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Dental Knowledge, Behaviors, and Patterns of Missing Teeth

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Abstract

General Background: Oral health knowledge and daily behaviors are essential determinants of tooth retention, yet limited awareness of preventive practices continues to contribute to avoidable tooth loss. **Specific Background:** In many communities, dental floss use, fluoride awareness, and dietary control remain inadequate despite regular toothbrushing habits. **Knowledge Gap:** Few studies have examined how these behavioral and knowledge-related factors correspond with the number and distribution of missing teeth among adults. **Aim:** This study assessed dental knowledge, oral hygiene behaviors, and dietary habits in relation to the number of missing teeth in adult patients. **Results:** Most participants had more than five missing teeth, predominantly in the lower posterior region. Very few used dental floss, many consumed sweets and sweetened drinks between meals, and awareness of fluoride was notably low. Participants often visited the dentist only when in pain and lacked proper instruction on flossing technique. **Novelty:** The study provides combined behavioral–knowledge profiling linked to quadrant-specific tooth loss within a middle-aged population. **Implications:** Findings underscore the need for strengthened preventive programs emphasizing dietary counseling, proper interdental cleaning, and improved fluoride awareness to reduce future tooth loss.

Highlights:

- Most missing teeth were located in the lower posterior region.
- Fluoride and flossing knowledge remained low despite frequent brushing.
- High intake of sweets and delayed dental visits contributed to tooth loss.

Keywords: Dental Knowledge; Oral Hygiene Behavior; Missing Teeth; Fluoride Awareness; Dietary Habits

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Introduction

Dental care plays a vital role in overall health and is essential for maintaining good oral hygiene. Dental care is the practice of preventing and treating diseases of the teeth, gingiva and other tissues of the mouth. Unlike other human tissue, such as skin, that continuously grows and self-rejuvenates, dental structures generally cannot repair themselves and require regular care to retain their health and vitality (1).

Neglecting oral hygiene can lead to, worsen, or contribute to diseases not only in the mouth but throughout the body. Increasing evidence shows that periodontal disease is associated with a higher risk of heart attacks, strokes, diabetes, ulcers, respiratory conditions, premature births, low birth-weight infants, and other serious systemic health issues (1).

On the other hand, Maintaining good oral health allows a person to eat, speak, and interact socially without pain or embarrassment. Practicing proper oral hygiene is linked to a lower risk of dental diseases, and individuals who visit the dentist regularly tend to have healthier mouths and retain more of their natural teeth. (2).

Achieving good oral health requires knowledge of how to prevent dental diseases, practicing healthy oral habits such as proper hygiene and safe dietary choices, and making use of dental services for prevention, early diagnosis, and treatment. Preventive measures include brushing teeth carefully twice daily, flossing regularly, limiting sugar consumption between meals, and visiting the dentist at least once a year (2).

Although the prevalence of edentulism has reportedly decreased in many developed nations, tooth loss remains a significant global public health concern, with numerous contributing factors. tooth extractions had large geographical and cultural differences among various regions in a country, and from one country to another (3).

This study was conducted to determine whether oral hygiene knowledge and practice had impact on the number of missing teeth.

Review of Literature

A. Tooth loss

In the modern era of preventive care, dentists choose more restorative methods overremoving teeth. This means that complete tooth loss is becoming less common. The American Dental Association found that in the past 50 years, complete tooth lossdecreased by over 75 percentin adults (4).

The prevalence of tooth loss was defined as the percentage of individuals with one or more missing teeth, and the extent was defined as the number of missing teeth per person. The two most common oral diseases; dental caries and periodontal disease are typically progress without noticeable symptoms in their early stages. If left untreated, they can lead to tooth loss, which in turn may result in functional difficulties, such as problems with chewing and aesthetic concerns, depending on the site of the missing teeth. Data from several countries have consistently shown that edentulism is more prevalent among lower socioeconomic groups and among women, and that women have tended to become edentulous at a younger age. These gender differences are not easy to explain; many think that they reflect dentist–patient relationships more than disease occurrence (5).

B. Causes of tooth loss

a) Dental caries :

Dental caries is multifactorial localized destruction of susceptible dental hard tissues by acidic by-products from bacterial fermentation of dietary carbohydrates. The signs of the carious demineralisation are seen on the hard dental tissues, but the disease process is initiated within the bacterial biofilm (dental plaque) that covers a tooth surface (6).

Currently, the widely accepted cause of dental caries is explained by a four-factor theory, which involves oral microorganisms, the oral environment, the host, and time. Frequent consumption of dietary carbohydrates promotes the growth of acid-producing and acid-resistant bacteria in the mouth. Dental caries results from a disruption in the balance of the dental biofilm that adheres to the enamel surface. (7).

Dental caries is a highly prevalent and severe condition affecting adult populations worldwide. It impacts more than half of individuals in industrialized nations, and because it is a cumulative disease, its occurrence rises with age. Research indicates that adults typically experience decay in 5 to 10 teeth, making dental caries the leading cause of tooth loss in this group. The resulting damage not only reduces the quality of life but also imposes substantial economic burdens on both individuals and society, establishing dental caries as a major public health issue. (8).

Dental caries initiated with Initial demineralization Followed by Enamel decay, Dentin decay, Pulp damage respectively and finally the abscess which is the last stage that will cause the tooth loss as tooth decay advances into the pulp, bacteria can invade and cause an infection. Increased inflammation in the tooth can lead to a pocket of pus forming at the bottom of your tooth, called an abscess. A tooth abscess requires prompt treatment, as the infection can spread into the bones of your jaw as well as other areas of your head and neck. In some cases, treatment may involve removing the affected tooth (9).

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b) Periodontal disease :

A chronic, destructive condition affecting a large portion of the adult population, is one of the major causes of tooth loss in adults. Periodontal disease is characterized by a chronic oral bacterial infection which results in inflammation of the gums, leading to the gradual destruction of periodontal tissues and alveolar bone supporting the teeth (10).

The accumulation of plaque bacteria can irritate the gums and potentially lead to gum disease. This irritation may cause redness, swelling, and bleeding during brushing or flossing—common symptoms of the early stage of gum disease known as gingivitis. If this is left untreated it can develop into the irreversible second stage, periodontitis and eventually tooth loss (10).

Periodontitis represents the advanced stage of gum disease. Unlike gingivitis, it is irreversible and can have significant, lasting effects on the appearance and health of your teeth and gums, potentially resulting in permanent tooth loss. Therefore, it is crucial to recognize the symptoms early and seek prompt medical or dental treatment to manage the condition.(Meyer, 2008). The risk of periodontal disease is tobacco smoking, diabetes mellitus, cardiovascular disease, drug induced disorders, obesity (11).

Fluctuations in a woman's hormonal levels have a notable impact on the oral cavity and are often reflected in the condition of the periodontal tissues. Receptors for androgens, estrogens, and progesterone are present in these tissues. Estrogen and progesterone play key roles in physiological changes during different life stages. Estrogens influence the development of stratified squamous epithelium and the production and maintenance of fibrous collagen, while progesterone directly affects the periodontium and may regulate the balance between bone resorption and formation. Overall, hormones act on multiple tissues and can significantly affect overall health. Phases such as puberty, menstruation, pregnancy, and menopause all have distinct effects on women's oral and periodontal health. Pregnancy gingivitis, which can range from mild redness to severe inflammation with pain and bleeding, affects 30%–100% of pregnant women in industrialized countries. Increased tooth mobility is also observed during pregnancy and may occur during the menstrual cycle or with hormonal contraceptive use, although some studies report no significant mobility changes related to the menstrual cycle. (12).

c) Orthodontic treatment :

One of the main challenges in orthodontics is completing treatment while minimizing adverse effects on the tooth roots and surrounding periodontium. Root resorption is viewed as an unwanted yet often unavoidable iatrogenic outcome of orthodontic therapy. Factors such as individual biological differences, genetic susceptibility, and mechanical influences are thought to contribute to apical root resorption. This condition may cause teeth to become loose and, in extreme cases, result in permanent tooth loss. The process is inflammatory in nature, involving ischemic necrosis of the periodontal ligament due to the application of orthodontic forces. Overall, apical root resorption appears to result not solely from orthodontic force but from the combined impact of biological variability and mechanical factors. (13).

d) Systemic diseases :

Several systemic diseases, including diabetes, hypophosphatasia, leukemia, and hyperthyroidism, can negatively impact the oral cavity, making teeth more prone to exfoliation. These conditions may increase the risk of dental caries by disrupting normal salivary gland function or by compromising the periodontal tissues that provide support to the teeth. (14).

There's a clear link between elevated blood sugar and oral health problems: the higher your blood sugar, the more sugars and starches are present, leading to increased acid that erodes your teeth and gums. (14).

Unfortunately, the connection between diabetes and tooth loss tends to be a vicious cycle. Poor overall health can lead to diabetes, which then contributes to gum problems and eventual tooth loss. In turn, losing teeth can lower self-esteem, alter eating habits, and further worsen general health (14).

e) Harmful behaviors :

Sometimes, tooth loss isn't just caused by diet, hygiene, or accidents—it can also stem from harmful habits and behaviors we develop over time. One common examples of One common behavior is teeth grinding, or bruxism, which typically occurs during sleep. Occasional grinding is generally harmless, but chronic grinding can wear teeth down, loosen them, and in severe cases, lead to total tooth loss. The challenge is that many people are unaware they grind their teeth frequently, as it often happens semi-consciously. (15).

f) Smoking :

One of the main challenges in orthodontics is completing treatment while minimizing adverse effects on the tooth roots and surrounding periodontium. Root resorption is viewed as an unwanted yet often unavoidable iatrogenic outcome of orthodontic therapy.

Factors such as individual biological differences, genetic susceptibility, and mechanical influences are thought to contribute to apical root resorption. This complication can lead to tooth mobility and, in extreme cases, permanent tooth loss. The process is inflammatory in nature, involving ischemic necrosis of the periodontal ligament due to the application of orthodontic forces. Overall, apical root resorption appears to result not solely from orthodontic force but from the combined

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impact of biological variability and mechanical factors. (16).

g) Teeth loss due to trauma or accidents :

Sadly, traumatic dental injuries and accidents are among the main causes of tooth loss worldwide. Whether from car or bike crashes, sports injuries, falls, fights, or collisions, accidental tooth loss is both widespread and relatively common. Most cases lead to chipped or partially damaged teeth, but severe accidents can result in complete tooth loss. (17).

C. Dental Knowledge And Practice:

Oral health is a highly personalized concept the awareness, of which highly relies on an individual's culture and socio-economic status. Maintaining good oral health requires a collaborative effort between the dentist and the patient. One of the key determinants of a population's dental health is the attitude of its people toward their teeth. Oral health is recognized as being just as vital as general health, and awareness of oral hygiene is considered a crucial factor influencing overall well-being. It has a significant impact on an individual's physical, psychological, and social health.

(18).

Toothbrushes.

Interdental oral hygiene aids.

Dentifrices.

a) Toothbrush :

Tooth brushing, the most common method for cleaning teeth and promoting gum health, is heavily influenced by both technique and duration, which are often difficult to control. Maintaining a toothbrush properly is crucial for oral hygiene, as A worn toothbrush is less effective at cleaning. The American Dental Association recommends replacing toothbrushes every three to four months, or sooner if the bristles become frayed (19).

Toothbrush design, brushing duration ,the brushing method, manipulative skill, and manual dexterity are the most cited determinants of the effectiveness of tooth brushing. Many types of brushing techniques have been recommended by various researchers over the past years (20).

D. PURPOSE OF TOOTH BRUSHING:

The tooth brush known as the most effective tool in the removing of plaque and food debris.

To remove food particles, debris, and stains from the teeth and the spaces between them.

To prevent plaque formation.

To disturb and remove plaque.

To stimulate and massage gingival tissue

To clean the tongue. (20).

E. MANUAL TOOTHBRUSH DESIGNS:

Manual toothbrushes vary in size, shape, texture, and design. A manual toothbrush is designed of a handle with a head fitted bristles. When the bristles are clustered, they create tufts. The head is generally separated into two sections: the toe, which is at the outer end, and the heel, which lies closest to the handle. The shank is the narrower section that connects the handle to the head. The handle is the area held by the hand during brushing. Toothbrushes come with different sizes—large, medium, and small—to better accommodate the diverse oral anatomies of individuals (21).

Toothbrushes usually vary in bristle hardness or texture, being categorized as hard, medium, soft, or extra soft. Extra soft and soft toothbrush bristles are preferred because hard bristles damage teeth by causing abrasion of the tooth surface. More recently, toothbrush heads have been altered to vary bristle lengths and placement in attempts to better reach inter proximal areas. Handles have also been ergonomically designed to accommodate multiple dexterity levels to work efficiently and safely without causing stress to hand muscles or damage to the gingiva (21).

F. The ideal toothbrush should meet the following criteria:

1. The toothbrush should match the user's specific needs regarding size, shape, and bristle type.

2. It must be comfortable to hold and easy to use effectively.

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3. It should be easy to clean, allow proper airflow for drying, and resist moisture retention.

4. It needs to be sturdy, cost-effective, and designed to ensure both efficiency and hygiene. (21).

G. Electric toothbrush :

Powered toothbrushes were introduced as an alternative to manual brushing, primarily to assist individuals with limited manual dexterity or other physical challenges. They come in various designs and modes of operation. Early versions, which used a simple back-and-forth motion, were not very effective at controlling plaque. However, the development of Modern powered toothbrushes, equipped with rotation-oscillation technology (ROA) and advanced features like timers, pressure sensors, and Bluetooth connectivity, have become increasingly popular. These brushes are now recommended not only for individuals with special needs but also for the general public. However, the question of whether electrical toothbrushes are superior to manual ones in terms of plaque removal and periodontal health improvement remains a subject of ongoing debate. (22).

INDICATIONS

For Orthodontic patients

1. People receiving ongoing periodontal maintenance therapy

2. Patients with dental restorations or implants

3. Individuals who are hospitalized

4. Those with reduced manual dexterity, such as children and persons with physical limitations (22)

Contraindications:

Tooth sensitivity: The vibrations from powered toothbrushes can aggravate existing tooth hypersensitivity.

Patients with pacemakers: The electrical signals from these devices might interfere with the normal operation of implanted cardiac pacemakers.(22).

H. CLASSIFICATION OF POWERED TOOTHBRUSH :

1) **Rotary:** The brush head rotates in a circular motion at 3,000 to 7,500 strokes per minute. If the head alternates its direction, it is called a rotation-oscillation brush.

2) **Sonic:** These brushes move side to side at much higher speeds—around 31,000 strokes per minute, roughly ten times faster than a rotary brush.

3) **Ultrasonic:** Rapid side-to-side vibrations generated by the brush help dislodge plaque.

4) **Ionic:** The brush head remains stationary, but a low electrical current in the bristles helps attract and remove plaque (23).

b) Interdental oral hygiene aids :

DENTAL FLOSS

dental floss is most effective in cleaning plaque and food remnant of Type I embrasures, in this case the interdental papilla completely fills the gap and the teeth are closely positioned. In contrast, for Type II and Type III embrasures, other interdental cleaning tools are often more efficient at removing plaque from the surfaces between teeth. When used properly, dental floss serves several important oral hygiene purposes. Since the shape and contour of interproximal contact areas—whether natural or restored—vary among individuals, different types of dental floss are available. These include thin unwaxed floss, thicker waxed tapes, and flosses with variable thickness to accommodate different needs. Unwaxed floss is frequently recommended because it is thin and slips easily through tight contact areas. Thin silk floss has the advantage of " squeaking " when the proximal surface is clean (24).

However unwaxed floss can fray or tear if used around heavy calculus deposits, defective and overhanging restorations, or rotated teeth, which may discourage continued use. In these situations, shred - resistant, lightly waxed, or waxed floss are recommended. Some varieties of unwaxed dental floss, particularly those made from polytetrafluoroethylene (PTFE), have a Teflon-like texture that allows them to slide easily between teeth and resist shredding during use , also known as Gore), are stronger, more resistant to shredding, and particularly suitable for tight contacts, rough proximal surfaces, and irregular restorations. Waxed dental tape differs from round floss in that it is broader and flatter, making it ideal for cleaning Class I and Class II embrasures and interproximal spaces without tight contacts. It can also be used with dentifrice to polish stains between teeth.

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Another option is variable-thickness floss, which alternates between sections of soft tufts and regular floss. The standard portion can pass easily through contact points, while the tufted sections clean larger interproximal areas more effectively, especially in Type II and III embrasures. This type of floss is also recommended for cleaning around implant abutments, Open tooth contacts, large embrasure spaces, or regions with gum recession and bone loss that expose the furcation areas of teeth.

Additionally, tufted floss with a thicker, stretchable mesh design allows for easier insertion and is effective in removing plaque biofilm from the distal surfaces of terminal molars or from spaces left by missing teeth (24).

I. Embrasure Classifications:

Type I: The interdental papilla entirely occupies the space between adjacent teeth.

Type II: The interdental papilla is partially receded, showing mild to moderate loss.

Type III: There is significant recession or total absence of the interdental papilla.

Objectives Accomplished with Effective Use of Dental Floss:

Removing plaque and debris that adheres to proximal surfaces of the teeth and restorations ,orthodontic appliances , undersurfaces of fixed prostheses and pontics , and implant abutments.

Helping to control bleeding even before initiation of scaling and root planning.

Controlling the formation of calculus.

Helping the clinician identify calculus deposits, overhanging restorations, or cavities located between the teeth (25).

Interdental brush (IDB)

At present, interdental brushing represents one of the main methods available for cleaning between teeth. Most studies have reported a significant improvement in plaque index scores when using interdental brushes (IDBs) compared to dental floss. Although evidence remains limited regarding whether IDBs reduce or increase plaque levels relative to flossing, research indicates that interdental brushes are more effective at removing plaque than toothbrushing alone or in combination with flossing (26).

Selecting the appropriate size of an interdental brush to match an individual’s oral morphology is largely empirical. Choosing a brush that is too small can reduce cleaning effectiveness, while an oversized brush may affect comfort, efficiency, and potentially cause gum injury. Accessibility of the areas to be cleaned is also a key factor in motivating individuals to maintain interdental hygiene. The shape and size of interproximal spaces vary greatly between individuals and even within the same mouth, depending on tooth and papilla morphology. These spaces can further change with age, periodontal condition, or dental treatment. Initially, interdental brushes were recommended mainly for wide gaps, but the availability of various diameters has expanded their use to include mixed and narrow interdental spaces. The guiding principle is to select a brush that fits comfortably into the space while allowing the bristles to contact the tooth surfaces and effectively disrupt biofilm. However, applying this concept in clinical practice remains challenging due to the absence of a standardized method for determining the most suitable interdental brush size (26).

Interdental brushes (IDBs) are commonly recommended by dental professionals for individuals who have adequate spacing between their teeth. These brushes are specifically designed to clean the areas between teeth and consist of soft nylon bristles wound around a thin stainless steel wire. They typically come in **conical or cylindrical** shapes, with most featuring a **circular cross-section**. However, more recently, **triangular cross-section IDBs** have been introduced to the market, following suggestions by **Axelsson and Dörfer et al.**

IDBs are manufactured in various sizes to suit different interdental spaces, with diameters ranging from **1.9 mm to 14 mm**. Research by **Waerhaug**, which examined extracted teeth from regular IDB users, revealed that the **supragingival proximal surfaces**—the central areas between the teeth and the embrasures—were **free of plaque**. Additionally, some **subgingival deposits** were also removed, reaching depths of approximately **2 to 2.5 mm** beneath the **gum line**.

(27).

c) Dentifrice :

Dentifrice known as a substance used combined with a toothbrush for the aim of cleaning the surfaces of the teeth. Dentifrices come with different types such as tooth powders, toothpastes, liquids and gels. They can be classified as either cosmetic, designed to clean and polish the teeth, or therapeutic dentifrices, therapeutic dentifrice is formulated to address specific oral health conditions. Its primary purpose is to help reduce disease processes in the mouth, such as lowering the risk of dental caries, minimizing gingivitis, preventing calculus buildup, or alleviating tooth sensitivity. (28).

Brushing teeth with a dentifrice is the most common method of maintaining oral hygiene across the world. Consequently,

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toothpaste serves as an excellent medium for incorporating chemical agents. Various compounds, particularly antimicrobial agents, are added to dentifrices to help directly inhibit the formation of dental plaque. (29).

Fluoride toothpastes are effective in reducing caries. A meta-analysis also concluded that fluoride is effective in preventing caries in adults of all ages . Brushing with a fluoride toothpaste should be recommended twice daily.Various forms of fluoride such as amine fluoride, stannous fluoride, sodium fluoride and sodium monofluoro- phosphate, have been used in toothpaste formulations (30).

Method

This study was carried out in the college of dentistry/Ibn Sina University for medical and pharmaceutical science, Baghdad/Iraq in the period between 3rd of January to the end of March 2021.

Samples were collected from patients receiving treatment in the prosthodontics, periodontics, and oral surgery departments. The total numbers of participants was 100 from males and females aged from 40-60 years old.

The number of teeth extracted due to dental carries and periodontal disease was calculated for each patient in upper and lower arch for both sides. Information related to name, age, gender, medical history and the level of education (primary school, secondary school, college or institute) was obtained from each participant.

A questionnaire in Arabic language was introduced to collect information about the dental knowledge and behavior. The questionnaire was containing 14 direct questions. Extracted or missing third molars was not calculated and complete edentulous individual was excluded from this study. The sample was divided in to 3 groups according to the number of teeth extracted. Inform consent was obtained from each participant before the administration of the questionnaire regarding the objectives of the study and was signed by the participants on the questionnaire sheet. The questionnaire contains six questions on oral health knowledge and eight questions on oral health practices, each question contains 2, 3 or 4 suggestions.

The questions on oral health knowledge is:

No	. Questions	Answers
1	What do you think the cause of tooth decay is?	A-lack of dental hygiene unhealthy food teeth are weak hereditary
2	What do you think the cause of gingivitis is?	lack of dental hygiene unhealthy food teeth are weak hereditary
3	Did you receive dental health instructions?	A- Yes B- No
4	Who was giving you the instructions? (if the previous answer was yes)	Parents Friends From media Dentist
5	Do you have information about dental floss?	A- Yes B- No
6	Do you have information about the benefits of fluoride for dental health?	A- Yes B- No

Table 1.
The questions on oral health practice:

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