

Rationale for Patient-fitted Alloplastic Temporomandibular Joint Replacement in Childhood Ankylosis



Juvenile temporomandibular joint ankylosis leads to problems with food intake and chewing, improper oral hygiene that results in tooth decay and pain, and facial deformity (“asymmetrical bird’s face”). Surgical treatment aims to provide a painless maximum mouth opening (MMO) >30 mm, to prevent reankylosis, to allow further growth of the mandible, to ameliorate or prevent obstructive sleep apnea, to ensure proper mastication, and to improve the overall quality of life.^[1]

Contemporary literature of Sawhney class III and IV ankylosis in children is still far from conclusive regarding its best treatment option. Although many therapies are available, such as gap and interpositional arthroplasty (IA) and medial pole retaining arthroplasty (MPRA), all are unpredictable in their success related to MMO, reankylosis, and facial growth. Due to the osteogenic potential in children, their rate of reankylosis is especially high, particularly after gap arthroplasty,^[2,3] which also causes shortening of the ascending ramus and contributes to “bird face” deformity.^[4] Thus, IA with or without condylar reconstruction is recommended. The latter approach has been described using dermis/fat, pinna cartilage, temporalis muscle/fascia, costal cartilage, and full-thickness skin grafts.^[5,6]

For IA with condylar reconstruction, costochondral grafting (CCG); use of the fibula, clavicle, iliac crest, metatarsal head, metatarsal free flap, and sternoclavicular joint; autologous coronoid process transplantation; distraction osteogenesis (DO); hydroxyapatite/collagen scaffold impregnated with platelet-rich plasma; and acrylic material have been reported.^[7,8,10-12] However, neither modality has produced uniformly successful results. A limited range of mandibular motion, reankylosis, and growth problems are the most commonly reported complications of IA with condylar reconstruction.^[2,9,13]

Interest in DO (boneless bone grafting)^[14] has waned due to the need for a second surgery to remove hardware, technical failures (e.g., pin pullout, hardware exposure), malocclusion, facial asymmetry due to an inappropriate transport vector, reankylosis, and the long duration of treatment.^[13]

CCG is prone to complications at the donor site, such as pleuritis pain, pneumothorax, and infection, while the recipient site faces risks of graft resorption, infection, fibrosis, and reankylosis.^[15,16] Reankylosis is described in 14%–35%^[17,18]

of CCG recipients, partly due to the immobilization required for the bony union to occur.^[19] In a systematic analysis without age restriction but with mainly pediatric reports, CCG showed the highest incidence of reankylosis among all procedures analyzed.^[20] In CCG, a primary growth center is transplanted, but the growth of the graft is highly unpredictable.^[21] Overgrowth is reported in 4%–30%,^[4,17,21,22] undergrowth in 1%–57%,^[4,17,18,22] and no growth in 1%–21%^[17,21] of grafts. Specifically, overcorrection of the chin with more functional stress of the muscle matrix may trigger overgrowth on the transplanted side of the face.^[23]

Mehrotra *et al.* concluded after analyzing a series of 791 patients that sternoclavicular joint reconstruction is the treatment of choice in children with ankylosis.^[9] In support of this conclusion, Thirunavukkarasu *et al.* reported a 10% clavicle fracture rate but otherwise complete regeneration of the joint after 1 year.^[24]

A systematic review failed to demonstrate the superiority of either IA technique (with or without condylar reconstruction) with respect to MMO^[6] and could not investigate alloplastic replacement.

MPRA results in more normal mandibular growth than CCG.^[25-28] In this approach, the residual disk is reused and condylar reconstruction is not required, although MPRA can only be attempted in Sawhney Class III ankylosis, which usually only occurs in adolescence.

Alloplastic total joint replacement (ATJR), a type of IA with condylar reconstruction, has become the main standard of care, especially in adults, when no financial constraints are present.^[1] ATJR is considered more effective than CCG, especially after multiple surgical procedures that have compromised wound bed vascularity.^[29] Potential advantages of using a patient-fitted ATJR in children include mimicking normal anatomy and restoring vertical facial dimension. The lateral open bite does not need to be obliterated by an occlusal splint, which allows rescue of maxillary alveolar growth, and donor site morbidity is avoided. The patient has a reduced risk for reankylosis, can endure immediate aggressive physiotherapy and will not experience over- or undergrowth or graft fracture.^[1,23,30,31] With ATJR, one can avoid a series of surgeries in childhood, as in the case described by Wu *et al.*, which involved tracheostomy, DO,

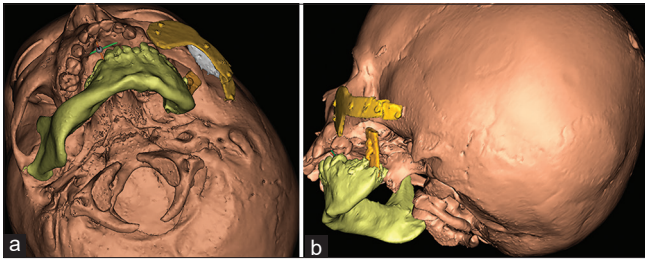


Figure 1: Reconstruction of the left-sided temporomandibular joint in a case of Pruzansky Kaban Class III hemifacial microsomia with the use of autologous costochondral and cranial bone grafts. (a) Postoperative three-dimensional computerized tomography of the craniofacial skeleton. Note the under-correction of the mandibular reconstruction to avoid graft overgrowth.^[23] Three-quarter submentoververtical view. The cartilage graft under the bone lid (grayish) replacing the fossa is not visible. (b) Postoperative three-dimensional computerized tomography of the craniofacial skeleton. Three-quarter posterolateral view. The cartilage cap on the costochondral grafting is not visible

gap arthroplasty with temporal muscle interpositioning,^[32,33] CCG, and finally, ATJR in a child with Nager syndrome.^[34]

Only two limitations of ATJR during childhood are apparent. The currently available ultra-high molecular weight polyethylene will likely need to be replaced every 20 years.^[6,32] In addition, heterotopic bone formation occurs in 50% of post-ATJR adults,^[35] although autologous fat packing can fence-off this adverse event.^[35-37]

An unwarranted concern related to ATJR may be that “growth at the affected joint will be restricted because alloplastic material cannot grow.” This concern must be weighed against the rates of reankylosis and growth problems experienced by IA patients and the benefit of resumed mandibular growth once ankylosis is permanently resolved and function is preserved by physiotherapy after ATJR. Indeed, function dictates form and it has been demonstrated that the mandibular body resumes normal growth even with an absent primary growth center.^[38] Moreover, the psychosocial benefit of the immediate normalization of the child’s face in a single operation should be considered. The same strategy has been employed by the author for the reconstruction of lateral skull base and vertical ramus compartment of Pruzansky Kaban Class IIb and III hemifacial microsomia cases [Figures 1 and 2].

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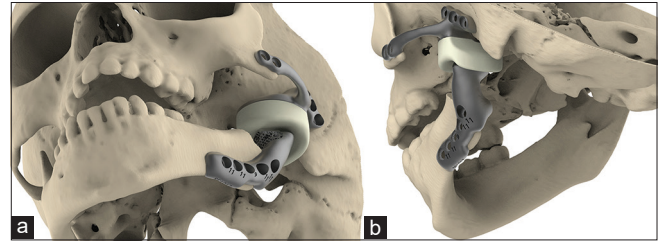



Figure 2: Renders of a reconstruction of the left-sided temporomandibular joint in a case of Pruzansky Kaban Class IIb hemifacial microsomia using alloplastic total joint replacement. Ascending ramus height correction and symphyseal/dental midline overcorrection are obvious. Maxillary alveolar growth during tooth eruption will close the open bite. (a) Three-quarter submentoververtical view. (b) Three-quarter posterolateral view

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