

## Role of coronoid process in reconstruction of temporomandibular joint

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### ABSTRACT

This article reports the role of coronoid process as a free graft and pedicled graft in reconstruction of temporomandibular joint in ankylosis cases. The cases treated were observed clinic-radiologically over a period of 12 months. Various autogenous and alloplastic materials used for reconstruction of TMJ were considered with their advantages and limitations. The use of coronoid process for reconstruction of the nose, orbital floor, alveolar ridge and paranasal augmentation has been reported by various authors. Due to its shape and size coronoid process is not a popular option for TMJ reconstruction. The advantage of using coronoid graft is autogenous bone of intramembranous origin harvested through same surgical site. Possibility of graft resorption can be minimized when used as pedicled graft. Postoperative radiograph revealed complete uptake and remodeling of the graft when used both as free and pedicled graft. There was no failure of treatment in terms of reankylosis. Therefore, coronoid process may be a suitable bone resource for condylar reconstruction in patients with TMJ ankylosis.

Key words: TMJ ankylosis, coronoid process, pedicled graft

### Introduction

Coronoid process of mandible is triangular shaped bony structure projecting from the antero-superior aspect of ramus. The superior border continues posteriorly to form sigmoid notch where as the anterior border continues inferiorly to forms the coronoid notch. Embryologically it is membranous in origin and the formation is evident at six weeks of intrauterine life. [1] It consists of dense bicortical bone with a thin intervening spongy layer. Temporalis muscle is attached to anteromedial aspect of coronoid process. Enlargement of coronoid process is seen in hemifacial hyperplasia, oral submucous fibrosis and temporomandibular joint (TMJ) ankylosis.

Coronoidectomy and reconstruction of TMJ are accepted modality of treatment

following osteoarthrectomy in TMJ ankylosis cases. Various autogenous such as calvarial bone grafts, iliac bone grafts, contralateral coronoid, ipsilateral Coronoid, Rib graft can all be used in reconstruction of TMJ and alloplastic materials such as artificial joints with metallic condylar prosthesis are used for TMJ reconstruction. [2, 3]

Presurgical assessment of the coronoid process can easily be done radiographically. Coronoid process can be approached either intraorally or extraorally depending upon the purpose of excision. In TMJ ankylosis cases Alkayat-Bramley or preauricular approach which is used to the excise the ankylosed mass is also used to excise the coronoid process. [4]

The aim of this article is to highlight the use of excised coronoid process as a free or pedicled graft for reconstruction of TMJ in ankylosis cases.

### **Coronoid process as a free graft**

The ankylosed TMJ is excised through Alkayat Bramley approach. Saucerisation is done with a rose head bur to create a glenoid fossa. Coronoidectomy is carried out at the level of sigmoid notch through the same surgical wound. A rotary instrument is used under normal saline coolant to mark the osteotomy line and final fracturing is done with the help of an osteotome. The coronoid process is pulled out with a Kocher's artery forceps while detaching the temporalis muscle with an electrocautery. The excised coronoid graft is trimmed from the distal end with a rotary instrument to a required length of approximately 12-14 mm. (Fig. 1) Trial of the coronoid graft is taken to check the fit and any premature contact with glenoid fossae.



**Fig. 1 Excised coronoid process**

A posteriorly based temporalis myofascial pedicled flap of adequate size is raised and rotated over the root of the zygomatic arch to line the glenoid fossa and transfixed

using 3-0 prolene suture. A four hole and two hole mini titanium plate are fixed to the graft extracorporeally by 2 mm diameter and 6mm length titanium mini screw using Mayers principle. (Fig. 2)<sup>[5]</sup> The graft is secured to the mandibular ramus using Ti-mini screw, while maintaining the teeth in occlusion. Mandibular movements are carried out to check for any interference.



**Fig. 2 Fixation of Coronoid process**

### **Coronoid process as a pedicled graft**

The coronoid process can also be used as a pedicled graft. (Fig. 3) After excision of the ankylosed mass the coronoid process is osteotomized at the level of sigmoid notch. The osteotomized coronoid process is pulled down with the help of Kocher's artery forceps. Selective myotomy of the temporalis muscle is carried out in the areas of maximum stretch with the help of electrocautery till such time the coronoid process can be adequately manipulated. A posteriorly based temporalis myofascial pedicled flap of adequate size is raised and rotated over the root of the zygomatic arch to line the glenoid fossa and transfixed using 3-0 prolene suture. The coronoid pedicled graft is fixed to the ramus with

titanium maniplate and screws using Mayers principle. Hemostasis achieved, suction drain placed and wound sutured in layers.



Fig. 3 Pedicled graft



Fig. 4 Excision of coronoid process

### Discussion

The primary role of the coronoid process is to provide attachment to temporalis muscle which controls various mandibular movements. It forms a musculo-skeletal unit of mandibular growth. In case of TMJ ankylosis, the coronoid process is elongated due to hyper activity of temporalis muscle. Hence coronoidectomy has been included in the protocol for management of TMJ ankylosis to improve mouth opening. This not only prevents the mechanical obstruction but also eliminates the effect of

temporalis muscle on mandibular movements.<sup>[6]</sup> Coronoid excision is also carried out to improve the mouth opening in oral submucous fibrosis<sup>[7]</sup> and post radiation trismus.<sup>[8]</sup>

Coronoid process of the mandible is a source for autogenous bone graft for maxillofacial reconstructions. It is used for reconstruction of the nose, orbital floor, alveolar ridge and paranasal augmentation.<sup>[9, 10, 11, 12]</sup> The advantages of using coronoid graft are its autogenous, and dense cortical bone of intramembranous origin.

In TMJ ankylosis, reconstruction of joint is carried out with various autogenous grafts like costochondral graft, (CCG) clavicle, iliac, fibula and metatarsal and alloplastic implants.<sup>[13, 14]</sup> All the donor sites are distant; hence require a second surgical wound. The disadvantage of CCG is unrestricted growth.<sup>[15]</sup> The complications of rib donor site include unsightly chest scars and possible pneumothorax.

The coronoid process bone graft offers advantage over other sources of autogenous bone that it is harvested through the same surgical wound without causing added discomfort and residual deformity to the patient. The operating time also reduced significantly.

The coronoid process is not commonly used for TMJ reconstruction because of its inadequate thickness. Size and shape of the coronoid process is a limitation in joint reconstruction. The limitation of coronoid as a free graft is resorption.<sup>[16]</sup>

To overcome the disadvantage of resorption of free graft, coronoid process can also be used as a pedicled graft. The advantage of using the pedicled graft is its viability as it is attached to the temporalis

muscle. The stimulus of temporalis muscle function is well maintained. Insertion of temporalis does not interfere with fixation of graft because of its medial attachment. Temporalis muscle pedicle also acts as a second layer of soft tissue interpositional material between the coronoid and the glenoid fossa. The disadvantage of the pedicled graft is poor manipulating ability. Some temporalis fibres are freed from the temporal fossa to improve the manipulation.

The uptake of free grafts is by replacement resorption. The complete revascularization of the graft takes place in 8 months.<sup>[17]</sup> However stable fixation of these grafts during this phase is of paramount importance. We used titanium mini plates for fixation of both the types of graft as per Mayers principle and on completion after one year the radiograph revealed complete integration of the graft and remodeling of the tip of the Coronoid process resembling like a condylar head. The chances of resorption of the pedicled graft are minimal because of its maintenance of its vascularity.<sup>[18]</sup> During the follow up period there was no change in the radiodensity of the pedicled coronoid process which is suggestive of viability of the graft. There was complete radiological union of the graft with the recipient site.

### Conclusion

Reconstruction of TMJ is an accepted protocol in management of ankylosis. In routine clinical practice the excised coronoid process is hardly used for reconstruction of TMJ. The cases treated by coronoid process reconstruction shows satisfactory clinico-radiological outcome without any recurrence of ankylosis. In days

to come both free and pedicled graft of coronoid process may replace the other autogenous graft materials. However effectiveness of these methods is required to be studied in a large sample size.

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