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# Technical Notes for a Conservative Surgical Approach to Temporomandibular Joint Ankylosis

AQ1 *Luca Guarda-Nardini, Francesco Cocilovo, Marco Olivo, MD, Giuseppe Ferronato, and Daniele Manfredini*

**Abstract:** The current article describes a case of a patient with temporomandibular joint (TMJ) ankylosis undergoing surgery performed with a tailored technique for condylar reshaping. A patient with posttraumatic bilateral TMJ ankylosis underwent interpositional arthroplasty with temporalis fascia, and focus was put on the need to maintain the vertical height of the mandible. The postoperative course was uneventful, and positive outcomes were kept during a 1-year follow-up span. The adoption of surgical strategies aiming at restoring a condylar shape as similar as possible to the natural one may be important in the light of the search for surgeries providing and/or recreating normal function of the TMJ.

**Key Words:** Temporomandibular joint, TMJ, ankylosis, TMJ surgery, temporalis fascia

(*J Craniofac Surg* 2014;25: 00–00)

Temporomandibular joint (TMJ) ankylosis is a severe pathology provoking clinical impairment, with restricted jaw motion and subsequent limitation of related functions such as mastication, speech, and oral hygiene.[1] Trauma is the commonest cause of TMJ ankylosis, and its severity seems to be related to the type of trauma and age of the patient.[2,3] Several diseases not directly related to the joint, as in the case of masticatory muscle disorders such as spasms, hematoma, and fibrosis, may mask a true TMJ ankylosis, which is actually a condition that results in osseous or fibrous adhesion between the surfaces of the TMJ, within the limits of articular capsule. Ankylosis of TMJ may be classified by a combination of location (intra-articular or extra-articular), type of tissue involved (bony, fibrous, or fibro-osseous), and different extent of fusion (complete or incomplete).[4]

Treatment is surgical, based on removal of the ankylotic mass, TMJ reconstruction, and correction of deformities. The literature provided several suggestions about the surgical procedures to remove the ankylosis and to avoid its recurrence by interposing biologic (ie, temporalis fascia, temporal muscle flap) or nonbiologic materials (ie, acrylic, silastic).[5,6] No consensus has been reached regarding the optimal strategy, even if limited range of motion and reankylosis are the most frequent long-term complications. In addition, a classification of the surgical techniques in relation to the type and the size of the ankylotic block was proposed,[7] but little attention has been put so far on the possibility to achieve a good condylar remodeling during surgery to try optimizing function in the postoperative period. With this premise, the current article describes a case report of a patient with TMJ ankylosis undergoing surgery performed with a tailored technique for condylar reshaping.

## CLINICAL REPORT

On November 1999, a 49-year-old man sought for advice and treatment of mouth opening limitation and severe pain. He reported that after a major car accident that occurred 2 years before, he had been treated conservatively for an intracapsular fracture of both condyles and surgically for a fracture of the symphysis.

Maximum mouth opening at the time of the first assessment measured 15 mm, and pain, measured 0 to 10 on a VAS rating scale, AQ4 was scored 8 at the right and 2 at the left TMJ area. A TMJ arthrocentesis according to the classic 2-needle technique successfully described by Nitzan et al[8] for patients affected by closed lock was performed followed by physical therapy; after that, the patient achieved a 25-mm unassisted and a 30-mm assisted mouth opening, which was maintained for a follow-up of approximately 2 years.

Approximately 10 years later, on October 2009, the patient came back to our department with a severely decreased mouth opening of 10 mm. Computed tomographic (CT) scans of the jaw in axial, coronal, and sagittal view showed complete bony fusion of the TMJs, especially on the right side, which can be classified as A4 according to He et al.[7] The surgical approach consisted of preauricular incisions, followed by tissue dissection with preservation of the seventh cranial nerve to gain access to the TMJs. On both the right and left sides, a condylelike structure could not be identified so that a gap between bone structures was to be created by removing the fibrous/osseus tissue with surgical burs and chisels. An attempt to direct the mediolateral cuts to recreate a concave shape of the condylar head was performed (Fig. 1). A U-shaped axial composite flap (fascia, F1 muscle, and periosteum) was obtained from the exposed temporal muscle and rotated inferiorly under the zygomatic arch through the space created by the osteotomy (Fig. 2). The standard procedure F2 provided that a 5- to 10-mm extension of the gap between the reshaped glenoid fossa and the mandible is sufficient when such interpositional arthroplasty is performed. In the case under description, an extremely conservative joint remodeling, with a small surgical gap, was performed by a dissection of the ankylotic tissue with a little Lindemann cutter, in the attempt to recreate TMJ's anatomy and to maintain the vertical height of the mandible (Fig. 3). The dis- F3 section was completed with a chisel, and then a distraction of the joint was performed with a Reich distractor to allow a better remodel- AQ5 ing of the new joint surfaces and to create enough space for the interpositional flap. The flap was sutured medially, anteriorly, and posteriorly with 3-0 Vicryl. A maximum incisal opening of 40 mm was obtained after the intervention by manually assisted passive stretch.

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Fig 1 4/C

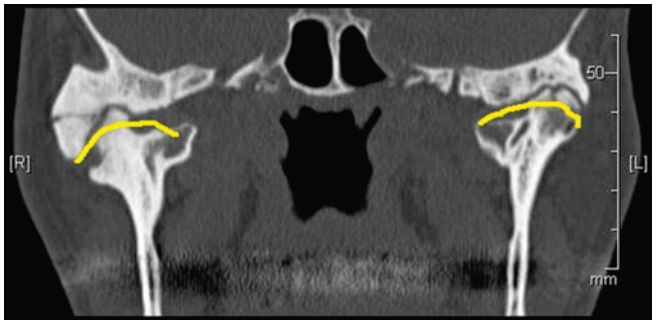


**FIGURE 1.** Presurgical coronal CT showing bilateral TMJ ankylosis with purported direction of mediolateral cuts (yellow lines). Note the extensive heterotopic bone that has grown vertically downward and the increased thickness of reactive bone in the fossa, which was not planned to be fully addressed to avoid aggressive surgery.

The postoperative course was uneventful, and only pain medication and antibiotics were prescribed. There was no motor deficit on either side of the face (Fig. 4). Vigorous physiotherapy was performed to maintain the mobility and to prevent hypomobility secondary to fibrous adhesions, consisting of active and passive exercises also performed with the Therabite device (Therabite, Atos Medical, AB) at least 15 minutes a day for a month after surgery. The patient's diet consisted of very soft foods for the first week and then a soft diet gradually advanced to a solid consistency within 3 to 4 weeks. The patient was followed up monthly for the first 3 months after surgery and then at 6 months and 1 year, with no observed limitations in maximum mouth opening. Mouth opening at the 1-year follow-up was 42 mm with absence of pain (Fig. 5), with an improved contour of the surgical surfaces and a good vertical height of the newly created TMJs (Fig. 6).

## DISCUSSION

The current case report described an attempt to approach conservatively the surgical management of TMJ ankylosis, in which vertical height of the ramus is kept intact with removal of bony fusion and remodeling of the altered anatomy to a shape closer to normal. It also showed how fractures of the mandibular condyles can be underestimated and can lead to a severe condition such as TMJ ankylosis. Posttraumatic TMJ ankylosis causes severe mouth opening restriction, and the presence of an ankylotic bone block is one of the few absolute indications for TMJ open surgery.[9] The literature has described several surgical approaches to remove ankylotic blocks and restore normal function. In any case, there is agreement that a full removal of the entire ankylotic block, including the medial part, is needed to enable free, passive jaw movement.[4] On the basis of this concept, 3 basic techniques have been used, namely, the gap arthroplasty, the interpositional arthroplasty, and the joint reconstruction.

The original gap arthroplasty, which provided that a gap was created between the 2 so-created joint surfaces without interposing any material between the articular cavity and the mandibular ramus, was associated with high recurrence rates. Several studies showed the high frequency of reankylosis due to the intra-articular bleeding resulting in new-born bone tissue and reported posttreatment mouth deviation or anterior open bite in cases of bilateral involvement.[5,10] Thus, modifications of the gap arthroplasty, namely, techniques aiming to avoid recurrence of the ankylosis by putting fibrous tissues between the 2 osseous blocks, were introduced into the clinical practice and gave interesting long-term outcomes; in particular, interpositional arthroplasty with temporalis fascia was superior to the classic gap arthroplasty as for long-term reduction of pain and mouth opening limitation.[5,6] The interpositional technique is based on the concept that postsurgical joint bleeding is a strong risk factor of reankylosis if the 2 joint surfaces are not separated, and different materials have been proposed to be inserted in the gap arthroplasty for the prevention of reankylosis. Among the others, biologic (temporalis

Fig 2 4/C

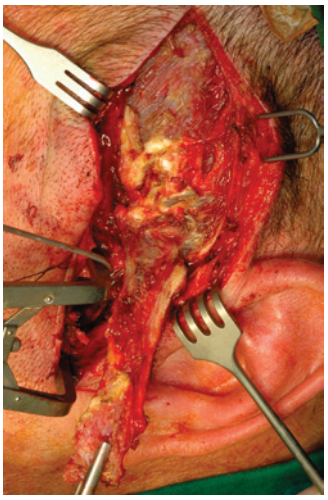

**FIGURE 2.** Temporalis flap is rotated anteriorly and positioned into the newly created gap.

Fig 3 4/C

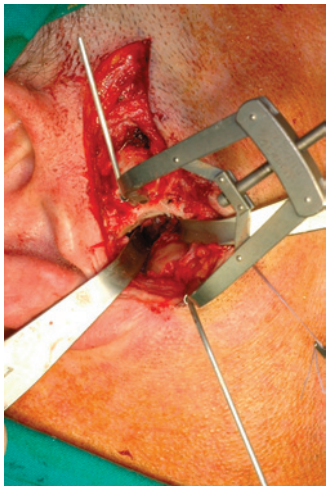

**FIGURE 3.** Joint remodeling and condylar shaping.

Fig 4 4/C

**FIGURE 4.** Absence of cranial nerve VII deficit after surgery.

fascia, temporal muscle flap) and nonbiologic materials (acrylic, silastic) were used. Autogenous-autologous materials (temporalis muscle, dura skin, dermis fat, ear tissues, combined muscle-fascia, buttocks grafts, etc) have to be carefully managed because of the potential donor site morbidity and some risk for resorption[6,11,12]; alloplastic materials (silastic, acrylic, and silicone materials) are used for stabilization problems to keep the alloplastic implant in position and avoid its displacement.[13,14] Thus, in recent years, some techniques for joint reconstruction by autogenous bone grafts or by total joint prosthesis have been described. In particular, TMJ prosthesis has also been introduced as a treatment option in the management of patients who had previously undergone multiple failed TMJ nonsurgical and surgical therapies,[15] and literature data on total alloplastic TMJ reconstructions gave encouraging results.[16] From a benefit-to-cost viewpoint, TMJ total prostheses have yet to stand in comparison with interpositional techniques, which are less cost demanding and are more suitable as a first-step surgery for removing ankylosis.

AQ7

From a technical viewpoint, although an improvement in clinical outcomes was achieved with the interpositional techniques, it must be pointed out that less attention has been put so far on the need to define conservative strategies to cut the ankylosis. Common TMJ surgery guidelines suggested to create the gap at the most superior aspect of the ramus to keep the original vertical height.[17] Actually, satisfying those needs is difficult even for experienced surgeons, and performing a straight lateromedial cut to separate the osseous block is the most widely adopted solution to create a gap between the 2 joint surfaces because of the difficulties to gain access to the medial aspects of the joint. Notwithstanding that, from a functional viewpoint, it can be hypothesized that further improvement in posttreatment outcome can be achieved with the adoption of more conservative strategies to remove the ankylotic block by trying to reshape a condylelike structure.[18]

In the case report described in this article, outcomes at 1 year after surgery were comparable with those achieved by our group with the classic interpositional arthroplasty with temporalis fascia.[19] Thus, the adoption of more conservative surgical strategies aiming to restore a condylar shape as similar as possible to the natural one may be important in the light of the search for surgeries providing and/or recreating normal function of the TMJ and avoiding invasive, resective-only major surgeries.

## CONCLUSIONS

The current case report described an attempt to approach conservatively the surgical management of TMJ ankylosis, in which vertical height of the ramus was kept intact with section and remodeling of bony fusion and remodeling of the altered anatomy to a shape closer to normal. The execution of conservative cuts aiming to pursue condylar reshaping is a potential strategy to improve further the postsurgical outcomes with respect to the classic full-thickness straight joint cut. The encouraging finding of similar outcomes at 1 year with respect to the classic interpositional arthroplasty with temporalis fascia usually performed by our group supports the usefulness of pursuing surgical strategies providing and/or recreating normal function of the TMJ.

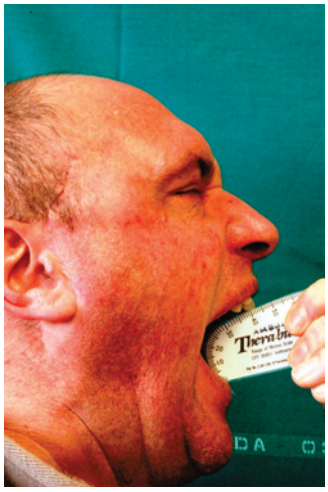

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**FIGURE 5.** Maximum mouth opening at 1 year.

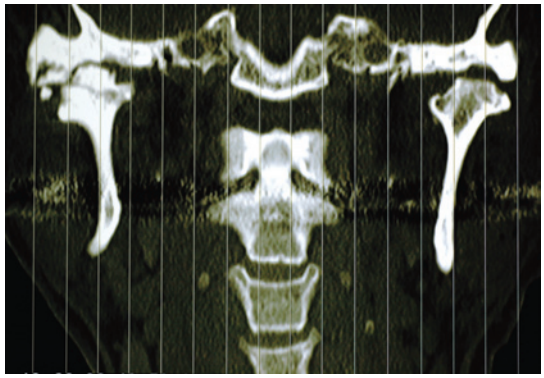

Fig 6 4/C

**FIGURE 6.** Follow-up CT at 1 year, showing the maintenance of the articular height.

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## REFERENCES

1. Chidzonga MM. Temporomandibular joint ankylosis: review of thirty-two cases. *Br J Oral Maxillofac Surg* 1999;37:123–126
2. Ferretti C, Bryant R, Becker P, et al. Temporomandibular joint morphology following post traumatic ankylosis in 26 patients. *Int J Oral Maxillofac Surg* 2005;34:376–381
3. Toyama M, Kurita K, Koga K, et al. Ankylosis of the temporomandibular joint developing shortly after multiple facial fractures. *Int J Oral Maxillofac Surg* 2003;32:360–362
4. Kaban LB, Perrot D, Fisher K. A protocol for management of temporomandibular joint ankylosis. *J Oral Maxillofac Surg* 1990;48:1145–1151
5. Roychoudhury A, Parkash H, Trikha A. Functional restoration by gap arthroplasty in temporomandibular joint ankylosis: a report of 50 cases. *Oral Surg Oral Med Oral Pathol* 1999;87:166–169
6. Su-Gwan K. Treatment of temporomandibular joint ankylosis with temporalis muscle and fascia flap. *Int J Oral Maxillofac Surg* 2001;30:189–193
7. He D, Yang C, Chen M, et al. Traumatic temporomandibular joint ankylosis: our classification and treatment experience. *J Oral Maxillofac Surg* 2011;69:1600–1607
8. Nitzan DW, Samson B, Better H. Long-term outcome of arthrocentesis for sudden-onset, persistent, severe closed lock of the temporomandibular joint. *J Oral Maxillofac Surg* 1997;55:151–157
9. Dimitroulis G. TMJ surgery. In: Manfredini D, ed. *Current Concepts on Temporomandibular Disorders*. Berlin, Germany: Quintessence Publishing, 2010:403–416
10. Tanrikulu R, Erol B, Gorgun B, et al. The contribution to success of various methods of treatment of temporomandibular joint ankylosis (a statistical study containing 24 cases). *Turk J Pediatr* 2005;47:261–265
11. Pogrel MA, Kaban LB. The role of a temporalis fascia and muscle flap in temporomandibular joint surgery. *J Oral Maxillofac Surg* 1990;48:14–19

12. Yadavalli G, Chauhan DM, Cariappa KM. A retrospective study of temporalis muscle and fascia flap in treatment of TMJ ankylosis. *J Oral Maxillofac Surg* 2010;9:363–368
13. Karaca C, Barutcu A, Baytekin C, et al. Modifications of the inverted T-shaped silicone implant for treatment of temporomandibular joint ankylosis. *J Craniomaxillofac Surg* 2004;32:243–246
14. Schliephake H, Schmelzeisen R, Maschek H, et al. Long-term results of the use of silicone sheets after diskectomy in the temporomandibular joint: clinical, radiographic and histopathologic findings. *Int J Oral Maxillofac Surg* 1999;28:323–329
15. Mercuri LG. Alloplastic temporomandibular joint reconstruction. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1998;85:631–637
16. Guarda-Nardini L, Manfredini D, Ferronato G. Temporomandibular joint total replacement prosthesis: current knowledge and considerations for the future. *Int J Oral Maxillofac Surg* 2008;37:103–110
17. Laskin DM. Indications and limitations of TMJ surgery. In: Laskin DM, Greene CS, Hylander WL, eds. *TMDs. An Evidence-Based Approach to Diagnosis and Treatment*. Chicago: Quintessence Publishing, 2006:413–420
18. Nitzan DW, Abu Tair J, Lehman H. Is entire removal of a post-traumatic temporomandibular joint ankylotic site necessary for an optimal outcome? *J Oral Maxillofac Surg* 2012;70:e683–e699
19. Manfredini D, Bucci MB, Guarda-Nardini L. Temporomandibular joint bilateral post-traumatic ankylosis: a report of a case treated with interpositional arthroplasty. *Minerva Stomatol* 2009;58:35–42

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