

## Comparison between Preauricular Approach and Submandibular Risdon Approach for Managing Condylar Fractures

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### ABSTRACT

**Background:** Concerning the fractures of the mandibular condylar process. Clinician's choice between surgical and conservative management remains controversial. To allow the accurate reduction of the fracture with anatomical considerations, the chosen treatment is the reduction of the fracture along with the fixation internally (ORIF) for fractured mandibular condyle.

**Aims:** The present clinical trial was aimed at evaluating and comparing the two most commonly used incision by the Preauricular approach and submandibular Risdon approach.

**Materials And Methods:** The 20 study subjects were split randomly in two groups depending on the approach used. They were treated with the preauricular approach or the submandibular Risdon approach. Complications related to these surgical procedures were assessed intra-operatively as well as post-operatively. Damage to the facial nerve, haemorrhage, and scar perception was analyzed for 6 months post-operatively.

**Results:** Intraoperative haemorrhage was seen in two patients of the preauricular approach and 3 with submandibular Risdon approach. In none of the cases, the internal maxillary artery was seen. In the preauricular approach, transparotid, transmassetric, preauricular, and marginal mandibular nerve was seen in 20% (n=2), 10% (n=1), 30% (n=3), and 20% (n=2) cases respectively. In the submandibular Risdon approach transparotid artery was encountered in 1 case i.e., 10% (n=1) and marginal mandibular branch in 20% subjects (n=2).

**Conclusions:** Preauricular, as well as submandibular approaches, have equally good outcomes in terms of intra-operative as well as postoperative complications. Significant improvement with the encountered complications, mouth opening, the mandibular movements at 6 months recall interval.

**Keywords:** Condylar fracture, Facial nerve injury, Preauricular, Risdon approach, Submandibular.

**Keynote:** Open reduction and internal fixation also allow the restoration of normal function early when compared to intermaxillary fixation. Out of the various approaches mentioned in the literature for treating mandibular condyle fracture via open reduction and internal fixation, the simplest method should be adopted by the surgeon

## INTRODUCTION

Out of all mandibular fractures encountered, 25-35% is condylar fractures. These condylar fractures require a distinct consideration apart from the rest of the mandibular fractures owing to their different healing potential and differences in the anatomy.<sup>1</sup> concerning the fractures of the mandibular condylar process, various controversies ensue. One of the major controversies is the clinician's choice between surgical and conservative management of the condylar fracture of the mandible.<sup>2</sup>

Condylar Fractures were conventionally treated by using the conservative approach only denying surgical management techniques due to clinician's choice. The reason for choosing the conservative management was that most of them reported comparable good results with conservative management. Additional advantages with conservative treatment were no surgical complications and less associated morbidity.<sup>2</sup> the ultimate objectives of treating the condylar fractures are optimal occlusion, facial symmetry, and painless free mandibular movements. As far as there is the ability to achieve these objectives, the technique selected should be least invasive and easy.<sup>3</sup>

Although traditionally non-surgical and conservative therapy is chosen to treat the mandibular condyle fracture, occlusion after such treatment is not optimally functional. Also, the condylar fracture is underestimated about its severity. The conservative treatment many times lead to the mandible deviation, ankylosis, a decrease in the incisal opening, internal disc derangement, and diminished occlusion. Subsequently, the focus was shifted towards the accurate reduction of the fracture considering the anatomy to ameliorate the result.<sup>2,3</sup>

The fracture of the condyle leads to the dislocation of the condylar head in the medial direction most commonly. This eventually leads to the reduction in the height of the ramus causing open bite and subsequent facial asymmetry.<sup>4</sup> to achieve the desired results, appropriate osteosynthesis is desirable, which is possible only with open reduction of the fracture followed by the internal fixation. This also results in better replacement for the condylar head to its natural position. On the contrary, intermaxillary fixation, in the long run, causes Ramal shortening on the fracture site. Bite forces show no significant difference with either ORIF or closed reduction.<sup>5,6</sup>

For a good reduction with anatomic considerations, satisfactory access to the surgical field is important. This, in turn, allows for better visibility of the fractured segments and their proper mobilization. Owing to the distance between the fracture line and level of the incision placed, aggressive retraction of the mid-way tissues is required which often leads to damage of the retracted tissues and injuries to the nerve in many cases. This necessitates the selection of such surgical techniques which causes the minimum post-operative complications.<sup>7,8</sup>

To allow the accurate reduction of the fracture with anatomical considerations, the chosen treatment is open reduction and internal fixation for fracture mandibular condyle.<sup>9,10</sup> This also allows restoration of the normal ramus length, prevention of developing arthritic changes, and clicking. Open reduction and internal fixation also allow the restoration of normal function early when compared to intermaxillary fixation. Out of the various approaches mentioned in the literature for treating mandibular condyle fracture via open reduction and internal fixation, the simplest method should be adopted by the surgeon.<sup>9</sup>

Although the intraoral route has an added advantage of leaving no extra-oral scar, it allows minimum exposure making the job tiring for the surgeon and increasing the surgical time. Hence, the extra-oral route is the more preferred one. However, all the extra-oral incisions have different complications owing to the proximity of the incision line to the parotid gland and facial nerve.<sup>11,12</sup>

One such simple method is the Preauricular approach which is quite useful for treating high condylar fractures. It has limitations when treatment of low condylar fractures and angle exposure is to be done. Another frequently used approach is the submandibular approach also known as the Risdon approach. This approach is most useful and is favored for treating the posterior body and ramus of the mandible. This method also allows easy access to TMJ ankylosis cases and condylar fractures.<sup>13,14</sup>

The present clinical trial was aimed at evaluating and comparing the two most commonly used incision approach i.e. Preauricular and submandibular Risdon approach and their outcomes.

## **MATERIALS AND METHODS**

The present clinical trial was conducted at Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar to evaluate and compare the two different approaches for treating mandibular condyle fractures. The two approaches were compared to assess their efficacy and complications. This clinical trial included a total of 20 patients comprising of both the genders (females and males) with the age ranging from 29 years to 54 years who had the mandibular condyle fracture. The 20 study subjects were split in two groups which depended on the approach used. Group I had 10 patients who were treated with the preauricular approach, whereas, Group II (10 subjects) were treated with the submandibular Risdon approach. Demographic data and detailed history of the fracture were recorded from each of the patients. Ethical clearance was obtained from the ethical committee review board of the institution. All the included subjects/ accompanying person (in case the subject was not in the state of giving consent) were made to sign a written informed consent for participating in the study.

For inclusion in the clinical study the patients should have a unilateral or bilateral mandibular condyle fracture (displaced), decreased Ramal height with associated with premature occlusal contacts of the molar teeth, inability to achieve optimal functional occlusion via closed reduction procedure, unilateral or bilateral mandibular condyle fracture in the edentulous subjects, foreign body invasion in the fracture/ fracture line, condylar fractures associated with other fractures requiring reduction and fixation, in cases where intermaxillary fixation is medically contraindicated (psychological condition of the study subject), no associated head injury, and no history of TMJ dysfunction.

After taking the inclusion and exclusion criteria under consideration, a detailed assessment of the fracture site was done clinically and radiographically. Any other fracture if associated and present was stabilized rigidly via plate and screw. All the surgical procedures were carried out under general anesthesia with nasal intubation. The two groups used the two different approaches as mentioned.

**Surgical Approach:** The surgical approaches were carried out according to the standard surgical procedures as followed

**Preauricular Approach:** All the 10 patients of Group I were treated with the Preauricular approach which utilizes a question mark shaped incision. This incision started with the length of pinna away from the ear in the anterosuperior direction in the hairline. The incision in the temporal region was placed in the skin and superficial fascia reaching till temporal fascia.

The skin and superficial fascia were then reflected up to the full depth followed by the blunt dissection carried till the region where the temporal fascia splits. An incision was then made at 45° angles from the malar arch root through the temporal fascia. Then the periosteum of the malar arch was incised along with superficial temporal fascia including both skin and associated nerves. The pocket hence formed is extended anteriorly and posteriorly till the frontal process (posterior border) and to preauricular incision near the auditory canal, parotid gland, and temporal vessels respectively. Then the downward progress was made from the articular fossa and the arch (lower border). After exposing the site of the fracture, the reduction was done using miniplate and screws osteosynthesis. After fracture reduction, the wound was closed.

***Submandibular Risdon Approach:*** This approach utilizes a curvilinear incision. In this approach, at the infero-superior mandibular angle region, a 4-5 cm long incision was made to reach the platysma muscle dissecting superficial fascia and subcutaneous fat and then the lower edge of the mandible preserving facial nerve branches. Masseter muscle was divided retracting soft tissues and associated periosteum to expose the fracture site. After exposing the site and fracture reduction, the wound was irrigated and closed using sutures. This approach requires more dissection of inferior pterygoid and masseter muscle.

After both the surgical procedures, anti-inflammatory drugs, and antibiotics were prescribed to avoid pain and infection in the post-operative period. Sutures were removed 1 week following surgery. Recall visit for suture removal was arranged at 1 week postoperatively, followed by recall once every month for 6 months. Elastics were placed to guide occlusion, whereas, associated intermaxillary fixation was not done in any case.

Complications related to these surgical procedures were assessed on the 7<sup>th</sup> postoperative day for continued every month for 6 months. Seventh nerve palsy was also assessed subjectively using the patient's cognizance about peri-oral tissues and lips about numbness and symmetry. Scars were also assessed based on the patient's perception.

All the patients were assessed up to 6 months post-surgery and were recalled once every month. The difference in the parameters at each recall interval was examined and recorded. The recorded data for both the groups were analyzed and the results were formulated.

## **RESULTS**

Complications related to these surgical procedures were assessed intra-operatively as well as post-operatively. Damage to facial nerve and haemorrhage was assessed at the intraoperative period. At one week post-operative period, Frey's syndrome, infection (pus discharge), and fistula formation (salivary) were assessed. These assessments were done on the 7<sup>th</sup> post-operative day. These findings are summarized in Table 1.

Intraoperative haemorrhage was seen in two patients who underwent the preauricular approach and in 3 patients with submandibular Risdon approach. Intraoperative bleeding was not severe in any of the reported cases and bloodtransfusion was not required for managing haemorrhage in any of the cases. Various nerves were also encountered during surgical procedures. In none of the cases, the internal maxillary artery was seen. In the preauricular approach, transparotid, transmassetric, preauricular, and marginal mandibular nerve was seen in 20% (n=2), 10% (n=1), 30% (n=3), and 20% (n=2) cases respectively. In the submandibular Risdon approach transparotid artery was encountered in 1 case i.e., 10% (n=1) and marginal mandibular branch in 20% subjects (n=2). Among all the nerves encountered, none was severed during the surgery, although, encountered nerves were stretched severely during the procedure.

On the 7<sup>th</sup> day post-operatively, sutures were removed for all the patients. At the time of suture removal, none of the study participants had any infection (pus formation) at the

incision site. The wound approximation achieved was satisfactory for the operator. Anatomic reduction of the fracture was achieved in all cases. Optimal occlusion was seen with no open bite and proper teeth relation in all the patients. The mandibular ramus was symmetrical. No complaint of pain, discomfort, and/or swelling was reported by any patient. Also, the parotid fistula was seen in 4 cases of transparotid and masseteric, which were treated with antisialogogue drugs and pressure dressings (occlusive).

At first month recall (4<sup>th</sup> week), it was noticed that all developed parotid fistula healed and regressed. No pus discharge, wound infection, abscess, or Frey's syndrome was recorded. The recall visits were then planned once a month and the various parameters in terms of facial nerve function were assessed (Table 2).

Various parameters used to assess the Facial nerve functions are listed in Table 2. Forehead wrinkling was seen in 30% (n=3) cases with the preauricular approach and 10% (n=1) cases with the Risdon approach, Ptosis was noticed in 40% cases in preauricular incision approach and 20% (n=2) cases of submandibular approach. Facial symmetry was compromised with the preauricular approach in 1 case (10%) while mouth blowing and smiling. In the Risdon approach group, 20% cases (n=2) had compromised facial symmetry at smiling and mouth blowing both. All the cases who reported the facial asymmetry, ptosis were restored to the normal functional and aesthetic state at the end of 6 months.

The assessment of the surgical scar was also done for all the patients. For the preauricular incision approach, all the patients had imperceptible scars (satisfactory scars according to patient's perception). In cases with submandibular Risdon incision, one case had wide thickened scar white was lighter in color in comparison to the surrounding normal skin. No keloid formation was seen.

<b>Parameter</b>	<b>Preauricular Approach Percentage (n=10)</b>	<b>Submandibular Risdon Approach Percentage (n=10)</b>
<b>Haemorrhage</b>		
Mild	0	0
Moderate	20% (2)	30% (3)
Severe	0	0
<b>Nerves/Branches Encountered</b>		
Internal Maxillary Artery	0	0
Transparotid	20% (2)	10% (1)
Transmassetric	10% (1)	0
Preauricular	30% (3)	0
Marginal Mandibular Branch	20% (2)	20% (2)
<b>Nerves Severed</b>		
Internal Maxillary Artery	0	0
Transparotid	0	0
Transmassetric	0	0
Preauricular	0	0
Marginal Mandibular Branch	0	0

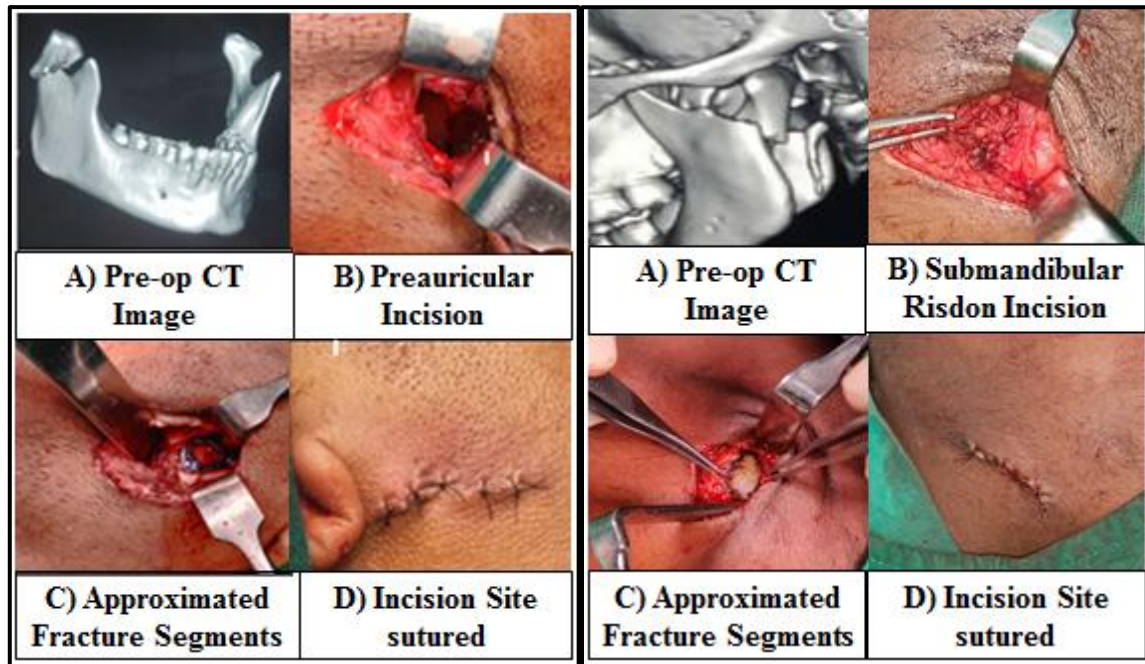
**Table 1: Intraoperative Complications encountered with the two approaches**

<b>Facial Nerve Function Parameter</b>	<b>Preauricular Approach</b>	<b>Submandibular Risdon Approach</b>
Forehead Wrinkling Loss	30% (n=3)	10% (n=1)

Ptosis	40% (n=4)	20% (n=2)
<b>Facial Symmetry</b>		
At smiling	20% (n=2)	20% (n=1)
At mouth blowing	10% (n=1)	20% (n=1)

**Table 2: Facial Nerve Functions**

**ATLAS**



**DISCUSSION**

Earlier reduction for the condylar fracture was achieved using the conservative approach via closed reduction. It was the treatment of choice for the operators as well due to various reasons such as complications associated with the complex TMJ surgical procedure encountering the facial nerve, difficult accessibility and manipulation of fracture segments, extra-oral scar compromising the aesthetic, difficult anatomic reduction of the fracture, and acceptable results attained with the closed reduction conservatively.<sup>15</sup> With the advancement of pre, intra and post-operative management, positive and less complicated functional results were obtained.<sup>16</sup>

Also, in a study by Karan A et al<sup>2</sup> in 2019, it was suggested that surgical treatment of condylar fracture resulted in satisfying results including pain relief, adequate mouth opening, limited deviation, ramal height restoration, and smooth lateral movements compared to patients treated non-surgically. Hence, this study supports the present study in choosing a surgical treatment modality.

Subcondylar, as well as condylar fractures, are quite common, the proper reduction is required to avoid serious complications including ankylosis of joint. A study to find a suitable approach was carried out by Algan S et al<sup>1</sup> in 2018 where they used a new modified mini-incision approach along with the Preauricular incision approach. The authors concluded that The Preauricular approach is a feasible, reliable, and effective method for condylar fracture treatment, which also help in vital structure preservation. Hence, these findings of the study justify the choice of incision in the present study.

Over many years, various surgical procedures were developed to access TMJ hence allowing the reduction and fixation of the condylar fracture. These approaches to TMJ include

Preauricular, submandibular Risdon approach, intraoral, retromandibular, endaural, rhytidectomy, endoscopic approach, and retro auricular approach. Each of these approaches has its associated benefits, complications, and disadvantages. One approach over another is chosen based on the ease of accessibility, visibility, and soft tissue manipulation.<sup>17</sup>

In the results of the present study, the postoperative complications were assessed. It was shown that no mild or severe haemorrhage was seen in any of the study subjects of both the groups. However, only moderate haemorrhage was seen in 2 and 3 subjects respectively for Preauricular and Risdon approach which was controlled successfully. These findings were consistent with the findings by Mohan A.P et al<sup>20</sup> in 2012 where no haemorrhage was seen in any patient treated with Preauricular and retromandibular approach intra-operatively. However, mild haemorrhage was seen as immediate postoperatively.

Nerves are bound to be encountered while treating the condylar fractures surgically. In the present study, it was seen the internal maxillary nerve was not encountered with either approach. Transparotid, transmassetric, Preauricular, and the marginal mandibular nerve were encountered in 2, 1, 3, and 2 subjects respectively with the Preauricular approach. However, with the Risdon approach, only in 1 subject transparotid nerve and in 2 subjects marginal mandibular nerve was encountered by the surgeon in the submandibular Risdon approach.

The Preauricular approach is one of the most widely used approaches for treating the condylar fracture. The classic preauricular approach was modified constantly over time to avoid injury to the facial nerve, to achieve better visibility and accessibility. Also, to minimize the exposure of the mandibular ramus.<sup>18</sup> This approach is favored by various operators owing to various reasons including better alignment and visibility it provides for high condylar fractures, reduction of distracted condylar segments. This approach is associated with few complications including visible extra oral scar, Frey's syndrome, proximity to the facial nerve, and loss of sensory function.<sup>19</sup>

Concerning the facial nerve functions, ptosis and loss of wrinkling of the forehead were seen in 3 and 4 subjects respectively with the Preauricular approach, whereas, only 1 subject had forehead wrinkling loss and 2 subjects had ptosis. Although there were signs of facial nerve dysfunctions, these signs showed marked improvement with complete restoration over the successive recall periods. These findings were in agreement with the findings of the study by Al-Moraissi EA et al in 2018 where authors quoted that the Preauricular approach was safest for protecting the facial nerve and was associated with very few incidences of compromised facial nerve function.

The submandibular Risdon approach requires the approach from below the marginal mandibular nerve hence avoiding the risk for facial nerve damage. Also, the marginal mandibular nerve is easily identified using this procedure. Although this approach allows less exposure of the fracture site, it allows better fixation as well as the reduction of the fracture segments.<sup>7</sup>

A comparison of present two surgical approaches concerning the complications does not define the superiority of one approach over another. Surgical approaches for the treatment of mandibular condylar fractures should provide safety against the injury to the facial nerve and its branches. To access the condyle dissection is required between the marginal mandibular nerve and the buccal branches of the facial nerve.<sup>3</sup>

The results of the study showed that the facial asymmetry was observed in very few cases with both the approaches where it was seen that with the Preauricular approach 20% study subjects had facial asymmetry while smiling and 10% had it at the time of mouth blowing, whereas, with submandibular Risdon approach 20% study subjects showed facial asymmetry

at both smiling and mouth blowing. These findings were consistent with the study of Ellis E et al<sup>5</sup> in 2000 where authors reported more facial asymmetry with the closed approach and better symmetry with the open treatment.

Although there are very chances of encountering and severing the facial nerve branches in treating the mandibular condyle fractures, owing to the experience, intelligent pre-operative surgical assessment, and planning no nerve injury were reported in the present study. This can be attributed to the more retraction leading to neuropraxia.<sup>17</sup> However, it was not injury, and hence no patient required any intervention for the same, and all the symptoms got resolved for all the study subjects in a post-operative period of 6 months. These findings were in agreement with the study by Mohan A.P et al<sup>20</sup> in the year 2012 where the authors concluded such symptoms attributing to over-stretching of nerve and not nerve injury itself. However, these findings were in contrast to the study by Lutz et al in where authors suggested the more encounter of facial nerve branches with submandibular approach.<sup>21</sup>

Nerves are bound to be encountered while treating the condylar fractures surgically. In the present study, it was seen the internal maxillary nerve was not encountered with either approach. Transparotid, transmassetric, Preauricular, and the marginal mandibular nerve were encountered in 2, 1, 3, and 2 subjects respectively with the Preauricular approach. However, with the Risdon approach, only in 1 subject transparotid nerve and in 2 subjects marginal mandibular nerve was encountered by the surgeon in the submandibular Risdon approach. No nerve was severed in any of the patients in either group. These findings were in agreement with the study by Ebenezer V et al<sup>22</sup> in 2011 where the internal maxillary artery was not encountered in any subject treated for condylar fracture. Other nerves encountered in their study were as follows: submandibular and transmassetric nerve was seen in 4 subjects, Preauricular in 2 subjects, and transparotid in 5 subjects in Preauricular and submandibular approach.

Mandibular movements including the lateral movements and the mouth opening improved considerably with both the techniques at the 6 month recall period. Clicking and pain as reported with the perception of the patients were higher with the preauricular incision approach. This can be attributed to the introduction to the joint space.

## CONCLUSION

Both the approaches (preauricular as well as submandibular) have equally good outcomes in terms of intra-operative as well as postoperative complications. Significant improvement with the encountered complications, mouth opening, and the mandibular movements at 6 months recall interval. The selection of the approaches was based on the operator's comfort and ease. The Preauricular approach was selected in cases who reported late for surgery after the fracture.

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