Importance of Proper Oral Hygiene in Patients Undergoing Treatment with Fixed Orthodontic Appliances

SUMMARY

Objective: The aim of this study was to evaluate the importance of proper oral hygiene in patients undergoing treatment with fixed orthodontic appliances.

Materials and Methods: Clinical examinations encompassed 40 patients with diagnosed malocclusion - and it started before the orthodontic treatment. Subjects were divided in 2 groups (20 subjects in each group). The first group was treated with dental cream GC Tooth Mousse, and the second group with Fluorogal-solution containing low concentration of fluoride - 0.05%F). Control group comprised 20 patients. OHI-index was registered in all subjects (60) before and at the end of orthodontic treatment, using the simplified method of Greene-Vermillion (OHI-S).

Results: Improvement of oral hygiene was detected in the group where preventive treatment with Fluorogal was implemented (statistically significant difference between medium values of the OHI-S index before and after the orthodontic treatment), which was not the case with control group. The subjects treated with dental cream (GC Tooth Mousse) at the end of the orthodontic treatment had decreased OHI-S (1.49) in comparison to the beginning of the treatment, where the average monthly value of the index was 1.55 (however, the difference was not statistically significant).

Conclusions: The habit to maintain oral hygiene regularly is very important for maintaining gingival health throughout the orthodontic treatment and after it is completed. A high level of oral hygiene should be achieved before, during and after any orthodontic treatment in order to prevent side effects on periodontal tissues.

Keywords: Oral Hygiene; Fixed Orthodontic Appliances; Periodontal Tissue

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Introduction

Orthodontic treatment has a preventive effect against periodontal disease and caries because it facilitates establishing functional occlusion and makes all tooth areas accessible to oral hygiene. Numerous studies have shown that orthodontic patients are in high risk of developing periodontal disease and caries due to long-term orthodontic treatment. Presence and position of fixed orthodontic appliance create poor conditions for maintaining oral hygiene¹. The region of the tooth surface around the brackets is prone to adhesion of oral bacteria and subsequent biofilm formation. Oral biofilm, or “dental plaque”, is difficult to be removed and regular brushing is often insufficient to remove plaque from retention sites, such as the vulnerable brackets-adhesive-enamel junction and the sensitive region between brackets and the gingiva. Moreover, orthodontic appliances severely hamper the efficacy of tooth brushing, reduce the self-clearance by saliva², change the composition of the oral flora³, and increase the amount of oral biofilm formed⁴, colonization of oral surfaces by cariogenic⁵ and periodontopathogenic bacteria⁶. These factors strongly complicate orthodontic treatment and illustrate that the need for oral biofilm
control is even greater during orthodontic treatment than usually.

Plaque accumulation is promoted by physical constitution of different parts of the fixed appliance, but there are some other factors that have a great impact on plaque accumulation. In the oral cavity all of the tooth surfaces are exposed and rapidly covered by salivary proteins causing different effects (interactions between material, pellicle and bacteria). As part of fixed appliances, orthodontic bands can cause gingival inflammation. Plaque accumulates particularly beneath bands from which some cement has been washed out adjacent to adhesive retention elements. Plaque is found predominantly cervical to brackets under the arch wires.

Maintaining oral hygiene during orthodontic treatment will help in maintaining good gingival health, which reflects in final orthodontic treatment outcome. However, the level of gingival health knowledge among orthodontic patients is not adequate. Poor maintenance of oral hygiene is due to either lack of knowledge or negligence by patients themselves. Patients are not given proper instructions, or they may not comply properly with the instructions.

Administration of topical agents containing fluoride or casein phosphopeptide-amorphous calcium phosphate (CPP-ACP), maintenance of oral hygiene, and dietary control have been suggested as mechanisms to control formation of enamel lesions during fixed-appliance treatment. Fluoride ions in plaque immediately promote remineralisation by formation of flourapatite. In addition, fluoride application can promote remineralisation of previously demineralised enamel in cases where adequate amounts of calcium and phosphate ions are available. Fluoride and CPP-ACP applications are accepted approaches for remineralising the previously demineralised enamel.

The aim of this study was to evaluate the importance of proper oral hygiene in patients undergoing treatment with fixed orthodontic appliances.

Materials and Methods

The study included clinical examination and statistical processing of the data. Clinical examination encompassed 40 patients with diagnosed malocclusion, and it started before the orthodontic treatment. Subjects were divided in 2 groups (20 subjects in each group). The first group was treated with dental cream GC Tooth Mousse, and the second group with Fluorogal - solution with a low concentration of fluoride (0.05%F). Control group comprised 20 patients.

OHI-index was registered in all subjects (60) before and at the end of the orthodontic treatment, using the simplified method of Greene-Vermillion (OHI-S), where index values are within the 0 to 3: index 0 - absence of sediments; index 1 - presence of a third layer on the surface of the tooth crown; index 2 - presence of a number of deposits of a third, and less than ⅔ of the crown surface; index 3 - presence of a number of deposits of the ⅔of the crown surface.

Using the simplified method for determination of the oral hygiene index (OHI-S), only 6 areas have been assessed, which are representative sample for the entire dentition: vestibular area in upper first molars, top cover right central incisor and lower left central incisor; oral surface of the first molars. The obtained values were added together, and the score was divided with the number of the examined teeth.

For preventive treatment of the teeth in clinical conditions, the following tools were used: (1) a tool with a rich mineral composition (GC Tooth Mousse), from which we expected mineralization effect, and enrichment of the surrounding enamel brackets (clinical), or the enamel tooth crown; (2) a tool which also contains fluoride exempt (Fluorogal); (3) material for bonding the brackets which contained the fluorine GC Fuji Ortho™ LC, or did not contain fluoride - Dentaurum (Orthodontic Bonding System).

Results

Student’s t-test for dependent samples in subjects treated with fluoride solution (Fluorogal) showed a statistically significant difference between medium values of the OHI-S index before and after orthodontic treatment. The differences were not statistically significant between the group treated with preventive dental cream (GC Tooth Mousse), and in the control group (Tab. 1).

<table>
<thead>
<tr>
<th>groups*</th>
<th>OHI-S</th>
<th>X</th>
<th>SD</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>before treatment</td>
<td>1.55</td>
<td>0.48</td>
<td>1.087</td>
<td>0.2905</td>
</tr>
<tr>
<td></td>
<td>after treatment</td>
<td>1.49</td>
<td>0.46</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>before treatment</td>
<td>1.71</td>
<td>0.45</td>
<td>5.849</td>
<td>0.000012†</td>
</tr>
<tr>
<td></td>
<td>after treatment</td>
<td>1.43</td>
<td>0.47</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>before treatment</td>
<td>1.67</td>
<td>0.56</td>
<td>-0.684</td>
<td>0.5016</td>
</tr>
<tr>
<td></td>
<td>after treatment</td>
<td>1.75</td>
<td>0.44</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* - 1. group: brackets bonded with Fuji Ortho™ LC and treatment with GC Tooth Mousse
2. group: brackets bonded with Fuji Ortho™ LC and treatment with Fluorogal
3. group: brackets bonded with Fuji Ortho™ LC (control group)
† statistically significant differences
The analysis of variance (Tab. 2; Fig. 1) showed no statistically significant difference between the groups in relation to the OHI-S index by the treatment ($F=0.486; p=0.6176$). Tukey’s HSD (honestly significant difference) test showed differences (not statistically significant), among medium values in the OHI-S index in the examined groups before the treatment (Tab. 3).

**Table 2. Values of OHI-S index before treatment in I, II and III group**

<table>
<thead>
<tr>
<th>Group</th>
<th>$\bar{X}$</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.55</td>
<td>0.48</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>1.71</td>
<td>0.45</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>1.67</td>
<td>0.56</td>
<td>20</td>
</tr>
</tbody>
</table>

The analysis of variance (Tab. 4; Fig. 2) showed no statistically significant difference between the groups in relation to the OHI-S index by the treatment ($F=2.744; p=0.0727$). Tukey’s HSD test showed differences (not statistically significant), among medium values in the OHI-S index in the examined groups after the treatment (Tab. 5).

**Table 4. Values of OHI-S index in subjects after the treatment**

<table>
<thead>
<tr>
<th>groups</th>
<th>$\bar{X}$</th>
<th>SD</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>1.49</td>
<td>0.46</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>1.43</td>
<td>0.47</td>
<td>20</td>
</tr>
<tr>
<td>3.</td>
<td>1.75</td>
<td>0.44</td>
<td>20</td>
</tr>
</tbody>
</table>

**Table 5. Difference between values of OHI-S index in subjects after the treatment**

<table>
<thead>
<tr>
<th>groups</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. and 2.</td>
<td>0.9127</td>
</tr>
<tr>
<td>1. and 3.</td>
<td>0.1806</td>
</tr>
<tr>
<td>2. and 3.</td>
<td>0.0795</td>
</tr>
</tbody>
</table>

*Tukey (HSD) test

**Discussion**

Orthodontic treatment has preventive effect against periodontal disease and caries because it facilitates establishing functional occlusion and makes all tooth areas accessible to oral hygiene. Numerous studies have shown that orthodontic patients are in high risk of developing periodontal disease and caries because orthodontic treatment lasts for long time. Presence and position of fixed orthodontic appliances gives poor conditions for maintaining oral hygiene.

Biofilm is often seen as a complex structure which is prone to a number of external factors. They can both alter its structure and the formation process. Wearing of removable and fixed orthodontic appliances is listed among these factors. Biofilm has a tendency...
to accumulate on retentive areas of springs, clasps and acrylic base plates. According to Jordan et al. the increase in number of bacteria belonging to *Streptococci mutants* and *Lactobacilli* species, as well as the alteration of oral microbiota is observed during orthodontic treatment with removable appliances. Furthermore, according to Mitchell, fixed orthodontic appliances also pose threat to both patients and clinicians by increasing the risk of biofilm formation. It has been demonstrated that in the majority of orthodontic patients biofilm is present resulting in enamel decalcification around orthodontic brackets.

Evaluation of oral hygiene index (OHI) can be useful in biofilm diagnostics. Importance of oral hygiene in orthodontic patients is always intensified to prevent any further periodontal disease. In the absence of oral hygiene maintenance, plaque accumulation on orthodontic appliance components is paving way to destruction of periodontal tissues. Positive effects of orthodontic treatment may be compromised if adequate and regular oral hygiene is not maintained. Efficient plaque control consists of developing several effective methods and instruments for plaque removal, materials and methods for improving the resistance of teeth and oral tissues to caries and gingivitis, as well as instructions for oral hygiene maintenance. The role of oral hygiene in the genesis of caries was illustrated. However, remains a question on what and how much is the participation of oral hygiene in the development of these diseases.

Oral hygiene is a significant factor for oral and dental health. Mathiesen et al., analyzing association among oral hygiene (OHI-index), DMFT-index and index of gingival inflammation in 14-year-old children confirmed the inverse relationship to the appearance of caries and oral hygiene. The positive effects of oral hygiene instructions for patients with fixed orthodontic appliances have been recognized, and significant improvement of the OHI-S index was observed in our study as well; this is in accordance with the results by Al-Jewair et al., who reported good OHI compliance in 73% of patients. Our research confirms the significance of cleaning the oral cavity. Improvement of oral hygiene was detected in the group where preventive treatment with Fluorogal was implemented (statistically significant difference between medium values of the OHI-S index before and after orthodontic treatment), which was not the case with the control group. This finding might be a result of explanation in the way of oral hygiene maintenance (adequate and not adequate oral hygiene). The subjects treated with dental cream (GC Tooth Mousse) at the end of orthodontic treatment had a decreased oral hygiene index (1.49) in comparison to the beginning of the treatment, where the average monthly value of the index of oral hygiene was 1.55 (however, the difference was not statistically significant).

Improvement in OHI-S index can be explained by the precise instructions in oral hygiene measures during each check up and the resolving of crowding during the first 12 weeks of the orthodontic treatment, but it can also be attributable to the Hawthorne effect (patients’ awareness of being examined and evaluated).

**Conclusions**

Before commencing the treatment, patients should be informed about the increased risk of developing caries and periodontal disease and the necessity for ultimate and regular oral hygiene in order to reduce this risk to the minimum. The habit to maintain oral hygiene regularly is very important for maintaining gingival health throughout the treatment and after it is completed. A high level of oral hygiene should be achieved before, during and after any orthodontic treatment in order to prevent any side effects on periodontal tissues.

**References**


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