

STATE OF ORAL HYGIENE IN PATIENTS USING ACRYLIC STABILIZATION SPLINTS

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Abstract

Introduction. Investigation of an influence of using acrylic stabilization splint on the state of oral hygiene is essential from prophylactic and therapeutic point of view.

Aim. The aim of the study was evaluation of state of oral hygiene in patients who were using acrylic stabilization splints during a therapy treating functional disorders of the masticatory system.

Material and methods. The study comprised a group of 45 male and female patients aged 16-38 years old who were treated in the Department of Functional Masticatory Disorders of the Medical University of Lublin. The control group included 15 persons in whom the diagnosed dysfunctions of the masticatory system were treated without the use of acrylic stabilization splint. The study group included 30 patients with a diagnosed dysfunction of temporomandibular joint who were treated with the help of acrylic stabilization splint which was used while sleeping. Dental examinations were performed four times: before the beginning of treatment (I), after two (II), six (III) and twelve weeks (IV) from the beginning of treatment. State of oral hygiene was evaluated on the basis of two indexes: API (Approximal Plaque Index) and OHI-S (Simplified Oral Hygiene Index). The obtained results were statistically analysed.

Results. In both, the control and study, groups the average API values in examination I were statistically significantly higher compared to the average API values in examination IV, while in the case of OHI-S, the average values were decreasing along with duration of treatment (I-IV) in both groups, however, they were not statistically significant.

Conclusions

1. Using acrylic stabilization splint during treatment of functional disorders of the masticatory system does not contribute to worsening of state of oral hygiene.
2. An appropriate prevention and treatment dental procedure in the case of persons treated with the use of acrylic stabilization splints should comprise appropriately frequent visits to the dentist, during which state of oral hygiene and of stabilization splint should be evaluated, instruction on proper hygienic procedures and cleaning, as well as on the way of using and keeping of stabilization splint should be made.

Keywords: stabilization splint, oral hygiene, API, OHI-S.

Introduction

For many years in Poland there has been a program by the Ministry of Health which aims at evaluating state of oral hygiene of children and adults on the basis

of the nationwide epidemiological and sociomedical studies, as well as at identifying preventive and therapeutic needs. As epidemiological studies conducted in the Polish population aged 35-44 and 65-74 years old show, in 2003 over 22% of respondents did not, even once, visit a dentist, and over 45% of patients as a reason for visiting a dentist gave a follow up visit, while 40% – pain. In 2014 there were also conducted studies among 12-year-old children concerning self-assessment of their dental knowledge. Very high or high level of knowledge was declared by 43% of respondents, while insufficient knowledge or its lack by only 2.9%; over 40% of the studied as a main source of dental knowledge gave a dentist [1].

The results of the surveys carried out among 120 people aged from 18 to 65 years old showed that approximately 37% of respondents visit a dentist once every six months, and the vast majority (67.5%) of them as a reason for visiting a dentist gave a follow up visit. Only half of the persons surveyed (50.8%) declared using mouthwash as an element of everyday oral hygiene [2]. The need to take action that could influence the patients' awareness is proved by the study of Włosowicz *et al.* [3], who, after assessing state of oral hygiene and periodontal tissues of the citizens of Kielce aged 35-44 years old, found their state of oral health insufficient.

State of oral hygiene is significant for health of the whole organism. Biofilm, which sticks to teeth and/or braces used in oral cavity, is often associated with systemic diseases [4,5]. Among health problems, which are influenced by the lack of appropriate oral hygiene, the following can be mentioned: heart, kidneys, joints, respiratory system diseases or inflammations of the maxillary sinuses. For instance, aspiration of bacterial plaque from teeth and/or dentures to respiratory tracts may be the cause of pneumonia (especially in artificially ventilated patients) or may sustain existing inflammations, and also negatively influence the course of existing chronic obstructive pulmonary disease [6-11]. Periodontitis caused by poor oral hygiene has an impact on development and course of diabetes, and according to some authors, it even intensifies the disease [12].

Data obtained from the literature show that moveable braces or moveable acrylic prosthetic restoration, similarly to acrylic stabilization splint, pose a serious difficulty in keeping proper oral hygiene. Numerous retention spaces, which facilitate food debris retention; specific bacterial plaque; high moisture of the environment; impaired self-cleaning function of saliva; and characteristics of material they are made of, foster the development of microorganisms in oral cavity and consequently, increase susceptibility to decay as well as to gingivitis and periodontitis [13,14].

Aim

The aim of the study was evaluation of state of oral hygiene in patients who were using acrylic stabilization splints during a therapy treating functional disorders of the masticatory system.

Materials and methods

The study comprised a group of 45 male and female patients aged 16-38 years old who went to the Department of Functional Masticatory Disorders of the Medical

University of Lublin to have their pain in the area of temporomandibular joint diagnosed and treated. Persons qualified to the study had to be generally healthy and could not be at least 3 weeks before the study treated pharmacologically, including antibiotic therapy and corticotherapy. All the respondents were informed about the character of the research and they gave their written consent to participate in the conduction of clinical study. The project of the study obtained a positive opinion of the Bioethics Committee of Medical University of Lublin – resolution no. KE-0254/38/2016.

The control group included 15 persons, in whom splint therapy was not used, but they were treated using physiotherapy, manual techniques and muscle exercises. The study group included 30 patients with diagnosed dysfunction of temporomandibular joint, treated with the acrylic stabilization splint, which was recommended to be used at night while sleeping. In both groups persons were divided with an analogue method according to age and sex. Women constituted 77.78% of all respondents, while men – 22.22%.

State of oral hygiene was examined in the artificial lighting, using periodontal probes and dental mirror, in accordance with the rules of asepsis. The results of examinations were placed on individual patient's card. Examinations were made in 4 time intervals:

- examination I (T1) – before the beginning of treatment;
- examination II (T2) – after two weeks from the beginning of treatment;
- examination III (T3) – after six weeks from the beginning of treatment;
- examination IV (T4) – after twelve weeks from the beginning of treatment.

State of oral hygiene was evaluated on the basis of two indexes: API (Approximal Plaque Index) and OHI-S (Simplified Oral Hygiene Index). The API index (without staining) was evaluated examining teeth surfaces with the use of probe inserted into the interdental space. The clue was identifying bacterial plaque or its lack. The examination was made from the side of oral cavity proper in quadrants 1 and 3, as well as from the vestibular side in quadrants 2 and 4. The value of the index was calculated according to the following formula:

$$\text{API (in \%)} = \frac{\text{sum of interdental spaces with plaque}}{\text{sum of all the assessed interdental spaces}} \times 100\%.$$

Ranges of the index values were interpreted as follows:

- < 25% – optimal oral hygiene;
- 39-25% – relatively good oral hygiene;
- 70-40% – average oral hygiene;
- 70-100% – improper oral hygiene.

Modified oral hygiene index (OHI-S) was evaluated examining presence of bacterial plaque and/or calculus on the six surfaces of six teeth: buccal surfaces of teeth 16 and 26, lingual surfaces of teeth 36 and 46, labial surface of tooth 11, lingual surface of tooth 31.

Criteria of evaluating bacterial plaque and calculus were the following:

- 0 – lack of plaque or calculus;
- 1 – plaque or supragingival calculus covering up to 1/3 of tooth surface;
- 2 – plaque or supragingival calculus covering over 1/3 but not more than 2/3 of tooth surface;
- 3 – plaque or supragingival calculus covering over 2/3 of tooth surface.

The value of the index was calculated according to the following formula:

$$\text{OHI-S} = \frac{\text{sum of values of deposits presence on six surfaces}}{\text{number of assessed dental surfaces}} \text{ [15,16].}$$

To evaluate differences between the analysed groups for nominal features, Pearson's Chi² Test for Independence was used or when it came to small numbers – Yates's Chi² Test, while to identify presence of differences between two analysed groups for quantitative features, Student's t-test was used with breakdown variables or Mann-Whitney U test. Conclusion error of 5% was adapted and connected with it p<0.05 significance level, which indicates presence of statistically significant dependencies or differences. Statistical base and analyses were made in Statistica 12.0 (StatSoft, Poland) program [17,18].

Results

In the control group, statistically significant differences in the average API values during the subsequent examinations (ANOVA test for variables with repeated measurements p<0.05) were found (Table 1). An analysis of multiple comparisons also showed that the average API values in examination I (T1) statistically significantly differ in relation to average API values after 12 weeks from the beginning of treatment (T4) (Table 2). Nevertheless, average OHI-S values did not statistically significantly differ (p>0.05) in the whole cycle of examinations (T1-T4). However, higher average values of the studied variable can be noticed in examination I (T1) than in examination IV (T4) (Table 3).

Table 1. Comparison of the average API values in the control group during the examinations I-IV (T1-T4)

| TIME | TIME; Least Squares means (control group) Current effect: F(3,42) = 3.1352, p=.03534 Effective hypothesis decomposition | | | | | |
|-----------|---|---------|------|---------|---------|------|
| | API% | Average | SD | -95.00% | +95.00% | N |
| T1 | API (%) | 44.74 | 6.98 | 29.77 | 59.71 | 5.00 |
| T2 | API (%) | 34.82 | 8.09 | 17.46 | 52.18 | 5.00 |
| T3 | API (%) | 31.35 | 7.47 | 15.33 | 47.37 | 5.00 |
| T4 | API (%) | 24.60 | 5.83 | 12.10 | 37.11 | 5.00 |

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Table 2. Results of multiple comparisons analysis of the average API values in the control group during the examinations I-IV (T1-T4)

| TIME | Tukey's range test; variable API% in time (control group) Approximate probability for post-hoc tests Error: MS of repeated measurements = 336.92, df = 42,000 | | | | |
|------|---|---------------|---------------|---------------|---------------|
| | API% | {1} 44.741 | {2} 34.819 | {3} 31.353 | {4} 24.604 |
| T1 | API (%) | | 0.458179 | 0.205308 | 0.022423 |
| T2 | API (%) | 0.458179 | | 0.954619 | 0.432695 |
| T3 | API (%) | 0.205308 | 0.954619 | | 0.746324 |
| T4 | API (%) | 0.022423 | 0.432695 | 0.746324 | |

Table 3. Average OHI-S values in the control group during the examinations I-IV (T1-T4)

| TIME | TIME; Least Squares means (control group) Current effect: F(3,42) = 1.6721, p = .18753 Effective hypothesis decomposition | | | | | |
|------|---|---------|------|---------|---------|-------|
| | OHI-S | Average | SD | -95.00% | +95.00% | N |
| T1 | OHI-S | 0.42 | 0.07 | 0.27 | 0.57 | 15.00 |
| T2 | OHI-S | 0.27 | 0.04 | 0.18 | 0.36 | 15.00 |
| T3 | OHI-S | 0.30 | 0.06 | 0.16 | 0.44 | 15.00 |
| T4 | OHI-S | 0.30 | 0.05 | 0.18 | 0.42 | 15.00 |

In the control group, basing on the related variables test ANOVA, statistically significant differences in the average API values in the subsequent examinations (T1-T4) ($F=4.72$; $p=0.004$) were found (Table 4). The highest API values were observed before the beginning of treatment (T1), while the lowest – after 12 weeks from the beginning of treatment (T4). Analysis of multiple comparisons showed that statistically significant differences in the average API values are present: before the beginning of treatment and treatment lasting 6 weeks (examinations I and III), as well as before the beginning of treatment and treatment lasting 12 weeks (examinations I and IV)

Table 4. Comparison of the average API values in the study group during the examinations I-IV (T1-T4)

| TIME | TIME; Least Squares means (study group) Current effect: F(3,87) = 4.7153, p=0.00426 Effective hypothesis decomposition | | | | | |
|------|--|---------|------|---------|---------|----|
| | API% | Average | SD | -95.00% | +95.00% | N |
| T1 | API (%) | 42.70 | 5.08 | 32.31 | 53.08 | 30 |
| T2 | API (%) | 31.64 | 4.36 | 22.72 | 40.56 | 30 |
| T3 | API (%) | 29.98 | 4.35 | 21.09 | 38.86 | 30 |
| T4 | API (%) | 27.14 | 3.95 | 19.06 | 35.21 | 30 |

(Table 5). When it comes to OHI-S, statistical analysis indicated that the average values decrease with treatment duration (Table 6).

Table 5. Results of multiple comparisons analysis of the average API values in the study group during the examinations I-IV (T1-T4)

| Subclass no. | TIME | Bonferroni Test; variable API% (study group) Probability for post hoc tests Error: MS of repeated measurements = 295.54, df = 87,000 | | | |
|--------------|------|--|----------|----------|----------|
| | | {1} | {2} | {3} | {4} |
| 1 | T1 | 42.699 | 31.639 | 29.977 | 27.137 |
| 2 | T2 | 0.087679 | 0.087679 | 1.000000 | 1.000000 |
| 3 | T3 | 0.031266 | 1.000000 | 1.000000 | 1.000000 |
| 4 | T4 | 0.004332 | 1.000000 | 1.000000 | 1.000000 |

Table 6. Average OHI-S values in the study group during the examinations I-IV (T1-T4)

| TIME | OHI-S | TIME; Least Squares means (study group) Current effect: F(3.87) = 2.1896, p = 0.09499 Effective hypothesis decomposition | | | | |
|------|-------|--|------|---------|---------|----|
| | | Average | SD | -95.00% | +95.00% | N |
| T1 | OHI-S | 0.44 | 0.05 | 0.33 | 0.55 | 30 |
| T2 | OHI-S | 0.39 | 0.05 | 0.29 | 0.50 | 30 |
| T3 | OHI-S | 0.38 | 0.06 | 0.27 | 0.50 | 30 |
| T4 | OHI-S | 0.33 | 0.05 | 0.22 | 0.43 | 30 |

Comparative analysis of the variables in patients from control and study groups did not show any statistically significant differences in average API values (Student t-test $t=0.23$; $df=43$; $p=0.82$). Similarly, comparable average values were found for OHI-S (Student t-test $t=-0.25$; $df=43$; $p=0.81$).

Discussion

In the literature there are reports telling about worsening of oral hygiene in the cases of patients using removable acrylic dentures (or removable acrylic partial dentures) and removable acrylic braces. Presence of extensive acrylic parts, clamps and retention spaces foster adhesion and accumulation of microorganisms, what have significant influence on change of oral ecosystem and consequently, on development of decay and periodontal diseases. Other additional factors include: porous structure of acrylic material, moist and hot environment under the denture or braces base, reduced self-cleaning function of saliva, disorders in tissue metabolism, less oxygen availability and clinging of food debris in retention spaces. Moreover, presence of dentures or braces significantly worsens oral hygiene [13,14,19]. Babiak *et al.* [20] made research aimed at evaluating state of oral hygiene in 120 children aged 7-15 years old treated with

fixed and removable braces, in whom OHI-S and GI values were assessed. In children undergoing orthodontic treatment, OHI-S values were significantly higher, mainly due to difficulties in keeping appropriate oral hygiene. The highest OHI-S values were found in patients treated with fixed braces. This accuracy was confirmed by foreign studies [21,22].

The results of own research proved that setting more frequent appointments resulting from course of treatment has an impact on improvements of health-oriented behaviours and state of oral hygiene in patients. After 3 months from the beginning of treatment of patients included in the study, there was a significant decrease of API and OHI values, both in the control group and in the group using acrylic stabilization splint. The comparable study results were presented by other Polish authors [23-25].

Conclusions

1. Using acrylic stabilization splint during treatment of functional disorders of the masticatory system does not contribute to worsening of state of oral hygiene.
2. An appropriate prevention and treatment dental procedure in the case of persons treated with the use of acrylic stabilization splints constitutes a significant element of prevention of oral microbiological balance disorders. It should comprise appropriately frequent visits at the dentist during which, state of oral hygiene and of stabilization splint should be evaluated, instruction on proper hygienic procedures and cleaning, as well as on the way of using and keeping of stabilization splint should be made.

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