Prospective study of soft tissue contour changes following chin bone graft harvesting


Abstract. This study sought to evaluate changes in the soft tissue contour after chin bone graft harvesting. Thirty selected patients underwent chin bone graft harvesting and evaluations were made using lateral cephalograms preoperatively and postoperatively at 30 and 180 days. Fixed points and lines were established on cephalometric tracings and used to measure the selected vertical and sagittal parameters. Results showed statistically significant alterations to the vertical position values of the vermilion (V-VPV) which increased from 9.70 to 11.01 and the exposure of lower incisors (V-EL1) which increased from 1.85 to 3.5, showing an increase in their distance from the plane of reference and a lowering of their position, the clinical equivalent of a labial ptosis condition. None of the sagittal parameters analysed showed any statistically significant variation in the final evaluation. The study concluded that the alterations to patients’ soft tissue contours resulted mainly from failure to ensure precise reattachment of the mentalis muscles and identified the need for further investigation of that aspect.

The use of autogenous bone grafts harvested from the mandibular symphysis has been widely reported as a reliable procedure offering easy access and bone tissue of a suitable quality. The bone tissue’s ectomesenchymal and membranous origin ensures early vascularisation and the maintenance of its volume and viability. Most of the patients undergoing this type of grafting procedure experience some postoperative morbidity but it is transitory and considered to be acceptable.

The use of this donor area is indicated in cases of alveolar reconstruction involving extensions of up to four teeth, or sites involving one or two teeth that require gains in alveolar height and/or thickness and also in the correction of alveolar-palatine clefts.

Most studies on mandibular symphysis grafts focus on the bone graft itself rather than on procedures to take care of the soft tissues involved. Studies are needed to assess the alterations to soft tissues after the bone graft material has been harvested from this donor area. Accordingly, this prospective, non-randomized study analyses the alterations occurring in the surrounding soft tissues after the removal of chin bone grafts.

Materials and methods

This prospective, non-randomized study included 30 patients (22 women; eight men), aged 21–65 years (average 45 years) who needed to undergo the harvesting of a chin bone graft to be used in alveolar ridge augmentation pre-maxilla, preparatory to subsequent rehabilitation with implants. Patients were excluded if they: had undergone chin surgery; had no first or second molar or lower central incisors; or did not agree to participate in the study. Two surgeons conducted the operations using standard surgical techniques.
The surgical procedure to harvest the graft involved a horizontal incision in the alveolar mucosa in the inter-canine region, 5 mm below the mucogingival line. Subsequently an incision was made through the mentalis muscles on each side and on down to the bone. After carefully raising the muco-periosteal flap at the lower border of the mandible and locating the mental foramina, the osteotomy was carried out using a No 702 cross-cut fissure burr. The form of each graft block removed was determined by the reconstruction it was destined for, but in every case a distance of at least 5 mm was maintained from the roots of the canine teeth, the mental nerves and the base of the mandible. The final separation and removal of the graft block was achieved using chisels. In all patients a 30 x 10 mm corticocancellous block was removed. Closure was carried out in two stages. The internal sutures consisted of three stitches using 3-0 suture catgut (Point Suture, Fortaleza, Brazil) and were designed to achieve precise repositioning of the mentalis muscles. A continuous suture using the same kind of catgut was used for closure of the mucosa. A microporous tape was then placed over the site to minimize oedema and haematoma formation. The tape was removed 72 h later.

Evaluation
To assess any alterations occurring in the soft tissues in the region, lateral cephalograms were taken preoperatively and post-operatively after 30 and 180 days (Figs 1–3). All of the radiographs were made using the same technique, and the same X-ray machine and the cephalometric tracings were made by the same researcher on 0.07 mm acetate sheet using a 0.5 mm lead pencil. The cephalometric tracings were all done by the same professional individual and three separate tracings were made for each lateral cephalogram, at each one of the periods when they were taken. The measurements considered for research purposes were the average of the measurements obtained from the tracings.

The analysis of the soft tissue contours was based on a set of points and lines proposed by Chaushu et al.3 (Fig. 4): 1, mandibular occlusal plane (MOPL), a horizontal plane tangent to the uppermost points of the lower first or second molar and the lower incisor; 2, soft tissue menton (Mes), the most inferior point of the soft tissue of the chin; 3, soft tissue pogonion (Pgs), the most anterior point on the soft tissue of the chin; 4, soft tissue supramental (Sms), the point of greatest concavity in the midline of the lower lip between the vermilion inferius and the soft tissue pogonion; 5, vermilion inferius (Ve), a point on the mucocutaneous border of the lower lip; and 6, the stomion inferior (Stoi), the uppermost point on the vermilion of the lower lip.

The analysis of soft tissue positions in the vertical direction made use of the following parameters (Fig. 5): lower lip length (V-LLL), the distance from Stoi (6) to Mes (2), perpendicular to the MOPL (1); exposure of the lower incisors (V-ELI), the distance from Stoi (6) to the MOPL (1); vertical position of the vermilion (V-VPV), the distance from Ve (5) to the MOPL (1); vertical position of the soft tissue supramental (V-VPSms), the distance from Sms (4) and the MOPL (1); and vertical position of the soft tissue pogonion (V-VPg), the distance from Pgs (3) and the MOPL (1).

The analysis of soft tissue positions in the sagittal plane made use of the following parameters (Fig. 6): lower lip thickness (S-LLT), the distance from Ve (5) and the lower incisor, parallel to the MOPL; soft tissue thickness at supramental (S-SmTs), the distance from Sms (4)
to the hard tissue, parallel to MOPL; soft tissue thickness at pogonion (S-PgTs), the distance from Pgs (3) to the hard tissue, parallel to MOPL; depth of mentolabial sulcus (S-MLS), the distance from Sms (4) to VeI (5), perpendicular to the MOPL; mentolabial angle (S-MLA), the angle formed by the intersection of tangents through VeI (5) and Pgs (3) drawn from Sms (4).

### Statistical analysis

Initially an exploratory analysis was made using PROC LAB from the SAS statistics programme. In the case of the S-MLA variable it proved necessary to transform the data to a logarithmic format to carry out a parametric analysis, then analysis of variance (ANOVA) for repeated measurements was done and the Tukey test. The V-ELI variable was subjected to the Friedman non-parametric test with the data expressed in means, maximums and minimums, because it does not meet the requirements for conducting a parametric analysis. In all cases, the level of significance was 5%.

### Results

Changes in the vertical parameters studied are given in Tables 1 and 2. Statistically significant differences were observed for the variable lower lip length (V-LLL), which increased from 49.46 to 50.3 between preoperative and postoperative measurements at 30 days. In the comparison between preoperative and postoperative measurements at 180 days there was a statistically significant change in the variables exposure of the lower incisors (V-ELI) and vertical position of the vermillion (V-VPV), which also increased from 1.85 to 3.5 and 9.70 to 11.01, respectively.

In the sagittal parameters, statistically significant changes were observed between the preoperative and postoperative measurements at 30 days for the variables soft tissue thickness at supramentale (S-SmTs), which varied from 13.33 to 15.18, soft tissue thickness at pogonion (S-PgTs), ranging from 14.45 to 16.21, and the mentolabial angle (S-MLA) which varied from 132.25 to 135.0. When the analysis compared the preoperative values and the postoperative measurements at 180 days the differences were no longer statistically significant (Table 3).

### Discussion

Three types of intra-oral incision are commonly used for graft harvesting the chin bone: sulcular, marginal, and alveolar mucosal.\(^{2,6,9,11}\). This study used alveolar mucosal incisions exclusively to avoid introducing errors caused by variations in the mode of access. After graft removal the surgeons sought to reposition the mentalis muscles as accurately as possible.

There are very few reports of studies involving follow-up methodology designed to assess changes to soft tissue profiles after the harvesting of this type of bone graft.\(^{13}\) evaluated patients submitted to mentoplasty, studying the effect of precise repositioning of the mentalis muscles achieved by identifying, isolating and marking them prior to incision. They reported that no statistically significant alterations to soft tissue profiles were observable in those cases where precise reattachment of the muscle had been carried out. The opposite was the case when precise reattachment was attempted but without

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**Table 1.** Vertical parameters: mean values (standard deviation) of investigated variables against time.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Preoperative</th>
<th>1 month</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-LLL</td>
<td>49.46 (3.91)</td>
<td>50.3 (3.25)</td>
<td>48.99 (3.90)</td>
</tr>
<tr>
<td>V-VPV</td>
<td>10.08 (2.96)</td>
<td>9.70 (2.68)</td>
<td>11.01 (2.16)</td>
</tr>
<tr>
<td>V-VPSms</td>
<td>18.30 (3.43)</td>
<td>18.41 (3.82)</td>
<td>18.62 (3.10)</td>
</tr>
<tr>
<td>V-VPPgs</td>
<td>36.63 (3.66)</td>
<td>36.88 (4.00)</td>
<td>37.03 (4.42)</td>
</tr>
</tbody>
</table>

Different capital letters in the lines indicate statistically significant differences where \( P \leq 0.05 \).

**Table 2.** Vertical parameters: mean (minimum; maximum) V-ELI values by time.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Preoperative</th>
<th>1 month</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>V-ELI</td>
<td>2.0 (–2; 7)</td>
<td>1.85 (–3; 7)</td>
<td>3.5 (–3; 12)</td>
</tr>
</tbody>
</table>

Different capital letters in the lines indicate statistically significant differences where \( P \leq 0.05 \).
prior identification, isolation and marking of the muscles. Dix et al.\textsuperscript{5} evaluated the effects of harvesting chin bone grafts on soft tissue profiles in alveolar cleft patients (average age 12 years), by examining some of the sagittal parameters. The authors confirmed a considerable increase in the soft tissue thickness in the graft removal region but concluded that it was due to the patient’s normal growth processes rather than the effects of surgery.

Vertical parameters analysed in this study that showed no statistically significant changes at the end of the study period were lower lip length (V-LLL), vertical position of the soft tissue supramental (V-VPsms) and the vertical position of the soft tissue pogion (V-VPPGs). The vertical position of the vermillion (V-VPV) and the exposure of the lower incisors (V-ELI) both showed increased distances from the plane of reference as well as a drop to a lower position; a condition compatible with labial ptosis. These findings corroborate the results obtained by Chaushu et al.\textsuperscript{2} in patients undergoing mentoplasty in which precise reattachment of the mentalis muscles was attempted but without prior identification, isolation or marking of the same.

None of the sagittal parameters selected for study showed any statistically significant alterations at the end of the study. These results are consistent with the findings of Chaushu et al.\textsuperscript{2} both for a group of patients in which prior identification, isolation and marking of the mentalis muscle was done and the group in which it was not done. A comparison of the findings of this study with those of Dix et al.\textsuperscript{5} reveals discrepancies. Although they reported a significant increase in soft tissue thickness, they attributed it to the normal growth processes of the patients rather than any effects stemming from surgery.

Based on the results of this study and those of Chaushu et al.\textsuperscript{2}, the authors state that bone graft harvesting from the chin causes contour changes in the soft tissue in this region. The changes that occurred in the soft tissues of the chin are not the direct result of harvesting the bone graft but rather of the failure to reattach the mentalis muscle accurately in its original position. The authors suggest that in future, such surgery should always include a careful and precise repositioning of the mentalis muscles achieved by previously identifying, isolating and marking them.

Competing interests
None declared.

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None.

Ethical approval
This research was approved by the Ethical Committee for Research, Piracicaba Dental School, University of Campinas, Brazil (Protocol 040/2009).

References

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Table 3. Sagittal parameters: mean values (standard deviation) of investigated variables against time.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Preoperative</th>
<th>1 month</th>
<th>6 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>S-LTT</td>
<td>15.90 (2.05)</td>
<td>16.30 (2.16)</td>
<td>15.73 (2.23)</td>
</tr>
<tr>
<td>S-SmTts</td>
<td>13.33 (1.51)</td>
<td>15.18 (2.66)</td>
<td>13.63 (2.05)</td>
</tr>
<tr>
<td>S-PgTts</td>
<td>14.45 (1.85)</td>
<td>16.21 (2.49)</td>
<td>14.80 (2.69)</td>
</tr>
<tr>
<td>S-MLS</td>
<td>11.10 (2.38)</td>
<td>11.25 (3.42)</td>
<td>10.90 (3.08)</td>
</tr>
<tr>
<td>S-MLA</td>
<td>132.25 (11.62)</td>
<td>135.01 (11.99)</td>
<td>132.10 (11.70)</td>
</tr>
</tbody>
</table>

Different capital letters in the lines indicate statistically significant differences where \( P \leq 0.05. \)