ASSESSMENT OF BACTERIAL BIOFILM ON PATIENTS WITH ORTHODONTIC FIXED APPLIANCES FOLLOWING NON OPERATIVE/PREVENTIVE TREATMENTS

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ABSTRACT:
The orthodontic fixed appliances determine increased retention of bacteria associated with increased cariogenic activity and enamel demineralization. The aim of study is to quantify, by ATP luminiscence method the effectiveness of a remineralizing calcium-phosphate-fluoride-based product used to decrease cariogenic activity to patients submitted to orthodontic fixed appliances therapy. Results. Initially, ATP mean values increased from 3818.3 to 7439.2 after 3 weeks of orthodontic therapy; following the non operative treatment with MI Paste Plus, ATP mean value decreased to 3883.0. Conclusions. The use of fixed appliances in orthodontic treatment influences the retention rate and increases the cariogenic activity of the adjacent bacterial biofilm. The remineralizing calcium-phosphate-fluoride-based products can decrease the cariogenic activity of the bacterial biofilm associated to orthodontic braces. ATP bioluminescence technique can be used for the rapid quantification of bacterial levels and for monitoring the oral hygiene and effectiveness of preventive-therapeutic measures during orthodontic therapy.

Key words: dental plaque, brackets, bioluminescence measurement technique, remineralization.

INTRODUCTION
Nowadays the orthodontic therapy is spreading both among young patients and aged patients due to increased esthetic needs. However orthodontic therapy based on fixed appliances is associated with higher cariogenic risk related to higher retention of bacterial biofilm [1-7].

The preventive and etiological treatment of carious disease must be related to the knowledge of formation, structure and properties of bacterial biofilm [6].

The cariogenic potential of bacteria is related to numerous metabolic features as follows: ability to metabolise various polysaccharides, high acidogenicity, extracellular polysaccharides synthesis (energetic reserves and adhesion), intracellular polysaccharides synthesis (catabolised in acids in relation to decreased supply of nutrients) [6].

The orthodontic fixed appliances favourise higher retention of acidogenic bacteria associated to enamel demineralization and followed later by cavitation (8-14). If local environment conditions favourise demineralization processes and selection of a cariogenic bacterial plaque, dental caries will appear [6].

Some studies prove the association between fixed appliances and higher incidence of dental caries [11-17]. However the researchers are not focused on the preventive and non operative measures aimed to counteract the apparition of dental caries for this category of patients. One of the possibilities to do that is ATP bioluminscence method. The presence of ATP prove the existance of a living organism or a substance produced by living organism [18,22,23]. ATP technology is rapid, accurate and non invasive and has been used recently in dentistry researches.
related to bacterial biofilm [18-25]. The bacteria producing acids contain higher ATP levels (even 100 times) comparing with non-cariogenic bacteria. The devices using ATP bioluminescence method measure light quantity generated by the contact with reference liquid, offering informations about levels of cariogenic bacteria.

Numerous studies proved the role of calcium-phosphate-fluoride-based products in the dental caries [26-35].

The products using activ agent CPP-ACPF (casein phosphopeptide, amorphous calcium-phosphate, fluoride 0.2%), increase calcium, phosphate, and fluoride levels in dental tissues. The saliva secretion will increase the CPP-ACPF effectiveness, especially when maintained longer time in oral cavity. These products have the ability to remineralize affected enamel, to neutralize both the acidogenic bacteria and external acids related to non-cariogenic lesions [33-37].

AIM OF STUDY:

The aim of study is to quantify, by ATP luminiscence method the effectiveness of a remineralizing calcium-phosphate-fluoride-based product used to decrease cariogenic activity to patients submitted to orthodontic fixed appliances therapy.

Table 1. ATP quantification before, after braces appliance and after remineralizing procedures

<table>
<thead>
<tr>
<th>Time</th>
<th>ATP Quantification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before orthodontic treatment</td>
<td></td>
</tr>
<tr>
<td>3 weeks after orthodontic treatment</td>
<td></td>
</tr>
</tbody>
</table>
RESULTS AND DISCUSSIONS:

The results related to values recorded before orthodontic therapy, immediate after the start of orthodontic therapy and after 3 weeks of orthodontic therapy associated with local treatment with Recaldent MI Paste Plus (table 2):

Table 2. ATP values.

<table>
<thead>
<tr>
<th>ATP values</th>
<th>initiation</th>
<th>post ortod.</th>
<th>post Paste</th>
<th>MI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>125 4</td>
<td>4288</td>
<td>3288</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>234 1</td>
<td>6711</td>
<td>6211</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>335 1</td>
<td>8314</td>
<td>1383</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>297 3</td>
<td>7636</td>
<td>3210</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>316 2</td>
<td>5644</td>
<td>3219</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>422 1</td>
<td>9722</td>
<td>3421</td>
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</tr>
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<td>7</td>
<td>239 0</td>
<td>6921</td>
<td>4127</td>
<td></td>
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<tr>
<td>8</td>
<td>562 1</td>
<td>9299</td>
<td>5210</td>
<td></td>
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<tr>
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<td>418 9</td>
<td>7892</td>
<td>3971</td>
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<td>213 1</td>
<td>6729</td>
<td>3288</td>
<td></td>
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<tr>
<td>11</td>
<td>522 1</td>
<td>6524</td>
<td>4392</td>
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<td>12</td>
<td>691 1</td>
<td>9789</td>
<td>4362</td>
<td></td>
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<tr>
<td>13</td>
<td>521 9</td>
<td>7852</td>
<td>3202</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>398 2</td>
<td>6822</td>
<td>2199</td>
<td></td>
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<tr>
<td>15</td>
<td>423 9</td>
<td>7542</td>
<td>3911</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>381 8.3</td>
<td>7439.2</td>
<td>3883</td>
<td></td>
</tr>
<tr>
<td>STD EV</td>
<td>151 6.4</td>
<td>1485.5</td>
<td>962.7</td>
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</tr>
</tbody>
</table>

Before the start of orthodontic therapy ATP values ranged between 1254
(minimum) to 6911 (maximum). After the start of orthodontic therapy, ATP values increased from 4288 (minimum) to 9789 (maximum). After the start of MI Paste Plus local treatment, ATP values decreased to 2199 (minimum) and 6211 (maximum) (table.2, fig.1.)

Our results show that orthodontic therapy based on fixed appliances (braces) constitutes a factor for retention and development of bacterial plaque. Our study also shows that local treatment with calcium-phosphate-fluoride-based products contributes to the decrease of development rate of bacterial plaque. The choice of Recaldent GC MI Paste Plus is motivated by some clinical and paraclinical studies [25-27,33]. The advantages are as follows: long-term contact with dental tissues, high fluoride levels inside bacterial plaque, easy-to-use, absence of secondary effects, mild stimulation of saliva secretion. As bacterial metabolism requests ATP, ATP-based tests can be used to measure the viability of bacterial cells in biological samples. While standard culture technique requests 5 days, ATP test can give results in a few minutes.

Similar studies confirm the increase of cariogenic activity of bacterial biofilm during fixed appliances orthodontic therapy [18-25]. However our study proves the preventive and therapeutic role of Recaldent GC MI Paste Plus used on patients during orthodontic therapy.

CONCLUSIONS:

- The use of fixed appliances in orthodontic treatment influences the retention rate and increases the cariogenic activity of the adjacent bacterial biofilm. The remineralizing calcium-phosphate-fluoride-based products can decrease the cariogenic activity of the bacterial biofilm associated to orthodontic braces. ATP bioluminescence technique can be used for the rapid quantification of bacterial levels and for monitoring the oral hygiene and effectiveness of preventive-therapeutic measures during orthodontic therapy.

REFERENCES: