Review Article

From Plaque to Perfect: Essentials of Oral Hygiene

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ABSTRACT

Dental plaque, or "oral biofilm," is a resilient layer that adheres to tooth surfaces, resistant to rinsing. Composed of salivary glycoproteins and microbial products, it includes both organic elements (polysaccharides, proteins, lipids) and inorganic components (calcium, fluoride). Promoting oral health can significantly reduce oral diseases while improving quality of life, especially in India, where common issues include periodontal disease, dental caries, and oral cancer. Dental caries affect 60% to 80% of children, driven by factors like genetics, poor hygiene, and trauma. Preventive measures are crucial for managing oral health issues. Recommended practices include brushing twice daily with fluoride toothpaste, replacing toothbrushes regularly, daily flossing, using interdental cleaners, and tongue scraping. Regular dental visits are essential for check-ups, diagnostic X-rays, and preventive care, all vital for maintaining optimal oral hygiene and overall health.

Keywords: Toothbrushing; oral hygiene; dentifrice; dental devices home care; health

1. INTRODUCTION:

The notion of "health" broadly encompasses an individual's total well-being, as defined by the World Health Organization: "health is the state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" [1].

1.1 Overview of Oral Health and its Systemic Impact:

According to the WHO Global Oral Health Status Report (2022), oral diseases affect approximately 3.5 billion individuals worldwide, with nearly 75% of cases occurring in middle-income countries. Globally, an estimated 2 billion people have caries in their permanent teeth, while 514 million children are affected by caries in their primary teeth [2].

Optimal oral health is crucial for both the aesthetic and functional aspects of dentition, enabling effective engagement in social and daily activities. In contrast, poor oral health can result in alterations to oro-facial structure and function, such as difficulties with speech or chewing, which may adversely affect social well-being and overall quality of life, including heightened self-consciousness due to compromised dental appearance.

Oral health also has significant ramifications for systemic health. Poor oral hygiene is linked with an elevated risk of various systemic conditions, including infective endocarditis, digestive issues in the elderly, cardiovascular diseases, stroke, bacterial pneumonia, and preterm birth. Research has established a direct connection between oral infections, such as periodontitis, and cardiovascular diseases [3, 4]. Oral bacteria can also contribute to systemic complications in conditions like rheumatic fever and organ transplants [4]. Potential mechanisms include direct microbial effects on atherosclerosis, inflammatory responses triggered by the host, or genetic predispositions. Moreover, maternal oral health influences birth outcomes and infant oral health, with periodontal disease during pregnancy associated with preterm birth, preeclampsia, and low birth weight [5]. Maternal

oral flora can also affect the development of dental caries in infants [6].

The oral cavity often reflects broader health conditions, with systemic diseases such as osteoporosis, diabetes, HIV, and endocrine disorders sometimes manifesting through oral symptoms. Poor oral health can significantly impact daily life and quality of life. Oral pain in children can result in sleep disturbances, poor growth, behavioral issues, and learning difficulties. In older adults, common problems include caries, periodontal disease, tooth loss, edentulism, xerostomia, and denture-related issues, all of which can affect eating and overall health-related quality of life. Conditions such as oral clefts, missing teeth, severe malocclusion, and significant caries can lead to embarrassment, social withdrawal, and anxiety, while oral and facial pain from dentures, temporomandibular joint disorders, and infections can affect social interactions and daily activities.

1.2 Significance of Oral Hygiene in Disease Prevention:

Dental plaque, often called "oral biofilm," is a robust, smooth layer that adheres to tooth surfaces and is not easily dislodged by rinsing alone [7]. This complex structure consists of salivary glycoproteins and extracellular microbial products, forming a biofilm on hard, non-shedding surfaces in the mouth. Its composition includes both organic components (such as polysaccharides, proteins, salivary glycoproteins, and lipids) and inorganic substances (including calcium, sodium, phosphorus, potassium, fluoride, and gingival crevicular fluid) [7]. Dental plaque is mainly classified into two types: supragingival and subgingival plaque.

Effective promotion of oral health can significantly reduce the prevalence of oral diseases while maintaining dental health and quality of life cost-effectively. Globally, and especially in India, prevalent dental issues include periodontal diseases, dental caries, malocclusion, and oral cancer. Dental caries is a major public health concern in India, affecting 60% to 80% of children, and oral cancer remains a critical issue [8]. Contributing factors include genetic predisposition, developmental anomalies, poor oral hygiene, and trauma.

Preventive measures are crucial for avoiding common oral health problems such as periodontal disease and dental caries. To achieve optimal oral hygiene and effectively manage plaque, several essential preventive measures are recommended. These include both at-home oral care practices and professional dental care [9].

To maintain optimal oral health recommended home care practices includes:

1. Brush twice daily with a soft-bristled conventional or electric toothbrush for two minutes.
2. Use fluoride toothpaste.
3. Replace your toothbrush every three to four months or sooner if bristles are frayed.
4. Floss daily between teeth.
5. Use an interdental cleaner as recommended by your dentist.
6. Use of Tongue scrapper

Regular dental visits are crucial for sustaining oral health. These appointments generally include routine check-ups to identify potential issues, diagnostic X-rays to uncover hidden problems, and consultations to discuss treatment options and preventive care, all of which are essential professional care for maintaining optimal oral hygiene and overall dental health.

2. Toothbrush types, brushing techniques and their effectiveness:

Among the different mechanical aids for plaque removal, tooth brushing is the most fundamental and widely recommended method. Various brushing techniques have been developed, each designed to meet the unique dental and periodontal requirements of individual patients.

Types of toothbrushes include manual toothbrushes, powered toothbrushes, super brushes, single-tuft toothbrushes, interdental brushes, sulca toothbrushes, ecological toothbrushes, and chewable toothbrushes. Additionally, modern options feature sonic toothbrushes, ionic toothbrushes, and disposable toothbrushes.

2.1 Common types of Toothbrush [10]:

- **Electric Toothbrushes**: Often recommended for their advanced features,

such as superior plaque removal, pressure sensors, and built-in timers. Brands like Sonicare and Oral-B offer innovative designs that enhance brushing with features such as oscillation and multiple brush heads. Some models cater to specific needs, such as gum massage or sensitive teeth.

- **Manual Toothbrushes [11]**: Cost-effective and available in various designs for different needs, including options for children, teeth whitening, periodontal care, or individuals with dexterity issues [12]. They should be replaced every 3-4 months or sooner if the bristles become worn.

The ideal toothbrush design is characterized by user-friendliness, effective plaque removal, and the absence of harmful effects on both soft and hard tissues. Conventional manual toothbrushes typically consist of a head, bristles, and a handle. The ADA specifications for acceptable toothbrushes are brushing surface length of 1-1.25 inches and width of 5/16-3/8 inches; surface area of 2.54-3.2 cm^2; 2-4 rows of bristles; 5-12 tufts per row; and 80-85 bristles per tuft [13].

2.2 Factors to Consider in a Toothbrush:

1. **Bristles**: The stiffness of toothbrush bristles is important. Hard and medium bristles can cause gum recession and enamel erosion, while soft, rippled, or angled bristles are more effective at plaque removal without damaging teeth or gums.
2. **Handle**: An ergonomic or non-slip handle can significantly affect brushing technique. Choose a brush that allows easy access to all areas of the mouth.
3. **Toothbrush Head**: Toothbrush heads vary in size. Smaller heads are better for reaching tight spaces, while standard-sized heads are effective for cleaning all teeth and gums thoroughly.
4. **ADA Seal**: Selecting a toothbrush with the ADA Seal of acceptance ensures that the product has undergone rigorous testing for safety and effectiveness in plaque removal.

Toothbrush heads consist of tufts, which are individual bundles of filaments secured in holes within the head. These filaments are known as bristles, and they are essential because they come into direct contact with teeth and gum tissue. Bristles can differ in several features, including texture, the number and length of filaments in each tuft, the total number of tufts, their arrangement, and the brushing plane, which may be flat with uniform filament lengths, bilevel, multilevel, rippled, or crisscrossed, with tufts angled in at least two different directions. According to ADA specifications, toothbrushes should have 2-4 rows of bristles, 5-12 tufts per row, and 80-86 bristles per tuft. The diameters of commonly used bristles are as follows: soft = 0.007 inch (0.2 mm), medium = 0.012 inch (0.3 mm), and hard = 0.014 inch (0.4 mm).

2.3 Recommended brushing techniques [14, 15]:

1. For preschool children: Fones technique
2. For gingivitis patients: Modified Bass Technique
3. For periodontitis/recession patients: Modified Stillman Technique
4. For bridge wearers/fixed prostheses: Modified Charters Technique
5. For fixed orthodontic appliance patients: Horizontal scrub, interdental brush, and Waterpik
6. For hypersensitive dentin: Rolling method
7. For removable partial dentures and full dentures: Rolling method with denture cleaning brush and denture cleaning tablets

3. Toothpastes and its composition:

The global prevalence of major oral diseases continues to rise, driven by increasing urbanization and evolving living conditions. This trend is largely attributed to insufficient fluoride exposure from water supplies and oral hygiene products (e.g., toothpaste), the widespread availability and affordability of sugar-rich foods, and limited access to community-based oral healthcare services [2].

3.1 Dentrifices are substances used for cleaning teeth and maintaining oral hygiene. Commonly known as toothpaste, they help remove dental plaque, prevent cavities, and freshen breath.

3.1.1 Composition of Dentrifices:

1. **Abrasives**: Help remove plaque and stains. Common abrasives include calcium carbonate, silica, and hydrated aluminum oxide.

2. **Fluoride**: Strengthens tooth enamel and helps prevent decay. Sodium fluoride and stannous fluoride are commonly used.
3. **Humectants**: Prevent moisture loss and keep the dentifrice from drying out. Glycerin and sorbitol are typical humectants.
4. **Thickeners**: Give toothpaste its texture. Common thickeners include xanthan gum and carbomer.
5. **Detergents**: Create foam and help spread the toothpaste. Sodium lauryl sulfate is a common detergent.
6. **Flavoring Agents**: Provide taste and freshness. Peppermint, spearmint, and other flavorings are often used.
7. **Preservatives**: Extend shelf life by preventing microbial growth. Common preservatives include sodium benzoate and methylparaben.

3.2 Types of Toothpaste available:

- **Fluoride Toothpaste**: Recommended for its ability to strengthen enamel and prevent decay [16, 17].
    - **Pros**: Prevents cavities, available in various flavors, endorsed by dental professionals.
    - **Cons**: May not suit individuals with fluoride sensitivity, excessive use can lead to fluorosis.
- **Tartar Control Toothpaste**: Formulated to prevent tartar buildup.
    - **Pros**: Prevents tartar and gum disease, available in various flavors.
    - **Cons**: May be less effective for severe tartar buildup, overuse can lead to enamel erosion.
- **Whitening Toothpaste**: Removes surface stains and brightens teeth.
    - **Pros**: Enhances tooth brightness, generally safe and non-invasive.
    - **Cons**: May not address severe discoloration, overuse can cause enamel erosion.
- **Desensitizing Toothpaste**: Reduces tooth sensitivity.
    - **Pros**: Alleviates sensitivity, available in various flavors.
    - **Cons**: May not be effective for severe sensitivity, overuse can lead to enamel erosion.
- **Natural Toothpaste**: Made with natural ingredients.
    - **Pros**: Less irritating for some users, environmentally friendly.
    - **Cons**: May not prevent decay as effectively, often lacks fluoride.
- **Toothpaste for bleeding gums:**

3.3 Guidelines for Fluoride Recommendation in Toothpaste by WHO:

Recommendations from the World Health Organization are that toothpaste should contain at least 1000 ppm and no more than 1500 ppm of fluoride; special formulations for children are not advised due to a lack of evidence for caries prevention with less than 1000 ppm [18]. For children under 3, start brushing as soon as teeth emerge with a smear of regular (adult) fluoride toothpaste, ensuring supervision for proper spitting and no rinsing. For children aged 3 to 6, use a pea-sized amount of regular toothpaste with the same supervision guidelines. Children over 6 and adults should also brush twice daily with a pea-sized amount of fluoride toothpaste, without rinsing afterward.

4. Mouthwash:

Mouthwash, also known as mouth rinse or oral rinse, is a liquid solution designed for use in the mouth to help prevent and treat oral conditions, maintain oral hygiene, and freshen breath [19].

4.1 Composition of Mouthwash:

1. Active Ingredients:
    - Antimicrobial Agents: Such as chlorhexidine, cetylpyridinium chloride, or essential oils, to reduce bacteria and plaque.
    - Fluoride: Helps strengthen tooth enamel and prevent cavities.
2. Astringents: Ingredients like zinc compounds to reduce oral odour and tighten tissues.
3. Flavouring Agents: Provide a pleasant taste and freshen breath; common flavours include mint, cinnamon, and fruit extracts.

4. Sweeteners: Such as sorbitol or xylitol, to enhance taste without contributing to tooth decay.
5. Preservatives: Prevent microbial growth and extend shelf life; examples include sodium benzoate.
6. Thickeners: Improve the texture of the mouthwash; common thickeners include xanthan gum or carbomer.
7. Water: Acts as the primary solvent for all other ingredients.

According to the findings of existing systematic reviews, mouthwashes can help reduce supragingival plaque and gingival inflammation (gingivitis) when used in conjunction with self-care and professional oral hygiene practices [20].

5. Different Interdental Cleaning Aids and Their Effectiveness:

5.1 Dental Floss:

Dental floss is a thin cord utilized for cleaning between teeth by gently inserting it beneath the contact points and employing a back-and-forth or up-and-down motion to remove plaque. It is particularly effective in tight spaces and between closely packed teeth. However, due to the necessity of proper technique, patient adherence and acceptance are often suboptimal. Incorrect use of floss can also pose a risk of trauma to the gingiva. Given that dental plaque is pathogenic and flossing disrupts and removes some interproximal plaque, it is hypothesized that flossing may contribute to a reduction in gingival inflammation [21-23].

Dental floss is widely acknowledged for its efficacy in plaque removal, especially in accessing subgingival plaque located 2-3.5 mm below the tip of the papilla [24]. Flossing has been shown to diminish gingival inflammation and plaque levels. Nonetheless, a systematic review by Berchier *et al.*, (2008) found no conclusive scientific evidence supporting the efficacy of flossing [25]. Furthermore, flossing is less effective for cleaning large interdental spaces, root surfaces, or concavities [26]. As individuals age, reduced dexterity and visual acuity can further complicate the use of floss, rendering it less effective in periodontally compromised dentitions.

Although substantial evidence suggests that flossing is not particularly effective for plaque removal, it may still provide some benefits [27, 28]. Flossing is generally safe and carries minimal health risks, apart from occasional short-term soft-tissue trauma. While professional flossing has been effective in reducing interproximal caries risk, this benefit decreases when performed by patients themselves [29]. For those with limited dexterity or compliance, floss holders can be a practical alternative. Research indicates that floss holders are similarly effective as traditional handheld floss in reducing interproximal plaque and gingivitis, making them especially useful for individuals who have difficulty with manual flossing [30]. Additionally, floss holders significantly increase the likelihood of developing a long-term flossing habit, as users are more likely to floss regularly compared to those using handheld floss. Plaque and gingivitis reductions can only be anticipated if patients are able to achieve consistent, high-quality flossing, which may be an unrealistic expectation for some [31].

5.2 Techniques for Flossing:

Floss Loop Method:

1. Cut a piece of dental floss approximately 20-25 cm long.
2. Tie the ends of the floss together with three overlapping knots in the same location.
3. Pull the floss taut to secure the knots, ensuring that the loop remains tight during use.
4. Use both hands to hold the floss loop taut, managing a 2 cm segment of floss with your thumbs and forefingers.

Finger Wrap Method:

1. Cut a piece of dental floss approximately 30-45 cm long.
2. Wrap each end of the floss around the middle fingers of both hands, leaving about 6 cm of floss between them.
3. Hold the floss with the thumbs and forefingers of both hands, maintaining about 2 cm of floss between them.

Flossing Sequence

Flossing should be performed systematically. Begin by flossing all adjacent tooth surfaces of the upper jaw, starting from the posterior teeth

and working forward. Repeat the process for the lower teeth to ensure complete removal of dental plaque from all adjacent tooth surfaces.

5.3 Types of Floss:

- **Waxed Floss**
- **Unwaxed Floss**
- **Superfloss**

Interdental brushes (IDBs), introduced in the 1960s, consist of a handle, a steel wire, and multiple bristles [32]. While the metal wire can be uncomfortable for patients with root sensitivity, a plastic coating is applied to alleviate this issue [31].

IDBs are highly effective at cleaning interproximal areas, reaching spaces inaccessible to a standard toothbrush. They are often preferred over flossing and are available in sizes ranging from 1.9 to 14 mm in diameter [33]. IDBs can also be used to apply antibacterial or desensitizing agents to sensitive root surfaces [28].

Usage Instructions:

1. Select the appropriate size interdental brush.
2. Hold the brush firmly between your thumb and index finger.
3. Insert the brush gently between the teeth and brush in and out a few times.
4. Rinse the brush under tap water after use and replace the cover.

6. Tongue Cleaner:

Tongue coating is identified by a white appearance on the tongue, resulting from the buildup of residue, white blood cells, microorganisms (including fungi and bacteria), and food particles trapped between the filiform papillae. The protein breakdown by these microorganisms in the mouth leads to the production of volatile sulfur compounds, which are responsible for bad odors [34]. Mechanical tongue cleaning is a crucial oral hygiene practice, as bacteria in tongue coating are a significant source of volatile sulfur compounds (VSCs), a key contributor to bad breath [35]. Enhancing oral hygiene through tongue cleaning-by using a toothbrush or tongue scraper to remove food debris, cells, and bacteria from the back of the tongue-can help reduce oral bacteria [36].

A tongue scraper is a small tool made of metal or plastic designed to remove bacteria, food particles, and dead cells from the tongue's surface. This practice helps freshen breath and reduces the risk of cavities and gum disease.

Tongue scrapers come in various shapes and sizes and are widely available. They are intended to complement, not replace, regular brushing and flossing. Using a tongue scraper is a quick method to clear additional unwanted particles from the tongue's surface. A systematic review on effective methods for managing tongue coating found that tongue scrapers are more effective at reducing bad breath compared to toothbrushes [37].

6.1 Benefits of Using a Tongue Scraper:

1. **Reduces Bacteria:** Tongue scraping removes up to 79% more bacteria compared to brushing alone, targeting harmful bacteria like Mutans streptococci and Lactobacilli.
2. **Enhances Taste Perception:** Tongue scraping twice daily can improve taste perception, allowing better detection of flavors.
3. **Eliminates Excess Debris:** Removes the white-coated appearance from the tongue, indicating excess debris buildup.
4. **Improves Digestion:** Activates enzymes in saliva, aiding in more effective digestion.
5. **Reduces Bad Breath:** Helps combat bad breath by removing bacteria responsible for it.
6. **Boosts Overall Health:** Enhances the immune system by removing harmful bacteria, thereby helping prevent cavities, gum disease, and other oral health issues.

6.2 How to Use a Tongue Scraper:

1. Open your mouth in front of a mirror and extend your tongue.
2. Place the rounded end of the scraper at the back of your tongue. If sensitive to gag reflexes, start in the middle and gradually move further back.
3. Gently pull the scraper forward toward the tip of your tongue, avoiding pushing backward.
4. Wipe the scraper clean with a washcloth or tissue after each scrape.
5. Repeat the process until the entire tongue surface is covered. Usually, one or two scrapes per area are sufficient.

6. Wash the scraper with soap and warm water, dry it, and store it in a clean place.

The entire process typically takes less than two minutes, making it a quick addition to your daily routine. While generally safe, be mindful of the gag reflex and avoid pressing too hard to prevent damage to the tongue. Inspect the scraper before use to ensure it is smooth and free from rough edges.

7. Recommendations by WHO for oral public health:

Sufficient fluoride exposure is a critical factor in the prevention of dental caries. Regular tooth brushing with fluoride-containing toothpaste (1,000–1,500 ppm) twice daily is recommended to enhance oral health and reduce the risk of caries development [2].

Although certain obstacles exist in maintaining oral hygiene and implementing preventive measures at an early stage, key barriers include lack of awareness, socioeconomic status, and other related factors.

8. CONCLUSION:

Achieving optimal oral hygiene and transforming plaque management into a healthy mouth requires a consistent home care routine. This includes using the right toothbrush with proper technique, selecting an effective toothpaste, and incorporating mouthwash as an adjunct. Additionally, utilizing interdental brushes or floss, along with a tongue cleaner, on a regular basis significantly enhances oral health. By following these essential measures, individuals can effectively prevent dental issues and maintain a pristine oral environment.

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