Changes in Lip Length and Strain after En-masse Retraction with Maximum Anchorage in Female Patients with Bimaxillary Protrusion

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Changes in Lip Length and Strain after En-masse Retraction with Maximum Anchorage in Female Patients with Bimaxillary Protrusion

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Aim: The aim of the study is to evaluate the effect of en-masse retraction with maximum anchorage on the lip length, lip strain, and interlabial gap in adult female patients with bimaxillary protrusion.

Materials and Methods: Thirteen patients underwent initial records including photographs, study casts, and cephalometric x-rays. En-masse retraction was performed using friction mechanics, with the use of temporary anchorage devices and power chains after the extraction of first premolars. The soft tissue was analyzed using lateral cephalometric radiographs before and after retraction. Results: The results showed that en-masse retraction had a significant effect on reducing lip strain, increasing lip length, and reducing interlabial gap.

Conclusion: The findings suggest that en-masse retraction can be an effective tool in improving the soft tissue profile in patients with bimaxillary protrusion.

Sample Size Calculation:

Sample size calculation was done using the comparison of lip thickness before and after retraction using en-masse mechanics, with absolute anchorage. Thus, the purpose of this study was to analyse the soft tissue, in regard to the lip strain, lip length, and interlabial gap, before and after retraction using en-masse retraction.

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2. MATERIALS AND METHODS:

The current study was conducted using cephalometric radiographs from 13 adult female bimaxillary protrusion patients who underwent orthodontic treatment. Initially, patients were screened at Future University in Egypt, Orthodontic Clinic to ensure they fulfilled the inclusion and exclusion criteria. Inclusion criteria consisted of adult female patients that required first premolar extraction with maximum anchorage. Full set of permanent dentitions (excluding the third molars) were required. Patients that suffered from systemic diseases, parafunctional habits (tongue thrusting, mouth breathing, etc.), or craniofacial anomalies were excluded from the study.

Each recruited patient had initial records taken, which included photographs, study casts, and panoramic and lateral cephalometric x-rays. The initial cephalometric radiographs were considered T₀ (Fig. 1A). The same orthodontist managed each case with fixed orthodontic appliance (0.022” slot – American Orthodontics, Sheboygan, Wis.), followed by levelling and alignment until reaching 0.017X0.025” stainless steel wire. Prior to extraction of the first premolar, temporary anchorage devices (TADs) were added to each quadrant, placed between the first molar and the second premolar at the mucogingival junction. To reinforce the posterior anchorage, the TADs were ligated to the second premolar.

After extraction, crimpable hooks, 9mm in length to approximate the centre of resistance⁴, were placed on the final arch wire, distal to the lateral incisor. Power chains with 200 gm of force were used, extending from the miniscrew to the crimpable hooks for retraction (Fig. 2). The case was considered complete when the extraction space was closed and class I canine relationship was achieved. Post-retraction lateral cephalometric radiographs were taken, denoted as T₁ (Fig. 1B).

The soft tissue analysis was performed on WebCeph by a single outcome assessor. The landmarks and the measurements made are present in table 1 and 2, respectively.

| Table (1) |
|---------------------------------|----------------|----------------------------------|
| **Landmarks** | **Abbreviations** | **Definition** |
| Soft tissue A point | A’ | Most posterior point of the curvature of the maxillary sulcus |
| Subnasale | Sn | The point between the columella nasi and the philtrum of the upper lip |
| Labralis Superius | Ls | Most prominent point of the upper lip |
| Stomion Superioris | Stms | The most inferior point of the upper lip |
| Stomium Inferius | Stmi | The most superior point of the lower lip |

| Table (2) |
|---------------------------------|----------------|----------------------------------|
| **Measurement** | **Definition** |
| Lip thickness at A point | Distance measured between A’ to A point |
| Lip thickness at upper Lip | Distance measured between Ls and labial surface of upper incisor |
| Lip strain | Lip thickness at Labralis Superius minus Lip thickness at A point in millimeters |
| Lip length | Distance from Sn to Stms in millimeters |
| Interlabial gap | Vertical distance between upper and lower lips, from Stms to Stmi in millimeters |

Statistical Analysis and Data Presentation

Data were statistically described in terms of mean ± standard deviation (±SD). Comparison between the study groups was done One Way Analysis of Variance (ANOVA) test. Two-sided p values less than 0.05 was considered statistically significant. IBM SPSS (Statistical Package for the Social Science; IBM Corp, Armonk, NY, USA) release 22 for Microsoft Windows was used for all statistical analyses.
3. RESULTS

Every measurement in this study is represented in table 2. The lip strain was measured as the difference between two measurements – one at labialis superius and one at Apoin. A large difference between the two measurements is indicative of excessive lip strain caused by proclined incisors. In this study, the lip strain decreased significantly with the en-masse retraction of the anterior teeth, from 2.8 mm to 0.27 mm.

Lip length was the distance measured between the subnasale and the stomion superius of the upper lip. The lip length increased significantly after retraction by 1.32 mm.

Finally, the interlabial gap, measured as the distance between stomion superius and inferius, decreased significantly after retraction by 1.49 mm. The results can be summarized in table 3.

Table (3)

<table>
<thead>
<tr>
<th>Soft Tissue results</th>
<th>Pre (n = 13) Mean (SD) (mm)</th>
<th>Post (n = 13) Mean (SD) (mm)</th>
<th>Mean diff</th>
<th>95% CI</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lip Strain</td>
<td>2.8(1.5)</td>
<td>0.27(1.6)</td>
<td>2.56</td>
<td>1.19, 3.93</td>
<td>0.002*</td>
</tr>
<tr>
<td>Lip Length</td>
<td>21.4(1.9)</td>
<td>22.7(2.2)</td>
<td>1.32</td>
<td>0.76, 1.89</td>
<td>&lt;0.001*</td>
</tr>
<tr>
<td>Interlabial Gap</td>
<td>2.8(2.0)</td>
<td>1.3(0.80)</td>
<td>1.49</td>
<td>0.67, 2.31</td>
<td>0.002*</td>
</tr>
</tbody>
</table>

Mean: Arithmetic mean; SD: standard deviation; CI: confidence interval, * = Statistically significant

4. DISCUSSION

Lip aesthetics is by far one of the most important aspects of orthodontic treatment. The lips are supported by the underlying teeth, and their position determines the soft tissue lip support. Thus, the present prospective clinical trial evaluated the variations in soft tissue lip form following orthodontic management of patients with bimaxillary protrusion and class II division 1 cases treated through the extraction of the first premolars and followed by the retraction of the 6 anterior teeth.

When treating maxillary protrusive cases, anchorage control is vital to achieve proper soft tissue results9. To reinforce anchorage, several techniques can be used, including headgears, Nance appliance, intermaxillary elastics, and so on. Recently, temporary anchorage devices (TADs) have been a successful alternative in regards to anchorage11. In this study, skeletal anchorage was used to ensure maximum retraction of the anterior teeth into the extraction space. Skeletal anchorage for the retraction of anterior teeth has been advocated in several studies6,12–14. When looking at it from a soft tissue perspective, a systematic review by Mohan et al.15 evaluated the evidence researching skeletal anchorage in relation to soft tissue changes. They found that, although the evidence was low quality, using mini-implant anchorage may significantly change the nasolabial angle, upper and lower lip procumbence, and facial convexity angle compared to conventional anchorage.

In this study, lateral cephalometric radiographs were taken before retraction and immediately after retraction was completed. These radiographs were taken in order to measure the lip strain, lip length, and the interlabial gap before and after retraction.

In terms of the lip strain, the results of this study showed that the strain decreased significantly after retraction of the 6 anterior teeth, from 2.8mm to 0.27mm. Significant correlation between retraction and patients with high lip strain was reported in a pre and post cephalometric study by Oliver16. However, Rains and Nanda17 found a negligible correlation between the two.

After retraction, the lip length of the patients studied increased significantly. Pre-retraction, the lip length was 21.4mm. Retraction of the six anterior teeth led to an elongation of the upper lip by 1.32mm. A significant increase in the lip length was also found in a study by Alqahtani et al.18, where the mean difference between pre and post retraction was 1.1mm. These results were unlike the study made by Talas et al.19, where they found that the length of the upper lip did not increase with orthodontic treatment.

Finally, the interlabial gap significantly decreased by 1.49mm when comparing pre to post retraction measurements. Similar significant difference was also noted in the study by Alqahtani et al.18, where the interlabial gap decreased from 5.6mm to 3mm post retraction. These results were concurrent with a study by Marzouk and Kassem20, where the interlabial gap also decreased significantly after retraction.

5. CONCLUSION

Following premolar extraction and the retraction of the 6 anterior teeth, the upper lip strain decreased, the lip length increased, and the interlabial gap decreased. From this limited study, we can conclude that, with en-masse retraction with maximum anchorage, the soft tissue profile of the upper lip significantly changes post retraction. Thus, en-masse retraction with the use of miniscrews produces satisfactory soft tissue profile of the upper lip.

6. REFERENCES


