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Review Article

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Changing Trends in Oral Hygeine and Plaque Control in Children

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Abstract

Dental caries and periodontal disease are the two main diseases initiated in childhood and their prevention should be carried out early before the insidious onset of the disease. Dental plaque is the most important etiologic factor for these diseases. Therefore dental plaque control using various methods and agents helps in controlling initiation of gingival and periodontal diseases. A combination of oral hygiene instructions and mechanical and chemical professional tooth cleaning at proper intervals can almost completely prevent the development of both dental caries and periodontal diseases. This review presents an outline of mechanical and chemical methods of plaque control with certain modifications for young children and adolescents including handicapped children for effective control of dental plaque.

Keywords: Biological plaque control; Chemical plaque control; Disabled children; Mechanical plaque control

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Introduction

The emergence of new philosophy and dentistry based on prevention rather than replacement has been one of the most significant developments in the history of dentistry. Despite of such substantial improvements in health, dental disease still remains a chronic health problem. Two main dental diseases namely dental caries and periodontal disease begin in childhood and have long sequelae. Primary preventive dentistry must begin early in life before the insidious onset of these diseases. Dental plaque, which is a specific but highly variable structural entity resulting from colonization and growth of microorganism consisting of various species and strains embedded on an extracellular matrix, is the main etiological factor for development of periodontal diseases[1]. Dental plaque is broadly classified as supragingival or subgingival based on its position on the tooth surfaces[2]. Inhibition of biofilm formation and its mechanical removal continue to be the leading procedures for prevention and treatment of dental caries and periodontal diseases. As such, personal daily oral hygiene by brushing and using other hygiene aids in conjunction with professional plaque control is crucial for oral health[3]. It is a more accessible, effective and economical method to achieve plaque control. This review focuses on recent advances in various oral hygiene aids including improved toothbrush designs, chemical and biological methods, which would help to achieve better plaque control in children, also taking into consideration children with disabilities.

Mechanical Plaque Control

Tooth Brush

Tooth brush which was first introduced by William Addis in 1780 is the most commonly used aids for maintaining oral hygiene and is by far the most widely accepted and adopted tooth cleaning tool. The role of toothbrushes in preventing the initiation and progression of periodontal diseases has been well documented[3]. During the 1900s, celluloid handles gradually replaced bone handles in tooth brushes[4]. Natural animal bristles were also replaced by synthetic fibres usually nylon, by DuPont in 1938. As of the turn of the Twenty-First Century, nylon had come to be widely used for the bristles, and the handles were usually moulded from thermoplastic materials[5]. Variety of toothbrushes with sophisticated handle and bristle designs are available[6]. Bristles are considered to be the most important consideration in selecting a good toothbrush. There is a constant development of new

brush designs which would help select an appropriate design for individual needs including children and adolescents. Variety of bristle patterns have been introduced which include flat trim, multilevel, wavy design, zigzag design etc[7-9]. ADA has given certain specifications for an effective toothbrush (Table 1)[10].

Table1: ADA specifications for brushing surface

Length	1 to 1.25 inches
Width	5/16 to 3/8 inches
Surface area	2.54 to 3.2 sq.cm
No. of rows	2 to 4 rows of bristles
No. of tufts	5 to 12 per row
No. of bristles	80 to 85 per tuft

Toothbrush with any kind of brush head cleans teeth effectively, but size of the toothbrush should be considered according to size of the oral cavity[9-11]. It varies in different age groups (Table 2)[11].

Table 2: Sizes of toothbrush head according to age

Age	Brush head diameter
0-2 years	15 mm
2-6 years	19mm
6-12 years	22 mm
Above 12 years	25 mm

Various techniques of tooth brushing have been reviewed by Greene (1966). However Smita, P. et al[12] suggested that modified Bass technique was the most effective brushing technique in children. Statistically significant reduction in plaque score was seen in modified Bass technique followed by horizontal scrub technique. Least efficacy was seen in Fones technique. The duration of brushing has also been investigated. GT Terezhalmy et.al.[13] found greater whole mouth and gingival margin plaque removal scores by brushing with ADA brush after 5 min as compared to 2 min of brushing.

Modifications In Toothbrush Design

Level of oral hygiene achieved by an individual is dependent on technique, motivation, dexterity and perseverance. Mentally disabled children are generally incapable of obtaining an adequate oral hygiene level by manual brushing because of their limited motor skills, their lack of knowledge about oral hygiene and effective brushing, and the reduced amount of time spent brushing their teeth[14-16]. Newer toothbrush designs to improve effective plaque removal are being studied. In addition, caregiver education programs on providing oral care to individuals with intellectual and developmental disabilities have also improved oral hygiene among these individuals. Nancy, A. et al[17] in their study concluded that caregiver education improves knowledge, skill, and compliance in oral hygiene. Since the behavioural practices of children with disabilities can't be modified, the greatest potential for improving oral hygiene will come from advancements of brush designs that will enhance plaque removal. Shory, et al.[18] found the Collis curved brush, with two short middle rows and curved outer rows. Williams and Schuman[19] had found that handicapped children were able to remove more lingual plaque with this curved brush.

Other newer toothbrushes include:

Powered Tooth Brushes: Commercial powered (electric) toothbrushes which are the devices plugged into a standard wall outlet and run on AC line voltage were first introduced in the early 1960s, under the name Broxodent[20]. Powered toothbrushes Powered toothbrushes operated in side to side, counter oscillation, circular motions may be useful in individuals lacking motor skills, Handicapped patients, Patients undergoing orthodontic treatment. Current powered toothbrushes have Back and forth, Circular and Elliptical motions[21]. Heanue, et al.[22] concluded in his study that toothbrushes with rotation oscillation action Superior plaque removal efficacy as compared to manual brushes. The Braun Oral-B Plaque remover, by Gillette Co. is among the leading products in the rotational oscillation category[21]. A new Oral-B kid's power toothbrush has been introduced, with Oscillatory round brush head that causes no soft tissue damage. it especially appeals to children as it plays music at 1 min time interval thereby monitoring brushing time. Silverman, et al.[23] found in his study that Braun Oral-B powered toothbrush was effective in removing plaque as compared to other toothbrushes.

Super Brush: It is a triple headed manual tooth brush in which three brush heads are combined together. It is designed such that when placed on the chewing surface, all the three surfaces of tooth are cleaned simultaneously. Dogan M chem, et al.[24] concluded in his study that triple headed super brush could be an effective and cheaper alternative for use in children including disabled individuals.

Ultrasonic Tooth Brush: Emident is the first ultrasonic toothbrush generating ultrasound with its patented ultrasonic microchip embedded inside brush head. Chip creates up to 96 million ultrasonic impulses per min transmitted via bristles, together with nano bubble toothpaste into gums and teeth[11]. It can be used effectively in individuals undergoing orthodontic treatment. Also, it is gentle enough to use immediately after oral surgery including implants, avoiding damage to teeth and gums and is painless on sensitive teeth and gums[20].

Chewable Tooth Brush: It is a miniature plastic moulded toothbrush which can be used when no water is available. They are small toothbrushes but should not be swallowed. They are available in different flavours such as mint, bubblegum. They are also available as small breakable plastic ball of toothpaste on the bristles as they can be used without water, they prove to be handy to travellers and small children[25].

Accessory Aids to Plaque Control

There is a wide variety of aids used to supplement conventional tooth brushing. It includes

Interdental Cleaning Aids:

Dental Floss: Dental floss is a popular means of interdental cleaning. It has been seen to effectively remove supragingival and subgingival dental plaque[26]. However, it requires a high level of manual dexterity for effective flossing[27]. Certain precautions like avoiding snapping the floss through contact area and gentle pressure while flossing may avoid trauma to the

gingival attachment.

Interproximal Brushes: These are Cone shaped brushes made of bristle mounted on handle and may be particularly suitable for cleaning large, irregular or concave tooth surface adjacent to wide interdental space. Current interdental brushes are available for the smallest to largest interdental space sizes[27].

End-Tufted Brushes: These are a type of toothbrush used specifically for cleaning along the gumline adjacent to the teeth. Bristles are shaped in a pointed arrow pattern to allow closer adaptation to gums Ideal for cleaning areas between the crowns, bridgework, crowded teeth and fixed orthodontic appliances[11].

Wooden Tips: These are soft triangular in shape which can be placed in interdental space in gingiva and slide with contacting the proximal tooth surface. These are made up of bass wood or balsa wood. In addition to removing soft deposits, they also help in reducing gingival inflammation and encourage keratinisation of gingival tissue[28].

Oral irrigation: It is a power driven or a non power driven device providing a targeted application of a pulsated or steady stream of water for removing debris. These are the additional oral hygiene aids developed in an attempt to augment the effect of tooth brushing on reducing interdental plaque[29]. This device has been demonstrated to be safe and provides a particular benefit for gingival health to the general public that does not clean interproximal spaces on a regular basis[30].

Dentrifrices: Toothpastes containing Sodium fluoride and Monofluorophosphate commercially available as Cheerio gel and Colgate (anti tooth decay toothpaste) are found to be effective in remineralization of carious lesions[31]. Brushing twice a day with an introduction of fluoride-containing toothpaste after the age of 3 years and cleaning between the teeth once daily with floss or another interdental cleaner has been recommended[32]. In the modern era, increased attention has been on using natural herbal ingredients in dentifrices due observed adverse effects of other chemical agents. Tatikonda, et al.[33] in his study concluded that Herbal dentifrices do not cause any adverse effects on the oral cavity and are effective in reduction of plaque and gingivitis, as that of fluoridated non-herbal dentifrice.

Chemical Plaque Control

Various chemical agents also work as adjuncts to mechanical plaque control for effective removal of dental plaque. There has been an increased interest in the use of these agents among disabled population as mechanical plaque control remains inadequate in this group.

Chlorhexidine: It is the most widely used bisbiguanide with its unique properties of substantivity, broad spectrum anti-microbial activity. Its antimicrobial activity is seen to be larger than other chemical agents[34]. It has been shown that 0.2% chlorhexidine mouth rinse prevents the development of gingivitis[35]. However, certain disadvantages like Brown staining of teeth and tongue, Formation of supragingival calculus, Taste alteration, oral desquamation in children, allergic reaction, mucosal erosion, Parotid swelling have been reported[36].

Listerine: It is a phenol related essential oil which has shown to have moderate plaque inhibitory effects and some antigingivitis effects. However it lacks profound plaque inhibitory effect due to absence of property of retention in oral cavity. Also some of the adverse effects include initial burning sensation and bitter taste[37].

Triclosan: It is a bisphenol and a nonionic germicide, available in dentrifrices and mouthrinses. It also has anti-inflammatory action. It has been shown to inhibit both cyclo-oxygenase and lipoxygenase and thus decrease synthesis of prostaglandin and leukotiene which are key mediators in inflammation[38]. It is combined with other agents like Zinc citrate, Methoxyethylene and maleic acid, Pyrophosphates to increase its potential anti-plaque property, retention time, and calculus reducing properties respectively[37].

Natural Products: Sanguinarine and propolis have also been incorporated currently in toothpastes and mouthrinses. Sanguinarine is Alkaloid extract from bloodroot plant-Sanguinaria Canadensis. It is an effective plaque inhibitory agent but is less effective than chlorhexidine[37]. Propolis is a naturally occurring bee product used by bees to seal opening on their hives. It has been suggested to be an effective agent in mouthrinses due to its antiseptic, anti-inflammatory, antimycotic and bacteriostatic properties[39].

Other Agents: Povidone iodine 1% mouthwash, salifluor, oxygenating agents like hydrogen peroxide, buffered sodium peroxyborate and peroxycarbonate is also incorporated in mouthrinses and are helpful in acute ulcerative gingivitis[40].

Metal Ions: Zinc, copper and tin, have been shown to possess plaque inhibitory activity. Additive or synergistic effect has been seen with the combination of zinc and other metal ions with other antiseptics like Hexetidine[41] Triclosan[42] and Sanguinarine[43].

Newer agents: Currently newer agents are being incorporated in mouth rinses especially for children. R.K .Srikant, et.al.[44] studied the use of cocoa bean husk extract which is a waste material generated in chocolate industry having anti glucosyltransferase activity, and incorporated it into mouth rinses and named it as chocolate mouth rinse. It is seen to be acceptable to children with a significant decrease in mutans streptococci counts and plaque scores.

Fluorides: In addition to their remineralizing action, secondary benefit of inhibiting microbial plaque accumulation has also been seen. Fluoride mouthrinses are available as 0.05% and 0.2% sodium fluoride rinse, 0.044% and 0.021% acidulated phosphate fluoriderinse, 0.04% Stannous fluoride rinses[45]. However; their use is recommended for children older than 6 years of age.

Chewing Gums: Xylitol, mannitol, sucralose, and aspartame also have a role in decreasing plaque accumulation. Chewing gums with antimicrobial agents like chlorhexidine or herbal extracts namely Eucalyptus and magnolia have also shown positive effect with respect to plaque and gingivitis scores[46].

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Biological Plaque Control

Despite its important role in controlling gingival and periodontal disease, mechanical plaque control is not properly practiced by most individuals. Also, emergence of antimicrobial resistance is currently posing a major global challenge, with an increasing number of strains, including commensal and pathogenic oral bacteria, becoming resistant to commonly used antimicrobial agents. Therefore a newer approach for control of plaque has been suggested. Naoyuki Sugano[47] in his review suggested Probiotics and Vaccines as two approaches for control of periodontal diseases.

Probiotics: It is an interesting new field of periodontology research that aims to achieve biological plaque control by eliminating pathogenic bacteria. Live micro-organisms which, when administered in aquate amounts, confer a health benefit on the host. Oral administration of lactobacillus species (LS1) has shown to prevent the colonization of periodontopathic bacteria like Actinomycetemcomitans, Porphyromonas gingivalis, Prevotella intermedia[48].

Vaccines: Various Virulence factors, one of which is cysteine proteinases (gingipains), have been reported to contribute to the pathogenicity of P. Gingivalis[49]. Hence, Inhibition of gingipain by vaccination might reduce the periodontitis caused by P. gingivalis infection. In a study, Passive administration of Egg yolk antibody against gingipains (IgY-GP) has shown significant reduction in amount of P.gingivilis[50]. Application of this newer biological approach in children can be further studied.

Plaque Control in Disabled Children

Mechanical and chemical plaque control techniques may pose a problem in individuals with severe disabilities due to physical, cognitive and behavioural limitations. Therefore, modifications in usual preventive practices are required. Various modifications in toothbrush design, dentrifrices and use of antimicrobial agents are available. These help in stable grip and manipulation of toothbrush in the oral cavity and adequate cleaning.

A Velcro strap with a pocket in which toothbrush can be inserted is provided on palm side of individuals unable to grasp and hold efficiently. Improvement in the toothbrush handle size, shape and surface characteristics are made to improve the grip for individuals with reduced manual dexterity. Simple methods include use of sponges, tubing, bicycle handlebar grips or pushing it into soft rubber ball[51]. Kaschke, et.al[52] suggested the use of triple headed brush for these individuals.

Use of dentifrices and mouth rinses in severely disabled individuals should also be considered. Foaming caused by toothpaste and copious salivation stimulated by tooth brushing can cause obstructed visualization of areas to be cleaned, severe gagging and ingestion of excessive amounts of toothpaste. Use of non-foaming toothpaste commercially available as NASADENT, considered safe for ingestion and having pleasant taste has been suggested. The usual method of rinsing and expectorating is also difficult in individuals with severe disabilities, for whom alternative methods such as sprays or application by swab have been suggested[51].

Conclusion

Mechanical plaque control with the use various newer accessory aids and agents can be effective method of plaque control in children. Biological plaque control showing significant results in inhibiting periodontal pathogens in plaque requires further investigation. Clinical judgment should be based on the scientific validity of the products selected and their relationship to patients specific needs.

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