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The role of simultaneous gap arthroplasty and distraction osteogenesis in the management of temporo-mandibular joint ankylosis with mandibular deformity in children

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SUMMARY. Introduction: **Temporo-mandibular joint ankylosis is a common cause of acquired deformity in children.** Purpose: **Surgical correction of the ankylosis only leaves the patient with an uncorrected mandibular deformity. This study was to evaluate the use of distraction osteogenesis for simultaneous correction of the mandibular deformity.** Material: **This study was done on six children with temporo-mandibular joint ankylosis and mandibular deformity. Uniaxial double pin distractors with Schanz pins were used in this study.** Methods: **The patients underwent simultaneous gap arthroplasty and mandibular osteotomy (retromolar) with distractor insertion. Distraction was started on the fifth post-operative day. The patients were put on dynamic temporo-mandibular joint exercises on the first post-operative day.** Results: **All patients had a satisfactory mouth opening on follow-up. Satisfactory cosmetic correction of the mandibular deformity was also achieved in all these patients. Some degree of malocclusion resulted from treatment due to which the patients were placed on orthodontic treatment.** Conclusions: **Distraction osteogenesis can be used simultaneously with gap arthroplasty in patients with temporo-mandibular ankylosis, for the correction of the mandibular deformity. © 2003 European Association for Cranio-Maxillofacial Surgery.**

Keywords: **Temporomandibular joint; Mandibular deformity; Surgery; Distraction osteogenesis**

INTRODUCTION

Temporo-mandibular joint ankylosis is a common cause of acquired mandibular deformity in children. It can be caused by a variety of causes, trauma and infection being the commonest in the paediatric age group. Long standing temporo-mandibular ankylosis leads to damage of the condyle with deficiency of the mandibular body and ramus. Trismus in these patients can be managed by condylectomy or gap arthroplasty or by costochondral graft interposition (*Politis* et al., 1987). While a satisfactory mouth opening can be achieved with all these methods, the mandibular deformity needs separate treatment.

Distraction osteogenesis is one of the most commonly used methods for mandibular lengthening and is the best one to be used in patients with mixed dentition. It was used in the head and neck by *Snyder* et al. in 1973 after it had been extensively used by orthopaedicians for lengthening of long bones. Presently this technique is often applied for mandibular lengthening in various disorders like hemifacial microsomia, Pierre Robin sequence, etc. (*McCarthy*, 1994).

MATERIAL AND METHODS

This study included six patients aged 7–10 years, who presented to our out-patient department with mandibular deformity and trismus due to ankylosis of the temporo-mandibular joints. A pre-operative assessment was done in all these patients, which included a thorough history and clinical examination. Radiological evaluation included cephalogram (antero-posterior and lateral), orthopantomogram and transcranial projection of the temporo-mandibular joints. Following assessment, the patients were taken up for surgery under general anaesthesia. This included a gap arthroplasty of the temporo-mandibular joint and osteotomy plus distractor fixation of the mandible. The first step in the surgery was fixation of two 2.5 mm Schanz pins on either side of the proposed osteotomy site (i.e. four pins in all). The pins were aligned so that the axis of the distractor was parallel to the occlusal plane. The temporo-mandibular joint was exposed via a standard preauricular approach. A minimum of 2 cm vertical segment of ankylotic bone was removed, plus stripping of the coronoid process. No interposition of any kind of material was done in these patients. Following this, haemostasis and closure of the incision was done. The mandibular osteotomy, involving both the cortices, followed through an intraoral route in the retromolar region using a curved Tessier osteotome. An extraoral uniaxial double distractor (Adler Ltd., India) was fixed and completeness of the osteotomy was judged by distracting the segments intra-operatively. Dental impressions of the patients were taken intra-operatively. The position of the pins was confirmed using an orthopantomogram. On the first post-operative

day active temporo-mandibular joint exercises were started. An acrylic exerciser was fashioned with an occlusal splint for active exercising of the temporo-mandibular joint. Distraction was started on the fifth post-operative day at the rate of 0.5 mm twice daily. The patient's parents were instructed of the technique of distraction with regular monitoring of the patient. To correct the asymmetry distraction was continued until the menton reached the midline followed by an overcorrection of about 5 mm. After the end of the distraction a consolidation period of 6–8 weeks was given. Removal of the distractor was done following a cephalogram. Temporo-mandibular joint exercises were continued throughout this period. A complete dental examination was done in all the patients following removal of the distractor. The patients were put on orthodontic treatment for any residual occlusal abnormality.

Radiological parameters

In all patients radiological evaluation was done before and after initiation of distraction osteogenesis. This included estimation of the SNA, SNB angles and the mandibular plane angle. A rough estimate of the bony defect was done after projecting the desired Supramentale point (Point B) and measuring the amount of anterior translocation required. The chin position was checked by repeat cephalograms and distraction was continued for about 5 mm (5 days) after the chin was in the midline (Figs. 1–6).

RESULTS

Six patients presented with unilateral temporo-mandibular joint ankylosis and mandibular deformity. The mean duration of the trismus was 1 year. The mean age of the patients was 8.5 years (range 7–10 years). The average mouth opening present was 1.6 mm (range 0–6 mm). The aetiology was infection in two cases and trauma in the other four. All patients underwent gap arthroplasty with simultaneous osteotomy and distractor fixation as described above. Seventy-five millimetre double pin standard uniaxial extraoral distractors (Adler Ltd., India) were used in all these patients. Average mouth opening achieved was 28 mm (range 24–36) at 3 months. Post-operative jaw exercises were started without any difficulty in all these patients and were started within 24 h of surgery. These included active chewing movements (active maximal mouth opening) and

Fig. 1 – Photograph of a 9-year-old patient with severe micrognathia and asymmetry secondary to temporomandibular joint ankylosis.

Fig. 2 – Same patient with acceptable mouth opening. Distraction device in situ.

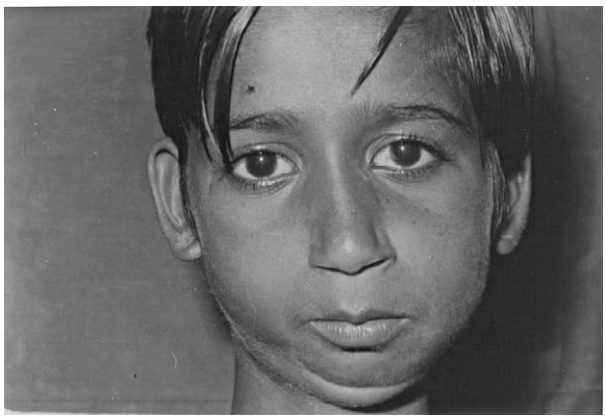

Fig. 3 – Post-distraction photograph (same patient) with chin in the centre.

Fig. 4 – Three millimetre open bite deformity post-distraction (same patient).

the use of an acrylic exerciser, which works by causing passive mouth opening. The mean duration of distraction was 21.5 days ranging from 17 to 27 days. Distraction was temporarily suspended if the patient complained of excess pain at the distraction site. Distraction was done until the chin crossed the midline at which point radiological examination, i.e. cephalogram, was done for evaluation and distraction was terminated if satisfactory.

The mean mandibular length (Gonion-Pogonion) was 51 mm (mean Gonion-Menton was 49.5 mm; Table 1). The mean mandibular plane angle was 41°. The mean post-distraction mandibular plane was 34°.

Fig. 5 – Pre-distraction cephalogram (same patient).

Fig. 6 – Post-distraction cephalogram (same patient).

The mean deficit as considered by the position of the ideal point B (Supramentale) was calculated to be 12.5 mm. The mean pre-distraction Sella-Nasion-Subnasale angle (SNA) was 79.7° and the mean Sella-Nasion-Supramentale angle (SNB) was 67.8°. The mean post-distraction SNB angle was 76.5°. Thus, there was a significant lengthening of the mandible in these patients with a favourable alteration in the mandibular plane angle.

The mean lengthening achieved as per the anterior movement of the point B (Supramentale) was 12.2 mm. The mean post-distraction mandibular length was 61.8 mm (Gonion-Pogonion) (60.3 mm Gonion-Menton).

One of the patients developed an anterior open bite of 3 mm and another of 5 mm. This was tackled using acrylic occlusal splints with thickening posteriorly. Sensory supply to the chin was preserved in all the patients. All patients developed post-operative swelling in excess of what was expected but this swelling resolved in all patients. One patient had fever in the post-operative phase, which responded well to antibiotics. In three of the patients minor discharge from the pin site occurred while in one patient, there was significant pin site infection, which ameliorated with local care and was completely resolved after distractor removal. Some degree of scarring at the pin site occurred in all patients as expected. Injury to an unerupted third molar occurred in one of the patients, and this was conveniently removed at the time of osteotomy. In all the patients, the gap arthroplasty created was well maintained on the post distraction orthopantomograms at 6 months post-operatively.

DISCUSSION

Temporo-mandibular joint ankylosis is a common cause of mandibular deformity in children mostly due to trauma or infection (*Heggie*, 1996). The reason may be the high susceptibility of the articular cartilage to injury, in this age group. Symptoms of ankylosis in children are progressive trismus and mandibular deformity with retrognathia and lateral displacement of the chin. The various treatment modalities for the treatment of mandibular deformity with temporo-mandibular joint ankylosis include gap arthroplasty (*Roychoudhury* et al., 1999), interposi-

Table 1 – Summary of results

Age (years)	Mouth opening (pre op) (mm)	Mouth opening (post op) (mm)	Mandibular body length (pre distrn.) (mm)	Mandibular body length (post distrn.) (mm)	Lengthening achieved (mm)	Mandibular plane angle (pre distraction) (deg)	Mandibular plane angle (post distraction) (deg)
8	6	36	56	67.5	11.5	46	39
7	1	28	48	60	12	42	37
10	1	26	44	57	13	36	36
7	2	28	46	57	11	41	31
9	0	24	54	64	10	41	41
10	0	26	46	65	19	40	35

tion arthroplasty (*Sawhney*, 1986) and costochondral graft interposition (*Ko* et al., 1999). Costochondral graft interposition has a potential for growth of the mandible (*Lello*, 1990). However, in children, we favour the use of gap arthroplasty in conjunction with distraction osteogenesis. This is because correction of the mandibular hypoplasia is also possible using this technique. The other techniques do not address the problem of the mandibular deformity, which also leads to significant disfiguration in these children. In addition, the reduced length of the mandibular body has an adverse impact on mouth opening and occlusion.

Gap arthroplasty can be combined with distraction osteogenesis of the mandibular body. Distraction osteogenesis is a good means of mandibular lengthening in patients with mixed dentition (*McCarthy* et al., 1992). *Dean* and *Alamillos* (1999) used simultaneous gap arthroplasty and distraction osteogenesis for the treatment of mandibular deformity in temporo-mandibular joint ankylosis. In their study, three patients successfully underwent this kind of combination of treatment for temporo-mandibular joint ankylosis deformity. A maximum mouth opening of 25 mm was achieved in their patients. *Papageorge* and *Apostolidis* (1999) reported similar results with gap arthroplasty and distraction osteogenesis in patients with TMJ ankylosis and mandibular deformity.

Yoon and *Kim* (2002) successfully used gap arthroplasty with intraoral mandibular distraction osteogenesis in two patients with TMJ ankylosis and mandibular deformity. Both the patients had undergone failed gap arthroplasty and costochondral graft interposition. This study reported a positive result with a total follow-up of 2 years.

Douglas et al. (2000) used a pin and tube device for intraoral distraction in an adult patient with micrognathia due to temporo-mandibular joint ankylosis. The authors achieved a lengthening of 10 mm in their patient, which remained stationary after surgery. *Yonehara* et al. (2000) used bilateral distraction osteogenesis of the mandible with LeFort I osteotomy of the maxilla (with orthodontic rubber band fixation) in a patient with temporo-mandibular joint ankylosis and mandibular deformity. The authors achieved a lengthening of 23.5 mm in the ipsilateral mandibular body and 21 mm on the contralateral side.

Open bite deformity is a well-known complication of mandibular distraction (*Kuntz* et al., 2000). In the patients of this study, distractors were oriented as parallel to the occlusal plane as possible, regardless of the direction of the osteotomy. This was done so as to distract the chin in a plane parallel to the occlusal plane. Another advantage of such an arrangement was that distraction did not lead to impingement on the gap arthroplasty. The osteotomy line was not always kept perpendicular to the direction of distraction (which was the same as the occlusal plane). *Kuntz* et al. (2000) performed manual remodelling of the distracted callus under general anaesthesia for treatment of open bite deformity after distraction osteogenesis. In this study, a custom-made acrylic jaw exerciser was used with an orthodontic splint, as postoperative exercises are essential for a successful outcome (*Kozak* and *Ramba*, 1998). In patients who are developing an open bite deformity this can be minimized by increasing the thickness of the splint between the molars. This was done to minimize the open bite deformity in this study also.

CONCLUSION

Simultaneous gap arthroplasty and distraction osteogenesis seem to be a useful and effective technique for the management of mandibular deformity with temporo-mandibular joint ankylosis. At present it is obviously the only way to address both the joint ankylosis and the mandibular deformity at the same time, which has special relevance in children.

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