Extraoral or Intraoral Approach in the Oblique Sliding Osteotomy of the Mandibular Rami?

Clinical Experience and Results

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Introduction

Osteotomies of the mandibular rami may be performed through an intraoral or an extraoral approach. Sagittal osteotomy of the rami is a popular method for set-back and advancement of the mandible (Obwegeser, 1955) and it has been claimed as one of the advantages of this osteotomy that it is an intraoral method. Vertical osteotomy (Caldwell and Letterman, 1954) and oblique sliding (subsigmoid, subcondylar) osteotomy have mostly been made through an extraoral approach (Hinds, 1958; Robinson, 1958). The possibility of performing the oblique sliding osteotomy intraorally has been pointed out by several authors. Moose (1964) described a technique for performing an osteotomy from the subsigmoid notch to the posterior border of the ramus from the medial aspect of the ascending ramus. Wilbanks in 1971 described the "double-oblique" osteotomy which was also performed from an intraoral approach but from the lateral surface of the ramus. The first description of the intraoral oblique sliding osteotomy using an oscillating saw was made by Hebert et al., (1970). He used a specially designed retractor to expose the lateral surface of the ramus and a Stryker oscillating saw with a rightangle blade.

The long term results following extraoral oblique sliding osteotomy have been investigated in several reports (Astrand et al., 1973, 1983; Wisth, 1973 and others). Follow-up studies of osteotomies performed via the intraoral approach have, however, been scarce (Greebe and Tuinzing 1982). In an earlier study Nyström et al., 1984 compared extraoral and intraoral oblique sliding osteotomies with regard to the cephalometrically measured results.

The aim of the present study was to compare the extraoral and the intraoral approaches to the oblique sliding osteotomy with regard to clinical aspects.

Summary

The clinical results of oblique sliding (subcondylar) osteotomy of the mandibular rami performed by the extraoral or intraoral approach were compared. The patient material comprised 40 patients with mandibular prognathism. Twenty patients were operated upon using the extraoral approach and 20 patients were operated on using the intraoral approach. All patients had intermaxillary fixation for 7 weeks. The patients in both groups were followed up for 18 months.

The experience of the operations was that the intraoral approach gave a shorter operation time than the extraoral approach. The extraoral approach, however, gave better visibility in the operation field and greater possibilities of manipulating the proximal fragment into an optimal position. In the follow-up evaluation, there were no significant differences between the two surgical techniques with regard to dental relapse, postoperative occlusion and mandibular function.

Key-Words

Oblique sliding osteotomy – Mandible Approach – Follow up

Material and Methods

All patients treated for mandibular prognathism by osteotomies in the mandibular rami between May 1978 and November 1981 were included in this study; 40 patients in all. The patients were operated on either by the extraoral (I.O.-group) or extraoral technique (E.O.-group). Twenty patients were randomized to the E.O.-group and 20 patients to the I.O.-group (Table 1).

Orthodontic treatment

Preoperative orthodontic treatment was carried out in ten patients; 4 patients in the I.O.-group and 6 in the E.O.-group. The orthodontic treatment mostly consisted of leveling of the mandibular arch or transverse expansion of the maxilla. Two cases of mandibular arch levelling were performed in each group. In the I.O.-group two patients had segmental orthodontics in the maxillary cuspid and bicuspid region. In the E.O.-group four patients were subjected to transverse expansion of the upper dental arch. Postoperative orthodontic treatment was performed in 20 patients; 11 of the patients in the I.O.-group and 9 in the E.O.-group. In all patients the treatment was given to prevent relapse and not as a part of a preoperatively commenced levelling or alignment of the arches. Class III

<table>
<thead>
<tr>
<th>Group</th>
<th>n</th>
<th>Sex</th>
<th>Age range</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>male</td>
<td>female</td>
<td>mean</td>
</tr>
<tr>
<td>E.O.</td>
<td>20</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>I.O.</td>
<td>20</td>
<td>6</td>
<td>14</td>
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This Study was supported by the Swedish Dental Association.
Fig. 1 Occlusal changes in the 1st molar region were investigated by marking easily identified points on the upper and lower first molars.

Fig. 2 The maximum incisal distance measured in mm before operation and up to 18 months after operation.

Surgical treatment
The surgical procedures in the extraoral and intraoral approaches have been described earlier (Nyström et al., 1984). Prophylactic antibiotics were not given to the patients in the E.O.-group. Three patients in this group however, received antibiotic treatment postoperatively when signs of infection appeared. In the I.O.-group antibiotics were given prophylactically to 7 patients. Another 5 patients received antibiotics postoperatively after developing signs of infection. Blood loss at operation, hospitalization time and postoperative discomfort were recorded.

Fixation
Intermaxillary fixation was used in all patients for a period of seven weeks. Cap splints or orthodontic appliances with an inter-occlusal acrylic wafer were used for the fixation; altogether, 10 orthodontic appliances and 10 cap splints were used in each of the groups. No skeletal fixation was used.

Follow-up
All patients were followed up at clinical examinations at 1, 3 and 7 weeks after release of fixation, and 6 months and 18 months after operation. At the examinations the following variables were recorded: tissue reaction and scar appearance at the operation site, symptoms arising in the temporo-mandibular joints or masticatory muscles, maximal mouth opening, sagittal changes of the occlusion (impressions for dental models were made after release of fixation and 6 to 18 months postoperatively).

The dental relapse was evaluated on the dental models in the first molar region and in the anterior region. Occlusal changes in the 1st molar region were investigated by marking easily identified points on the upper and lower first molars. The distance between these points (Fig. 1) was measured on the models made after release of fixation (post-op models) and on the models obtained 6 and 18 months after operation. From these measurements occlusal changes 6 months and 18 months post-op were calculated. The occlusal changes in the anterior region were evaluated by measuring the horizontal and vertical overbite (Lundström, 1948). The number of observations in the tables sometimes differs from twenty. This is due to unintentional omission to make models.

Precision of measurements: Double registrations of the dental relapse were performed on 19 pairs of models. The precision

\[ S_e = \sqrt{ \frac{d^2}{2n} } \]

was 1.2, 0.8 and 1.2 mm for the 1st molar measurements, horizontal and vertical overbite respectively.

The final occlusion was evaluated at the 18-month-follow-up with registration of all occlusal contacts and whether these were situated in the right, left or anterior region of the dentition.

Radiographic examination with lateral cephalograms was performed. The results of those examinations have been published earlier (Nyström et al., 1984).

Results
At operation there was a mean set-back of the mandible by 10.0 mm in the E.O.-group and 9.1 mm in the I.O.-group, according to the values found on the preoperative occlusal analysis. In this analysis there was also a planned change in rami length which was 2.5 mm in the E.O.-group and 2.7 mm in the I.O.-group. The set-back, measured on post-operative dental models in the first molar region, differed slightly from that planned and was 8.1 mm in the E.O.-group and 7.7 mm in the I.O.-group.

Surgical findings
The soft tissue dissection is more time-consuming using the extraoral approach. The intraoral technique gives a very easy and rapid access to the rami but the visibility at the osteotomy site is very limited. If the lateral surface of the rami is parallel to the sagittal plane it is difficult to inspect the osteotomy site, therefore the bone cut has to be performed more or less blindly. If there is greater lateral angulation of the rami the visibility may be good. The overall impression is that visibility is better with the extraoral approach and it is more easy to determine the exact...
position of the bone-cut, to approximate the fragments and to control bleeding.

The operation time in these series of patients was a little shorter with the intraoral technique than with the extraoral. (E.O. = 139 min, range 105–195, I.O. = 112.5 min, range 55–180). The blood loss was similar in the both groups. (E.O.-group: 190 ml, I.O.-group: 205 ml). The postoperative discomfort of the patients was about the same, with moderate swelling in both groups. The hospitalization time was 4–5 days in both groups.

In 3 patients in the E.O.-group and 5 in the I.O.-group there were slight signs of infection which subsided after antibiotic treatment.

The external scars in the E.O.-group were clearly visible at the end of the fixation period. At the 1½ year follow-up appointment they were mostly pale and inconspicuous. None of the patients complained of the scars.

In the I.O.-group there was often a slight persistent swelling and tenderness over the anterior border of the rami which was still present at the final examination. In some cases there was a contraction in the mucosal scar.

Mandibular function

The maximum incisal distance increased in the same pattern in both groups after release of the IMF (Fig. 2). At

the 1½ year follow-up examination most patients had regained their preoperative mouth opening capacity. Before the operations, 6 patients (4 patients in the E.O. and 2 patients in the I.O.-group) had symptoms referable to the TMJ and masticatory muscles. These symptoms usually subsided after operation and at the final follow-up only one patient (from the I.O.-group) still had discomfort in this area. In no patient did TMJ-symptoms develop after the operation.

In some patients in the I.O.-group a dual-bite was observed. In the habitual occlusal position there was good intercuspi-

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>6 months</th>
<th>18 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relapse, 1st molar</td>
<td>E.O.</td>
<td>n ± SEM</td>
<td>n ± SEM</td>
</tr>
<tr>
<td>change in mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Change in E.O.</td>
<td></td>
<td></td>
<td>-0.1 ± 0.3</td>
</tr>
<tr>
<td>vert. overbite I.O.</td>
<td></td>
<td></td>
<td>15 -0.2 ± 0.3</td>
</tr>
<tr>
<td>hor. overbite I.O.</td>
<td></td>
<td></td>
<td>18 -0.8 ± 0.4*</td>
</tr>
<tr>
<td>Change in I.O.</td>
<td>18 -0.5 ± 0.2</td>
<td>18 -0.8 ± 0.4</td>
<td></td>
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</tbody>
</table>
dation while the distance between this position and the retracted position of the mandible was greater than normal (2–3 mm).

Dental relapse

Significant relapse, measured on dental models, occurred in both groups. However, there was no significant difference between the extraoral and the intraoral group. (Table 2 and Fig. 3 and 4).

In the 1st molar region the mean relapse (both groups together) was 0.8 mm at the 6 month examination and 1.2 mm at the 18 months examination. The corresponding changes in horizontal overbite were 0.7 and 0.9 mm respectively. In no case did a reverse horizontal overbite develop. The vertical overbite did not change significantly in either of the two groups.

Final occlusion

The mean number of contact points between upper and lower teeth was 9.5 (Table 3). There was no significant difference between the groups. Most patients (75%) had contacts in all three segments of the dentition. Nor was there in this respect any difference between the E.O.- group and the I.O.-group.

Discussion

In a comparative study it is important to use groups which may be samples from the same population. In the material of this study there was a close resemblance between the patient groups with regard to age and sex (Tab. 1), cephalometric characteristics (Nyström et al., 1984) and the amount of set-back of the mandible. The orthodontic treatment was of the same extent in both groups with only minor changes. Thus the main difference between the groups was the type of surgical approach. Differences found between the groups may therefore be ascribed to the surgical procedure.

From a surgical point of view, neither of the two procedures is difficult to perform. The soft tissue dissection is however easier in the intraoral procedure than in the extraoral. On the other hand visibility in the intraoral approach may be so limited that the bone-cut is difficult to perform. Sometimes the proximal fragment will slip medially to the distal one and difficulties may arise in getting it into the correct position. However, for the intraoral oblique osteotomy this lateral approach must be easier than the medial one proposed by Moose (1964). Wiring of the fragments has been discussed in relation to both extraoral (Shira7, 1961; Thoma, 1961; Rankow, et al., 1974; Hall et al., 1975; Astrand et al., 1983) and intraoral methods (Lindorf 1981) but has not been used by us in this study. After repositioning of the mandible the proximal fragment has merely been pressed upwards towards the fossa. Whether this has been sufficient to obtain good positioning of the condyle has not yet been evaluated in this material. However, it may be mentioned that in two patients treated later than the patient groups reported here, the proximal fragment has been dislocated in an antero-inferior position requiring reoperation.

The operation time was a little shorter using the intraoral technique which reflects the easier exposure of the rami. The slight difference in operation time is, however, of no clinical importance.

Six patients had TMJ-symptoms before the operation. These symptoms disappeared after the operation in all patients but one. This observation is interesting, because changes in the condyle/fossa relationship are frequent after osteotomies of this kind (Sund, et al., 1983). The set-back of the mandible measured preoperatively in the occlusal analyzer was greater than the set-back measured on the dental models. This discrepancy is probably due to vertical adjustments made in the analyzer, where a lengthening of the rami indicates a greater set-back, which is apparent rather than real.

In longitudinal studies of osteotomies of the rami, different degrees of relapse have been reported depending on whether the relapse has been measured on cephalograms or on dental models. It was therefore of great interest to perform measurements of dental models to compare them with the earlier-described skeletal relapse reported for these groups of patients (Nyström et al., 1984). While the skeletal relapse found on cephalograms was 2.4 mm at the 18 months examination (1.9 of the E.O.-group and 2.9 of the I.O.-group) the dental relapse was much smaller, which demonstrates considerable dentoalveolar compensation along with the skeletal relapse. In spite of the methodological errors involved in measurements on models significant changes between the different examination could be demonstrated. However, the precision of the method was not high enough to demonstrate possible differences between the two patient groups.

Our finding that there was no significant change in vertical overbite is in agreement with earlier results (Astrand et al., 1973) and indicates that on average there is no tendency to bite-opening. Mean values, however, always conceal extreme values and there are cases with both bite-opening and bite-closure.

When comparing the postoperative occlusal changes of the two groups one also has to consider the postoperative orthodontic treatment. During the period when these patients were treated, we did not use as much orthodontics as we do now, and the postoperative orthodontic treatment consisted mostly of applying class III mechanics to control

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Number of contact points between upper and lower teeth in different segments of the dentition (mean value) and the ratio between the total number of occluding points and the total number of teeth.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number of contact points</td>
</tr>
<tr>
<td></td>
<td>n</td>
</tr>
<tr>
<td>E.O. group</td>
<td>19</td>
</tr>
<tr>
<td>I.O. group</td>
<td>17</td>
</tr>
</tbody>
</table>

Th. Nordin et al., 1983) and indicates that on average there is no tendency to bite-opening. Mean values, however, always conceal extreme values and there are cases with both bite-opening and bite-closure.
the tendency to relapse. Such relapse-preventing orthodontics was used to the same extent in both groups (9 cases in the extraoral and 11 in the intraoral group). An interesting observation is, however, that 14 out of the 20 patients receiving this treatment had orthodontic appliances for intermaxillary fixation and only 6 had cap splints. This may indicate that cap splints offer a more stable fixation.

The increased distance between RP and IP in some patients in the I.O.-group may be due to a "drop" of the condyle with antero-inferior displacement. Such displacement of the condyle has earlier been demonstrated after oblique sliding osteotomy via an extraoral approach (Sund et al., 1983). This displacement may perhaps be greater with the intraoral approach and this problem is worth further investigation.

Conclusions

This study does not reveal any significant difference between the results of osteotomies made from an intraoral or extraoral approach. The choice between the two methods described in this study is mainly determined by the surgeon's wish for good visibility and greater possibility of manipulating the fragments, with the use of transosseous wiring and a less time consuming operation. Avoidance of an extraoral scar may also influence the choice of method.

References


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