



ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2020; 6(2): 520-522
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www.oraljournal.com
Received: 22-02-2020
Accepted: 24-03-2020

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Mandibular distraction osteogenesis in children with TMJ ankylosis: A literature review

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Abstract

Temporomandibular joint (TMJ) ankylosis leads to a significant amount of facial deformity in the affected individuals. Osteogenic distraction is one of the treatments that can treat ankylosis in children with success. However, the successful treatment of children with TMJ ankylosis with dentofacial deformities is slow and prolonged, and the earlier it is initiated, the greater the success of treatment completion, always depending on the joint work of a multidisciplinary team, as well as family support and patient collaboration. This review aims to find a scientific evidence based background for the mandibular distraction osteogenesis in treatment of temporomandibular ankylosis.

Keywords: Distraction osteogenesis, ankylosis, facial deformity, intra oral distractors, micrognathia

1. Introduction

Temporomandibular Joint ankylosis is a condition characterised by fibrous, osseous or fibro-osseous fusion between the mandibular condyle and the roof of glenoid fossa in the temporal bone, resulting in loss of normal rotational and translational movement. The term “ankylosis” is of Greek origin meaning bent or crooked and corresponds to a “stiff joint”, since it leads to a partial or total loss of mobility of the TMJ. The most common causes of ankylosis include trauma and local or systemic infections ^[1].

Ankylosis of TMJ in children does not only disturb growth of mandible but also hinders facial skeletal development depending on its onset and magnitude. Underdeveloped mandible with asymmetrical face, limited chewing ability and oral hygiene care, narrowed airway and speech alterations are among its observed effects ^[2]. Hence early diagnosis and treatment, would save the patient from psychological trauma and help in the overall growth and better treatment outcome. The surgical treatment of TMJ ankylosis constitutes a set of highly controversial subjects ^[3].

A literature search using google scholar and science direct was made using the following terms: ankylosis, temporomandibular joint, distraction. The inclusion criteria for the review consisted of: controlled clinical trials, retrospective studies, case reports, and follow-up studies. Thus, the study aims to find a scientific evidence based background for the mandibular distraction osteogenesis in treatment of temporomandibular ankylosis.

2. Literature Review

With the advancement of miniaturised intra oral distractors, the distraction osteogenesis technique has drastically transformed the concept of correction of maxillofacial deformities having multiple advantages over extra-oral distractors, considering the patient's better acceptance and compliance during the activation and consolidation phases because they are discrete and easy to handle, the reduction of the scar of the skin caused by the traction of transcutaneous fixation pins, preventing injury to the neurovascular bundles, allowing the invisible distraction of the jaw, thus eliminating frequent monitoring and limitation in social life and improving the stability of the attachment to the bone ^[4, 5] The treatment option in tmj ankylosis managemnt could be single stage or two stage treatment.

2.1 Single stage procedure

This procedure involves performing distraction osteogenesis and ankylotic mass removal simultaneously, thus could improve the restriction of mouth opening and maxillofacial

deformity simultaneously, avoid second surgery, and reduce the economic burden of patients. However, it may have the following disadvantages which includes the effect of distraction osteogenesis may be unsatisfactory because of the unstable condyle, there may exist interference between physical exercises and distraction and there still needs the second surgery to remove the distraction devices.

Recently, transport distraction technique has been utilised to reconstruct a neocondyle. This technique does not require bone graft, and could form a false fibrous disk by compression of the connective tissue between the neocondyle and glenoid fossa to minimise the risks for relapse. But a long-term follow-up study found that the stability and height of the neocondyle is less desirable and stable [5, 6].

2.2 Distraction Osteogenesis before Ankylosis Removal:

Mandibular distraction has revolutionised the treatment of children with ankylosis and associated micrognathia. These patients present with severe obstruction of the airways. Distraction osteogenesis may be applied to the retruded ankylosed mandible to correct secondary deformities and widen thyro-pharyngeal airway by mobilising the genioglossus muscle and the whole tongue forward. In turn, the symptoms of snoring and obstructive sleep apnea may improve. The distraction technique remains the only intervention that directly corrects mandibular hypoplasia and the back tongue, providing efficient relief of airway stenosis. Multiple studies have demonstrated the efficacy of distraction to avoid tracheostomy and decrease the severity of airway obstruction in this group of patients. It is therefore not surprising that distraction mandibular has become the first-line intervention in many centres for the surgical treatment of patients with micrognathia. The reported complications associated with mandibular distraction are relatively low, with infection being the most common and easily treated with antibiotics [7-9].

On Performing distraction osteogenesis of the mandible as the initial surgery, followed by arthroplasty or TMJ reconstruction, will enable advancement of the mandible but without achieving favourable dental occlusion. Since TMJ ankylosis frequently leads to more complex facial deformity which are not amenable by simple distraction procedure, some patients require orthognathic surgery to improve occlusion and facial profile along with or following arthroplasty or TMJ reconstruction. Few other surgeons persist that arthroplasty should be performed at the first stage to solve the problem of limited mouth opening, and distraction osteogenesis at the second stage [10].

2.3 Distraction after Ankylosis Removal

Correction of mouth opening and advancing the mandible in one single operation. Able to control and decide the amount of mandibular advancement to enlarge the posterior airway to correct obstructive sleep apnea. Improve feeding immediately. Challenges usually faced would be patient will be unable to perform immediate intensive mouth opening exercise due to distraction osteogenesis procedure and secondly, Early jaw exercise may hinder the new callus formation at the healing osteotomy sites. For patients who were diagnosed as TMJ ankylosis with OSAHS, distraction osteogenesis should be performed before release of the TMJ ankylosis, and thus we could treat mandibular bone deficiency and increase the airway volume at the same time, and the late surgery would be safer. If TMJ ankylosis was released at the first stage, then the already diminished airway space would be further

shrunk and may lead to lower blood oxygen saturation or even apnoea that requiring emergency tracheostomy in the postoperative period or the late surgery [11, 12]

3. Discussion

Management of TMJ ankylosis in children differs from adult as it involves growth period and developing dentition. Facial and mandibular growth disturbance, invariably results in acute compromise of the airway, affecting physical and psychological disability. The treatment of TMJ ankylosis varies from center to center, which includes resection of the ankylotic mass with physiotherapy, reconstruction with costochondral graft, and orthognathic surgery to reconstruction with prosthesis recently to the distraction. The distraction osteogenesis (DO) offered the option of lengthening the mandible, providing space for correction of crowding and eruption of hitherto unerupted teeth, correction of occlusal cant, midline shift, and gross asymmetry. Most of the surgeon experience the dilemma of performing a single stage procedure or as a two-staged procedure [13].

The advantage of distraction osteogenesis over other treatment methods means it is possible to initiate physiotherapy on the day following surgery, and there is no need to harvest bone from a donor site for the graft. This is extremely important in juvenile patients because it does not impose restrictions on their normal activity and involves no risk of a complication at the donor site (such as wound infection or oedema in the case of a rib graft). Another advantage is the simultaneous gradual soft tissue adaptation during distraction [14]. It is also of importance that the amount and direction of bone lengthening is quite predictable, since the callus distraction may be controlled. A disadvantage of this is the fact that the distraction device has to remain in place for the period of distraction and subsequent bone healing. The high cost of the distraction device is also of importance. Orthognathic surgery can increase the length in the body of the mandible with bilateral sagittal split osteotomy and inverted "L" osteotomy, on the other hand, DO increases both ramus height and length of the body of the mandible. Moreover, since the process of DO is slow, over a period, tissues around the mandible adapt and improve the asymmetry [15].

Distraction osteogenesis constitutes another reconstruction method applied to the TMJ structures damaged by ankylosis. A reverse L-osteotomy is made, creating a transport segment, which is advanced through the defect. New bone is created in the distraction gap and the leading edge of the transported bone fragment becomes enveloped by a fibrocartilaginous cap, thus reconstructing a neo-condyle and a pseudo-disc [16]. The transport segment is advanced superiorly 0.5 mm twice a day until contact with the glenoid fossa is achieved. Further advancement provides a correction of the vertical deficiency of the mandibular ramus. The longterm results are good provided intensive postoperative physiotherapy is carried out. A negative aspect of the distraction osteogenesis is the amount of bone left after the removal of affected tissues, limiting the possibility of creating a segment for the transporting distraction osteogenesis.

4. Conclusion

Distraction osteogenesis of mandible in the first phase and followed by release of ankylosis (with gap or inter-positional arthroplasty) in the second phase operation or Release of ankylosis (with gap or inter positional arthroplasty) followed immediately by distraction osteogenesis. Either of these two

techniques can be carried out considering its own advantages and disadvantages. The treatment planning should be sequenced according to individual needs depending on the age at diagnosis and expertise available. Goal should be focussed on achieving the highest inter incisal distance possible and immediate relieve of the narrow posterior airway space through release of the ankylosis. Intensive mouth opening physiotherapy is mandatory to achieve and maintain an acceptable inter incisal distance.

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