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Evaluation of transmasseteric anteroparotid approach to mandibular subcondylar fractures

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Abstract--Introduction: Different techniques employing, retromandibular, preauricular, or submandibular incisions have been used for the treatment of subcondylar and condylar fractures. The approaches listed above may lead to some disadvantages which include limited visibility, facial nerve damage, and problems associated with the parotid gland. Study objective: Clinically, case studies were performed to evaluate the efficacy of P-TMAP approach for open reduction and internal fixation (ORIF) of condylar and

subcondylar fractures. The study comprised of 7 people within the condylar and subcondylar fractures group who were treated by ORIF. We analyzed the administrative hours, accessibility, and medical review on perioperative complications. A CT scan was done to confirm the site where condylar fractures were reduced. Findings: Visibility and accessibility were good. The patients underwent careful anatomical alignment and stabilization. These reported complications were limited and only lasted temporarily. The facial nerve (buccal branch) palsy of one patient was the only adverse event that was reported, and it resolved spontaneously in 3 months. No case of Frey's syndrome and sialocele was spotted. Conclusion: The P-TMAP method is an effective way of access for closing the reduction and fixing the condylar fractures. It facilitates retention, transference, relocation, and fixation of the condyle. It offers a direct way to the ramus and the condylar head which provides for the screws to be inserted at right angles with a minimum risk of injuring facial nerve.

Keywords---P-TMAP approach, condylar fractures, mandibular.

Introduction

Mandibular condylar fractures are the most debated issue in maxillofacial trauma because of the uncertainties in classification, diagnosis, and management, despite their high prevalence. The goals of condylar fracture treatment cover painless opening of interincisal distance, proper chewing movement, symmetry of the jaw and face, pre-injury bite restoration, and stable temporomandibular joints. ^(1, 2)

Treatment possibilities for condylar and subcondylar fractures can be divided into three general categories: 1. closed reduction, 2. observation with physiotherapy, and 3. open reduction with internal fixation using different surgical approaches. The decision making on the treatment method for these fractures is based on several factors such as dental condition, the age of the patient, the severity of the fracture, proximity to the glenoid fossa, displacement, fracture alignment, and other fractures of the face. ORIF are the main treatment in many medical centers in the world because it allows the surgeon to achieve precise condyle alignment and quicker patient recovery with lower occlusal disorders or temporomandibular joint problems. ⁽³⁾

Several ORIF methods to fix the condylar fracture are outlined with different combinations of approaches used by both surgeons. All three options have pros, cons, and complexities. Surgeons almost invariably opt for extraoral approaches because of the visualization of the surgical field that they provide. Consequently, along with the external methods, there are surgical risks. Still, there are complications associated with the extraoral approach in terms of possible complications in surgery like salivary fistulae, nerve damage or palsy, and visible scars, facial. There are various extraoral approaches for condylar and subcondylar fractures described in literature, such as submandibular, preauricular, intraoral, retromandibular, and transmasseteric/transparotid. ⁽⁴⁻⁹⁾

Submandibular approach is filled with complications due to difficult access and restricted view which result in angled drilling and screw placement. Research about preauricular approaches that involve the exposing of the facial nerve with 20% incidence of buccal branch palsy has been reported to have complications. The most frequent complications following the retromandibular approach such as salivary fistula, Frey's syndrome and sialoceles often follow incisions of the parotid gland. ⁽¹⁰⁾

The TMAP approach deals with the problem by dissections along the subdermal fat plane until we reach the front edge of parotid gland. The gland is now moved backward, and the masseter fibers are taken out to give way for the fracture site. This study aimed to evaluate the transmasseteric approach for ORIF (open reduction and internal fixation) for subcondylar and condylar fractures.

Patients and Methods

In the study, 7 patients with an age range of more than 15 years were given medical attention using open reduction and internal fixation through a PTMAP incision for the mandibular condyle and subcondylar fractures, either bilateral or unilateral, with or without other accompanying mandibular or facial bone fractures. Facial skeletal CT scans were acquired for all patients to help in the diagnosis and treatment planning of the cases, and a detailed clinical examination was performed. The patient treatment and follow-up data were reanalyzed.

Condylar fracture type, other mandible and facial bone fractures, anatomic reduction quality, facial nerve function after the operation, sialocele occurrence, Frey's syndrome, and infection at the surgical site. The operating surgeon ranked the visibility and accessibility as good, fair, and poor.

Surgical procedure: After induction of general anesthesia, all patients underwent ORIF. The PTMAP approach was used in condyle fracture management.

PTMAP approach

All cases were undertaken on a transmasseteric anteroparotid approach. An incision was made in front of the ear and was extended downwards in a curved way just along the skin fold between the neck and chest. The auricular nerve was protected by dissecting it subdermally in the superficial musculoaponeurotic layer above the subdermal fat layer to reach the masseter muscle near the anterior lining of the parotid gland. The gland is pushed back a little to disclose the muscle fibers of the masseter. Then the fibers were divided parallel to the facial nerve branches to be able to expose the periosteum which covers the condyle and ramus. By dissecting below the periosteum on the outer side of the ramus, fracture surfaces are exposed. In two patients, there was no terminal branch other than the buccal branch, which got gently retracted either upward or downward. ⁽¹¹⁾

MMF was conducted. Each fractured condylar segment was fixed by using a 2.0 mm titanium miniplate after placement of the fixed segments. The fracture was

reduced by a downward traction of the ramus to create a space for the medially displaced and dislocated condyle to return to its anatomic position. The wound was closed in layers with 4-0 prolene and 3-0 vicryl respectively in interrupted fashion for the deep layers and the skin. A sterile gauze is put in place to cover the wound and a drain is kept in place for 48 hours to reduce swelling.

Post-operative assessment: Complications were all clinically evaluated in all the patients. The pain-severity post-surgery was assessed by inquiring patients, all of whom reported experiencing slight/mild pain at the surgical site. In total, five patients had slight discomfort and had minor swelling on the operation day, and the swelling disappeared in four days after the operation. Out of the four patients, two had mild pain and a mild swelling that was completely resolved by the 4th day after the operation. The other patient had post-surgical very severe pain and edema due to extra facial fractures, which demanded a 5-day intensive care unit stay. The facial nerve branches were examined by asking patients to close their eyes, raise their eyebrows, resist pressure and smile, to inflate their cheeks, and to hold these actions for a few seconds.





Results

7 patients were part of the study, one of which was female, and six were male. In the study, two patients had condylar head fractures and five patients had condylar neck fractures, their ages ranged between 16 to 52 years, where the average age was 31.7 years. The follow-up period was about 6 months. All patients had ORIF applied by the transmasseteric anterior parotid approach.

The operation times were recalculated for each individual. The maximum length of operation using the transmasseteric anteroparotid approach was 90 min with the average of 64 min. The visual and access variables in all patients were good enough for performing ORIF using the PTMAP approach. No patients had facial nerve injury documented. All normal occlusion patients had significant anatomical reduction and stable fixation. All patients were restricted in mouth opening and sideways movement in the postoperative period of 1-2 weeks, which improved when they exercised the mouth muscles. There were no TMD symptoms like pain or TMJ sounds in the postoperative period, and no cases of such symptom as Frey's syndrome or paresthesia of great auricular nerve were reported.

All the cases had good incision healing. All the patients had demonstrated usual facial nerve functions at the last consult. The rest of the problems relating to saliva leakage (sialoceles) and Frey's syndrome were not noticed.

Discussion

Although there is still no unanimous agreement on the condition to handle condylar fractures, the open method is gaining popularity due to its ability to realize precise anatomical reconstruction of the condyle in a quicker manner and rehabilitate the patient back to their normal lifestyle. Open reduction is based on putting the broken bones into the correct place with direct visualization of the bones and fixing them with the help of osteosynthesis.

The standard treatment strategies of the mandibular condyle can be split into either extraoral or intraoral. Silverman was the first to perform intraoral in 1925(11), and Steinhäuser was the second one in 1964(12). The procedure is also less invasive than the external ones and thus avoids complications such as visible scars and facial nerve damage. However, the intra-oral approach is complex, especially when it comes to fractures located at elevated levels or with the proximal stump medially displaced. The surgery requires the use of some specific instruments, practitioners who are trained to deal with the issue, and the operative time which is extended despite the help of the endoscope. Also, some researchers have indicated more complications when using the intraoral approach compared to the extraoral one. It may cause complications like condylar head resorption, fragment misplacement, and postoperative misalignment, persisting also temporomandibular joint functional problems. Some extraoral methods have been shown, among which the submandibular, preauricular, and retro-mandibular approaches are the most widely utilized. ⁽¹³⁾

Maxillofacial surgeons are still worried about possible complications and risks associated with the surgery. Extraoral approaches may be associated with such complications as salivary fistulas, sialoceles, malocclusions, facial nerve paralysis, decreased mouth opening, miniplate fracture, hematoma formation, and infections. ⁽¹⁴⁾

Such approaches (submandibular and retromandibular) have restricted access and visibility because they are located far away from the fracture site. It is therefore necessary to retract a lot of soft tissue which may cause facial nerve injury. Illegitimate access can result in the screws being placed at a strangely angled position, which can make the long-term stability and adaptability of plate fixation difficult. ⁽¹⁵⁾

A study of 53 patients with low subcondylar fractures and condylar neck in the Netherlands demonstrated the temporary appearance of facial nerve weakness in the patients who underwent surgical treatment. All patients were treated using a retromandibular transparotid approach in the 5 year period studied. 7.5% of the four patients who had the surgery experienced temporary facial nerve weakness, but none of them had lasting effects. In a different study, Ellis et al. found that out of the 83 patients who underwent the treatment for their subcondylar fracture with the retromandibular approach, 17.2% developed facial nerve palsy when

assessed six weeks post-surgery. But this matter was settled in all patients within 6 months. ⁽¹⁴⁾

In a clinical study, 34 patients were involved with 36 subcondylar fractures of which 14 were those who had dislocated fractures. Out of the 36 cases in the post-surgical survey, 22% had a temporary facial nerve weakness which resided in 4 to 8 weeks of the surgery. The patient experienced the most severe symptoms of drooping of the upper lip and lower eyelid during the first fourteen months only. ⁽¹⁵⁾ In a clinical study, 34 patients were involved with 36 subcondylar fractures of which 14 were those who had dislocated fractures. Out of the 36 cases in the post-surgical survey, 22% had a temporary facial nerve weakness which resided in 4 to 8 weeks of the surgery. The patient experienced the most severe symptoms of drooping of the upper lip and lower eyelid during the first fourteen months only. In a recent study 6 cases of 7th nerve weakness were observed out of 18 patients treated for subcondylar fracture repair using a preauricular approach. The duration of the paralysis ranged from four to eight weeks, and the authors explained that the reason for this was the unusually aggressive approach of this method relative to the other conservative methods approaches. ⁽³⁾

In a study carried out in the late 2000s to early 2010s, 8% of 25 patients who had undergone a submandibular/modified-risdon approach for subcondylar fracture developed post-operative facial nerve palsy. The nerve had not been precisely located during the fracture dissection. After the operation, the palsy was resolved within six weeks of the operation. ⁽¹⁶⁾ Then in another study, a modified Risdon approach was used to treat 25 patients with subcondylar fractures, and 16% of them had mild temporary neuropraxia of the marginal mandibular nerve. The follow-up appointments in the 2-month mark were also improved. ⁽¹⁷⁾ In the study of the anteroparotid transmasseteric approach in twenty patients, two patients developed sialoceles (10%) and three patients experienced salivary fistulae (15%). The two issues, however, were successfully treated, and they were non-invasive, right after the surgery.

The transmasseteric anteroparotid approach of Wilson could be performed by a preauricular incision with an extension towards the rhytidectomy or inferior cervicocervical mastoid/retromandibular, based on the surgeon's preference or the patient's requirements. Wilson did not have any reports of postoperative facial palsy in cases of three patients who had bilateral condyle fractures. We utilized the PTMAP approach in an observational study of seven patients, one of whom developed temporary buccal branch palsy that resolved within three months. ⁽¹⁸⁾

The extracranial course of the facial nerve has been experimentally studied and the connections between branches of the upper division are revealed to be more numerous than those between the lower branches. The zygomatic and buccal branches are often connected, which is observed in the range of 87%-100%. In contrast, anastomotic branches are seen in only 0% to 16% of the marginal mandibular nerve of the latter cases. ⁽¹⁹⁾ This is why it is susceptible to submandibular and retromandibular approaches.

Almost all the branches, except buccal and zygomatic, are usually avoided using this technique. Usually because of their strong linkage, the breakup is less dangerous. Trost et al. ^(20,21), and Lutz et al. ⁽²²⁾ applied the TMAP technique in treating condylar fractures via the high cervical approach. Both studies showed the method to be very accessible with a low complication rate when subcondylar fractures are treated with the approach.

The study with 20 patients showed that paralysis of the facial nerve after anteroparotid transmasseteric approach did not cause any long-term deficits among the patients treated with this method ⁽²³⁾. No patients had any temporal impairments. Studies on the retromandibular approach have revealed incidence of 2.3-7.3% sialocele and parotid cutaneous fistula. ^(14,16) 5-22% of the patients with preauricular approach and fracture repair had these complications. In the group of patients who had transmasseteric anteroparotid approach for their subcondylar fractures, there were no problems such as infection, hypertrophic scarring, hematoma formation, Frey's syndrome and hardware failure reported.

Conclusion

The PTMAP technique provides a functional way of managing the fracture fixation and reduction of the condyle. Medially displaced condylar fractures may find benefit in extracorporeal fixation, which would assist in retrieval, repositioning, transplantation and fixing the condyle, thus reducing the requirement of vertical ramus osteotomy. This route offers a straight access to the proximal stump and ramus that enables the screws to be placed at a right-angled position.

When upper origin of facial nerve is approached with submandibular and retromandibular approaches, the probability of permanent facial nerve damage is almost nil due to the fact that its upper branches have good connections. Frey's syndrome and Salivary fistula are rare to occur as there is no longer penetration through the parotid gland. The incision merges invisibly with the pre-auricular and cervico-mastoid skin folds, which gives an aesthetically perfect appearance. The anteroparotid transmasseteric approach is a technique used to treat subcondylar fractures with a lower risk of complications and a shorter procedure time compared to other methods. The final cosmetic outcome is generally considered satisfactory.

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