



Educational strategies and an individual approach to developing a responsible attitude towards oral hygiene

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Abstract. Oral hygiene is an important component of overall human health, as its condition directly affects the cardiovascular, endocrine, digestive and other systems of the body. Therefore, the aim of this study was outline effective strategies for establishing and maintaining oral hygiene among adolescents, based on survey data on their oral hygiene habits. An anonymous, face-to-face, cohort, cross-sectional survey of 55 adolescents aged 16-17 years was conducted. The results

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showed that the vast majority of adolescents brush their teeth twice a day and use fluoride toothpaste. However, only 3.6% use electric toothbrushes, despite their potential to improve hygiene habits, and only 40% use dental floss. There were a number of findings that require the attention of dentists to improve the situation: only 59.9% of respondents make preventive visits to the dentist; 38% of teenagers reported bleeding gums; 9% reported bad breath. A comparison of the results of the previous 2021 study with the results presented in this article showed that there are good reasons to believe that some progress has been made in introducing beneficial hygiene habits such as brushing teeth twice a day and using fluoride toothpaste. The results of the study indicate areas in which adolescents and their parents should be informed about the role of the dentist as a mentor, communicator and educator, as the main link in ensuring sustainable oral care and preventing systemic complications

Keywords: prevention of dental diseases; oral health; survey; testing of statistical hypotheses; adolescent hygiene

Introduction

Oral health is an important component of physical, mental, social and economic well-being for both individuals and society. Due to the increasing prevalence of periodontal disease, the growing popularity of fast food and carbonated sweet drinks, as well as a decline in preventive care and a lack of adequate hygiene education among young people, especially adolescents, there is a growing need for a systematic review of approaches to oral care. The formation of sustainable oral care habits in adolescence is critically important, as it is during this period that behavioural patterns are established that affect health throughout life. In this regard, it has become relevant to introduce personalised approaches to oral hygiene education, taking into account individual needs, motivation levels, the availability of hygiene products, and the capabilities of digital technologies. Such approaches should form the basis for improving the effectiveness of preventive dental care.

Numerous studies, in particular the work of N.I. Shovkova *et al.* [1], have emphasised the need to study oral hygiene habits as a prerequisite for the development of personalised approaches to hygiene education. The state of oral hygiene is considered to be a reflection of the overall health of the body. The publication by S.I. Boitsaniuk & M.O. Levkiv [2] states that the basic measures are regular brushing of teeth with a fluoride toothpaste. The modern literature covers a wide range of strategies for the prevention of oral diseases. In particular, the research of O.S. Almajed *et al.* [3] emphasised the role of social determinants of health in the formation of hygienic behaviour. The authors pointed out that educational level and access to medical care significantly affect the level of oral hygiene. The work of L.S. de Albuquerque *et al.* [4] analysed the effectiveness of school hygiene education programmes and emphasised their long-term impact on reducing the incidence of caries. The study by A. Murariu *et al.* [5] emphasised that the use of mobile applications contributes to improving hygienic behaviour among adolescents, especially when combined with individual consultations. These conclusions are supported by data from studies by E. Väyrynen *et al.* [6] and S. Sharma *et al.* [7], which showed that the use of digital platforms for feedback with patients increases their responsibility for the condition of their oral cavity, as well as increases the level of literacy in the field of oral hygiene, improves oral health and, thus, plays a key role in achieving overall health.

Numerous researchers have focused on the educational aspects of oral hygiene in Ukraine. In particular, S.P. Jarova *et al.* [8] pointed out the need to introduce a regional preventive programme for adolescents aimed at improving hygiene and monitoring the condition of the oral cavity, since the main reason for adolescents seeking periodontal care is catarrhal gingivitis, which is associated with poor oral hygiene. The authors noted that awareness remains insufficient and the frequency of preventive visits to the dentist is low. A study by I. Lisetska & M. Rozhko [9] confirmed the negative impact of smoking, both traditional and alternative, on oral hygiene. The data obtained emphasised the importance of systematic educational work by dentists to promote healthy habits and motivation to quit smoking. The publication by V.S. Melnyk *et al.* [10] also emphasised the need to strengthen the motivational component in the dentist's work with patients.

Given the importance of an individual approach in modern dentistry, more and more scientists and professional organisations are emphasising the need to adapt hygiene recommendations to the personal characteristics of each patient. For example, the American Dental Association (ADA) emphasises that no two people are exactly alike, and therefore the approach to oral care must be individualised [11]. Dentists should provide patients with personalised recommendations, taking into account their age, health status, existing diseases, lifestyle and level of motivation. According to C. Gallione *et al.* [12], such recommendations should be based on scientific evidence and take into account the latest data on the effectiveness of hygiene products.

At the same time, the combination of traditional hygiene education methods with modern mobile technologies, as well as the impact of a personalised approach on the level of compliance with hygiene recommendations among adolescents, remains insufficiently studied. The role of active communication by the dentist in this process has also been little studied, taking into account the patient's psychological profile, level of motivation and access to hygiene products. In this regard, the aim of the current study was to determine the level of their awareness of professional oral care and to justify the feasibility of implementing personalised, motivation-oriented hygiene education programmes using modern digital tools. The main tasks were: to conduct a survey of adolescents with an analysis of current hygiene practices; to identify

existing gaps in knowledge and motivation; to formulate recommendations for improving approaches to oral hygiene education in dental clinics and educational events.

Materials and Methods

As part of career guidance events held by the I.Ya. Horbachevsky Ternopil National Medical University of the Ministry of Health of Ukraine for prospective students (senior high school pupils in the city of Ternopil), an anonymous, in-person, cohort, cross-sectional survey was carried out on adolescents aged 16-17 years (Years 10-11 of secondary school), during September 2024 to February 2025. All pupils present at the events were included in the study. A total of 55 adolescents were surveyed, comprising 20 boys and 35 girls. Before participating in the study, all participants were given detailed information about the research goals and signed a consent form to confirm their willingness to take part. Participation in the survey was voluntary. The research was conducted with the informed consent of each individual in accordance with Ethics and data protection [13].

The questionnaire was developed independently by the authors based on an analysis of studies [4, 14]. All questions required a descriptive answer, without predefined answer options. The questionnaire included 11 questions covering the main aspects of oral hygiene and dental care:

- Indicate your gender and age.
- Do you brush your teeth twice a day?
- What type of toothbrush do you use (manual or electric)?
- How often do you replace your toothbrush?
- What brand of toothpaste do you use?
- Do you use mouthwash?
- Do you use dental floss?
- Do you use additional oral hygiene products (interdental brushes, single-tufted brushes, etc.)?
- How often do you visit the dentist for preventive check-ups?
- Have you experienced bleeding gums when brushing your teeth?
- Have you experienced bad breath that is not related to eating?

The results were processed and graphically represented using MS Excel spreadsheets. Descriptive statistics were used to analyse the results of this study [15]. A questionnaire was used to analyse the hygiene habits of adolescents and determine their level of awareness of the forms, methods and means of oral care. This made it possible to identify shortcomings and gaps in the preventive and educational activities of dentists working with adolescent and young adult patients.

Based on the results of the questionnaire, analysis of the data obtained, and a summary of current scientific sources on effective methods of doctor-patient communication, the main problems in the formation of hygiene habits among adolescents were identified. In accordance with these conclusions, a scheme for effective interaction between dentists and patients and a generalised scheme for

oral care were developed, combining preventive and educational approaches to maintaining the dental health of adolescents. The schemes were created based on the analysis of questionnaire data, clinical observations, and current recommendations from leading professional organisations (ADA, FDI). In addition, based on a review of the scientific literature, the possibilities of using digital and mobile technologies to improve the hygiene habits of adolescents were studied. This information was integrated into the doctor-patient interaction scheme as an additional element that enhances the motivational component and promotes the formation of sustainable hygiene habits in adolescents.

Results and Discussion

The survey results showed that 89.09% of schoolchildren brush their teeth twice a day, in the morning and in the evening, although a fairly high percentage – 10.9% – indicated that they brush their teeth only once a day. None of the students indicated that they brush their teeth less than once a day (Fig. 1).

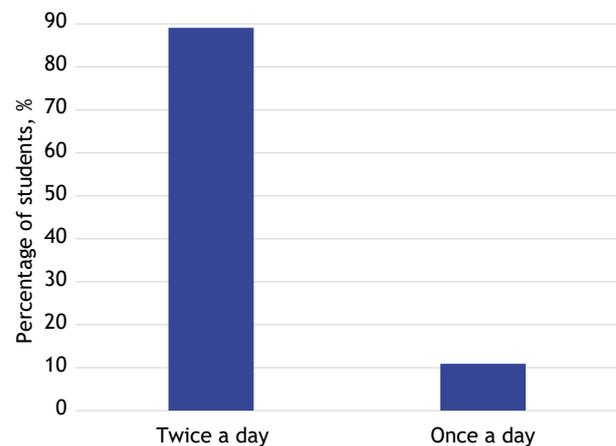


Figure 1. Frequency of tooth brushing
Source: created by the authors

The frequency of toothbrush replacement is important from a hygiene perspective. As the responses showed, the vast majority of adolescents (about 85%) change their toothbrushes regularly and frequently, with almost 42% of all respondents doing so more often than required by oral care standards – more often than every 2 months. Almost a third of teenagers do so every three months (Fig. 2). Only one in seven respondents (14.59%) replace their toothbrush less frequently than recommended by experts. In particular, according to the recommendations of the American Dental Association, manual toothbrushes should be replaced every 3-4 months to ensure effective cleaning of the teeth [16]. The frequent need to change toothbrushes, reported by 41.81% of adolescents, may be the result of improper brushing technique, excessive pressure of the toothbrush on the teeth, or the wrong choice of toothbrush. In this case, the use of an electric toothbrush with a sensor would help.

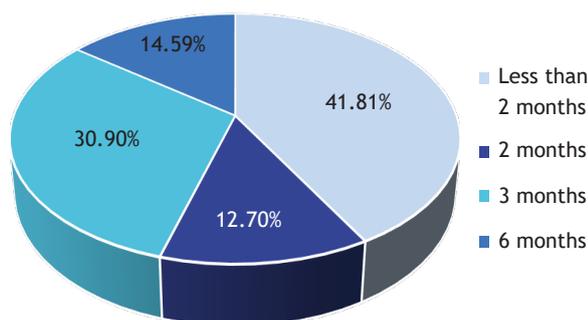


Figure 2. Frequency of toothbrush replacement among survey participants

Source: created by the authors

The survey results showed that the vast majority of respondents use regular toothbrushes, and only 3.63% of them brush their teeth with an electric toothbrush. All respondents also indicated that they use toothpastes containing 1,400 ppm of fluoride, which should provide a good caries-preventive effect. Almost half of the adolescents (43.63%) use mouthwashes, but in their responses they emphasised that they did not study the composition of the products and chose them based on the aroma for “fresh breath” (Fig. 3). In this regard, educational work should be carried out, taking into account that the composition of the rinse is important from a medical point of view, especially for adolescent patients. It should not contain alcohol or parabens, as these have a negative effect on the microflora of the oral cavity and periodontal tissue [17].

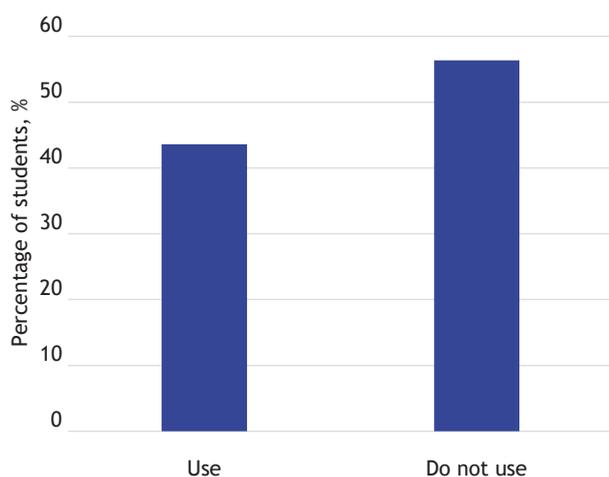


Figure 3. Use of mouthwash by survey participants

Source: created by the authors

As for additional oral hygiene products (dental floss, interdental brushes, single-tufted brushes), the study showed that they are not very popular among adolescents. In particular, less than half of respondents (40%) use dental floss to clean between their teeth (Fig. 4). Only 7.27% of schoolchildren use interdental brushes and single-tufted brushes, and only those who have braces (Fig. 5).

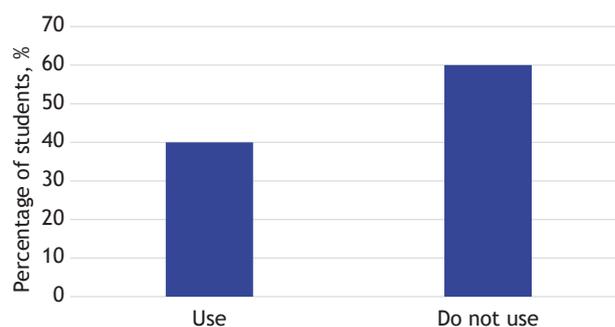


Figure 4. Use of floss

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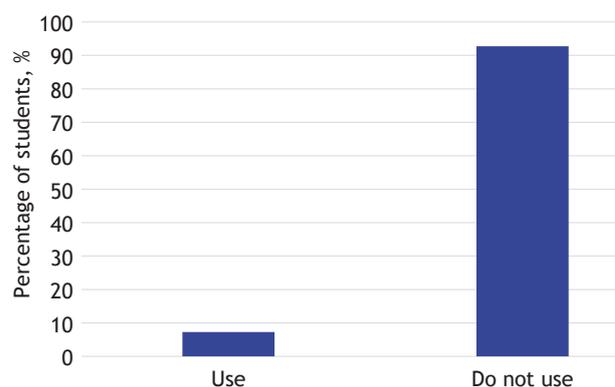


Figure 5. Use of additional oral hygiene products

Source: created by the authors

Such results indicate insufficient promotion of additional preventive measures to prevent the development of caries and periodontal diseases, particularly among school-age youth. At the same time, the survey showed that the majority of respondents undergo regular preventive dental examinations (Fig. 6). In particular, more than a quarter of respondents (27.27%) undergo such examinations twice a year, and 32.72% of students undergo them once a year. At the same time, 40.1% of respondents visit the dentist only when necessary. There is a need for educational work with both adolescents and parents, who need to be made aware of the importance of regular preventive check-ups, professional oral hygiene and the selection of individual oral care products.

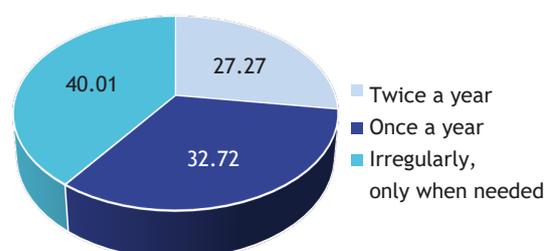


Figure 6. Frequency of preventive dental check-ups according to the survey results, %

Source: created by the authors

Due to the above-mentioned problems, a significant proportion of adolescents reported problems with periodontal tissue (bleeding gums, bad breath). 38.18% of adolescents indicated in the questionnaires that they experience bleeding gums, and 9.09% complained of bad breath (Figs. 7, 8). The high frequency of bleeding gums in adolescents may indicate the presence of an inflammatory process in the periodontal tissues, most often the initial manifestations of gingivitis.

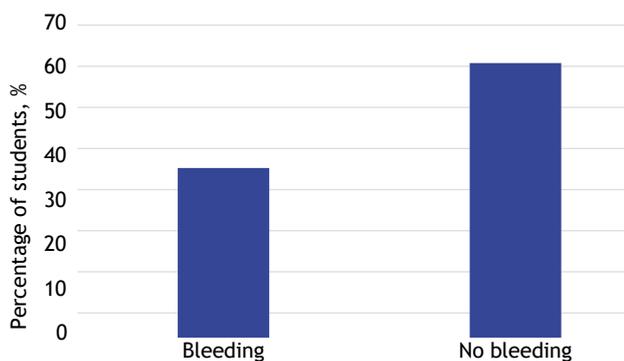


Figure 7. Presence of bleeding gums in respondents

Source: created by the authors

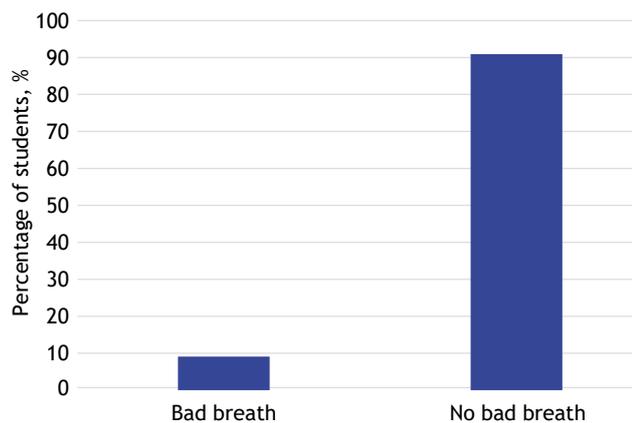


Figure 8. Presence of bad breath in the oral cavity in respondents

Source: created by the authors

Such changes may be caused not only by poor hygiene, but also by pubertal hormonal fluctuations. During puberty, increased sex hormone levels enhance vascularisation and reactivity of gum tissue, leading to the development of pubertal gingivitis even with relatively small amounts of plaque accumulation in the cervical area of the teeth. In addition, the risk of chronic gingivitis also increases in patients undergoing orthodontic treatment, which also occurs mainly in adolescence [18]. If these manifestations of the disease are not addressed and individual oral care is not adjusted, the disease will progress over time. The results obtained in the study indicate the need to raise awareness of dental care rules and the importance of regular visits to the dentist. Therefore, the level of oral hygiene found among

schoolchildren in the city of Ternopil indicates a need for improvement, which emphasises the importance of patient education as a leading factor in the formation and maintenance of healthy hygiene habits.

When analysing the results and comparing them with existing data in the literature, an increase in the level of dental literacy among children can be observed. Thus, the results of a survey of schoolchildren by S.V. Lebedyk & S.O. Konovalenko [19] showed that only about 30% of schoolchildren brush their teeth twice a day, while in the current study the percentage was more than 80%, which may indicate the effectiveness of educational measures. However, the different ages of the samples raise certain reservations, so this difference requires further research. In both cases, the percentage of schoolchildren who use fluoride toothpaste was approximately the same. The results differed slightly with regard to preventive examinations by a dentist. In the current case, 37% of respondents visited once a year, while in the available literature data from previous surveys, this figure was almost 50%. The methodology of this study differs from that of S.V. Lebedyk & S.O. Konovalenko [19], but some questions were the same, in particular, question 2 about the number of brushings per day and question 5 about the choice of toothpaste. The questionnaire for schoolchildren proposed in the current study did not contain questions related to mobile applications. The questionnaire conducted by the aforementioned researchers also included questions related to harmful habits, in particular early smoking and consumption of large amounts of sugar, whereas in the current survey these aspects were not taken into account, although the questionnaire was expanded and included questions about awareness of various hygiene products and the presence of early signs of periodontal disease. Analysing various data from the literature on anonymous surveys of schoolchildren, one can note the importance of this study and the need to create expanded questionnaires that include all questions that affect oral health. At the same time, it is necessary to take a differentiated approach to different age groups of schoolchildren, including various risk factors inherent in different age periods (changing bite, puberty, etc.).

Oral health is important for overall human well-being, as it determines the quality of chewing, speech, appearance, and is associated with the prevention of systemic diseases [20]. Scientific research by O. Denefil *et al.* [21] has shown that diseases of the teeth and gums can have a systemic effect on the cardiovascular, renal, cerebral, and digestive systems, forming a bidirectional pathophysiological link. Oral care is not only the key to a beautiful smile, but also an integral part of overall health. In this context, patient education takes on special significance, as dentists have the opportunity not only to explain the technique of brushing and flossing, but also to discuss the harmful effects of smoking, excessive sugar consumption and other risk factors. In addition, the topic of patient hygiene education is not limited to basic aspects and can cover a wider

range of individual recommendations and approaches to oral care, taking into account the patient's age, health characteristics, lifestyle and level of motivation.

Despite this, there are certain reasons that prevent people from visiting the dentist: fear of dental procedures, lack of time, financial difficulties, and underestimation of the importance of prevention. This requires both educational work and a careful approach to communication, as well as adaptive planning of visits [22]. Every visit to the dentist is extremely important, because it is during the examination that the doctor has the opportunity to teach the patient individual oral hygiene skills, assess the level of existing hygiene competencies, and explain in detail the benefits of professional care. Although this process requires considerable time, patience and a high level of communication skills, the results of such work are worth the effort. An analysis by B. Xiang *et al.* [23] showed that early

intervention in the formation of hygiene habits has a noticeable positive effect on the condition of the oral cavity in the long term. A study by N. Torlińska-Walkowiak *et al.* [24] found that regular visits to the dentist in childhood are associated with a better perception of oral health in adulthood. Patients with oral health problems often seek optimal solutions for the treatment of dental diseases. They rely on their dentists, who not only provide the necessary treatment, but also teach effective oral care and introduce modern methods of prevention.

Since each patient has a unique perception and different learning styles, it is important to take a personalised approach. Dentists can help patients master oral care skills by taking their individual needs into account. This process requires doctors to be accessible, actively listen, observe carefully, ask relevant questions, and adapt their teaching to each patient's specific needs (Fig. 9).

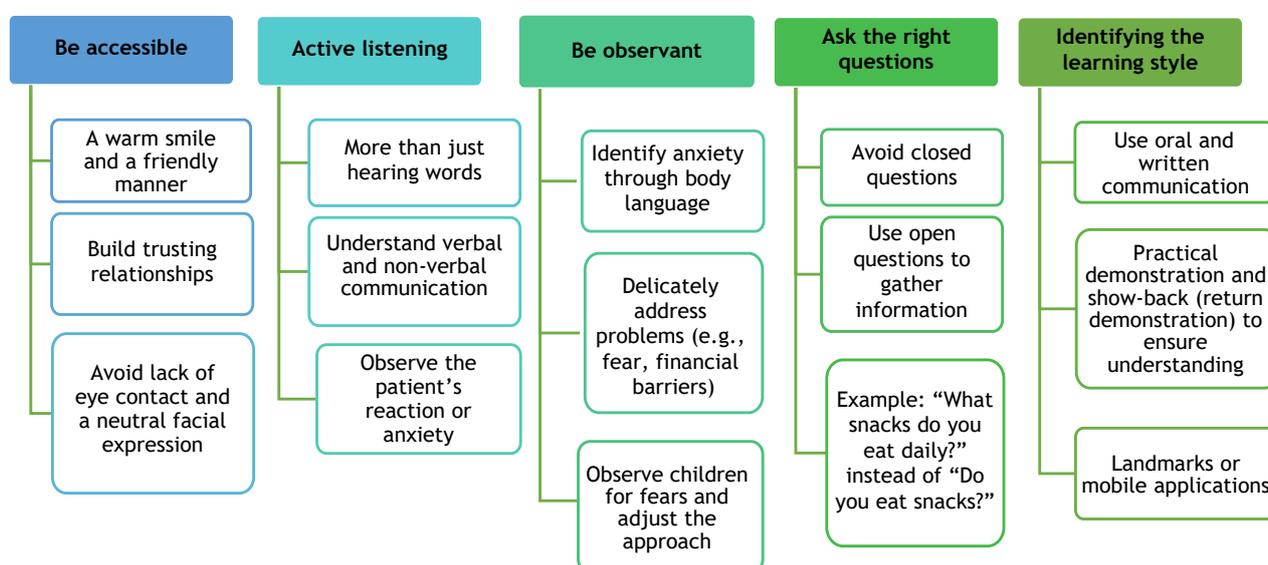


Figure 9. Diagram of effective interaction between dentist and patient

Source: created by the authors based on J.C.Y. Ho *et al.* [25]

As can be seen from the proposed scheme of communication with patients, the dentist must take a highly individual approach to each person, taking into account, first of all, their psycho-emotional state, how open and honest the patient is in their complaints and the reason for their visit to the doctor. This, in turn, will enable the dentist to build a proper dialogue with the patient, which will allow them to provide the patient with competent recommendations on oral hygiene. During regular check-ups, dentists can discuss the main aspects of dental care, such as proper brushing technique, flossing, and healthy diet. For example, the choice of toothpaste is very important for oral hygiene - toothpastes with probiotics that support oral health are especially popular today [26]. It is important to inform patients about the various products available for individual oral hygiene. The modern market offers a wide range of hygiene products [27]:

- manual and electric toothbrushes with different bristle stiffness and pressure sensors [28];
- toothpastes with fluoride, xylitol, enzymes, nano hydroxyapatite [29];
- alcohol-free mouthwashes (for children) or with chlorhexidine [17, 30];
- floss and interdental brushes for different interdental spaces;
- specialised products for patients with braces (single-tufted brushes, irrigators);
- probiotic or enzymatic products to support microflora [31].

These products allow for an individualised approach to care depending on the patient's needs. Regular and proper brushing and a healthy diet improve the condition of teeth and gums and help prevent oral diseases. Based on the results of the study, an oral care regimen was developed that

included recommendations not only for patients but also for dentists (Fig. 10). As can be seen in Figure 10, attention was focused not only on the need for brushing teeth and proper nutrition, but also on the importance of regular visits to the dentist, oral cancer screening, etc. The proposed actions form a closed cycle, emphasising a systematic approach to oral health prevention and maintenance. To effectively convey this information to schoolchildren, it is recommended to use interactive educational strategies based on the principles of active learning and a person-centred approach. In particular, it is worth combining

visual materials (posters, infographics), practical demonstrations (e.g., toothbrushing techniques on models), games (quests, quizzes), and introducing mini-lectures or master classes with the participation of medical professionals. An important tactical step is to create associative thinking, when oral care is perceived not as a routine activity, but as an integral part of overall well-being and a guarantee of self-confidence. It is also important to involve teachers and parents to ensure a triangle of interaction: student – school – family, which allows for the formation of stable hygiene habits.

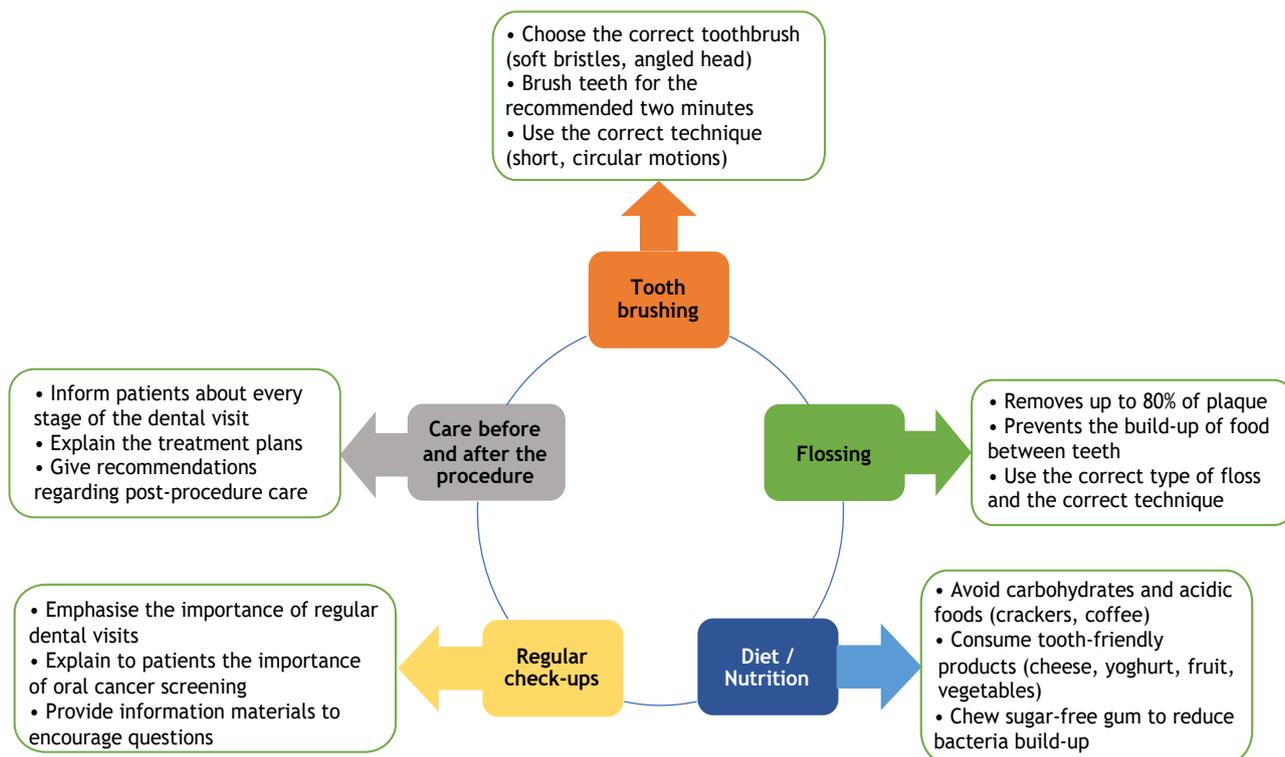


Figure 10. Diagram of basic dental care and oral health maintenance

Source: created by the authors

Modern technological advances have opened up new opportunities for the integration of mobile computing and communication devices into the healthcare system and public health sphere. According to the World Health Organisation (WHO) definition, mobile health, or mHealth, encompasses the use of mobile technologies – including smartphones, personal digital assistants and patient monitoring devices – in the delivery of healthcare and public health interventions. Scientists from the University of Hong Kong have demonstrated the importance of using mobile technologies to maintain oral health in elderly patients [32]. In their research, scientists A. Murariu *et al.* [5] assessed adolescents' awareness and use of various mobile applications related to oral health. For example, applications that track the time and technique of brushing teeth have proven to be effective in young people. These results are confirmed by studies conducted by other scientists. In particular, M. Alkilzy *et*

al. [33] showed in their studies how modern technologies allow the use of smart toothbrushes that connect to mobile applications and provide real-time feedback on brushing technique. A randomised controlled study by J.F.M. Scheerman *et al.* [34] in the Netherlands showed that using the WhiteTeeth mobile application in combination with regular care significantly improves oral hygiene in adolescents with fixed orthodontic appliances. The application provided educational materials and automatic coaching support, which contributed to a reduction in plaque levels. Studies show that mobile applications that track brushing time and technique are effective in improving oral hygiene among young people. They promote good habits, increase motivation and provide feedback, making them a valuable tool in the prevention of dental disease. It is important to take an individualised approach, which allows for the development of prevention programmes that address not only hygiene issues

but also lifestyle in general. This, in turn, will help improve oral hygiene skills and reduce the risk of dental problems.

Conclusions

The study was aimed at analysing the hygiene habits of adolescents, assessing their awareness of professional oral care, and justifying the feasibility of implementing personalised, motivation-oriented oral hygiene education programmes. It was found that the vast majority of adolescents brush their teeth twice a day and use fluoride toothpaste. At the same time, only 3.6% use electric toothbrushes, although recent studies show certain advantages of using modern tools in combination with phone applications. The survey also revealed a number of findings that require the attention of dentists in order to improve the situation. In particular, only 59.9% of respondents make preventive visits to the dentist. The following unsatisfactory facts were revealed during the research: 38% of adolescents reported bleeding gums; 9% reported bad breath. Given this, there is likely a lack of knowledge about the importance of regular visits to the dentist and professional oral hygiene.

Therefore, it can be assumed that the overall level of hygiene awareness and oral care among adolescents in general may be lower than that recorded in the current study, since the survey was conducted during career guidance events at a medical university among respondents who were likely to be more interested in their own health issues. This factor further emphasises the relevance and necessity of implementing targeted educational strategies to develop oral care skills among adolescents from different social groups. Taking into account the results obtained, the authors

propose an educational strategy in the form of an oral care plan containing recommendations for both patients and dentists. It emphasises the need for a comprehensive approach that covers not only the formation of hygiene skills and correction of eating behaviour, but also regular visits to the dentist, including preventive examinations and oral cancer screening. Systematic educational campaigns should be conducted among schoolchildren and their parents to foster a responsible attitude towards oral care from an early age, which, in turn, can form the basis for the prevention of dental diseases in the long term.

Further research should focus on the development, implementation and evaluation of the effectiveness of personalised educational programmes aimed at fostering a responsible attitude towards oral hygiene among adolescents. Particular emphasis should be placed on involving parents in such initiatives, as well as on studying the dynamics of changes in hygiene behaviour as a result of targeted information campaigns.

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Conflict of Interest

None.

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Освітні стратегії та індивідуальний підхід у формуванні відповідального ставлення до гігієни ротової порожнини

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Анотація. Гігієна ротової порожнини є важливою складовою загального здоров'я людини, адже стан її здоров'я безпосередньо впливає на серцево-судинну, ендокринну, травну та інші системи організму. Тому метою даної роботи було окреслити ефективні стратегії формування та підтримки гігієни порожнини рота серед підлітків, базуючись на даних опитування щодо їх звичок підтримання гігієни ротової порожнини. Проведено анонімне, очне, когортне, поперечне анкетування 55 підлітків у віці 16-17 років. Результати показали, що переважна більшість підлітків чистять зуби двічі на день і користуються фторвмісною пастою. При цьому лише 3,6 % застосовують електричні щітки, попри їх потенціал у покращенні гігієнічних звичок, і лише 40 % користуються флосами. Є ряд результатів, які вимагають уваги лікарів-стоматологів для покращення ситуації: профілактичні візити до стоматолога здійснює лише 59,9 % респондентів; 38 % підлітків зазначили кровоточивість ясен; 9 % вказали на неприємний запах із рота. Порівняння результатів попереднього дослідження 2021 року з результатами наведеними у даній статті, показали, що є вагомі підстави вважати, що досягнуто певного прогресу у впровадженні корисних гігієнічних звичок таких як чищення зубів двічі на день, та використання фторвмісних зубних паст. Результати дослідження показують напрямки, у яких слід проводити інформування підлітків та їх батьків про роль стоматолога як наставника, комунікатора й освітянина, як основної ланки у забезпеченні сталого догляду за ротовою порожниною та запобіганні системним ускладненням

Ключові слова: профілактика стоматологічних захворювань; здоров'я порожнини рота; опитування; тестування статистичних гіпотез; гігієна підлітків