

Functional Temporomandibular Joint Reconstruction in Costochondral Grafting of Micrognathia

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Summary: Rib bone and costochondral complex grafting has been used to treat micrognathia classified as Pruzansky type III. To acquire more physiological joint movement, we reconstructed a temporomandibular joint with the glenoid fossa in addition to the mandibular ramus. The patient underwent a tracheostomy to correct her airway obstruction at 2 months of age. After that, no further surgical treatments were performed on the micrognathia. When she was 6 years of age and during consultation at our department, micrognathia caused by Goldenhar syndrome was confirmed. A head and neck computed tomography scan showed hypoplasia and deficit of the mandible, severe glossoptosis and airway constriction. Initially, a bilateral mandibular body distraction was performed at 6 years of age, and 15 mm of elongation was obtained. Subsequently, reconstruction of the right ramus and right temporomandibular joint fossa was performed at 8 years of age to achieve extubation. Part of her sixth rib and costochondral complex graft was used for the ramus, and costochondral graft was used for the joint fossa. Some new ideas for temporomandibular joint reconstruction were added. Postoperatively, the open mouth range was increased and improvement of the airway space narrowing was observed in a computed tomography scan. The main points of this new method are prevention of ankylosis, skull cortex thinning, and reconstructed ramus' dislocation. This method may become an effective new treatment for cases of micrognathia with a ramus classified as Pruzansky type III. (*Plast Reconstr Surg Glob Open* 2018;6:e1925; doi: 10.1097/GOX.0000000000001925; Published online 2 October 2018.)

The severity of micrognathia depends on the degree of malformation and is classified as Pruzansky type I, IIA, IIB, and III.¹ There have been reports of various studies on temporomandibular joint reconstruction, and the reconstruction of a temporomandibular joint with costal cartilage was first described by Gillies² time in 1920. Prevention of ankylosis is very important in temporomandibular joint reconstruction. McCarthy et al.³ reported a

method involving reconstruction of the glenoid fossa on the zygomatic arch to prevent ankylosis of the temporomandibular joint. In contrast, Tahiri et al.⁴ reported that they did not reconstruct the glenoid fossa surgically in 33 costochondral graft cases. We believe in the necessity for temporomandibular joint fossa reconstruction with a costochondral graft because of the physiological function of the joint. We have developed an easy and useful method for temporomandibular joint reconstruction using a costochondral graft and well-vascularized soft-tissue flap. In this case report, we describe reconstruction of a more physiological temporomandibular joint on the skull bone of an 8-year-old female with micrognathia caused by Goldenhar syndrome.

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CASE REPORT

The patient underwent a tracheostomy to correct her airway obstruction at 2 months of age. Upon her referral to our department at 6 years of age, micrognathia

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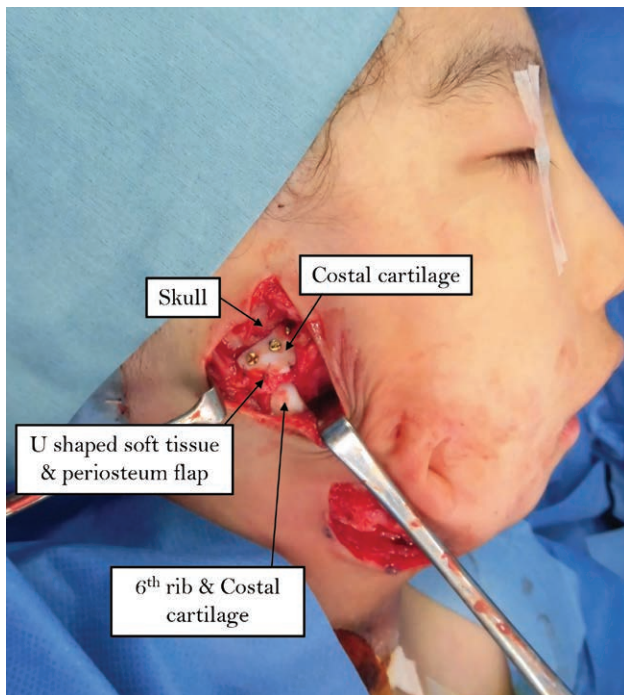


Fig. 1. Reconstructed mandibular joint. The shape of the joint fossa was designed to prevent dislocation during temporomandibular joint motion. A well-vascularized flap containing soft tissue and periosteum was inserted into the space between the implanted fossa and the costochondral graft.

caused by Goldenhar syndrome was confirmed. A head and neck computed tomography (CT) scan showed the following: (1) hypoplasia and deficit of the mandible (left ramus: Pruzansky type IIB; right ramus: Pruzansky type III); (2) severe glossoptosis; and (3) airway constriction resulting from marked hyperplasia of granulation tissue surrounding the tracheostomy site. Bilateral mandibular body distraction was performed in the initial

surgery. The distraction was completed at 15 mm. As a result, it became possible for her to speak with a speech cannula for the first time. Subsequently, after confirming the growth of the chest wall, a rib and costochondral complex graft and costochondral graft were performed at 8 years of age for reconstruction of the right ramus and the right temporomandibular joint to achieve extubation.

The mandibular ramus was reconstructed using the left sixth rib including the junction with the costal cartilage. For the glenoid fossa, a costochondral graft was performed. Submandibular and preauricular incisions were made. A subcutaneous layer tunnel between these incisions was created for rib grafting. A reverse U-shaped flap containing periosteum and soft tissue was raised from the skull base at the site of the joint fossa. The shape of the joint fossa was designed to prevent dislocation of the rib and costochondral complex graft during temporomandibular joint motion. It was fixed to the skull with lag screws. For prevention of ankylosis, a hinged vascularized flap from the skull base was then inserted into the space between the reconstructed glenoid fossa and the reconstructed ramus. The periosteum side was fixed to the fossa side and the soft tissue side was faced to the condylar process side (Figs. 1–3).

Intermaxillary fixation was performed for 1 week. Vocal training was conducted immediately after the operation. At 18 months postoperatively, the mouth opening had increased from 13 to 26 mm, and improvement of airway space narrowing was observed in a CT scan (Fig. 4). The patient is currently awaiting extubation.

DISCUSSION

Ankylosis is one of the most serious complications in temporomandibular joint reconstruction, and its prevention is very important. Frequency of ankylosis occurrence varies, and methods for its prevention have been

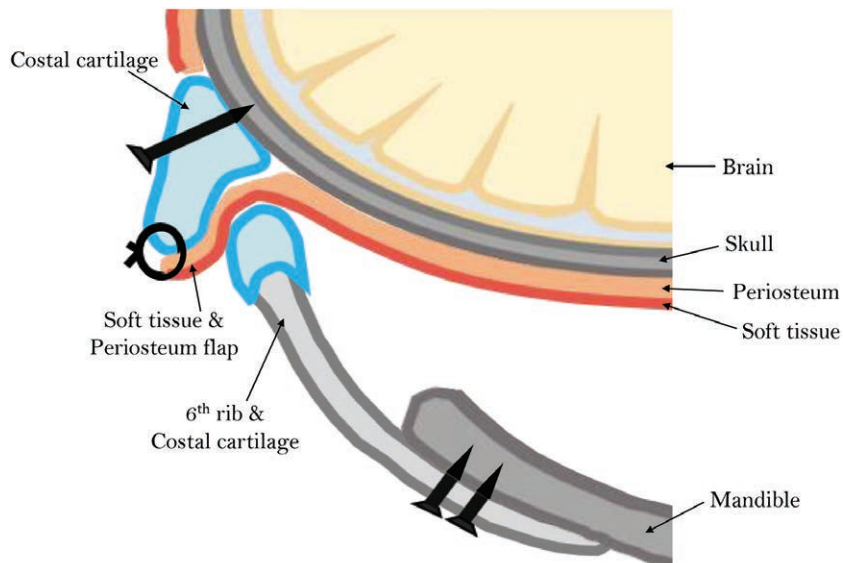


Fig. 2. A schema of mandibular reconstruction.



Fig. 3. Postoperative 3-dimensional CT image at 1 month after reconstruction of the right ramus and temporomandibular joint.



Fig. 4. Opening mouth state at 18 months postoperatively. The opening movement after reconstruction of the temporomandibular joint is smooth, and the open mouth range had increased from 13 to 26 mm.

reported. According to Guyuron and Lasa,⁵ about 38% of reconstructed cases were accompanied by ankylosis, whereas Tahiri et al.⁴ reported ankylosis in only 3% of cases and claimed that they did not try to recreate the glenoid fossa surgically. We believe that glenoid fossa reconstruction is necessary because of the physiological function of the joint. There have been reports of various studies on temporomandibular joint reconstruction involving sternal conjugation, iliac bone, fibula bone,⁶ and metatarsal bone^{7,8} (both vascularized bone graft and

free bone) among others. It is a general belief that the transplanted rib in a rib graft with costal cartilage can be recognized the growth after reconstruction. Thus, we chose the sixth rib to reconstruct the mandibular ramus with costochondral complex graft in consideration of jaw growth. However, the growth patterns of transplanted costochondral grafts have been reported to vary from overgrowth to no growth at all.^{5,9,10} This case is currently only in the 18 months follow-up period. At this stage, many articles claim that rib grafts have not been absorbed yet. However, in a recent report by Santamaría et al.,⁶ he claimed that the rib ended up being absorbed after an extended period of time (observed in the adult age). He insisted that it is necessary to use vascularized fibula instead of rib graft in such a case. To date, there are no noticeable concerns; however, long-term follow-up is necessary. To acquire more physiological joint movement, we devised 2 new details for reconstruction of the mandible. The first involved reconstruction of the mandibular fossa with a costochondral graft; the shape of the fossa is designed to prevent dislocation of the reconstructed ramus. The costochondral head tends to slip because the skull base is a sphere. Furthermore, the fossa supports physiological movement of the mandibular head. The second involved placement of a flap of well-vascularized soft tissue with periosteum between the fossa and the costochondral head to prevent ankylosis. Thus, the flap is well vascularized, tough, and stable. However, there is the possibility of flap ischemia in the long term. If blood circulation in the periosteum completely stops due to strong pressure to the rib cartilage from both sides, it will become a scar or it might lead to ankylosis in the end. So long-term follow-up is necessary.

CONCLUSIONS

The present method for temporomandibular joint reconstruction may become a new effective treatment for cases of micrognathia with a ramus classified as Pruzansky type III.

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