

Original Article

Preauricular transmasseteric anteroparotid approach for extracorporeal fixation of mandibular condyle fractures

Rajasekhar Gali, Sathya Kumar Devireddy, Kishore Kumar Rayadurgam Venkata, Sridhar Reddy Kanubaddy, Chaithanyaa Nemaly, Mallikarjuna Dasari

Department of Oral and Maxillofacial Surgery, Narayana Dental College and Hospital, Nellore, Andhra Pradesh, India

Address for correspondence: Dr. Rajasekhar Gali, Department of Oral and Maxillofacial Surgery, Narayana Dental College and Hospital, Nellore - 524 003, Andhra Pradesh, India. E-mail: rajmaxfac@gmail.com

ABSTRACT

Introduction: Free grafting or extracorporeal fixation of traumatically displaced mandibular condyles is sometimes required in patients with severe anteromedial displacement of condylar head. Majority of the published studies report the use of a submandibular, retromandibular or preauricular incisions for the access which have demerits of limited visibility, access and potential to cause damage to facial nerve and other parotid gland related complications. **Purpose:** This retrospective clinical case record study was done to evaluate the preauricular transmasseteric anteroparotid (P-TMAP) approach for open reduction and extracorporeal fixation of displaced and dislocated high condylar fractures of the mandible. **Patients and Methods:** This retrospective study involved search of clinical case records of seven patients with displaced and dislocated high condylar fractures treated by open reduction and extracorporeal fixation over a 3-year period. The parameters assessed were as follows: a) the ease of access for retrieval, reimplantation and fixation of the proximal segment; b) the postoperative approach related complications; c) the adequacy of anatomical reduction and stability of fixation; d) the occlusal changes; and the e) TMJ function and radiological changes. **Results:** Accessibility and visibility were good. Accurate anatomical reduction and fixation were achieved in all the patients. The recorded complications were minimal and transient. Facial nerve (buccal branch) palsy was noted in one patient with spontaneous resolution within 3 months. No cases of sialocele or Frey's syndrome were seen. **Conclusion:** The P-TMAP approach provides good access for open reduction and extracorporeal fixation of severely displaced condylar fractures. It facilitates retrieval, transplantation, repositioning, fixing the condyle and also reduces the chances of requirement of a vertical ramus osteotomy. It gives straight-line access to condylar head and ramus thereby permitting perpendicular placement of screws with minimal risk of damage to the facial nerve.

KEY WORDS

Access; approach; condylar fracture; extracorporeal fixation

Access this article online	
Quick Response Code:	Website: www.ijps.org
	DOI: 10.4103/0970-0358.182254

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How to cite this article: Gali R, Devireddy SK, Venkata KR, Kanubaddy SR, Nemaly C, Dasari M. Preauricular transmasseteric anteroparotid approach for extracorporeal fixation of mandibular condyle fractures. Indian J Plast Surg 2016;49:59-65.

INTRODUCTION

Condylar fractures account for 25–35% of all mandibular fractures.^[1] The management of condylar fractures has long been and still continues to be a matter of much debate and controversy. Open reduction and internal fixation is the most widely advocated and currently practised treatment option in majority of the centres throughout the world, as it helps in accurate anatomical reduction of condyle and faster rehabilitation of the patient to normal lifestyle with minimum occlusal and temporomandibular joint problems.

But in certain patients with severe anteromedial displacement of the condylar segment, the mandibular ramus gets telescoped into the glenoid fossa due to the pull of the pterygomasseteric muscular component in an upward direction. In these situations, it is difficult to locate, reduce and fix condylar segments in their accurate relationship with the ramus.^[2] Free grafting or extracorporeal fixation of traumatically displaced mandibular condyles has been described as a surgical option to overcome these problems.^[3-5] This involves stripping lateral pterygoid and capsular attachments to the condylar stump, retrieving it out of the body, fixing and adapting a plate outside the body, followed by retransplantation in to glenoid fossa and fixation to the ramus of the mandible. A vertical ramus osteotomy has also been used to locate, retrieve and fix the proximal stump.^[6,7]

Various established surgical approaches (preauricular, retromandibular, submandibular, etc.) exist to reach the condylar neck/head. Majority of the published studies on extracorporeal fixation of condyle fractures have used a submandibular approach.^[2-7] But the problems with this approach are the depth of dissection to reach condylar neck/head, difficulty in visibility and access leading to oblique angulation of drilling and screw fixation and the possible need of a ramus osteotomy.

Preauricular approaches with exposure of the facial nerve have been studied with reported complications such as facial nerve palsy affecting the buccal branches in 20% of the cases with salivary fistula, sialoceles and Frey's syndrome as with all procedures based on incision of the parotid gland.^[8]

The transmasseteric anteroparotid (TMAP) approach overcomes the above problems with dissection along

subdermal fat plane till the anterior edge of the parotid gland. The gland is then retracted posteriorly followed by stripping of masseter fibres to reach the fracture site.

To our knowledge, this is the first study to evaluate the use of preauricular TMAP (P-TMAP) for extracorporeal fixation of mandibular condylar fractures.

PATIENTS AND METHODS

Patients who were treated for mandibular condyle fractures between January 2009 and December 2011, who satisfied the following inclusion criteria, were included in the study. The institutional ethics committee approval was obtained prior to the starting of the study.

Patients above 15 years of age, with displaced/dislocated unilateral or bilateral condyle fractures treated by open reduction and extracorporeal fixation only, with co-existing fractures of the mandible and other facial bones, who had follow-up data available (minimum 6 months, maximum 36 months and average 15 months).

A clinical case record search of patients operated during that period revealed seven patients (six males and one female), ages ranging from 16 years to 52 years (average 31.7 years) who underwent extracorporeal fixation of condyle fractures through P-TMAP incision were included in the study. All the fractures were classified according to Lindahl's comprehensive classification system as Condylar head or neck fractures with displacement and dislocation [Table 1]. Computed tomography (CT) scans of facial skeleton were taken for all the patients to aid in the diagnosis and treatment planning, in addition to thorough clinical examination [Figure 1a-c].

The following patient treatment and follow-up data were analysed. The type of condylar fracture, other fractures of the mandible and facial bones, adequacy of anatomical reduction, postoperative facial nerve function, occurrence of sialoceles, Frey's syndrome, infection at operated site. Visibility and ease of access were rated as good, fair and poor by the operating surgeon. The need for a vertical ramus osteotomy was also assessed.

Surgical procedure

All the patients were treated by open reduction and extracorporeal fixation under general anaesthesia. All the coexisting fractures of the mandible were fixed first, to

Table 1: Patient characteristics

Age/sex (years)	Mode of injury	Type of condyle fracture-Lindahl's system	Other facial fractures	Time between injury and surgery	Follow-up	Complications	Clinical outcome
28/M	RTA	Rt. condylar neck fracture, displacement with medial override, dislocation	Lt. parasymphysis of the mandible	9 days	7 months	None	Healing satisfactorily
52/M	RTA	Lt. condylar neck, displaced, dislocated-anteromedial	Rt. parasymphysis of mandible	5 days	1 year, 3 months	None	Healing satisfactorily
30/M	Assault	Rt. condylar neck-displaced and dislocated-anteromedial	Lt. Anglesagittal split	7 days	8 months	Buccal branch of facial nerve weakness	Spontaneous recovery of nerve weakness in 3 months Healing satisfactorily
33/M	RTA	Lt. condylar neck-displaced and dislocated-anteromedial	Lt. parasymphysis of mandible	5 days	1 year, 2 months	None	Healing satisfactorily
16/F	RTA	Lt. condylar head-displaced and dislocated-anteromedial	Nil	20 days	2 years, 4 months	None	Healing satisfactorily
29/M	RTA	Rt. condylar head medially displaced	Lt. parasymphysis of mandible, Lt. zygoma	6 days	1 year, 9 months	None	Healing satisfactorily
34/M	RTA	Rt. condylar neckdislocated, medially displaced	Symphysis of mandible	23 days	1 year	None	Healing satisfactorily

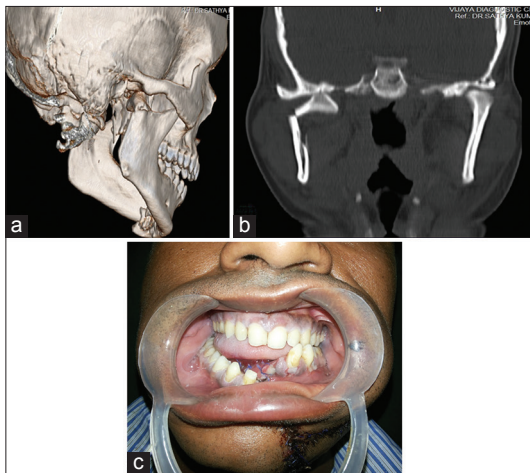


Figure 1: (a) Displaced and dislocated condylar fracture on a reconstructed CT scan (b) Coronal section CT showing antero-medially displaced and dislocated condylar neck fracture and telescoping of the ramus superiorly due to pterygomasseteric pull (c) Preoperative clinical picture showing severely deranged occlusion due to grossly displaced fractures of mandibular condyle, symphysis and anterior dentoalveolar region

establish the continuity of the mandibular arch, followed by fixation of condyle fractures. Condyle fractures were approached through a P-TMAP approach.

P-TMAP approach

A preauricular incision with a curvilinear extension in the retromandibular or cervicomastoid skin crease was made [Figure 2a]. Dissection was done in the subdermal fat plane just above the superficial musculo-aponeurotic (SMAS) layer till the anterior margin of the parotid gland [Figure 2b]. Along the anterior border of the gland, just below the parotid duct, the gland is gently retracted posteriorly to expose the masseter muscle fibres

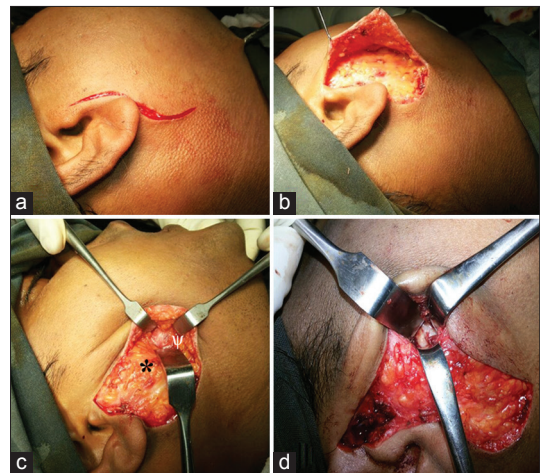


Figure 2: (a) Preauricular incision with retromandibular extension. The inferior limb of incision can be modified to include either a cervicomastoid or rhytidectomy extension as per individual needs. (b) Subcutaneous dissection along subdermal fat plane, just superficial to the SMAS layer till the anterior border of parotid gland. (c) Anterior border of parotid gland (*) is gently retracted posteriorly to expose the masseter muscle (ψ), which is divided in fashion parallel to facial nerve branches leading to exposure of periosteum overlying ramus of mandible (d) Subperiosteal dissection exposes the ramus and fracture of condyle of mandible

[Figure 2c], which were then divided in the direction parallel to the course of facial nerve branches to expose the periosteum overlying the ramus and condyle. Subperiosteal dissection over lateral aspect of ramus exposes the fracture [Figure 2d].

Intentional dissection to identify facial nerve branches was not done. Buccal branch was the only terminal branch of the facial nerve that was encountered (in two patients only), it was gently retracted either superiorly or inferiorly.

Extracorporeal fixation

After exposure of the fracture, attempts were made to reduce the anteromedially displaced and dislocated condylar stump into its anatomical position and fix it by conventional intracorporeal fixation. The methods employed in trying to achieve this included: A) Wedging periosteal elevators between condyle and ramus, simultaneously displacing ramus inferiorly and relocating the condyle. B) The assistant surgeon disimpacts the upwardly displaced ramus in an inferior direction by bi-manual inferior traction (with thumbs of both hands placed intraorally on molar teeth while the other fingers hold the lower border of the mandible extra-orally). C) through the inferior limit of the incision lower part of the mandibular angle is exposed and a trans-osseous wire is placed on angle to give inferior traction on ramus, thereby providing better access and visibility to reduce displaced condylar head.

After all attempts at reduction of the condyle fracture by conventional methods have failed, the decision to do extracorporeal fixation was taken intraoperatively, as a last resort. The condyle was stripped free of its attachments from the lateral pterygoid muscle and capsular attachments, and it was retrieved from the body. It was placed on the sterile surgical trolley and a four-hole miniplate was adapted and fixed to its posterior border using 2 mm × 8 mm length monocortical screws under copious saline irrigation [Figure 3a]. The condylar segment was replaced into the glenoid fossa, ensuring continuity of anterior and posterior borders of the mandible that was fixed to the ramus [Figure 3b].

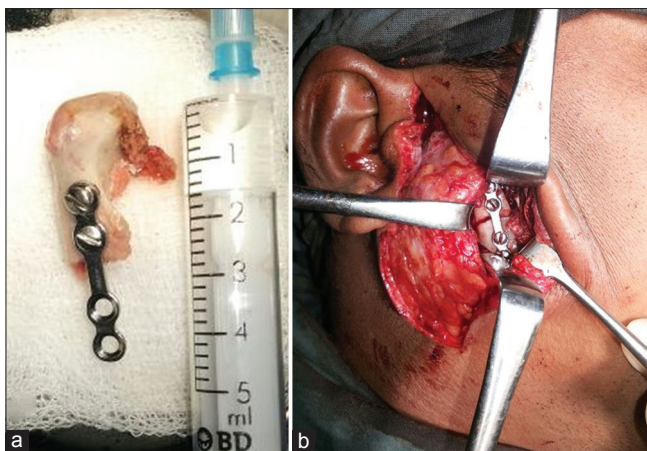


Figure 3: (a) Extracorporeal fixation of retrieved mandibular condyle
(b) Reimplantation and fixation of condyle to ramus

RESULTS

Of the seven patients involved in the study, six patients were males and one was female. Five patients had condylar neck fractures and two patients had fractures of condylar head [Table 1]. Their age ranged from 16 years to 52 years with a mean age of 31.7 years. All the seven patients in the study had unilateral severely displaced or dislocated high condylar neck or head fractures associated with deranged occlusion, facial asymmetry, restricted mouth opening and radiographic evidence of shortening of the ramus. Co-existing fractures of the mandible were seen in six patients.

The follow-up period ranged from 7 months to 2 years, 4 months with an average follow-up of 15 months. Visibility and access to carry out extracorporeal fixation was good through P-TMAP approach in all the patients. Buccal branch was the only branch of facial nerve encountered and was seen in only two patients. Only one patient had transient weakness of the buccal branch that had improved spontaneously by 3 months. Anatomical reduction and stability of fixation were good in all the patients [Figure 4a and b]. Normal occlusion and mouth opening were restored in all the patients [Figure 5a and b]. Healing of the incision was satisfactory in all the patients [Figure 6a]. At the last follow-up visit, all the patients had normal facial nerve function [Figure 6b and c]. No other gland related complications, such as sialocele or Frey's syndrome, were encountered.

DISCUSSION

Despite the lack of a general consensus on the ideal method of condylar fracture management, there is a growing tendency towards open method of treatment as it permits accurate anatomical reconstruction of the condyle and faster rehabilitation of the patient to normal life style.

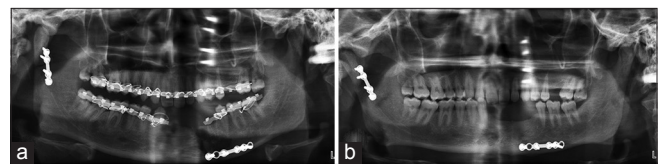


Figure 4: (a) Immediate postoperative orthopantomogram showing good anatomical reduction of mandibular condyle fracture. (b) Eight months postoperative orthopantomogram showing stable position of condylar head



Figure 5: (a and b) Eight months postoperative—Restoration of normal occlusion and good mouth opening

Potential complications and risks associated with the surgical procedure are still a matter of concern for maxillofacial surgeons.^[9] Visibility and access to the fracture line is sometimes very limited in some of the most commonly followed incisions such as Risdon's submandibular, retromandibular incisions, as they are placed far off from the fracture site, demanding strong soft tissue retraction that can also increase the risk of facial nerve damage ranging from 30% to 48%.^[10] Improper access is the cause for oblique angulation of screw placement that can jeopardize the plate adaptability and stability of fixation.

Studies on the branching pattern of extracranial course of facial nerve have shown that the cross anastomosis between the branches of the upper division is considerably high than that between those of lower divisions. The incidence of cross anastomosis between the zygomatic and buccal branches is 87–100%, whereas the marginal mandibular nerve receives anastomotic branches in only 0–16% of cases.^[11] This is the reason behind its vulnerability in submandibular and retromandibular approaches.

The transmasseteric anteroparotid approach introduced by Wilson minimized these potential complications and improved surgical exposure.^[12] A preauricular incision with an inferior cervicomastoid/retromandibular or rhytidectomy extension was made as per the preference of the surgeon or patient's needs. Wilson reported no case of postoperative facial palsy, but on a series only based on a total of three patients each of them had bilateral fracture condyle. The same P-TMAP approach was used in our case series of seven patients, of whom only one had transient buccal branch palsy that improved spontaneously within 3 months. In this approach, buccal and the zygomatic branches are the only branches normally encountered (if any at all), their retraction, given their excellent cross anastomoses, is inherently less risky.

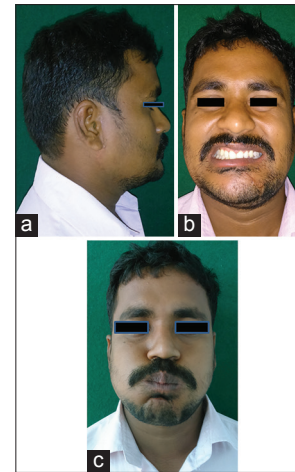


Figure 6: (a) Good postoperative healing of incision—eight months postoperative. (b and c) Intact facial nerve function post-operatively

The same concept of TMAP approach was described using high cervical approach by Trost *et al.*^[13,14] and Lutz *et al.*^[15] who used it for condylar fracture reduction and fixation. Both the studies reported good access and very low complication rate with the approach when used for subcondylar fractures.

Reduction of high condylar neck or head fracture with severe displacement and dislocation is a challenging task, as the lateral pterygoid muscle pulls the fractured fragment of the condylar head anteromedially. In these situations, detachment of the condylar head and free grafting or extracorporeal fixation is used as a last resort. This is used for satisfactory repositioning of the condyle, because the lateral fragment can obstruct the surgeon's view and manipulation of the displaced medial fragment.^[2,3,5]

Majority of the published studies in the literature have used submandibular or retromandibular incision for extracorporeal fixation. Retrieval of the condyle and refixing it through submandibular or retromandibular incisions is a daunting task because of the depth of dissection required to reach the condyle and abnormal angulation of screws. To overcome these problems, the use of a vertical ramus osteotomy has been reported by many studies.^[2,6] Gupta *et al.* in their study of 18 cases of extracorporeal fixation reported the use of vertical subsigmoid osteotomy in three patients to retrieve the medially displaced condyle.^[2]

Nam introduced 'Nam's method', which includes vertical ramus osteotomy, extraoral reduction and fixation

of the fractured condyle to the osteotomy fragment, and re-fixation of the ramus.^[6] This technique allows for anatomically accurate reduction of fragments. However, this extracorporeal fixation procedure requires detachment of all soft tissue from the medial fragment, thereby leading to potential complications such as avascular necrosis of condyle stump and the osteotomized ramus segment.

Hammond *et al.* reported a similar study involving 21 patients with displaced and dislocated condylar fractures that were treated with free grafting of the mandibular condyle with vertical ramus osteotomy, through a submandibular approach. They observed a complication rate of 12% (8%—resorption of the condyle, 4%—fracture of plate).^[16]

Conventional or intra-corporeal fixation beyond doubt is the ideal method that gives optimal healing of condylar fractures. But, in clinical situations where this is not feasible, extracorporeal fixation is considered as the last resort.^[2,5,17] Though free grafting or extracorporeal fixation permits near accurate anatomical reduction and fixation, it is not free of problems. Complications, such as avascular necrosis, resorption of condyle, temporomandibular joint (TMJ) pain, dysfunction, screw loosening, re-displacement of fracture, have been reported.^[2,3,6,7,16]

The performance of a ramus osteotomy increases the chances of avascular necrosis, because in addition to condylar head, ramus segment also acts as a free graft and its revascularisation and survival is risky. The factors that affect the vascularisation and survival of free grafted condyle are as follows: a) Time taken for extracorporeal fixation, b) the number of free grafted segments of bone segments, c) damage to the condylar head that contains cancellous marrow.^[2,3,6,7,16]

However, in our case series, the need for osteotomy of the ramus did not arise as the P-TMAP incision provided a good straight-line access for the retrieval, repositioning and re-fixing of the condyle. No cases of avascular necrosis were noted till the last follow-up visit.

CONCLUSION

The P-TMAP approach provides good access to medially displaced condylar fractures, and if the need arises

for extracorporeal fixation, it facilitates retrieval, transplantation, repositioning and fixing the condyle can also reduce the chances of requirement of a vertical ramus osteotomy. It gives straight-line access to the proximal stump and ramus thereby permitting perpendicular placement of the screws. The risk of permanent facial nerve injury is very low compared with retromandibular and submandibular approaches owing to the excellent cross anastomosis in the upper branches of the facial nerve. Other salivary complications as salivary fistula and Frey's syndrome are rare as intraglandular dissection is avoided. As the incision merges with preauricular and cervicomastoid skin creases, it is cosmetically acceptable.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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