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PREVENTION OF DENTAL CARIES AND GINGIVITIS AMONG YOUNG PEOPLE: BEHAVIORAL FACTORS, MODERN PREVENTIVE APPROACHES, AND THE EFFECTIVENESS OF DIGITAL EDUCATION

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Abstract: Dental caries and gingivitis are common oral diseases among young people, and their development is closely associated with factors such as dietary habits, oral hygiene practices, the use of fluoride-containing products, and regular attendance at preventive dental check-ups. This article analyzes the behavioral factors contributing to the development of dental caries and gingivitis among young people, modern preventive approaches aimed at reducing the risk of these diseases, and the potential effectiveness of digital educational tools in promoting preventive knowledge and establishing proper oral hygiene practices. Particular attention is given to the use of mobile applications, video-based educational materials, interactive platforms, and reminder systems in oral hygiene education. The advantages and limitations of integrating digital tools with conventional oral hygiene education are also discussed. The article aims to synthesize the scientific evidence supporting the development of effective, accessible, and sustainable preventive strategies to reduce the burden of dental diseases among young people.

Keywords: dental caries, gingivitis, young people, oral hygiene, behavioral factors, prevention, fluorides, digital education, mobile applications, oral health.

Introduction

Oral health is one of the key determinants of overall health and quality of life. Dental caries and gingivitis are among the most prevalent oral diseases worldwide, and their development is closely associated with oral hygiene practices, dietary habits, and individual behavioral factors. In young people, inadequate oral hygiene practices and high sugar consumption may increase the risk of developing these conditions.

The prevention of dental caries and gingivitis relies on proper toothbrushing techniques, the use of fluoride-containing products, a balanced diet, and regular dental check-ups. At the same time, modern digital technologies, including mobile applications, video-based educational materials, and interactive learning platforms, offer additional opportunities to improve young people's knowledge of oral hygiene and promote the adoption of healthy habits.

In this context, the aim of this article is to analyze, based on the scientific literature, the behavioral factors contributing to the development of dental caries and gingivitis among young people,

contemporary preventive approaches, and the effectiveness of digital educational tools in maintaining oral health.

Main Body

1. Pathophysiological Basis of Dental Caries and Gingivitis in Young People

Dental caries and gingivitis are common oral diseases in which the microbial biofilm formed on tooth surfaces plays a major role in their development. Dental caries is a dynamic process that damages the hard tissues of the teeth and develops through interactions between the biofilm and fermentable carbohydrates. Acids produced when oral microorganisms metabolize sugars cause the loss of minerals from tooth enamel, a process known as demineralization. When demineralization exceeds remineralization, an initial carious lesion may develop, potentially progressing to involve deeper layers of the tooth. Frequent sugar consumption, inadequate removal of dental plaque, and insufficient fluoride exposure are among the main factors that contribute to this process [1, 2].

Gingivitis is characterized by an inflammatory response of the gingival tissues surrounding the teeth to microorganisms present in dental plaque. The accumulation of biofilm along the gingival margin activates the local immune-inflammatory response. Consequently, gingival redness, swelling, tenderness, and bleeding during toothbrushing may occur. Gingivitis can be reduced through effective plaque control and appropriate oral hygiene measures [3]. Although identifying common risk factors is important for preventing both dental caries and gingivitis, the specific characteristics of each condition must also be considered. Limiting sugar consumption and using fluoride-containing products are essential for caries prevention, whereas the regular removal of biofilm from the gingival margin and interdental spaces is particularly important for preventing gingivitis.

2. Behavioral Factors Among Young People and Their Impact on Oral Health

Factors contributing to the development of dental caries and gingivitis among young people are not limited to biological characteristics. Daily habits, health literacy, motivation, the social environment, and access to dental services also influence preventive outcomes. The World Health Organization identifies high sugar consumption, tobacco use, and inadequate oral hygiene among the modifiable risk factors for oral diseases [1].

Dietary habits. Frequent consumption of sugar-containing beverages, confectionery, and sugary snacks increases the risk of dental caries. Both the total amount of sugar consumed and the frequency of its consumption are important. Frequent intake of sugary products throughout the day may repeatedly expose tooth surfaces to acids. The World Health Organization recommends limiting free sugar intake to less than 10% of total energy intake and, where possible, reducing it to below 5% [2]. Reducing sugar consumption among young people, choosing water instead of sugar-sweetened beverages, and limiting sugary snacks are important components of caries prevention.

Oral Hygiene. Failure to brush teeth regularly or the use of improper brushing techniques can lead to plaque accumulation. Brushing twice daily with fluoride-containing toothpaste is essential for preventing dental caries [1, 4]. Interdental cleaning also helps reduce biofilm in areas that a

conventional toothbrush cannot adequately reach. Careful yet effective cleaning along the gingival margin is particularly important for gingivitis prevention. Interdental cleaning aids should be selected according to tooth alignment and individual needs [5, 6].

Motivation and Health Literacy. Young people may be aware of measures for preventing dental diseases; however, this knowledge is not always translated into daily practice. Lack of time, forgetting oral hygiene routines, underestimating the importance of prevention, and poorly established habits may make adherence to recommendations difficult. Therefore, educational interventions should go beyond providing theoretical information and focus on developing practical skills, supporting motivation, and reinforcing daily oral hygiene habits [7].

Social and Economic Factors. The availability of toothpaste, toothbrushes, and other oral hygiene products, the cost of dental services, place of residence, and healthy lifestyle habits within the family may influence preventive behaviors. The prevalence and severity of oral diseases are also associated with socioeconomic conditions [1]. Therefore, preventive programs designed for young people should be simple, understandable, affordable, and accessible to individuals from different social groups.

3. Modern Preventive Approaches to Dental Caries and Gingivitis

Modern preventive dentistry is not limited to treating diseases after they develop. Its primary objectives are to identify risk factors at an early stage, reduce the likelihood of disease onset, and maintain oral health over the long term. Individual preventive care, professional dental services, and improvements in public health literacy are complementary components of this approach [1, 6].

Use of Fluoride-Containing Products. Fluoride supports the remineralization of tooth enamel and increases its resistance to acid-induced dissolution. Regular use of fluoride-containing toothpaste is one of the principal evidence-based methods of preventing dental caries. The World Health Organization recommends brushing twice daily with toothpaste containing 1,000–1,500 ppm fluoride [1]. For individuals at high risk of dental caries, a dental professional may recommend additional fluoride-containing products according to individual needs. The benefits of fluoride toothpaste and other topical fluoride agents in caries prevention have also been demonstrated in systematic reviews [4].

Mechanical Plaque Control. Regular toothbrushing using proper techniques is a fundamental component of dental caries and gingivitis prevention. It is important to reach all tooth surfaces, clean along the gingival margin carefully, and pay particular attention to interdental spaces. Special interdental brushes or dental floss may be used for interdental cleaning, with the choice of aid determined by the width of the interdental spaces and individual circumstances. Systematic reviews indicate that interdental cleaning in addition to toothbrushing may reduce gingivitis and plaque under certain conditions, although the certainty of evidence varies among different cleaning aids [5]. Accordingly, providing individualized practical instructions on the use of oral hygiene products is advisable.

Improvement of Dietary Habits. Reducing free sugar consumption is important in preventing dental caries. The World Health Organization's recommendations aim to reduce the risk of caries

by limiting sugar intake [2]. To implement these recommendations among young people, it is necessary to encourage reduced consumption of sugar-containing beverages and sugary snacks, reading food labels, making water consumption a regular habit, and maintaining a balanced diet.

Professional Prevention and Individual Risk Assessment. Dental check-ups enable the identification of early signs of caries, gingival inflammation, and individual risk factors. During an examination, previous caries experience, oral hygiene practices, dietary habits, fluoride exposure, and other clinical factors may be assessed. Where indicated, professional plaque removal, the application of fluoride varnish, or other preventive measures may be recommended. The type and frequency of these interventions should be determined according to individual risk levels and clinical conditions [1, 6].

A Comprehensive Preventive Approach. Rather than relying on a single intervention, it is advisable to combine several preventive strategies. For example, the use of fluoride-containing toothpaste may be integrated with reduced sugar consumption, interdental cleaning, regular dental check-ups, and practical oral hygiene education. Prevention should not consist solely of providing information about diseases; it should also influence young people's daily habits and support the long-term maintenance of these behaviors [1, 6, 7].

4. The Role of Digital Education in Oral Hygiene Instruction Among Young People

Digital educational tools make it possible to disseminate health-related information to broad audiences, demonstrate practical skills, and provide users with ongoing encouragement. The widespread use of mobile phones and the internet creates favorable conditions for integrating these tools into preventive dental education. However, the availability of digital technologies does not automatically guarantee their effectiveness; the quality of educational content and user engagement are also important [8, 9].

Mobile Applications and Electronic Reminders. Mobile applications can be used to remind users when to brush their teeth, record oral hygiene habits, monitor their own activities, and reinforce preventive recommendations regularly. Electronic reminders may help reduce the likelihood of forgetting daily oral hygiene practices. A review of the literature published in 2025 reported improvements in plaque control and gingival bleeding indices in some studies involving adolescents who used mobile applications. However, other studies found better outcomes with conventional education or statistically insignificant differences between groups [8]. Therefore, although mobile applications are promising tools, their effectiveness cannot be assumed to be uniform across all settings.

Video Lessons and Visual Materials. Short videos may serve as useful educational tools for demonstrating toothbrushing techniques, the use of fluoride-containing products, interdental cleaning, and the early signs of gingivitis. Visual demonstrations simplify complex concepts and help users understand how to perform oral hygiene practices correctly. However, watching a video is not equivalent to acquiring a practical skill. A systematic review evaluating different educational approaches to oral health among children and adolescents found that some interventions improved oral hygiene and knowledge outcomes, although the quality of evidence was rated as low or very

low in most studies [7]. Therefore, video lessons should be combined with practical sessions, question-and-answer activities, and reassessment of the techniques performed.

Interactive Learning and Gamification. Quizzes, interactive exercises, and reward systems may increase young people's engagement in the learning process. Such approaches can support the development of healthy habits by enabling goal setting, activity tracking, and self-assessment. However, evaluating the effectiveness of digital education solely on the basis of user engagement or the frequency of application use is insufficient. Changes in hygiene-related behavior and clinical indicators must also be assessed [7–9].

Integration of Digital and Conventional Education. One of the most appropriate approaches is to combine digital education with practical guidance provided by dental professionals. For example, young people's oral hygiene knowledge and practical skills can initially be assessed, followed by educational interventions delivered through video lessons or a mobile application. At a subsequent stage, toothbrushing techniques and hygiene habits can be reassessed and compared with the initial findings. This approach makes it possible to investigate the effects of digital tools not only on knowledge but also on practical skills and behavior [8, 9].

5. Evaluation of Digital Education Effectiveness and Its Limitations

Evaluating the effectiveness of digital education solely on the basis of the number of users, application visits, or video views is insufficient. The primary focus should be on educational outcomes, changes in oral hygiene behavior, and, where possible, clinical indicators. To achieve this, comparable assessment criteria should be established before and after the intervention.

The first criterion is changes in knowledge and awareness. Young people's knowledge of the causes of dental caries and gingivitis, risk factors, fluoride-containing products, and proper oral hygiene practices can be assessed using standardized questions. The second criterion is behavior and oral hygiene skills. Relevant indicators include toothbrushing frequency, interdental cleaning habits, patterns of sugar-containing food consumption, and attendance at preventive dental check-ups. The third criterion is clinical status. Depending on the study design, dental plaque indices, gingival inflammation or bleeding indices, and clinical signs associated with dental caries may be assessed by a qualified professional.

To obtain more reliable assessments, it is important not to limit evaluation to short-term changes following education but also to determine whether these changes are maintained over time. Where feasible, comparing the outcomes of a group receiving digital education with those of a group receiving conventional education can help establish the additional benefits of digital tools. Because existing reviews report methodological and outcome differences across studies, future research should use standardized assessment criteria and ensure longer follow-up periods [7–9].

Digital preventive education also has several limitations. Differences in internet access, levels of digital literacy, declining interest in using applications, and habituation to reminders may limit program effectiveness. Furthermore, digital tools cannot replace individual clinical examinations or professional dental care. Therefore, digital education should be regarded not as an independent

treatment method but as a complementary approach that supports evidence-based preventive measures [8, 9].

6. An Integrated Preventive Model for Young People

To prevent dental caries and gingivitis among young people, it is advisable to integrate behavioral change strategies, clinical prevention, and digital education into a unified system. Such a model may comprise several consecutive stages. First, young people's oral health status, hygiene habits, and major risk factors are assessed. Individual or group-based educational interventions are then provided. Subsequently, mobile reminders, video lessons, and interactive materials are used to reinforce oral hygiene habits. Finally, changes in knowledge, behavior, and relevant clinical indicators are reassessed.

An essential feature of this model is the adaptation of preventive recommendations to young people's daily lives. Educational materials should be simple and understandable, reinforced by practical demonstrations, and promote affordable preventive measures. Access to dental services and individual risk factors should also be taken into account. The use of digital tools should be organized in accordance with principles of personal data protection and the selection of reliable scientific information.

Overall, achieving sustainable results in the prevention of dental caries and gingivitis requires more than simply providing information. It requires the development of appropriate oral hygiene skills, the promotion of healthy dietary habits, the use of fluoride-containing products, regular dental monitoring, and the integration of digital educational opportunities. The actual effectiveness of digital approaches should be evaluated according to their impact on young people's behavior, oral hygiene skills, and clinical indicators.

Discussion

The analysis of the scientific literature indicates that unhealthy dietary habits, excessive sugar consumption, inadequate oral hygiene, and infrequent preventive dental check-ups play important roles in the development of dental caries and gingivitis among young people [1–3]. The use of fluoride-containing toothpaste, regular toothbrushing, appropriate interdental hygiene, and limiting sugar consumption are important measures for preventing these conditions [4–6].

Modern digital educational tools, including mobile applications, video lessons, and reminders, may help improve young people's knowledge of oral health and support the development of daily oral hygiene habits [7–9]. However, their effectiveness depends on user engagement, the quality of educational content, and consistent participation in the program. Therefore, integrating digital education with conventional preventive measures and professional dental examinations is advisable.

Overall, the prevention of dental caries and gingivitis among young people requires a comprehensive approach. Combining oral hygiene education, a balanced diet, and digital technologies may help reinforce healthy habits. However, further research is needed to determine the long-term effectiveness of digital education.

Conclusion

Adherence to oral hygiene practices, limiting sugar consumption, using fluoride-containing products, and attending regular dental check-ups are essential for preventing dental caries and gingivitis among young people. Digital educational tools, including mobile applications, video lessons, and reminders, provide additional opportunities to improve oral health knowledge and promote the development of healthy habits among young people.

Thus, integrating conventional preventive measures with digital education represents a promising approach to maintaining oral health among young people. However, further scientific research is needed to evaluate the long-term effectiveness of this approach.

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