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Clinical Paper
TMJ Disorders

The autogenous graft versus transport distraction osteogenesis for reconstruction of the ramus–condyle unit: a prospective comparative study

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Abstract. This study aimed to compare the joint function and morphology achieved following condylar reconstruction using sternoclavicular grafts (SCG) versus transport distraction osteogenesis (TDO) in temporomandibular joint (TMJ) ankylosis patients. Twenty-two patients with TMJ ankylosis underwent TMJ reconstruction with SCG or TDO ($n = 11$ each). Radiographic and clinical evaluations were performed at 1 week and at 1, 3, and 6 months post-surgery. Clinical criteria examined included the duration of surgery, mean postoperative mouth opening, excursive jaw movements, and pain scores. The radiographic evaluation 6 months postoperatively (computed tomography) included subjective assessment of joint morphology and measurements of the mean condylar height, width achieved, and amount of condylar resorption. The χ^2 test and Student *t*-test were used to compare qualitative and quantitative variables, respectively. Similar mean mouth opening (SCG = 31.8 mm, TDO = 32.1 mm at 6 months), excursive movements, and pain scores were observed in the two groups throughout follow-up. Mean condylar resorption was significantly greater in the TDO group (TDO = 7.0 mm, SCG = 2.7 mm; $P = 0.005$). The duration of reconstruction surgery was greater in the SCG group ($P = 0.035$). A greater incidence of complications was observed with TDO. In conclusion, based on the protocols used in this study, SCGs are superior to TDO in terms of condylar morphology, stability, and surgical safety.

Key words: sternoclavicular; transport distraction; TMJ ankylosis; RCU reconstruction.

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''It is true that it may be necessary to remove the condyle in cases of ankylosis, but some provision should always be made to reconstruct the joint''. The value of reconstruction of the ramus–condyle unit (RCU) following osteoarthrectomy has been stressed since Smith and Robinson made this modest statement in 1953[1]. The quest for the ideal reconstructive modality using autogenous tissues has been a matter of contention for surgeons for decades, as they have endeavoured to fashion a temporomandibular joint (TMJ) from innumerable materials, tissues, and virtually every bone in the body. In spite of exhibiting variable success rates, autogenous bone grafts have stood the test of time, yielding adequate joint morphology and function, and they are still considered by some surgeons as a preferred method for TMJ reconstruction[2].

Among the various donor sites explored, the sternoclavicular graft (SCG), originally introduced in 1971[3], remains a favourable option, owing to its unique histomorphological resemblance to the TMJ[4]. Although it has hitherto failed to gain widespread popularity like the costochondral graft (CCG), the role of the SCG in RCU reconstruction may be revisited in an attempt to circumvent the unreliable growth characteristics of the CCG.

However, trends change. The 21st century has seen a revolution in the art of osseous reconstruction with the introduction of transport distraction osteogenesis (TDO), which represents a promising, less invasive, alternative technique for RCU reconstruction. TDO provides autogenous bone while obviating donor site morbidity and a period of immobilization, which are the undesirable corollaries of autogenous bone grafting. In addition, the early restoration of jaw function and the common histological observation of a pseudo-disc at the joint interface suggest favourable joint function and morphology following TDO[5–7].

Some surgeons believe that due to these benefits, TDO supersedes all preceding modalities for RCU reconstruction to the extent that it might replace the autogenous graft as the gold standard in the future. However, comparative clinical studies that definitively support this claim are limited. Animal studies comparing the histology of the condyle reconstructed with the CCG and TDO have been reported, which have established that both techniques are effective modalities for reconstruction[2]. However, human clinical studies comparing the morphological and functional outcomes between the two methods are lacking. Moreover, the overwhelming advantages of TDO have not yet been weighed against the SCG for adult RCU reconstruction.

In light of the above, the current study was conducted with the aim of comparing the morphological reconstruction and the functional outcomes of the RCU achieved with autogenous SCG versus TDO following osteoarthrectomy in adults with unilateral TMJ ankylosis.

Materials and methods

Twenty-three adult patients with unilateral TMJ ankylosis were included in the study and divided randomly (alternately) into two surgical groups based on the reconstruction modality that they would receive (Table 1). One patient was later excluded to maintain uniformity. The prior approval of the institutional review board, permission from the local ethics committee, and written informed consent from the patient/patient's parents were obtained.

Surgery for TMJ ankylosis release

All patients underwent osteoarthrectomy under general anaesthesia via the Al Kayat and Bramley approach (Fig. 1A). An ipsilateral coronoidectomy/coronoidotomy, with/without contralateral coronoidectomy/coronoidotomy (via an intraoral approach) was also performed if and when required to achieve the strict goal of an intraoperative inter-incisal opening of $\geq$35 mm. In both patient groups, the temporal end of the resection was contoured to simulate a glenoid fossa and lined with a partial thickness temporalis myofascial flap (Fig. 1B). This was followed by reconstruction of the defect with either the SCG or TDO, with all 22 reconstructions performed by a single surgeon.

Ramus–condyle unit reconstruction

Group I patients received SCGs. An autogenous, non-vascularized, split-thickness, corticocancellous SCG, approximately 4–5 cm in length, was harvested from the medial half of the right clavicle along with the fibrocartilaginous disc attached to its sternal end via a 4–5-cm long horizontal incision made 1–2 cm above the medial end of the clavicle (Fig. 2A, B). The right clavicle was selected for all cases due to the operator's comfort and to maintain uniformity in the study. The graft was then contoured to facilitate its adaptation to the recipient site and fixed, via a submandibular incision, over the lateral aspect of the ramus using positional screws (Fig. 2C).

Group II patients underwent TDO. The mandibular ramus was exposed via a submandibular incision, and an L-shaped osteotomy was marked over the lateral aspect of the ramus, representing the transport disc for condylar reconstruction (Fig. 3A). The vertical limb of the 'L' was designed parallel to a vector that would position the transport disc into the glenoid fossa and would move in close

Table 1. Study groups.

Group	Reconstruction technique
Group I	Autogenous sternoclavicular graft (SCG)
Group II	Transport distraction osteogenesis (TDO)

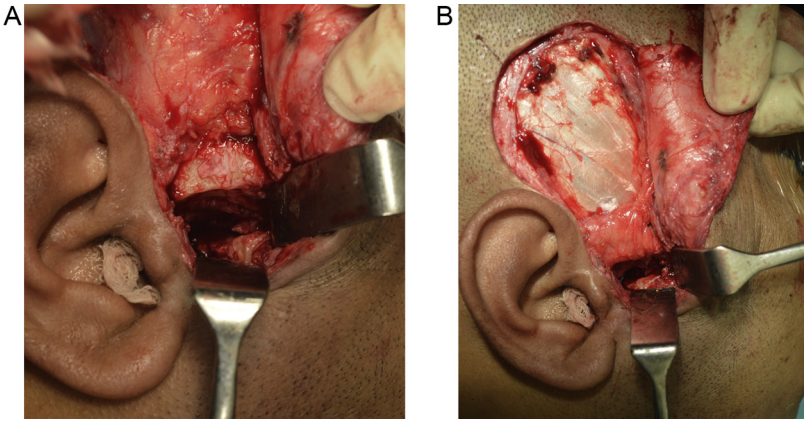

Fig. 1. Osteoarthrectomy and flap interposition. (A) TMJ ankylosis release completed with a defect of >1.5 cm between the temporal bone and ramus. (B) Partial thickness temporalis myofascial flap raised and used to line the glenoid fossa.