INTRODUCTION
Distraction osteogenesis (DO) was first described by Gavril Ilizarov during 1950's in long bones.1 McCarthy applied the same principles in craniofacial skeleton and since then a lot of research is being done on DO in craniofacial region.2 Distraction osteogenesis is a biologic process of new bone formation between the surfaces of bone segments that are gradually separated by incremental traction. A callus forms between the separated bone segments and as long as the traction proceeds, callus is stretched and induces the formation of new bone.3

The common indications for distraction in mandible are mandibular hypoplasia due to congenital deformities like Nager's syndrome, Treacher Collin's syndrome, Pierre Robin syndrome, craniofacial scoliosis and hemifacial microsomia, sequelae of TMJ ankylosis, mandibular asymmetry and tumour related defects utilizing transport DO.3-10

Initially, extroral distraction devices were introduced but their main disadvantages were social inconvenience to the patient and residual scarring at the site of insertion of pins. Later, these were replaced by smaller intraoral distraction devices which are more acceptable for the patients.6,11

The aim of this study was to determine the result of 7 cases of intraoral distraction osteogenesis.

METHODOLOGY
Seven cases of diverse maxillo-mandibular deformities which presented to our surgery department during the last 2 years were selected for the procedure (DO). Patients with airway obstruction and facial asymmetry willing to take part in the study were selected for DO while patients presenting with some craniofacial syndrome or considered unfit for surgical procedure under general anaesthesia were excluded from the study and were treated with alternative options. Presenting complaint of the patients were noted. Chief complaints were airway obstruction in 4 cases, facial asymmetry in 2 cases and unaesthetic appearance in one patient. Thorough past medical and dental history was obtained and complete evaluation was carried out including the clinical photographs, cephalometric tracings and study models (where mouth opening permitted). Orthodontic department was consulted,
Distraction vectors were defined and pre-surgical planning was completed, ethical issues discussed and informed consent was obtained from the adult patients and from parents in case of paediatric patients.

Per-operatively, the osteotomy site was exposed using submandibular incision in case of mandibular DO cases while a standard vestibular incision was utilized for the maxillary DO. Suitable distractors (Tri-Med, Turkey) were selected from the distraction kit and were adapted and secured before the osteotomy keeping in view the planned osteotomy site. After adaptation they were removed and osteotomy was carried out using surgical burs and chisels. In mandible, angle was the site for osteotomy, while in maxilla standard Lefort-I osteotomy was carried out and distractor was placed at the zygomatico-maxillary buttress area. Every attempt was made to preserve the tooth roots and IDN while performing the osteotomy. After completing the osteotomy the distractors were re-applied and their activation barrels were placed intraorally using a stab incision. Incisions were closed primarily.

In the patient, where simultaneous mandibular and maxillary distraction was achieved to correct her facial asymmetry, after completing standard Lefort-I osteotomy mandibular osteotomy site was exposed as described above. Then maxillo-mandibular fixation was carried out so that maxilla and mandible could move as a single unit.

In paediatric patients, the distraction was started on the 3rd postoperative day, while in adult patients a 7-day latency period was observed. Distraction was carried out at a rate of 0.5 mm twice daily (1.0 mm daily) and continued till the required amount was achieved. After completing the required distraction, a 2-month consolidation period was completed before removing the distractors. Serial digital orthopantomograms every week were taken throughout the distraction procedure to monitor the progress. Over correction was done in all cases to compensate post-distraction relapse.

Results were analyzed using Statistical Package for Social Sciences (SPSS) version 17.0. Descriptive statistics like mean, median, frequency and standard deviation were used for age, gender and amount of distraction achieved.

RESULTS

A total of 7 cases of distraction were carried out. Out of them 3 were males and 4 females. The age of the patient ranged from 2-24 years (mean 12.57 ± 9.48 years).

Out of a total 7 patients, 5 patients had their deformity, principally in the mandible (two had compensatory changes in maxilla), owing to TMJ ankylosis (3 had bilateral and 2 had unilateral ankylosis), one patient had congenital micrognathia and was on permanent tracheostomy since birth to relieve his airway obstruction and one patient had severe class-III skeletal deformity.

Amount of distraction depend on the nature and severity of deformity, ranging from 9.0 mm to 19.2 mm (mean 15.04 ± 4.33 mm). In one case, we did dancing distraction to correct asymmetry.

Patients with retrognathia noticed improvement in their chin position and relief of their airway obstruction. Similarly, patients with facial asymmetry also noticed improvement in their facial profile. Overall, patients were satisfied with the results obtained. Additional surgery to release the ankylosis was done in 3 patients once the consolidation was complete. Relapse is not observed in any case so far. Follow-up period ranged from 12 to 28 months with a mean of 18.14 ± 5.39 months. Results are summarized in Table I.

DISCUSSION

Distraction osteogenesis is an ingenious technique for creating new bone and to produce significant lengthening of bone and soft tissue without the need for bone grafting and associated donor site morbidity.1,2

DO is divided into various phases like; latency phase, active phase including the rate and rhythm of distraction, and the consolidation phase.10

TMJ ankylosis involves the fusion of the mandible and the temporal bone giving rise to myriad of facial deformities.7,11 DO can be carried out prior to release of ankylosis, after release of ankylosis or both procedures can be done simultaneously.11-13 In 5 patients of TMJ ankylosis, 2 had their arthroplasty done at some other centre and presented with the complaint of facial

Table I: Showing the consolidated patient data.

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Gender</th>
<th>Diagnosis of the problem</th>
<th>Amount of distraction</th>
<th>Unilateral/bilateral</th>
<th>Site</th>
<th>Additional surgery</th>
<th>Follow-up (months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>M</td>
<td>Congenital mandibular micrognathia</td>
<td>9.0 mm</td>
<td>Bilateral</td>
<td>Angle</td>
<td>None</td>
<td>21</td>
</tr>
<tr>
<td>4</td>
<td>M</td>
<td>TMJ ankylosis</td>
<td>9.4 mm</td>
<td>Bilateral</td>
<td>Angle</td>
<td>Arthroplasty</td>
<td>28</td>
</tr>
<tr>
<td>5</td>
<td>M</td>
<td>TMJ ankylosis</td>
<td>14.0 mm</td>
<td>Bilateral</td>
<td>(dancing)</td>
<td>Angle</td>
<td>Arthroplasty</td>
</tr>
<tr>
<td>10</td>
<td>F</td>
<td>TMJ ankylosis</td>
<td>19.2 mm</td>
<td>Bilateral</td>
<td>Angle</td>
<td>Arthroplasty</td>
<td>20</td>
</tr>
<tr>
<td>21</td>
<td>F</td>
<td>TMJ ankylosis</td>
<td>17.0 mm</td>
<td>Unilateral</td>
<td>Angle</td>
<td>None</td>
<td>14</td>
</tr>
<tr>
<td>22</td>
<td>F</td>
<td>Skeletal class III</td>
<td>18.7 mm</td>
<td>Bilateral</td>
<td>ZM buttress</td>
<td>None</td>
<td>17</td>
</tr>
<tr>
<td>24</td>
<td>F</td>
<td>TMJ ankylosis</td>
<td>18.0 mm</td>
<td>Bilateral</td>
<td>Angle</td>
<td>None</td>
<td>12</td>
</tr>
</tbody>
</table>

TMJ (Temporomandibular Joint); ZM Buttress (Zygomatico-maxillary buttress)
asymmetry, while the other 3 presented with the complaint of limited mouth opening. In these 3 patients, we did DO prior to arthroplasty. Interpositional arthroplasty was done one month post-consolidation. Dental interference was relieved through selective occlusal adjustments. Anterior open bite was treated by manually modifying the regenerate chamber under GA or by providing elastic traction later on.

Obstructive sleep apnoea can be a serious problem in patients with mandibular retrognathia. Three out of the 7 patients complained of sleep apnoea. Two had this problem due to TMJ ankylosis, while the third one had congenital mandibular hypoplasia and was on permanent tracheostomy since birth. All these patients reported improvement in their airway following distraction. We were able to remove the tracheostomy tube of that young boy owing to his DO, as he no longer suffered from airway obstruction.

DO can be a very plausible treatment modality in patients suffering from maxillary or mid face deficiency due to cleft lip/palate or skeletal class-III pattern. In skeletal class-III patient, maxilla was deficient in anteroposterior plane but the vertical component was normal so only horizontal DO was required in maxilla and mandible was kept intact.

Facial asymmetry can be due to TMJ ankylosis, trauma, malignancies, hemifacial microsomia, or Goldenhar syndrome. There were 2 cases of facial asymmetry owing to TMJ ankylosis. Both patients reported improvement in their chin position and an improvement in their midline.

All the intraoral distractors were placed using extraoral incisions. Ideally these should have been placed intraorally to further improve the aesthetics. In one patient a second osteotomy was needed as the segment ossified because of a loosened screw on the distractor barrel which went unnoticed. One patient noticed lower lip paresthesia secondary to her mandibular osteotomy. Another problem which we encountered was that the distractor barrels moved deep into the soft tissues because of bone lengthening and created problems, while performing distraction. Stability in the jaws where DO was performed was obtained by the distractors till the time consolidation (8 weeks) was completed and they were removed later on. In all cases, over correction was achieved to compensate for any possible relapse. Overall satisfactory results were achieved in all the cases.

CONCLUSION

DO is an effective tool in the armamentarium of maxillofacial surgeons and can be employed satisfactorily to correct a variety of maxillofacial deformities with predictable results.

REFERENCES


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