THE EFFICACY OF CLASS I DRIFTDONTICS TREATMENT WITH PREMOLAR EXTRACTIONS IN ADOLESCENT PATIENTS

A EFICÁCIA DO TRATAMENTO COM DRIFTDONTICS NA CLASSE I COM EXTRAÇÃO DE PRÉ-MOLAR EM PACIENTES ADOLESCENTES

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ABSTRACT: Objective: The aim of this study was to assess the efficacy of driftodontics in the lower arch after 6-month period in individuals with severe crowding who undergo the extraction of the first premolars. Materials and Methods: The principle of driftodontics have been applied to the lower arch without the use of orthodontic appliances. Results: The results showed significant decrease of extraction spaces, a significant decrease of the IMPA from T1 to T3, the angulation of the canines from T1 to T2 and inter-canine distances, inter-pre-molars and inter-molars, as demonstrated with the ANOVA and Tukey tests (p <0.05). Conclusion: It is concluded that the dentoalveolar changes following the physiological tooth movement observation occurred more intensely in the first three months after the extractions, and the anterior segment was the area with the most significant changes.

KEYWORDS: Angle Class I, Driftodontics, Tooth Extractions.
1. Introduction

Crowding of the anterior teeth is a common clinical issue faced by orthodontists, and its severity can greatly affect function, aesthetics, and periodontal health[1]. Patients with Class I malocclusion who exhibit negative model discrepancy often lack the required space for proper tooth alignment, resulting in severe crowding[2]. One treatment approach for addressing this issue involves extracting the first premolars to create sufficient space for crowding resolution[2]. Following extractions, the initial retraction of canines is achieved using removable appliances, continuous or segmented wires, with or without skeletal assistance[3,4]. The space gained from extractions is then utilized to correct model discrepancy and profile protrusion according to the established treatment plan[4-10]. Orthodontic appliances are often employed to occupy this space, distribute forces, and move the teeth toward the extraction sites[4-10].

However, after the removal of the first premolars, teeth often undergo spontaneous inclination and physiological movement, leading to the closure of the extraction space.11 This movement is challenging to observe for an extended period since dental appliances are usually used immediately after extractions[12-22]. Some studies have assessed the natural tooth movement in the lower arch following extractions, a phenomenon referred to as "drifodontics"[23-24]. This movement can be leveraged to establish a new tooth position. Alexander described the application of this principle to address severe crowding cases without orthodontic appliances in the lower arch[23]. Orthodontic accessories are typically placed in the lower arch approximately 4 to 6 months after initiating appliance treatment in the upper arch[23-24].

Several authors have studied the physiological tooth movement in the lower arch after first premolar extractions. For instance, Berg and Gebauer found that around 80% of space reduction is due to the distal displacement
of canines and that approximately 50% of the reduction in extraction spaces can be harnessed for therapeutic purposes with close monitoring[20]. Swessi and Stephens noted distal angulation of canines during the initial 6 months, followed by mild uprighting in the subsequent 6 months. In the long-term, the canines remained stable, but after 12 months, significant mesial angulation of premolars on both sides was observed[21]. Other studies, such as Papandreas et al., demonstrated favorable changes in the lower arch, especially related to incisors and canines, after the extraction of the first four premolars[22]. Gönül and Sayınsu showed that premolar extractions can be performed without soft tissue retrusion and stressed the importance of considering the patient's skeletal pattern, degree of crowding, and soft tissue characteristics in the decision-making process for extractions[25].

While some studies have explored this procedure through scientific investigations and case reports, there is limited information on the quantitative changes in tooth movement after extractions[14-19]. Understanding the nature of spontaneous tooth positional changes after extractions is crucial for managing patients with severe crowding[1].

The purpose of this study was to assess the effectiveness of driftodontics by examining changes in the lower dental arch concerning the positions of permanent incisors, canines, second premolars, and permanent lower first molars. Additionally, we examined changes in extraction spaces and the irregularity index of incisors at three and six months following the extraction of the first premolars in patients with Class I malocclusion and severe crowding, all without the use of orthodontic appliances.
2. Methodology

2.1 Material

This study was approved by the Research Ethics Committee of Araçatuba Dental School under process No. 2006-01604. A total of 11 Brazilian patients (7 boys and 4 girls) between the ages of 12 and 15 were selected. The inclusion criteria for the sample were as follows:

1 - Complete permanent dentition with erupted second molars and third molars in formation.
2 - Angle Class I malocclusion with severe crowding in the lower arch, necessitating the extraction of the first premolars for orthodontic treatment.
3 - Absence of sagittal, vertical, or transverse skeletal changes.
4 - No tooth loss or tooth agenesis.
5 - No periodontal issues or signs and symptoms of temporomandibular dysfunction.
6 - No history of previous orthodontic treatment.

The study utilized lateral teleradiographs, panoramic radiographs, and plaster models. These records played a crucial role in documenting the patient's condition and were essential for the diagnosis and planning of orthodontic treatment. The evaluation process followed a specific timeline, which can be summarized in the following stages:

T1 - Pre-extraction period.
T2 - 3 months after extractions.
T3 - 6 months after extractions.
2.2 Methods

The treatment approach involved the extraction of the lower first premolars. The upper arch underwent conventional orthodontic treatment using a fixed appliance (Brackets, slot .022”x.030”, REF 10.10.907, Morelli, Brazil). Meanwhile, the lower arch was monitored for a period of 6 months without receiving any orthodontic treatment. The radiographs used in this study were taken at an oral imaging diagnostic center (X-mind TOME CEPH – Soredex). Subsequently, the radiographs were scanned using a desktop scanner model (HP Scanjet 4890) to obtain digital images. These scanned images were then imported into AutoCAD 2006 software for cephalometric tracings, allowing for the identification of points, lines, planes, and angles.

To determine the angular measurements in the lateral teleradiography, the following cephalometric points, lines and planes were identified (Figures 1 and 2):

- Gonion (Go): the most postero-inferior point of the mandibular angle[3].
- Menton (Me): the most inferior point on the contour of the mandibular symphysis[3].
- 6c: point located on the tip of the mesial cuspid of the mandibular first molar.
- 6r: point located at the apex of the mesial root of the mandibular first molar.
- 1c: point located on the incisal side of the lower central incisor.
- 1r: point located on the root apex of the lower central incisor.
Figure 1 – Points used in lateral teleradiography. Mandibular plane (MP): formed by joining the Go and Me points. Long axis of the lower central incisor (LE1): formed by joining the points 1c and 1r. Long axis of the mandibular first molar (LE6): formed by joining the points 6c and 6r. After determining the lines and planes the following angles were evaluated: IMPA: angle formed by the intersection LE1 with PM; 6.PM: angle formed by intersecting LE6 with PM.

Source: The Authors
All angular and linear measurements (Figures 3, 4 and 5) were performed twice by the same examiner with a 10-day interval between both. To verify the intra-examiner systematic error the paired test was used. All variables studied were submitted to the Kolmogorov-Smirnov test, thus allowing the use of parametric tests. One-way Analysis of Variance (ANOVA) for repeated measures was used to make the comparison between the three times. When ANOVA indicated a statistically significant difference, Tukey’s post-ho test was used for multiple comparisons between the evaluated times. In all tests a 5% significance level was used (p<0.05). All tests were performed using the Graph Prism software (Version 10.0.1, Boston, MA).
Figure 3 – Interdental distances evaluated in plaster models. Using a digital caliper (Mitutoyo – Japan), the following distances were measured on the plaster models. The points identified on the models were: 33 and 43: points located on the tips of the cuspids of the left and right mandibular; 33 and 43: points located on the cusp tips of the left and right mandibular canines, respectively; 35 and 45: points located on the tips of the buccal cusps of the mandibular second second mandibular premolars, left and right, respectively; 36 and 46: points located on the tips of the mesiobuccal cusps of the left and right mandibular first molars, respectively.

Source: The Authors
Figure 4 – Linear measurements referring to the extraction spaces. Intercanine width (Length 33-43): corresponding to the distance between points 33 and 43; Inter-second premolar width (Length 35-45): corresponding to the distance between points 35 and 45; Interpremolar width (Length 36-46): corresponding to the distance between the points 36 and 46.

Source: The Authors
3. Results

The values obtained for dental changes during the 6 months of follow-up are shown in tables 1 to 8. Tables 1 and 2 show the means and standard deviations of alterations in the mandibular central incisor and in the mandibular first molar in the lateral teleradiography. Tables 3, 4, and 5 present the means and standard deviations of canine, second premolar, and lower first molar angulations, both for the right and left sides, as evaluated on panoramic radiographs. Table 6 displays the means and standard deviations of the intercanine, intersecond premolar, and interfirst molar distances as evaluated in the model. Table 7 presents the means and standard deviations of the measurement of spaces in the extractions of the first premolars evaluated in the models. Table 8 shows the means and standard deviations of the Lower Incisors Irregularity Index (LIII) evaluated in the models.
### Table 1 – Means and standard deviations of lower central incisor inclination.

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T1</th>
<th>T2</th>
<th>T2</th>
<th>T3</th>
<th>T3</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMPA</td>
<td>92,47&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7,93</td>
<td>90,37&lt;sup&gt;ab&lt;/sup&gt;</td>
<td>7,58</td>
<td>90,18&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8,01</td>
<td>0,027*</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 5% level (p<0.05).

Source: The Authors

### Table 2 – Means and standard deviations of first molar angulation.

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T1</th>
<th>T2</th>
<th>T2</th>
<th>T3</th>
<th>T3</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.PM</td>
<td>78,01</td>
<td>5,86</td>
<td>78,60</td>
<td>5,26</td>
<td>78,83</td>
<td>5,01</td>
<td>0,606ns</td>
</tr>
</tbody>
</table>

*ns No statistical significance at the 5% level (p<0.05).

Source: The Authors

### Table 3 - Means and standard deviations of lower canine angles for the right and left sides.

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T1</th>
<th>T2</th>
<th>T2</th>
<th>T3</th>
<th>T3</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.LM</td>
<td>84,70&lt;sup&gt;a&lt;/sup&gt;</td>
<td>11,33</td>
<td>90,07&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7,33</td>
<td>91,66&lt;sup&gt;b&lt;/sup&gt;</td>
<td>8,43</td>
<td>&lt;0,001*</td>
</tr>
<tr>
<td>33.LM</td>
<td>81,42&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6,13</td>
<td>87,03&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3,42</td>
<td>88,67&lt;sup&gt;b&lt;/sup&gt;</td>
<td>4,08</td>
<td>&lt;0,001*</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 5% level (p<0.05).

Times with the same letter indicate no statistical difference.

Source: The Authors

### Table 4 - Means and standard deviations of the angles of the right and left mandibular second premolars.

<table>
<thead>
<tr>
<th></th>
<th>T1</th>
<th>T1</th>
<th>T2</th>
<th>T2</th>
<th>T3</th>
<th>T3</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>43.LM</td>
<td>72,40</td>
<td>5,00</td>
<td>71,68</td>
<td>3,13</td>
<td>70,73</td>
<td>4,04</td>
<td>0,354ns</td>
</tr>
<tr>
<td>33.LM</td>
<td>75,00</td>
<td>4,15</td>
<td>72,30&lt;sup&gt;b&lt;/sup&gt;</td>
<td>3,91</td>
<td>71,53&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5,23</td>
<td>&lt;0,001*</td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 5% level (p<0.05).

*ns No statistical significance at the 5% level (p<0.05).

Source: The Authors
Table 5 – Means and standard deviations of the angles of the lower right and left first molars.

<table>
<thead>
<tr>
<th></th>
<th>T1 Mean</th>
<th>s.d.</th>
<th>T1 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T3 Mean</th>
<th>s.d.</th>
<th>T3 Mean</th>
<th>s.d.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>46.LM</td>
<td>69.08</td>
<td>3.87</td>
<td>67.89</td>
<td>5.12</td>
<td>67.94</td>
<td>4.61</td>
<td>0.277ns</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36.LM</td>
<td>69.59</td>
<td>4.21</td>
<td>69.35</td>
<td>5.99</td>
<td>70.20</td>
<td>6.05</td>
<td>0.571ns</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

ns No statistical significance at the 5% level (p<0.05).

Source: The Authors

Table 6 - Means and standard deviations of intercanine, intersecond premolar, and interfirst molar distances.

<table>
<thead>
<tr>
<th></th>
<th>T1 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T3 Mean</th>
<th>s.d.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length 33-43</td>
<td>25.78</td>
<td>2.13</td>
<td>26.47</td>
<td>1.94</td>
<td>26.87</td>
<td>1.99</td>
<td>0.001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length 35-45</td>
<td>38.23</td>
<td>1.98</td>
<td>37.45</td>
<td>1.60</td>
<td>37.29</td>
<td>1.63</td>
<td>0.009*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length 36-46</td>
<td>43.82</td>
<td>1.66</td>
<td>43.42</td>
<td>1.69</td>
<td>43.36</td>
<td>1.79</td>
<td>0.015*</td>
<td></td>
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</tr>
</tbody>
</table>

*Indicates statistical significance at the 5% level (p<0.05).

Times with the same letter indicate no statistical difference.

Source: The Authors

Table 7 – Means and standard deviations of spaces for extractions of first premolars.

<table>
<thead>
<tr>
<th></th>
<th>T1 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T3 Mean</th>
<th>s.d.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>ExtR</td>
<td>7.47</td>
<td>0.49</td>
<td>4.82</td>
<td>1.20</td>
<td>3.93</td>
<td>1.31</td>
<td>0.001*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ExtL</td>
<td>7.84</td>
<td>0.42</td>
<td>5.21</td>
<td>0.75</td>
<td>4.28</td>
<td>0.86</td>
<td>0.001*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 5% level (p<0.05).

Times with the same letter indicate no statistical difference.

Source: The Authors

Table 8 – Means and standard deviations of the Lower Incisors Irregularity Index.

<table>
<thead>
<tr>
<th></th>
<th>T1 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T2 Mean</th>
<th>s.d.</th>
<th>T3 Mean</th>
<th>s.d.</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIII</td>
<td>11.18</td>
<td>2.03</td>
<td>8.58</td>
<td>1.93</td>
<td>7.42</td>
<td>2.17</td>
<td>0.001*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Indicates statistical significance at the 5% level (p<0.05).

Source: The Authors
4. Discussion

This study investigated changes in tooth angulation and movement following extractions. In the panoramic radiograph, first molars initially displayed slight mesial angulation, followed by a mild distal angulation. In the lateral cephalometric radiograph, a minor mesial angulation was observed. The transverse distance between the first molars decreased significantly in the first trimester, followed by a slight decrease. The second premolars showed significant mesial angulation on the left side in the panoramic radiograph, and the models indicated a significant reduction in transverse distance from T1 to T2, followed by a slight decrease. These changes in tooth positions differed from previous research[12,15,19], likely due to varying follow-up times.

In contrast to prior studies, the results from Swessi & Stephens' study were similar to this research[21]. The first molars exhibited mesial angulation after 6 months of extractions, followed by distal angulation. The second premolars also displayed asymmetrical results with mesial angulation. Persson et al. suggested a tendency for canines to angle toward the extraction sites[18]. The lower second premolars in Berg and Gebauer's study had a mild tendency to rotate mesio-lingually[20]. In Papandreas et al.'s research, lower first molar angulation was small but higher than this study's results[22]. The canines in this study displayed distal angulation, aligning with previous research. Richardson[19] and Swessi & Stephens[21] reported distal angulation of the canines, with variation in the degree of distalization. Berg and Gebauer's study indicated distalization of the lower canines[20], and Persson's results suggested a tendency toward distal angulation over a longer follow-up period[18]. Campbell-Wilson found that the canines moved effectively toward extraction spaces[13].

The models revealed an increase in intercanine width, indicating distal movement of the canines toward a more posterior position in the dental arch,
consistent with Berg and Gebauer’s findings[20]. The analysis of the lateral cephalometric radiograph showed lingualization of the lower incisors, leading to a reduction in arch length and crowding. These results were consistent with Papandreas’ research[22], although the degree of reduction differed. Crossman & Reed[14], as well as Campbell-Wilson[13], observed improvements in the anterior region of the arch, particularly in the lower incisors.

The analysis of extraction spaces showed a reduction in space size in the first three months, followed by a milder decrease. This aligns with findings from Stephens, who reported space closure following extractions[16-17]. Some studies reported complete space closure in a substantial percentage of cases, with factors such as early premolar extractions and Class II malocclusions influencing the degree of closure[26-28]. Alveolar bone changes were not evaluated in this study, but regular follow-ups considered individual characteristics. The presence of third molars did not significantly impact dental angulations in the lower arch, as demonstrated by previous research[12,13].

5. Conclusion

It was concluded that the lower incisors showed lingual inclination after 6 months and a decrease in the Lower Incisors Irregularity Index at 3 and 6 months. The lower canines exhibited distal angulation at 3 and 6 months, with a greater degree at 3 months, and a slight increase in the intercanine distance in the first 3 months. The lower first molars and second premolars did not show changes in their angulations, except for the left side second premolars, which exhibited mesial angulation in the first 3 months after extractions. There was a slight decrease in the inter-first molar and inter-second premolar widths in the first 3 months. The extraction spaces showed a reduction over the evaluated periods.
References


