar-free gum for 20 minutes after eating reduces the fall in plaque pH and rapid recovery ensues. This action reduces the time for demineralization and enhances the potential for remineralization of early carious lesions. The saliva flow rate is stimulated three- to ten-fold above the resting level and may be prolonged for over 30 minutes. This approach may enhance saliva function in those with low flow rates such as elderly sufferers of xerostomia or provide symptomatic relief from dry mouth. However, effects on gingivitis or calculus formation have not been demonstrated (Choo et al., 2001).

TOOTH BRUSHING

Self oral hygiene maintenance is mainly by tooth brushing, mouth rinsing, and flossing (Patil, et al., 2014). Tooth brushing is the main method of self-removal of dental plaque and debris by an individual. It entails the use of a mechanical appliance (toothbrush) with a chemical adjunct (dentifrice) in a well and meticulous manner to remove plaque deposits from all tooth surfaces.
(Suhasini & Valiathan, 2020).

The objectives of tooth brushing

The objectives of toothbrushing include:

1. Elimination of bacteria biofilm and prevention of its re-formation
2. Cleaning the mouth of food debris, and stains
3. Massaging of gum tissues
4. Application of special medicaments to teeth through pastes. E.g. fluoride

Tooth brushing duration

Tooth-brushing duration is an important variable in plaque removal efficacy. It has been estimated that for brushing to effectively facilitate plaque reduction, about 30-45 seconds must be expended per quadrant. That, by extension, means that brushing should not last less than 120 to 180 seconds (2-3 minutes) (Baruah et al., 2017; Hayasaki et al., 2014; Asadoorian, 2006)

Tooth brushing frequency

Toothbrushing is mostly recommended to be performed after meals to eliminate both bacterial plaque and food impaction. The ADA opined that brushing is carried out regularly. However, occupational status, individual socio-economic situation, lifestyle, and frequency of dental visits have influenced toothbrushing behaviour; therefore, it is important to recommend that patients brush, at least, twice or more a day (Attin & Hornecker, 2005; Asadoorian, 2006; Baruah et al., 2017; Salzer et al, 2020).

Period of toothbrushing

Dental authorities recommend that teeth should be brushed in the morning, after breakfast, and at night, after dinner (Adamu & Eneojo, 2013).

Tooth brushing techniques

Several toothbrushing techniques (Bass, Stillman's, Fones', Charter's, horizontal, vertical, scrub, and roll) have been developed, over the years. However, no one method has been shown to be superior. Therefore, it has been concluded that conscientious and correct application of a brushing method is more critical than the use of any specific method (Claydon, 2008; Asadoorian, 2017). The following considerations were pointed out by Baruah et al. (2017) to be important when teaching patients or clients, a particular toothbrushing technique:

a. oral health status, including the number of teeth, their alignment, mouth size, presence of removable prostheses, orthodontic appliances, periodontal pockets, and gingival condition,

b. systemic health status, including muscular and joint diseases, and mental retardation,

c. age,

d. interest and motivation,

e. manual dexterity, and

f. the ease and effectiveness with which the technique can be explained or adopted.

The most common technique used by uninstructed individuals is the horizontal scrubbing motion that engages the occlusal and buccal/lingual surfaces. The bristles are placed at right angles to the long axis of the teeth and gentle horizontal scrubbing movement of the brush is performed. Though this method is easy to learn and practice, it is, however, ineffective at plaque removal causing tooth abrasion & gingival recession (Hayasaki et al., 2014).

The Bass method involves placing the head of the brush parallel to the occlusal plane, with the brush head covering almost 3-4 teeth starting from the distal-most teeth of the arch. The bristles are placed at the gingival margin at an angle of 45 degrees to the long axis of the tooth. The Bass technique emphasizes the removal of plaque from the area above and just below the gingival margin and provides good gingival stimulation however it suffers a setback of causing injury to the gingival margin (Suhasini & Valiathan, 2020).

Stillman's method was originally developed to provide gingival stimulation. The toothbrush is positioned with the bristles inclined at a 45-degree angle to the apex of the tooth, with part of the brush resting on the gingiva and the other part on the tooth. A vibratory motion is used with a slight pressure to stimulate the gingiva (Weinwright & Sheiham, 2014; Baruah et al, 2017).

In the Charter's method, the bristles of a toothbrush are placed at an angle of 45 degrees to the gingivae with the bristles directed coronally and activated by mild vibratory strokes with the bristle end lying inter-proximally. The technique specifically indicated in patients with orthodontic and prosthodontic appliances is effective in plaque removal and suitable after periodontal surgeries (Claydon, 2008; Suhasini & Valiathan, 2020).

In the Modified Bass technique/Sulcus cleaning method, the toothbrush is positioned in the gingival sulcus at a 45-degree angle to the tooth apex. The bristles are then gently pressed to enter the sulcus. A vibratory action, described as a back-and-forth horizontal jiggle, causes a pulsing of the bristles to clean the sulci. Ten strokes are advised for each area. It is important to note that the Bass technique was the first to focus on the removal of plaque and debris from the gingival sulcus. This method is effective for removing plaque adjacent to and directly beneath the gingival margins as part of the self-care regimen for controlling periodontal disease and caries. It is noteworthy that this technique requires moderate dexterity of the wrist (Suhasini & Valiathan, 2020).

In the roll method, the toothbrush bristles are positioned parallel to and against the attached gingivae, with the toothbrush head level with the occlusal plane. The wrist is then turned to flex the toothbrush bristles first against the gingiva and then the facial surface. A sweeping motion is continued until the occlusal or incisal surface is reached. The toothbrush bristles are at right angles to the tooth surface as the brush passes over the crown. The press roll action is repeated at least five times before proceeding to the next site (Baruah et al., 2017).

Though there are several techniques of tooth brushing, the Bass and roll methods are the most commonly recommended. It has been estimated that over 90% of people employ their "personal tooth-brushing method," which is generally the "scrub" method using vigorous horizontal, vertical, and/or circular movements. While this method will remove plaque from smooth outer and inner surfaces of the teeth, it has been considered detrimental because it can encourage gingival recession and areas of tooth abrasion (Asadoorian, 2006).

THE EFFECTIVENESS OF TOOTHBRUSHING AS AN ORAL HYGIENE MEASURE

Toothbrushing has remained the main most effective and primary oral hygiene measure for controlling plaque (which is the primary agent in the development of dental caries, periodontal disease, and calculus) and debris by an individual (Claydon, 2019; Adamu et al., 2020; Suhasini & Valiathan, 2020).

Clinical studies have proven that in patients with healthy periodontal conditions, meticulous and complete removal of supragingival bacteria plaque through brushing every

24-48 hours is sufficient to prevent gingivitis. This is because the progression of periodontal disease is advanced by subgingival bacteria which are in turn derived from the supragingival dental plaque. Conversely, plaque accumulation for about 72 hours will induce gingival inflammation. These studies underscore the fact that the frequency of daily tooth brushing is associated with a reduction in gingivitis while lack of toothbrushing or infrequent brushing contributes to the prevalence of gingivitis (Attin & Hornecker, 2005; Claydon, 2019).

It is important to consider that toothbrushing is usually performed using fluoridated dentifrices; the higher the frequency of the toothbrushing, the more fluoride is applied frequently. Therefore, brushing with water or other solvents may not be enough in preventing caries but toothbrushing with a fluoridated dentifrice is largely responsible for dental caries prevention (Attin & Hornecker, 2005).

ADVERSE EFFECTS OF TOOTHBRUSHING

Tooth brushing has no doubt been established to be effective in plaque removal, especially when the proper technique is adopted. However, when the wrong technique is used, the effect would be negative and unsavoury – the recession of the gingivae, abrasion of the teeth, deposits transfer, and poor oral hygiene (Atarbashi-Moghadam & Atarbashi-Moghadam, 2018; Adamu et al., 2020).

A commonly discussed concern related to toothbrushing is the development of gingival recession as a negative side effect. Toothbrushing factors that might be associated with gingival recession are toothbrushing frequency, a horizontal or scrub toothbrushing method, bristle hardness, tooth brushing duration, and the frequency of changing a toothbrush (Salzer et al., 2020).

Incorrect or over-vigorous tooth brushing with toothpaste has long been implicated in the aetiology of abrasive tooth wear. This association is supported, at least, circumstantially, by studies reporting an increase in cervical abrasive lesions in individuals who have fewer mobile, carious and calculus-covered teeth, as well as those who brush their teeth more often, for longer, and use a scrubbing technique rather than a less damaging method (Addy et al., 2003).

CONCLUSION

Toothbrushing is an important oral hygiene habit with many potential benefits. It is, perhaps, the most important activity an individual can practice to reduce plaque build-up, which is the precursor of periodontal disease and dental caries – the two most common oral diseases. Brushing twice daily for at least 2-3 minutes per session with the right technique is optimal for preventing common oral diseases. Tooth brushing alone may not be sufficient to attain complete health; therefore, the combination of dentifrices with other interproximal oral hygiene aids will go a long way in controlling the plaque that is the primary agent for the causation of oral diseases.

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