Original Article

Transmasseteric Anteroparotid Approach for Open Reduction and Internal Fixation of Mandibular Subcondylar Fractures

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Abstract

Background: Treatment of mandibular condylar process fractures has long been a topic of debate among the maxillofacial community. The conservative approach has been an age-old practice. The treatment of condylar process fractures has changed from closed reduction with maxillomandibular fixation to various types of semirigid internal fixation as a result of the advancement of better fixation materials and surgical technique improvement. The intended goal of selecting surgical therapy for condylar process fractures was to re-establish the pre-existing anatomic relationship of the fractured fragments by stable fixation and prompt restoration to normal function without the need for a lengthy period of maxillomandibular fixation. **Materials and Methods:** This was a retrospective analysis conducted at the department of oral and maxillofacial surgery after obtaining ethical clearance. Patients with clinical and radiographic evidence of subcondylar fractures (SCFs) were treated with open reduction and internal fixation (ORIF) through the transmasseteric anteroparotid (TMAP) approach. The maximal interincisal pain-free mouth opening, the deviation of the jaw when opening the mouth, occlusal discrepancies, pain, facial nerve function (FNF), infection, and scar quality were all assessed in each patient. Condylar displacement and vertical ramal height were measured radiographically. **Results:** The statistical program SPSS for Windows (version 17) was used to analyze the data (SPSS Inc., Chicago, IL, USA). $P < 0.05$ was considered statistically significant. Of the 20 patients, 17 (85%) were male and 3 (15%) were female, with ages ranging from the second to fifth decade. There was a substantially higher mean degree of displacement pre-operative than post-operative ($P = 0.001$). The mean Visual Analog Scale (VAS) scale significantly differed from pre-VAS to 1 month ($P = 0.001$). ORIF treatment for SCFs led to improved joint function, earlier pain relief, faster return to normal function, stable occlusion, and preservation of FNF. **Conclusion:** When treating patients with mandibular SCFs, ORIF using the TMAP approach to accomplish anatomical reduction can produce satisfactory functional and esthetic results.

Keywords: Anteroparotid, Condyle fracture, Maxillomandibular fixation, Open reduction and internal fixation, Transmasseteric.

Introduction

One of the most frequent facial fractures is a fracture of the mandibular condylar process, which accounts for 25–35% of all mandibular fractures.[1] 20 to 62% of all mandibular fractures are subcondylar area fractures.[2] There is an ongoing debate on how to treat condylar process fractures in the realm of oral and maxillofacial surgery.[3] The vast range of viewpoints and suggested treatment approaches presented in the literature reflect this debate. Yet, over time, a lot of surgeons have started to favor surgical treatment for displaced subcondylar fractures (SCFs).[4,5] Condylar process fractures have been treated surgically using a variety of techniques, but each has pros and cons, including the risk of facial nerve damage, unsightly scarring, salivary fistula, sialocele,[6] and Frey's syndrome. The transmasseteric anteroparotid (TMAP) technique was established in an effort to address these issues and was deemed successful. This study's primary objective was to assess open reduction and internal fixation (ORIF) effectiveness in treating patients with displaced SCFs. This retrospective randomized clinical investigation evaluated both clinical and radiographic markers on a sample of 20 patients. The goal was to accomplish anatomical repositioning of the broken segments, appropriate fracture stability, a shorter maxillomandibular fixation (MMF) time, early jaw mobilization, functional rehabilitation, a return to pre-traumatic dental occlusion, and vertical ramal height of the mandible. In our cases, we discovered that using this

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technique allowed for improved access, quick management, and precise anatomical reduction of fractured condylar fragments while protecting vital structures.

Materials and Methods

Study design and study sample

Patients who visited the department of maxillofacial surgery within the 3 years from November 2011 to August 2013 were included in the retrospective analysis. Institutional ethical clearance was obtained for the study. This study was performed in line with the principles of the Declaration of Helsinki. Approval was granted by the Ethics Approval Committee of Mallareddy Dental College for Women (MRDCW/IEC/AP/27/2023). The study comprised 20 patients with clinical and radiographic evidence of SCFs based on orthopantomogram (OPG) and reverse Townes' X-ray image, either with or without other concomitant maxillofacial fractures. The patients' ages ranged from the second to the fifth decade. Twenty patients in total with 24 SCFs were enrolled in the trial. Four individuals had bilateral fractures, compared to 13 who had unilateral fractures, and three who had isolated SCFs who were treated separately. Written informed consent was obtained from all patients. Each patient underwent a complete general examination as well as a detailed medical and dental history recording. The majority of patients expressed pain and difficulty opening their mouths. All of the patients were evaluated pre-operatively and post-operatively for maximum interincisal pain-free mouth opening using a paired t-test, deviation of the jaw when opening the mouth, occlusal discrepancies, facial nerve function (FNF), scar quality, infection, and pain using a Visual Analog Scale (VAS) by *post hoc* test. Radiographical evaluations were done for vertical ramal height and condylar displacement.

Inclusion criteria

1. Unilateral/bilateral SCFs with or without associated maxillofacial fractures
2. Age of the patients >16 years
3. Symptomatic patients having pain, deranged occlusion, and reduced mouth opening previously treated with closed reduction with MMF.
4. Patients willing to undergo ORIF with an extraoral approach for SCFs.

Exclusion criteria

1. Medically compromised patients – Psychological disorders
2. Patients <16 years of age
3. Undisplaced fractures.

Study variables

Vertical ramal height

On OPG

A horizontal reference line was drawn through both gonial angles. The height of the ramus was determined by measuring the perpendicular distance between the most superior point on the condyle and the reference line. The overlap of the fractured fragments in bilateral situations was measured.

Degree of displacement

On Townes' view

The medial and lateral poles of the condyle were connected by a line. Draw another line tangent to the ramus. The inner angle created by the junction of the two lines was calculated.

Surgical technique

To accomplish precise anatomical reduction, adequate surgical field exposure is a crucial requirement. Excessive space between the incision line and fracture segments causes excessive retraction, which injures the nerves and damages the surrounding tissue. When the nerves encountered may be seen and avoided, the TMAP approach appears to be a safe technique.[7] Since the parotid gland is not used for dissection, salivary problems can be avoided.[8] Under general anesthesia and nasotracheal intubation, we approached the patient either through a retromandibular or submandibular incision, depending on what was judged essential. After removing the subcutaneous tissue and SMAS layer and raising flaps to reveal the anterior top border of the parotid myofascial layer, the parotid tissue is pulled backward revealing the masseter muscle. The facial nerve's buccal branch is the one that is most frequently encountered; however, it is easily retracted either superiorly or inferiorly. The buccal and zygomatic branches of the facial nerve are anatomically close when they pass through the parotid gland, but once they emerge, they tend to diverge and leave a space between them. Since there is less risk of damaging the facial nerve when the condyle is addressed from an area anterior to the parotid gland, blunt dissection is done from this location to expose the fracture fragments. The masseter muscle is divided along the course of its fibers. Fracture fragments are exposed (Figure 1), the periosteum is cut over the lateral portion of the ramus at the condylar neck (CN) region, and MMF is accomplished using pre-stretched wires. Once desired occlusion is achieved with MMF, the anatomically reduced fracture is fixed by rigid

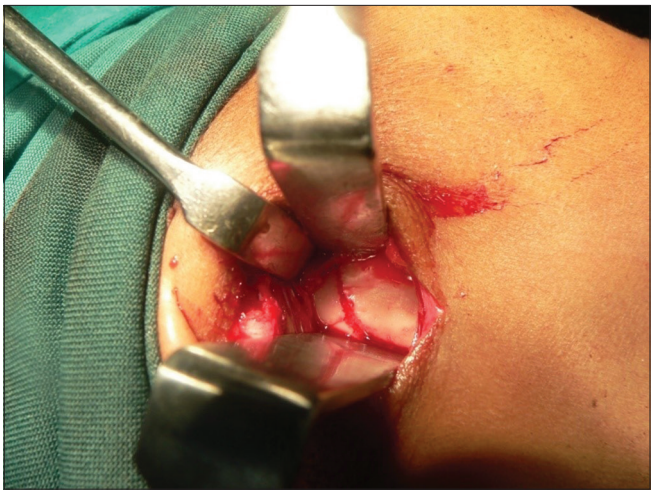

Figure 1: Fracture fragments exposed and reduced

internal fixation using either an "L"-shaped or single straight microplate and monocortical screws following the lines of osteosynthesis (Figure 2). Pre-operative reverse Townes' view, orthopantomogram, and post-operative reverse Townes' view and orthopantomogram were taken. Hemostasis was accomplished, thorough irrigation was done, and layer-by-layer wound closure was carried out. After MMF was released, the mouth opening and occlusion were examined.

Post-operative period

Patients were advised to take a soft diet. They were encouraged to practice mouth-opening exercises with effect from 3rd post-operative day. No MMF is kept in the post-operative period. The patients were followed up at regular intervals for a period of 6 months.

Data analyses

The statistical program SPSS for Windows (version 17) was used to analyze the data (SPSS Inc., Chicago, IL, USA). The degree of displacement, vertical ramal height, and mouth opening were all measured using the paired t-test. $P < 0.05$ was considered statistically significant.

Results

This retrospective analysis involved 20 patients who received ORIF for displaced SCFs of the mandible. The majority of the patients in this study were male. Of the 20 patients, 17 (85%) were male and 3 (15%) were female, ranging in the age from the second to the fifth decade. RTA was the main factor in 11 fractures (55%); this was followed by falls in 6 patients (30%), patients who were the victims of interpersonal violence in 2 patients (10%), and a patient who fell from a ladder when working on an electric pole (5%). Twenty patients in total with 24 SCFs were enrolled in the trial. Thirteen patients (65%) had unilateral fractures, 4 (20%) had bilateral fractures, and 3 (15%) had isolated SCFs. Out of 20 patients, 2 (13.3%) had symphysis fractures, 10 (66.67%) had parasymphysis fractures, 1 (6.67%) had a body fracture, 1 (6.67%) had an angle fracture, and 1 (6.67%) had a fractured maxilla. Fifteen individuals in all had comorbid facial fractures. When necessary, retromandibular (65%) or submandibular (35%) incisions were used to anatomically reduce all fractures.

Degree of displacement, vertical ramal height, and mouth opening using a paired t-test

In our study, during the pre-operative period, the mean degree of displacement was significantly larger ($P = 0.001$). In comparison to pre-operative, both the mean vertical ramal height and pain-free mouth opening were significantly higher ($P = 0.001$).

The mean degree of pre-operative fracture angulation was 25.90, and the mean pre-operative shortening of the ascending ramus was 6.75 (SD: 0.48) (SD: 4.38).

Occlusion – Table 1

Before surgery, every patient had occlusal disparity on clinical assessment. Six patients had anterior open bites, three had posterior open bites, and 11 patients had posterior premature contact. All patients who underwent ORIF had a post-operative occlusion that was good and stable, and they all quickly resumed their regular activities without the need for MMF. At further follow-ups, no patient reported having TMJ pain or clicking.

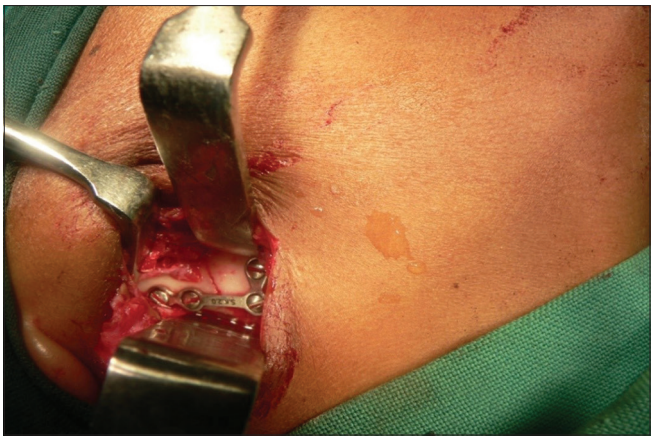

Figure 2: Reduction of fractured fragments using 4-hole "L"-shaped stainless steel miniplate

Table 1: Assessment of occlusion

S. No.	Occlusal discrepancy	Pre-operative	Post-operative
1.	No occlusal disturbances	00	20
2.	Occlusal discrepancy present		
	Anterior open bite	06	00
	Posterior open bite	03	
	Premature contact	11	
Total		20	20

Midline deviation

In the weeks before surgery, four patients had midline deviation observed. Similar deviations of the mandible on opening the mouth were observed in two individuals, with one patient receiving complete post-operative treatment. In all other unilateral cases, the mouth opening was symmetrical, with just one showing a slight variation in the direction of the shattered side.

Pain on VAS

The pain was significantly worse than the average at 1 week and 1 month in all patients during the mean pre-operative and immediate post-operative periods. The mean VAS scale significantly differed from pre-VAS to 1 month ($P = 0.001$). The average for 1 week was also much higher than for 1 month. Further notable variations were not observed. After 2 weeks, none of the patients complained of pain either on opening the mouth or on chewing food.

FNF – Table 2

The functional and esthetic outcomes met expectations and there was no corresponding permanent loss of FNF. However, three patients experienced brief facial nerve paresthesia

Table 2: Assessment of neurological disturbances

S. No.	Neurological deficit	Immediate post-operative	1-week post-operative	1 month	6 months	No. of patients
1.	Present (marginal mandibular nerve)	03	03	02	00	03
2.	Absent	-	-	-	-	17
Total						20

(marginal mandibular nerve) after surgery, which disappeared entirely after 3 months.

Post-operative infection

For the 1st week following surgery, 2 (10%) individuals reported having an infection. Several patients used herbal medications for the same condition and had a history of diabetes. Incision and drainage were performed, Sofra Tulle dressings were administered, and adequate oral antibiotic therapy was given for a week. Blood sugar levels were strictly controlled with antidiabetic medications and a diet.

Post-operative scar

In this study, every patient displayed an esthetic surgical scar. Scars from retromandibular incisions were smaller in size and blended well with the surrounding skin. They were also effectively concealed in the cervical hollowing behind the posterior border of the ramus.

None of the patients' fistula, seroma, or sialocele formation-related problems were identified.

Scar perception was evaluated using POSAS.

Discussion

Throughout the previous 20 years, the rigid internal fixation has been used more frequently on an injured craniomaxillofacial skeleton. Surgery with repositioning has become more popular as a result of improved anesthetic techniques, the development of antibiotics, better tools, and improved surgical skills.[9] An essential justification for open reduction occurs in patients who have functional abnormalities as a result of a shorter ramus. Fracture reduction is an uncommon occurrence, according to studies utilizing MMF in closed therapy of condylar fractures. Our primary objectives in doing ORIF on SCFs were to achieve anatomic reduction, maintain this reduction through stable osteosynthesis, shorten the MMF duration, and allow a smoother sooner return to the pre-injury state when maintaining FNF. According to Ellis and Throckmorton, patients who underwent ORIF had greater condyle position restoration and reinforcement of their broken condylar processes. Although 2-plate fixation is considered gold standard, in our study, we used "L" shaped or single straight miniplate and it provided good stability for reduced fractured fragments. Closed reduction patients had a significant shortening of the mandibular ramus on the fractured side, as well as displacement of the condylar process in the coronal plane.[10] Due to fragment overlap and aberrant segment orientation, all of the fractures in this investigation had mild displacement and vertical ramal height shortening. According to the findings, there was a substantially higher mean degree of displacement pre-operative than post-operative ($P = 0.001$). Post-operative compared to pre-operative, the mean vertical height was significantly higher ($P = 0.001$). All of our patients had appropriate post-operative pain-free mouth opening and a stable, satisfactory occlusion on future follow-ups. The accuracy of fracture reduction and the stability of fixation were assessed on the basis of radiographs taken postoperatively at subsequent follow-ups.

The ORIF of the condyle is thought to be a challenging and time-consuming procedure. The most frequent issues with open surgery include restricted access, damage to the parotid gland, facial and auriculotemporal nerve branches, and the likelihood of unsightly scarring.[11] Among these difficulties, 30–48% are attributable to facial nerve injury (FNI).[12] TMAP was introduced to prevent these issues. In this method, a region close to the parotid gland's anterior margin is chosen to be dissected all the way to the fracture fragments. As the facial nerve branches are recognized and safeguarded, any injury can be prevented in this location, which is thought to be generally free of them. Wilson *et al.*[12] reported three cases using the TMAP approach through a pre-auricular incision, with excellent functional and cosmetic results and no evidence of facial nerve paresthesia. Vinod *et al*. evaluated 129 cases and concluded that the TMAP approach avoids the complications of incision of the parotid gland, minimizes the risk of facial nerve palsy, and offers excellent access to the fractured condyle.[13]

In our cases, we used the TMAP method, either through a retromandibular incision or a submandibular incision, to treat SCFs, and we discovered that the strategy provided good visualization. For ORIF of SCFs, the retromandibular technique is frequently used.[14] For low-level SCFs, submandibular incision was used. The submandibular and retromandibular methods most frequently result in injury to the marginal mandibular branch, whereas the pre-auricular approach frequently results in injury to the temporal and zygomatic branches.[15] Excessive retraction results in nerve fiber compression and/or stretching, which temporarily impairs nerve function after surgery. The functional and esthetic outcomes met expectations and there was no corresponding permanent loss of FNF. Even though three patients experienced brief marginal mandibular nerve paralysis in the first 3 months following surgery due to edema or severe retraction, this was completely resolved with oral methylcobalamin use. According to Imai *et al.*, percutaneous techniques should be suggested for the treatment of CN/SCFs to lower the risk of FNI. This includes TMAP and high cervical TMAP.[16] Essam *et al.* showed through a meta-analysis that different surgical methods result in varying incidences of FNI by manipulating

the facial nerve. This should be taken into account when choosing a surgical strategy for a particular fracture.[17] There is a debate concerning the stability of miniplates and whether to employ single or double miniplates when fixing condylar fractures. However, double miniplate fixation is thought to be the most robust approach.[18] In our investigation, decreased fracture fragments were restored using a single miniplate that was either straight or shaped like an "L" and had a gap or not. No cases of plate fracture or screw loosening were reported. The plates provided good stability. Hardware placement was relatively easy and can follow principles of stress trajectory. According to Chen *et al.*, the infection rate was reduced for condylar fractures treated with ORIF.[19] Stitch abscess was described in two of our patients, but it was treated effectively with antibiotics, regular dressing changes, and drainage. The retromandibular approach is preferable to the other because it has a shorter working distance between the incision and the condyle/fracture site, resulting in less tissue retraction and nerve damage, greater access because the tissue can be retracted up to the level of the sigmoid notch, excellent exposure, and an inconspicuous scar.[20] All of the study participants had medium-to-dark skin tones and an esthetically pleasing scar. None of the patients needed correction of secondary scars. The limitation of this study is a small sample size and lack of advanced imaging.

Conclusion

In the current investigation, we were able to demonstrate that ORIF of SCFs resulted in a good restoration of joint function. Shorter operating periods, much-decreased complication rates, and improvements in technique and equipment are all possible. When treating patients with mandibular SCFs, ORIF using the TMAP approach to accomplish anatomical reduction can produce satisfactory functional and esthetic results.

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