

Review Article

Interdental Hygiene Devices for Periodontal Health

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Abstract

Although toothbrush is the most effective and widespread tool for the oral hygiene constitution and maintenance, none of the tooth brushing methods is efficient in eliminating the interproximal dental plaque. The interproximal cleaning should be an inseparable part of the daily plaque removal routine. In this short review, the interdental cleaning devices (dental floss, interdental brushes, single tufted brushes, wooden or plastic tips/interdental stimulators, and oral irrigators) were summarized and reminded.

INTRODUCTION

The primary etiologic agent of periodontal diseases is the microorganisms in dental plaque [1]. Dental plaque is the organized biofilm matrix comprised of salivary glycoproteins and extracellular microbial products on the non-shedding and steady hard surfaces [2].

The "Non-specific Plaque Hypothesis", accepted in 1960's, stated that the bacteria accumulated in the proximity near the marginal gingiva resulting in gingival inflammation and related periodontal tissue destruction [3]. The increasing plaque amount makes the neutralization of the microbial toxins by the host immune system complicated and result in gingivitis development. However, this hypothesis could not explain the periodontitis which has a multifactorial nature. The "Specific Plaque Hypothesis" was revealed in 1970's; suggesting that the pathogenicity of subgingival plaque varies and the presence and proliferation of some specific bacterial species increase the pathogenicity of subgingival dental plaque [4]. The development of the advanced microbiologic diagnostic techniques has revealed the questioning of this hypothesis. The presence of some species of putative periodontopathogens in the healthy microflora have led to the "Ecologic Plaque Hypothesis" in 1990's which suggested that the microbial composition in the subgingival environment determines the transition from health to disease [5]. With the non-specific plaque accumulation the inflammatory alterations in gingiva occur and gingivitis develops. The environmental alterations in favor of Gram negative and proteolytic bacteria in the gingival sulcus result in inflammatory cell mediated tissue alterations, tissue destruction with the proliferation of periodontopathogens.

Although the transition from gingivitis to periodontitis or the severity of periodontitis are mainly determined by the host immune system [6,7], the common features of all the above mentioned hypotheses are the sub- and supragingival accumulation of dental plaque. The importance of the elimination

of microbial dental plaque was reported for the prevention of periodontal diseases [8]. The plaque control measurements were recommended in primary, secondary and tertiary prevention from periodontal diseases; in other words not only for the maintenance of the oral health but also for the prevention of the onset of the disease, for the reversibility of the gingivitis status to the health status, and for the prevention from recurrence or progression of the periodontal disease [9].

Plaque elimination methods

Toothbrush is the most effective and widespread tool for the oral hygiene constitution and maintenance [10]. Manual, automatic (chargeable), battery-automated, sonic and ultrasonic, and ionic toothbrushes were developed, investigated and used with variable patient-related factors defining the preference of them. Although there are lots of methods for tooth brushing [10-15], none of these methods are superior in eliminating the dental plaque and ameliorate the gingival health, whereas the effectiveness of dental plaque removal depends on the appropriate method selection according to the manual dexterity and the present dentition of the subject.

Interdental hygiene tools

None of the tooth brushing methods is efficient in eliminating the interproximal dental plaque. The interproximal cleaning should be an inseparable part of the daily plaque removal routine. Dental floss, interdental brushes, single tufted brushes, wooden/plastic interdental stimulators/tips, and also oral irrigators are devices to eliminate dental plaque from interdental sites [10].

None of the interdental cleaning devices are superior to the other in plaque elimination, which lead to the application of one or more variations in different sites of the dentition. The efficiency of plaque removal is designated by the present dentition, the width of the interdental spaces, the type of the embrasures, and the position of the tooth (teeth) in the dental

arch, their inclinations, and most importantly by the motivation and the appropriate usage of these tools by the patient. The aim of the interdental tools should be instructed not only for the removal of the food debris from the interdental spaces, but also for the proper cleaning of the interdental surfaces. For this purpose, the interdental cleaning devices should be selected and recommended in accordance with the dimension of the interdental spaces, the presence and the degree of the furcation involvements, the presence and the type of the orthodontic appliances and prosthetic restorations.

Dental floss

According to American Dental Association, 80% of the plaque can be removed by dental floss usage [16]. However, it was reported that only a small portion of the population, generally the individuals with higher socioeconomic levels, uses dental floss on a daily basis [17]. In addition, the type of the dental floss was not proved to be superior to another [18,19]. The selection criteria of the appropriate dental floss type should include the contact tightness of the teeth, the roughness of the surface, and the manual dexterity of the patient.

The main point of the usage of dental floss is not only to position the floss to "the space between the teeth", but also to obtain the maximum contact in the interproximal surface area to remove the dental plaque as much as possible. It was also recommended that the dental floss should penetrate to the subgingival area with a caution to prevent the soft tissue destruction and hazard. To enhance the dental floss application the floss holders might also be used. However, it is time consuming and the floss should be replaced with a new clean floss part. Some floss holders have their own dental floss and they are disposable. Although the usage of floss holders was not reported to be unsuccessful or superior to the manual floss usage, their usage might be recommended to the "new beginners" and subjects presenting low dexterity with manual flossing [19,20]. The automatic dental flosses might be recommended to the subjects having trouble in removing plaque in posterior regions. The studies have revealed the success of the automatic dental flosses in removing interproximal dental plaque in anterior, premolar, and molar teeth [21], and suggested that their usage might be preferred to the manual dental flosses [22].

Dental floss is generally used after tooth brushing. However, it is also recommended before tooth brushing for individual subjects who will benefit the fluoride in dentifrices after removing the interdental plaque to prevent interdental caries. Besides, most of the subjects feel fresh after tooth brushing and think that they do not need flossing additionally, and might delay flossing. Torkezaban et al. [23], have also suggested that above mentioned sequence (brushing after flossing) is more effective than the other (flossing after brushing) with respect to plaque control.

Dental floss can remove dental plaque from flat and convex interdental surfaces with a mild pressure. To remove the higher amount of plaque repeated applications on the same surfaces might be needed. When the interproximal surfaces are concave, dental floss could not remove the plaque and additional interdental cleaning tools might be recommended.

The misused interdental tools lead to inefficiency regarding

plaque removal in addition to the gingival injuries and recessions. The interproximal abrasions in cemento-enamel junction are generally located to the posterior lingual and interproximal surfaces and are related to the long-term misuse (like a saw) of the dental floss [24,25]. The patients should be informed and warned against this hard tissue injury.

A meta-review has suggested that the routine recommendation of dental floss adjunctive to toothbrushing should be based on individual needs regarding plaque removal [26]. Similarly, Hujuel et al. [27], have reported that dental floss is effective only in reducing the risk for interdental caries. Matthews [28] has also suggested that the flossing reduces the risk for gingivitis, however the plaque removal efficiency was found not reliable. Sambunjak et al. [29], have found in their Cochrane review that flossing adjunctive to toothbrushing reveal a weak and very unreliable evidence of a possible small reduction in plaque. Nonetheless, dental flossing recommendation may play a role in situations where attachment loss is not evident at healthy sites preventing from the trauma related to the usage of interdental brushes [10]. It should be also kept in mind that not all interdental cleaning devices, in this case the dental floss, suit all patients, all types of dentitions and even not every inter-dental space.

Interdental brushes

Most of the patients remove plaque from open interdental sites with the usage of interdental brushes. It was also reported that patients could better clean the interdental spaces with interdental brushes when compared to the dental floss, even before thorough root surface debridement [30,31]. These studies have shown that the interdental cleaning with interdental brushes as adjunctive to tooth brushing is more effective than tooth brushing alone and dental flossing as adjunctive to tooth brushing [30,31]. Jackson et al. [32], have compared two different dental floss and interdental brush regarding plaque removal; they have revealed significant reduction in plaque scores in all of the groups, and no differences between floss and interdental brushes. However, they have reported that the patients prefer to use interdental brushes. Using interdental brushes was found to be easier and less time-consuming by the patients [33].

Interdental brushes have nylon filaments fitted onto a stainless-steel wire with different shapes and sizes to fit the interdental space. However, it was reported that the interdental brushes with metal core usage might cause dentin hypersensitivity and iatrogenic tooth damage [34]. Rubber interdental bristles were reported similarly efficient, when compared to the metal core interdental brushes. In addition, rubber interdental bristles were significantly more comfortable for participants than metal core brushes [35]. Besides, the stiffness of the interdental brushes (soft and hard ones were compared) was not found to be statistically different regarding plaque removal [33]. Ishak et al. [36], have investigated the subgingival plaque reduction efficiency between interdental brushes and dental floss; they have reported similar efficiency in reducing subgingival plaque.

The efficiency of different shapes of interdental brushes was also investigated. Chongcharoen et al. [37], have compared the straight (cylindrical-shaped) and waist-shaped interdental brushes, and have reported that waist-shaped interdental

brushes have higher cleansing effect on the buccal and lingual line angles than the straight interdental brushes. Rösing et al. [30], have compared cylindrical-shaped interdental brushes with conical-shaped interdental brushes. They have reported similar plaque reducing effect of both interdental brushes and it was found higher than the dental floss. Larsen et al. [38], have reported that the cylindrically shaped interdental brushes were similarly effective in reducing plaque except the lingual approximal sites where the cylindrical interdental brushes were suggested to be the first choice in patients receiving the supportive periodontal care.

The usage of interdental brushes was suggested to be not only related to the better plaque removal but also related to the gingival depression [33].

Single tufted brushes

Although the aim of the usage of single-tufted toothbrushes is to remove dental plaque from hard-to reach sites (buccal, oral and distal sites of the molars), they can be used also in the marginal/interproximal sites of the posterior molars. Lee et al. [39], have reported that the usage of single-tufted toothbrushes might be an effective tool for the removal of plaque at some, but not all, sites of the posterior molars, and one should keep in mind that the gingival abrasions might be a problem for their prolonged use.

Wooden or plastic tips/interdental stimulators

Although their access to the interdental areas is easy from the buccal sides their efficiency is limited to the anterior teeth and to the interdental areas of the premolars. This limitation was eliminated with the handled types. The wooden tips' shapes are generally triangular and the plastic tips are generally conical. Plastic tips might be handled or located on the toothbrush handle. The wooden tips are easy to access, carry and use; and might be used in the interdental cleaning, furcation involvements and almost in all teeth surfaces along the gingival margins. However, the wooden tips should not be confused with the tooth picks. Tooth picks are round shaped and designed to remove the food debris from the interdental area. The long term usage of wooden or plastic tips was reported to result in the depression of interdental papilla, leading to the consideration that the tips should be used in the wide interdental spaces [40].

Oral irrigators

Oral irrigators were introduced to the market in 1962 and demonstrated to be safe and efficient for plaque removal. Daily oral irrigation was reported to result in decreased dental plaque and calculus accumulation, gingivitis, bleeding, probing pocket depth, number of periodontal pathogens and levels of host inflammatory mediators [41-45]. Their usage was recommended as an additional tool to dental brushing and flossing rather than monotherapy. Besides, oral irrigators were reported to be better in reduction of plaque and inflammation markers compared with dental flosses and tooth brushes when compared regarding the penetration to the periodontal pockets [41-43]. The usage of oral irrigators might be recommended as an adjunct to mechanical cleaning also in sites predisposing to the plaque accumulation such as pontics, orthodontic appliances, diastemas, and subjects with problematic manual dexterity. The solutions (water,

chlorhexidine, saline, etc.) delivered via oral irrigators were reported to penetrate deeper than the mouth rinses could reach [44,45]. The benefits of the oral irrigators might also depend on the removal of food debris, loosely adherent plaque in the sulcus/pocket, bacterial cells; thus its usage results in interference with plaque maturation [46]. In a systematic review, it was suggested that the use of oral irrigators does not influence plaque scores; however, the gingival health was positively affected with the additional usage of oral irrigators to the regular tooth brushing regimen [47,48]. However, there is a lack of appropriate clinical investigations and/or meta-analysis (reviews) suggesting superiority in interdental cleaning for oral irrigators [10].

CONCLUSIONS

Dentists should evaluate the patients in terms of their willingness to maintain their dentition, their manual dexterity, the features of the present dentition (the number of remaining teeth, the position of the teeth in dentition, the predisposing factors for plaque accumulation, etc.); and then recommend the appropriate interdental cleaning devices. Furthermore, they should motivate the patient to maintain the right cleaning methods for a life time with appropriate control sessions (recalls) which include repetitive reinforcement.

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