ORAL HYGIENE IN 6–13-YEAR-OLDS UNDERGOING ORTHODONTIC THERAPY: THE IMPACT OF PARENTAL INVOLVEMENT ON ORAL HEALTH OUTCOMES

Higiena jamy ustnej u dzieci w wieku 6–13 lat poddawanych terapii ortodontycznej: wpływ zaangażowania rodziców lub opiekunów na wyniki w zakresie zdrowia jamy ustnej

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Abstract

Introduction: Oral hygiene is a crucial element during orthodontic treatment, particularly when patients use removable orthodontic appliances. In the 9–13 year age group, when oral cavity development is still dynamic, proper hygiene can affect the effectiveness of orthodontic therapy and prevent complications, such as tooth decay or gingivitis. Additionally, parental involvement can significantly impact the oral hygiene routine of children in this age group. **Aim:** The objective of this study was to assess the oral hygiene status in 9–13-year-olds using removable orthodontic appliances under care covered by the National Health Fund. Additionally, the study aimed to investigate the influence of parental involvement on the oral hygiene of these patients. **Methods:** Patients aged 9–13 years undergoing treatment with removable orthodontic appliances under the National Health Fund were included in the study. The oral hygiene status of patients was assessed using standard tools, such as the Oral Hygiene Index (OHI-S) and decay indices. Parents or guardians of patients were asked to complete a survey on the oral hygiene routine of their children and their involvement in maintaining their children's oral hygiene during orthodontic treatment. Data were subjected to statistical analysis to assess the relationship between oral hygiene status and parental/guardian influence. **Conclusions:** The anticipated conclusions from the study may help identify factors influencing effective oral hygiene in children using removable orthodontic appliances. Knowledge about the role of parents or guardians in oral hygiene care could lead to the development of educational strategies aimed at improving oral hygiene status in this patient group.

Streszczenie

Wstęp: Higiena jamy ustnej jest istotnym elementem podczas leczenia ortodontycznego, zwłaszcza gdy pacjenci korzystają z ruchomych aparatów ortodontycznych. W grupie wiekowej 9–13 lat, kiedy rozwój jamy ustnej jest jeszcze dynamiczny, właściwa higiena może wpłynąć na skuteczność leczenia ortodontycznego i zapobiec powikłaniom takim jak próchnica czy zapalenie dziąseł. Zaangażowanie rodziców lub opiekunów może znacząco wpłynąć na higienę jamy ustnej dzieci w tej grupie wiekowej. **Cel badania:** Celem pracy jest ocena stanu higieny jamy ustnej pacjentów w wieku 9–13 lat korzystających z ruchomych aparatów ortodontycznych, objętych opieką finansowaną ze środków Narodowego Funduszu Zdrowia. Dodatkowo celem badania było zbadanie wpływu rodziców lub opiekunów na higienę jamy ustnej tych pacjentów. **Metody:** Do badania zostali wybrani pacjenci w wieku 9–13 lat, leczeni aparatami ortodontycznymi ruchomymi w ramach Narodowego Funduszu Zdrowia. Stan higieny jamy ustnej pacjentów oceniano przy użyciu standardowych wskaźników, takich jak wskaźnik higieny jamy ustnej (OHI-S) i wskaźniki próchnicy. Rodzice lub opiekunowie pacjentów zostali poproszeni o wypełnienie ankiety dotyczącej higieny jamy ustnej ich dzieci oraz ich zaangażowania w utrzymanie higieny jamy ustnej podczas leczenia ortodontycznego. Dane poddano analizie statystycznej w celu oceny związku pomiędzy wpływem rodziców lub opiekunów a stanem higieny jamy ustnej. **Wnioski:** Wnioski z badania mogą pomóc w identyfikacji czynników wpływających na skuteczną higienę jamy ustnej u dzieci stosujących ruchome aparaty ortodontyczne. Wiedza na temat roli rodziców lub opiekunów w dbaniu o higienę jamy ustnej mogłaby pozwolić na opracowanie strategii edukacyjnych mających na celu poprawę stanu higieny jamy ustnej w tej grupie pacjentów.

Keywords: hygiene; removable appliances; orthodontics; the role of parents in treatment

Słowa kluczowe: higiena; aparaty ruchome; ortodoncja; rola rodziców w leczeniu

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Introduction

The aim of orthodontic treatment is to improve oral health. In early school children, it mainly uses removable orthodontic appliances. Treatment for children at this age is offered as part of reimbursable care until the age of 13 years. Parents are referred with children to orthodontic clinics by dentists and speech therapists, but also a result of their own concerns about their children's oral health.

Orthodontic treatment is associated with the risk of various complications [1–3]. Failure to comply with medical recommendations to maintain hygiene regime often leads to complications during removable orthodontic appliance therapy. Neglect of oral hygiene typically leads to microecological imbalance. Plaque accumulates on both tooth surfaces and removable braces. It is an aetiological factor for inflammation in the oral cavity. As a result, patients undergoing orthodontic treatment are more likely to develop gingivitis. They are also found to have an increased risk of dental caries [4, 5].

Therefore, the patient's oral hygiene should be assessed on the first orthodontic visit and, if necessary, oral hygiene instructions should be provided. In cases of very poor hygiene, orthodontic treatment should be postponed until it has improved to at least a satisfactory level [6]. Children receiving orthodontic appliances should be instructed on their use. Patients and their parents are also provided with precise information on how to clean the device [7–9].

When working with children, all instructions should be mostly directed to their parents [8].

Oral hygiene education involving children and their parents significantly improves treatment efficacy, as well as translates into improved oral health and optimal orthodontic outcomes [8–10].

Aim

The aim of this study was to assess the oral hygiene status of children receiving orthodontic treatment with removable appliances at an orthodontic clinic. Children's oral hygiene was checked during three consecutive visits to investigate the impact of an educational programme for children and their parents on improving hygiene practices. Additionally, the study aimed to assess parental role in shaping the quality of oral hygiene procedures performed by children.

Materials and methods

The parents of children undergoing orthodontic treatment were asked to complete an author's questionnaire to investigate the extent to which children were instructed, accompanied and supervised during hygiene procedures. The questionnaire enquired about the duration and manner in which the children brushed their teeth, and the toothpaste used.

The survey also assessed parental knowledge about oral hygiene:

- Do the parents know the correct technique for tooth brushing and use additional hygiene methods, such as mouthwash and flossing?
- Do parents know how long and how often teeth should be brushed?
- How do parents themselves implement oral hygiene and is it done properly?

The survey also included questions on the use of recommendations for cleaning the removable appliances (method and frequency).

At the visit prior to providing removable appliances, the children were checked for oral hygiene. If the level of hygiene was considered unsatisfactory, brushing instructions were given. The instructions were adapted to the child's developmental level. Parents were invited to participate in tooth brushing training in order to involve them in the process of learning, monitoring and reinforcing their child's hygiene. If the hygiene was considered satisfactory or appropriate, the child was given positive reinforcement and instructions to further maintain oral hygiene habits.

At this visit, the child's caregivers were instructed, depending on the child's needs and age, to assist with or supervise oral hygiene.

During another appointment, when the child was provided with orthodontic appliance, oral hygiene was reviewed. If necessary, patients and their parents were again educated on hygiene procedures. Parents and children were informed about the consequences of neglect in this area. Advice on oral hygiene was adjusted to the patients' age and their ability to understand. The

Table 1. Oral hygiene at visit 1

Patient age (years)/number of patients in a group	Hygiene level % (*n*)		
	Very good	Good	Moderate
6–7/ 10 patients	10% (1)	20% (2)	30% (3)
8–10/ 15 patients	13.3% (2)	13.3% (2)	20% (3)
11–13/ 30 patients	10% (3)	16.6% (5)	33.3% (10)

Table 2. Hygiene levels as declared by caregivers

Very good	Good	Moderate	Bad
10%	25%	55%	10%

importance of oral hygiene was also discussed with the patients' parents.

At the next follow-up visit, 2 months after providing patients with appliances, the oral hygiene status was checked in relation to previous visits and the hygiene status of the appliance was assessed.

The Oral Hygiene Index (OHI) was used for the assessment.

Due to the age of patients, dental plaque accumulation was assessed using the Simplified Oral Hygiene Index (OHI-S).

Evaluation criteria:
- 0 – no debris;
- 1 – soft debris covering up to 1/3 of the exposed tooth surface;
- 2 – soft debris covering up to 2/3 of the exposed tooth surface;
- 3 – debris covering up to 2/3 of the exposed tooth surface.

Each indicator should be assessed separately. OHI-S, which scores only 6 surfaces (teeth 11, 16, 26, 36, 31, 46), is most commonly used. The buccal surfaces of the upper molars, the lingual surfaces of the lower molars and the labial surfaces of incisors are typically assessed.

Result interpretation by category:
- 0–1.2 – good hygiene;
- 1.3–3.0 – moderate hygiene;
- ≥3.1 – bad hygiene.

Study group

The study group included children aged 6–13 years, who were receiving orthodontic treatment as part of reimbursable care. Patients were treated with removable orthodontic appliances. A questionnaire was administered to 55 patients and their parents. A total of 60 copies were distributed among the patients' families. After verification, 55 correctly and fully completed questionnaires were accepted for analysis. There were 10 patients in the 6–7-year-old group, 15 patients in the 8–10-year-old group and 30 patients in the 11–13-year-old group.

Results

At visit 1, very good oral hygiene was found in a total of 6 (about 11%) patients, whereas poor oral hygiene was observed in 45.5% of patients, as shown in table 1.

A very good oral hygiene status was achieved in the group of the youngest patients (6 to 7 years of age). Importantly, 30% of parents in this group reported supervision or assistance during tooth brushing.

The level of hygiene declared by the parents is summarised in table 2. The analysis did not take into account patients age, but only the respondents' self-reported assessment. Only 10% of respondents declared very good oral hygiene, the same percentage declared poor hygiene. Most respondents reported moderate hygiene.

Attention was also paid to parental involvement in child's hygiene procedures, with particular emphasis on assisting the youngest children, as well as supervising them to evaluate the correctness and effectiveness of hygiene practices. The data are included in table 3.

In the youngest group, 10% of parents declared that they performed hygiene activities for their children. In the older groups of children (8–10 and 10–13 years of age), all patients performed hygiene activities on their own, and these were not verified by their parents. The use of additional oral hygiene tools, such as dental floss or mouthwash, was declared by a small percentage of respondents (15%).

At the second visit, during which the orthodontic appliances were provided to the patients, oral hygiene was again verified. The results are shown in table 4.

Table 3. Parental involvement in hygiene procedures performed by their children at visit 1

Parental involvement	Patient age (years)		
	6–7	8–10	11–13
Teeth brushed by the parent	10%	0%	0%
Teeth brushed by the child themselves	90%	100%	100%
Parental supervision of tooth brushing	30%	0%	0%
Parental control of brushed teeth	10%	0%	0%

Table 4. Oral hygiene at visit 2

Patient age (years)/number of patients in a group	Hygiene level % (n)			
	Very good	Good	Moderate	Bad
6–7/ 10 patients	20% (2)	20% (2)	40% (4)	30% (3)
8–10/ 15 patients	13.3% (2)	26.6% (4)	6.6% (4)	33.3% (5)
11–13/ 30 patients	13.3% (4)	20% (6)	30% (10)	30% (10)

Table 5. Parental involvement in hygiene procedures performed by their children at visit 2

Parental involvement	Patient age (years)		
	6–7	8–10	11–13
Teeth brushed by the parent	20%	0%	0%
Teeth brushed by the child themselves	80%	100%	100%
Parental supervision of tooth brushing	40%	13.3%	0%
Parental control of brushed teeth	50%	13.3%	30%

Table 6. Oral hygiene at visit 3

Patient age (years)/number of patients in a group	Hygiene level % (n)			
	Very good	Good	Moderate	Bad
6–7/ 10 patients	10% (1)	20% (2)	40% (4)	30% (3)
8–10/ 15 patients	13.3% (2)	20%(3)	33.3% (5)	33.3% (5)
11–13/ 30 patients	10% (3)	20% (6)	36.6% (11)	33.3% (10)

At the same visit, parental attitudes towards the children's hygiene procedures were assessed, with a particular focus on supervising and monitoring, as well as the child's participation in tooth brushing.

At the second follow-up visit, the parents reported greater involvement in their children's hygiene procedures. In the youngest group of patients (6–7 years), the percentage of parents performing tooth brushing for their child increased from 10% to 20%, which was not statistically significant (p >0.05). In the older groups, on the other hand, the percentage of parents declaring verification of the effectiveness of these procedures increased and this change was statistically significant (p <0.001). The results are presented in table 5.

Due to insufficient improvement in hygiene among the patients at their visit during which they received removable appliances, training on proper brushing technique was repeated. Both children and their parents were instructed on tooth brushing, and they were reminded of the importance of the duration and number of brushing sessions. The use of additional oral hygiene products such as mouthwash, dental floss, and educational toothpaste (to verify the effectiveness of hygiene procedures) was suggested.

The third visit, which took place 2 months after the onset of orthodontic treatment, was the endpoint of the study. The questionnaire procedure from the previous visits was repeated. The obtained data are shown in table 6. Good oral hygiene was found in 9 children at visit 1 compared to 11 children at visit 3. Although the number of children maintaining good hygiene increased, this change was not statistically significant (p >0.05). Poor oral hygiene was reported in 25 patients at visit 1 and 18 patients at visit 3. This change was statistically significant (p <0.05).

Children maintaining hygiene at a poor level were the largest group in all age categories. Despite two educational sessions and parental involvement in hygiene practices, patients maintaining hygiene at a very good level still accounted for the minority.

During the same visit, the parents were surveyed again to investigate their involvement in hygiene procedures and the level of supervision and control of their children's oral hygiene. The results are presented in table 7. It was shown that parents of the youngest children (6–7 years) maintained a similar level of assistance in their children's hygiene routines; however, they supervised and controlled their children's brushing less frequently compared to data from visit 2 and 3, which was a statistically significant change (p <0.05), but at the same time they were more likely to control their children's hygiene behaviours compared to data from visit 1, which was not statistically significant (p >0.05). In the older groups, there was an increase in the percentage of parents controlling their child's oral hygiene status, which was statistically significant (p <0.05) compared to visit 1. Also in the older groups, a lower percentage of parents reported controlling the effectiveness of their children's hygiene procedures at visit 3.

Discussion

The study showed a significant correlation between the oral hygiene of orthodontic patients and plaque and biofilm accumulation. The effectiveness and regularity of hygiene procedures are crucial. Parental involvement, including control, supervision, and support in hygiene practices, is also an important factor, especially for younger patients. These observations are consistent with previous findings on orthodontically treated patients.

Table 7. Parental involvement in hygiene procedures performed by their children at visit 3

Parental involvement	Patient age (years)		
	6–7	8–10	11–13
Teeth brushed by the parent	20%	0%	0%
Teeth brushed by the child themselves	80%	100%	100%
Parental supervision of tooth brushing	20%	20%	0%
Parental control of brushed teeth	30%	33.3%	30%

Perzynski et al. conducted a study to assess the level of oral hygiene among patients undergoing orthodontic treatment [11]. Their conclusions are consistent with our study. They showed that oral hygiene among patients with orthodontic appliances was not maintained at an adequate level. In their conclusions, the authors emphasised the need to provide patients with individualised oral hygiene instructions.

The need to assess oral hygiene status in patients at various stages of orthodontic treatment is has been pointed out in many studies [5, 8, 11–15]. Many authors also report frequent complications of orthodontic treatment in the form of gingivitis and intensified caries due to the lack of proper oral hygiene [16, 17].

Poor maintenance of oral hygiene combined with the use of orthodontic appliances results in an increased level of microorganisms, as demonstrated among others by Brzezińska-Zając et al. Based on their observations, the authors concluded that long-term use of orthodontic appliances adversely affects the balance of microflora, contributing to the risk of dental caries and periodontal disease [18, 19].

Similarly, Volkan et al. assessed patients with space maintainers in their study and noted that these appliances contribute to an increased oral colonization with microorganisms and thus to an imbalance in the bacterial flora. They showed differences in this respect between fixed and removable appliances, emphasising the need for strict oral hygiene in patients treated with both types of devices [6].

A Polish study on oral hygiene in patients undergoing orthodontic treatment also reported difficulties in maintaining adequate hygiene [11].

Wites et al. surveyed patients about their oral hygiene habits, primarily in the context of manner and frequency at which they cleaned their teeth and orthodontic appliances. It was found that their oral hygiene was unsatisfactory, without correlation with the type of appliance used [20]. In the case of removable appliances, biofilm was more likely to be deposited directly on the device, whereas with fixed appliances, bacterial plaque deposition was more frequently observed on dental structures [3]. Słomska et al. found that hygiene procedures were unsatisfactory and irregular in 30% of patients. At the same time, the parents observed a deterioration in oral hygiene during treatment [18]. The authors concluded that failure to adhere to medical recommendations for hygiene procedures was the primary cause of oral infections in these patients. They also referred to parental attitude to educating and monitoring their children in developing oral hygiene habits, and found that increased parental control of children's hygiene routines contributes to its improved effectiveness [18].

The results obtained by the aforementioned authors correspond with our observations. In our study, parental influence on the hygiene level of children was monitored at subsequent visits. The level of hygiene improved significantly in the group of younger children as a result of an adult performing hygiene activities such as tooth brushing. In the case of older children and adolescents, such an improvement was observed only after implementing oral hygiene control. At the same time, a decrease in hygiene levels was observed when parental assistance or supervision was discontinued.

Many authors emphasise the need to assess the oral status of orthodontic patients, especially during the initial months of treatment [19]. Similarly, many studies have pointed to the need for hygiene education of patients treated with orthodontic appliances [21]. Kozak and Dunin-Wilczyńska indicated that patients undergoing orthodontic treatment should be instructed on oral hygiene [12]. Many studies have shown the need for thorough oral hygiene instruction and frequent motivation of the patient to perform these procedures and to maintain proper oral hygiene throughout the orthodontic treatment process [21].

Our observations on oral hygiene are consistent with reports from around the world [17, 22, 23]. The same is true for parental involvement in the implementation of hygiene practices of their children. All studies demonstrate the need for increased oral hygiene in children undergoing orthodontic treatment and emphasise the value of parental involvement in the process of implementing the above practices.

Conclusions

- The study found a higher proportion of children with poor oral hygiene at baseline (first visit) in each age group, resulting in the need for proving oral hygiene instructions to both children and their parents.
- The parental role model and involvement in assisting, supervising and monitoring the outcomes of oral hygiene interventions is important for the quality and effectiveness of these interventions.
- Increased parental involvement translates into increased child involvement in maintaining good hygiene.
- Supervising hygiene procedures and controlling their effectiveness is particularly important in the group of patients aged 10–13 years, whereas lack of such involvement reduces the frequency and quality of these practices.

- For the youngest children (6–7 years), it seems more important to assist them with these procedures, e.g. tooth brushing, and to involve the parent in teaching the child appropriate behaviour.
- Observation of patients in the 6–13 age group treated with removable appliances confirmed the results from previous studies on the direct relationship between the use of removable appliances and the need for both increased oral hygiene and parental involvement in the process.
- The study focused on the use of removable appliances. Although it may seem that this type of treatment should pose no difficulties in maintaining oral hygiene, the results have shown that a significant proportion of patients failed to maintain satisfactory oral hygiene.

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