

# Two-stage Treatment of TMJ Ankylosis by Early Surgical Approach and Distraction Osteogenesis

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**Temporomandibular joint (TMJ) ankylosis is characterized by the formation of bone or fibrous adhesion of the anatomic joint components, which replaces the normal articulation and limitation of mouth opening. Early surgical intervention is considered as a treatment procedure to release the joint ankylosis and to maintain the function of the joint. Longstanding temporomandibular joint ankylosis which starts during the active growth period in early childhood resulting in facial asymmetry. Thus, the importance of the evaluation for the facial asymmetries and unfavorable remodeling of the mandible has to be considered during the initial treatment planning. Further operations, either osteotomies or distraction osteogenesis, are required for the treatment of maxillofacial deformities. The present study reports a case of unilateral TMJ ankylosis treated by interpositional arthroplasty prior to distraction osteogenesis for the treatment of mandibular secondary deformity. Various treatment procedures and timing protocols are reviewed and discussed.**

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*Key Words:* Temporomandibular joint, ankylosis, intraoral distraction osteogenesis, mandibular asymmetry

**T**emporomandibular joint (TMJ) ankylosis is one of the functional disorders of the TMJ that refers to bone or fibrous adhesion of the anatomic joint components and can be classified as fibrous or osseous ankylosis.<sup>1</sup> Fibrous ankylosis occurs due to limited mandibular hypo-

mobility caused by the etiologic factors such as: extra-articular fibrosis, pathologic conditions, mechanical obstruction, depressed zygomatic arc fracture, adhesions and hypertrophy of the coronoid process, fracture dislocation of the condyle, fibrosis of the temporalis muscle, and tumor of the condyle or coronoid process. Mandibular mobility is restricted in both fibrous and osseous ankylosis.<sup>2</sup> Following etiologic factors such as trauma, local or systemic infections, surgical complications, otitis media, rheumatoid arthritis and ankylosing spondylitis may cause osseous ankylosis.<sup>3-5</sup>

The clinical findings in patients with TMJ ankylosis are related with the age, duration and whether the ankylosis is unilateral or bilateral. TMJ ankylosis causes severe growth dysplasia of the facial skeleton due to the restriction of the condylar mobility. The mandibular deformity is the result of destruction of the condyle and the loss of growth which is normally stimulated by mandibular function and movement. Unilateral ankylosis causes unilateral hypoplasia of the mandible with asymmetry and deviates the chin to the affected side. It also inhibits the growth of the ramus on the affected side. Clinical findings such as limitation of mouth opening, facial asymmetry, and upper-way obstruction are seen in early childhood.<sup>6</sup>

TMJ ankylosis is treated by various surgical techniques such as gap arthroplasty and interpositional arthroplasty. Surgical treatment of ankylosis in children has to improve mandibular function and maintain normal growth and development of the craniofacial complex. Early surgical intervention reduces the adverse effects on growth. Treatment procedure only for the ankylosis becomes inadequate when ankylosis in children is severe and growth deformities are also seen. Autogenous grafts such as costochondral grafts, temporalis fascia, dermal grafts or alloplastic materials including tantalum, vitalium, acrylic, Teflon-proplast, silicone sheets and silicone blocks are used for reconstruction.

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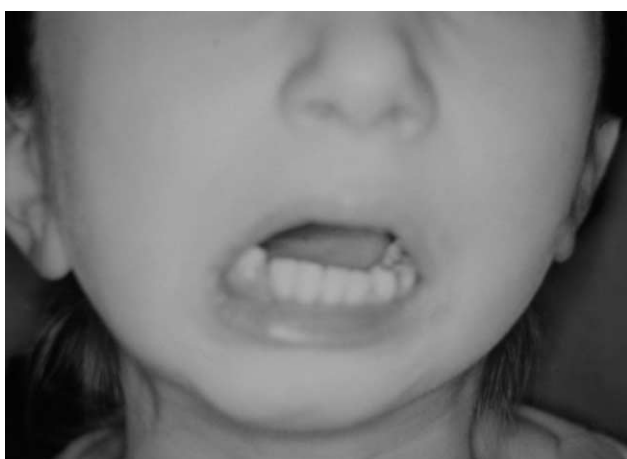
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**Fig 1** The front view of the patient at age 8.

After the treatment of TMJ ankylosis, patients need to have further operations necessary for the correction of the secondary maxillofacial deformities. The aim of these operations is to correct the asymmetries caused by the hypoplasia of the mandible.<sup>7</sup> Osteotomies of the mandible, Le Fort osteotomies and distraction osteogenesis are used to correct these facial asymmetries. Distraction osteogenesis is an inductive and regenerative technique depending on the formation of new bony tissue obtained by moving apart the two vascularized bony surfaces that are formed by osteotomy. Distraction osteogenesis procedure is carried out using variable devices such as unidirectional, multidirectional, extraoral and intraoral distractors.<sup>8,9</sup>

The present study reports interpositional arthroplasty as a treatment method of TMJ ankylosis caused by otitis media and mandibular distraction



**Fig 2** The patient had 12 mm of maximum interincisal opening before interpositional arthroplasty.



**Fig 3** The panoramic radiograph of TMJ ankylosis before interpositional arthroplasty.

osteogenesis using an intraoral distraction device for the correction of the mandibular asymmetry caused due to the restriction of the mandibular growth.

#### CLINICAL REPORT

**T**he patient, an 8-year-old girl, was referred to our clinic due to a complaint of limited mouth opening (Fig 1). According to the history, the patient had an otitis media of her right ear at 1, 5 years of age. Clinical examination revealed limited mandibular growth, 12 mm of maximum interincisal opening of the mouth, absence of lateral excursion to the left and limitation of lateral excursion to the right of 2 mm (Fig 2).

An ankylotic mass of the right TMJ was seen in the panoramic radiograph (Fig 3). The surgical plan was to perform unilateral interpositional arthroplasty with release of the ankylotic mass according to the clinical and radiographic findings.

The patient was placed under general anesthesia by nasal fiberoptic intubation. After the routine surgical preparations, standard preauricular incision was made to expose the TMJ. The ankylotic mass was



**Fig 4** The panoramic radiograph after interpositional arthroplasty.



**Fig 5** The panoramic radiograph after unilateral distraction.

consisted of both bony and fibrous adhesions. Initial lateral osteotomy cut with burr was directed to make a groove between the fossa and the condylar neck. Osteotomy was done with the osteotomes and the ankylosed mass was totally resected. A  $20 \times 5 \times 20$  mm of silicone block (Silastic, Dow Corning, Midland) was placed as an interpositional material between the bony segments. A passive interincisal mouth opening of at least 36 mm was achieved. Drain was placed in the operation site. The patient was instructed in jaw-opening exercises during postoperative days.

The patient was discharged from the clinic four days after the operation and was controlled in the follow-up period (Fig 4). Routine controls which were done in the first year were showed that mouth opening was 36 mm and there were no adverse reactions of the Silastic block. The patient had a



**Fig 6** The interincisal opening of the patient before bilateral distraction.



**Fig 7** The front view of the patient before bilateral distraction.

foreign body reaction of the silicon block at an age of 10, thus the Silastic block was removed.

The patient was able to maintain a maximum interincisal opening of 36 mm and to function reasonably well. The patient had a mandibular asymmetry on the right side. The bony skeleton is formed as a result of the function and growth of the soft tissues according to the functional matrix theory. The release of the ankylotic mass was expected to be adequate to overcome the asymmetry but the growth pattern did not catch up and restrict the growth of the mandible in the follow-up period, thus asymmetry remained. Treatment plan was to perform distraction osteogenesis to the right mandible to overcome the



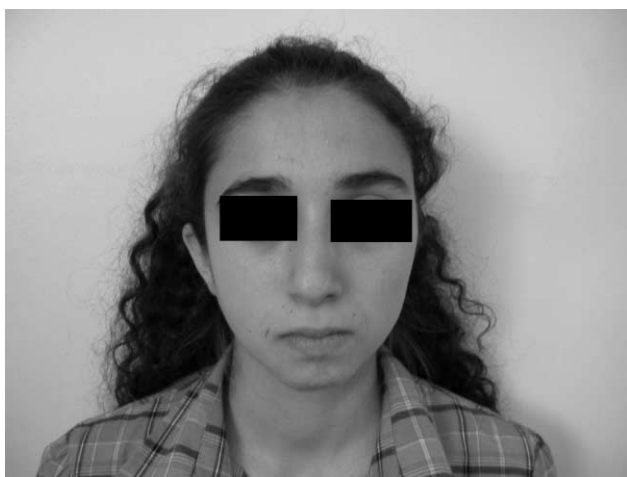
**Fig 8** The lateral view of the patient before bilateral distraction.



**Fig 9** The panoramic radiograph of bilateral distraction.

asymmetry and improve the esthetic appearance of the patient at an age of 13.

The patient was placed under general anesthesia. An incision similar to sagittal split osteotomy was carried out on the vestibular side. A subperiosteal detachment was undertaken to expose the corpus and the ramus of the mandible. A corticotomy was performed in an oblique direction starting from the retromolar triangle to the angle of the mandible and fracture of the remaining spongiosa was performed. Unidirectional distractor (Medicon) was inserted at an angulation able to develop a vector of distraction that is both oblique and vertical. The distractor was first activated at the fourth postsurgical day and the activation continued with a turn of the screw (0.5 mm) twice a day for a total of 1 mm per day until the programmed result was achieved. The distractor was left in place for the consolidation



**Fig 10** The front view of the patient after bilateral distraction.

period of 8 weeks and was removed after the radiographic examination of the newly formed cortical bony tissue (Fig 5).

The patient had a mandibular retrognathia at an age of 16 during the active growth period after the treatment of the asymmetry of the right mandible (Figs 6–8). Bilateral distraction osteogenesis of the corpus of the mandible was planned to correct the mandibular retrognathia (Fig 9). Presurgical orthodontic therapy was performed to prepare the occlusal relation to the postsurgical skeletal modifications. The same distraction procedure was used bilaterally (Medicon and Surgi-Tec) and later genioplasty was performed to correct the retrognathic and deviated chin (Fig 10, Fig 11).

## DISCUSSION

**T**reatment of TMJ ankylosis varies from gap arthroplasty and reconstruction with autogenous or alloplastic materials.<sup>10</sup> Interpositional arthroplasty is characterized by reshaping the condylar stump with eventual interposition among the articular ends of the autogenous or alloplastic material.<sup>11,10</sup> Silastic block was first used in arthroplasty by Hansen and Deshazo.<sup>12</sup> This alloplastic material has the advantages of large availability, low cost and ease of handling. However, it can induce foreign body reactions. Valentini et al<sup>3</sup> reported re-ankylosis in some cases favored by Silastic inducement of foreign body granuloma.

The most widely accepted autogenous technique is the reconstruction with a costochondral graft. Although the graft has advantages such as biological



**Fig 11** The lateral view of the patient after bilateral distraction.

compatibility, functional adaptation and growth potential,<sup>13</sup> this technique may have unsatisfactory results.<sup>14,15</sup> These may be fractures, re-ankylosis, donor site morbidity and unpredictable growth of the graft.<sup>16,17</sup> Growth may not proceed normally thus resorption or overgrowth may be seen and this will cause the need to further surgical procedures.<sup>17</sup>

In this case report reconstruction with Silastic block was performed related to ease of handling in consideration the disadvantages of all of the techniques.<sup>3</sup> However, it was rejected due to a foreign body reaction and re-ankylosis did not occur.

Unilateral TMJ ankylosis occurred during the active growth period caused secondary mandibular deformities. The ramus of the mandible on the affected side is short whereas the contralateral side is long and flat. The chin deviates to the affected side and retrognathia occurs. Resection of the ankylosed mass result in further shortening of the ramus on the affected side.<sup>6</sup>

In this report unilateral intraoral distraction osteogenesis was chosen to correct the secondary deformity over more conventional osteotomies. Removal of the ankylosed mass and correction of the deformity at the end of the growth was used as a treatment protocol before the presentation of distraction osteogenesis.<sup>7</sup> Distraction osteogenesis was initially used in orthopedic field for lengthening of the long bones.<sup>18</sup> This technique was used for the maxillofacial region by Synder et al<sup>19</sup> for lengthening the mandibles in dogs using external distraction device and became a satisfactory treatment modality for the craniofacial deformities. McCarthy et al<sup>20</sup> demonstrated the feasibility of mandibular lengthening using Ilizarov's<sup>21</sup> concept of gradual distraction and introduced an intraoral distraction device. The stability of distraction osteogenesis was thought to be superior to that of conventional osteotomies because of the soft tissue adaptation, harmonic modification of the muscles and advantage of the controlled retention phase.<sup>22</sup>

In this clinical report, distraction osteogenesis was performed in the growing mandibular bone. Release of the ankylosed mass for the young patients with mild to severe facial asymmetries may be adequate. If this approach catches up the growth pattern, in this condition there is no need to have further surgical procedures.<sup>16</sup> In our case the ankylosed mass was released but secondary deformity occurred. In order to correct the deformity, distraction osteogenesis was performed. Although the patient was in the active growth period, the surgical procedure was not postponed to the end of the growth to overcome the social and psychological problems.

Combined surgical therapies consisting both arthroplasty and distraction osteogenesis are also used for treatment of TMJ ankylosis.<sup>7,22</sup> This technique causes the delay of postoperative mandibular movement, jaw opening exercises and physical therapy, which can cause negative results of the arthroplasty.<sup>16</sup> In our case only the release of the ankylosed mass was performed in order to catch up the growth pattern due to literature review.<sup>16</sup>

Secondary bilateral distraction osteogenesis procedure was required due to the correlation inconsistency of the growth pattern related with the ankylosed mass. The condyle is normally thought to have a growth potential, in response to the functional matrix theory. Restriction of the growth occurs due to the TMJ ankylosis.<sup>23</sup> At the same time, the patient might have a mandibular retrognathia due to the hereditary factors.<sup>15</sup>

The interincisal opening of 35 mm was reported in the cases of combined surgical therapy using intraoral distraction devices.<sup>7</sup> Similar to the report of Piero et al, in the present report the patient was able to maintain a maximal interincisal opening of 36 mm.

Similar to the presented study, distraction osteogenesis was also used as a treatment modality for the patients having severe micrognathia caused secondary to TMJ ankylosis. Distraction was performed after an interincisal opening of 34 mm was achieved.<sup>22</sup> In the present case although the timing of the surgical procedures are controversial, these findings suggest that interpositional arthroplasty and additional distraction osteogenesis procedure is an acceptable treatment method of TMJ ankylosis and the correction of the mandibular asymmetry caused due to the restriction of the mandibular growth.

## CONCLUSION

**I**nterpositional arthroplasty is one of the surgical procedures essential for the treatment of TMJ ankylosis. Early surgical approach provides functional growth of the maxillomandibular complex. However, secondary deformities and insufficient growth which may be seen after the treatment of the TMJ ankylosis can be operated by additional distraction osteogenesis procedures.

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