Original Article - Retrospective Study

The Retromandibular Transparotid Approach for Reduction and Internal Fixation of Mandibular Condylar Fractures

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Abstract

Introduction: The retromandibular transparotid approach is most useful for condylar and subcondylar fractures and provides the best access to the joint and ascending ramus. The study aims at evaluating the ease of access and outcomes encountered on using the retromandibular transparotid approach to access the fracture site for the open reduction and internal fixation (ORIF) of condylar and sub-condylar fractures. **Materials and Methods:** An observational clinical study was carried out among 10 patients with unilateral and bilateral condylar fracture requiring ORIF. Maximal interincisal mouth opening, facial swelling, occlusal discrepancy, facial nerve injury, scar formation, and acceptability and complications including wound dehiscence, infection, and sialocele/salivary fistula were assessed and measured preoperatively and postoperatively. **Results:** There was a notable improvement in mouth opening and facial nerve weakness. Postoperative intermaxillary fixation was done with selective patients who had a discrepancy in their occlusion. Preoperatively, swelling was present in four patients (40%) out of 10 patients studied. There was no incidence of sialocele/salivary fistula in any of the cases studied. **Conclusion:** Retromandibular transparotid incision is technique sensitive and thorough knowledge about the retromandibular area is must for good results and minimal morbidity. The cosmetic results are good in this approach, as well as the facial nerve injury were less in this without any permanent damages.

Keywords: Condylar fractures, open reduction and internal fixation, retromandibular transparotid approach

Introduction

The condylar region is one of the most frequent sites of mandibular fracture, accounting for 9%–50% of all such maxillofacial fractures.[1] These fractures can occur as single unilateral or bilateral condylar fractures of the mandibular symphysis or corpus, or with dentoalveolar injuries.[2] The fractures of the condyle prevent intracranial displacement of mandible and protect the brain from trauma.[3] The management of these fractures stimulates more controversy than any other area of maxillofacial trauma.[4]

Closed treatment, such as maxillomandibular fixation (MMF), with early physical therapy has previously been the most widely used method,[5] even for the treatment of dislocated condylar fractures, anatomical reduction can be difficult to achieve compared with that achievable by surgical open reduction and internal fixation (ORIF).[6] Optimal osteosynthesis of such a fracture can be obtained only by rigid internal fixation after anatomic reduction.[7]

Furthermore, consensus has recently been reached regarding the ORIF of condylar fractures: Specifically, displaced bilateral fractures or severe unilateral displacement with dislocation in the condylar neck or subcondylar position (except in growing children) may be appropriate indications for ORIF.[8] This is because better, quicker functional rehabilitation of the temporomandibular joint (TMJ) can be achieved with ORIF, and superior clinical functional results have been reported.[9]

Conventionally, the closed method for the management of condylar fractures was the treatment of choice.[10] The rationale for ORIF in selected cases is that it allows accurate anatomical reduction[11] of the fractured condylar process and earlier return to normal function without the need for intermaxillary fixation.[12] Various surgical techniques, approaches, and fixation methods have been

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described for ORIF of condylar process fractures, together with the establishment of stability using miniplate osteosynthetic fixation.[13] Most surgeons prefer extraoral over intraoral approaches because they provide good visualization and a better surgical field.[14] However, extraoral approaches including pre-auricular, retromandibular, submandibular are associated with a risk of surgical complications such as, sialocele or salivary fistulas, visible scars, and facial nerve damage or palsy (typically temporary), which may make surgeons hesitant to perform ORIF.[15,16]

The retromandibular approach is most useful for all condylar neck and subcondylar fractures and provides the best access to the joint and ascending ramus.[1,17] Ellis and Dean have become a preferred approach these days for most of oral and maxillofacial surgeons.[18]

Therefore, the study aims at evaluating the ease of access and outcomes encountered on using the retromandibular transparotid approach to access the fracture site for the ORIF of condylar and subcondylar fractures.

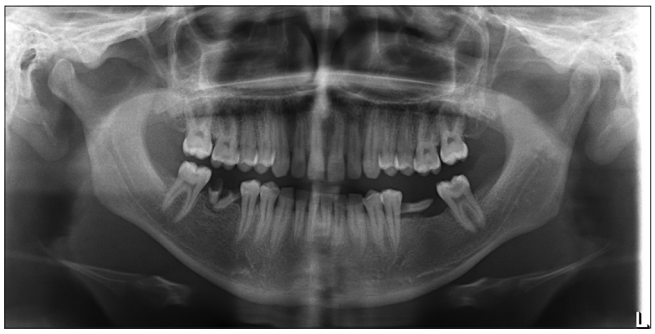


Figure 1: Preoperative orthopantomogram

Figure 2: Retromandibular transparotid incision marking

Figure 3: Dissection through parotid gland

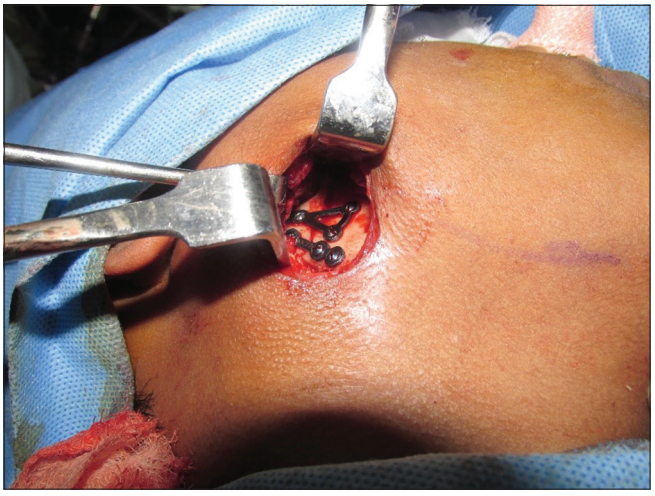


Figure 4: Fixation using miniplates

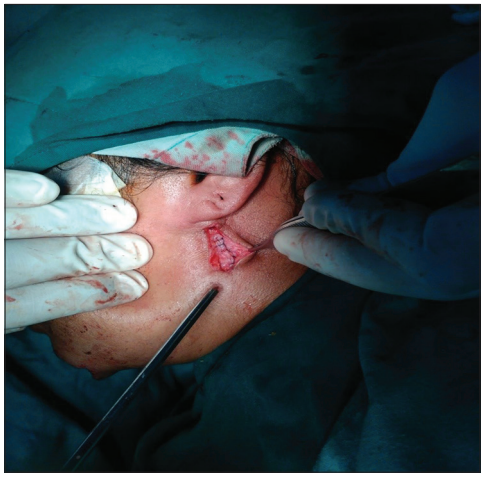


Figure 5: Suturing of parotid capsule with vicryl 3-0

Figure 6: Postoperative orthopantomogram showing fixation using miniplates

Figure 7: Postoperative scar

Figure 8: Postoperative complication marginal mandibular nerve weakness

Figure 9: Infection of wound

Aim

The study aims at evaluating the ease of access and outcomes encountered on using the retromandibular transparotid approach to access the fracture site for the ORIF of condylar and subcondylar fractures.

Objective

1. Postoperative mouth opening
2. Quality of reduction and fixation by means of X-rays
3. Restoration of occlusion
4. Facial swelling (presence or absence)
5. Injury to branches of the facial nerve, if any
6. Scar formation and patient acceptability
7. Any other complications (wound dehiscence, infection, sialocele).

Materials and Methods

The study was carried out among 10 patients with unilateral and bilateral condylar fracture requiring ORIF, who visited the Department of Oral and Maxillofacial Surgery.

Inclusion criteria

1. Unilateral or Bilateral condylar and subcondylar fracture, which is indicated for open reduction
2. Dentulous with sufficient bilateral dentition to allow MMF and assessment of the occlusal relationship
3. No previous history of TMJ dysfunction, muscular or nervous problems
4. No history of head injury.

Exclusion criteria

1. Intracapsular Fracture
2. Comminuted Fractures
3. Age <18
4. Medically compromised patients who are unfit for general anesthesia.

A written informed consent was obtained from patients, which explains the procedure and also any complications that may arise as a result of the surgery done for all the patients. A detailed case history, including past exposure to anesthetics, sedative agents, and previous surgical procedure or hospital admission, were recorded. General physical examination, routine hematological investigations, HIV and HBsAG testing was done for all the patients. In addition, a chest X-ray and electrocardiogram evaluation was done for all the patients.

Any additional investigations, when required, as per the systemic condition of the patient was carried out. Preoperative photographs and relevant radiographs were taken for all the patients.

For the patients who were treated by open reduction, surgery was performed under general anesthesia with endotracheal intubation in a standardized manner by the same group of surgeons.

Preoperatively, the following variables were observed and recorded, from the patients and radiographs on a datasheet:

1. Mouth opening (Interincisal opening)
2. Condylar fracture (According to the categorization of Ellis)

3. Facial swelling: Present/Absent Postoperatively, the following variables were to be observed and recorded:
    1. Mouth opening (interincisal opening)
    2. Swelling (Evaluated on 1st and 2nd postoperative days and after 1 week)
    3. Occlusion (Evaluation of teeth intercuspation)
4. Facial nerve injury (Facial nerve involvement was classified by assessment of motor function of the five peripheral branches of facial nerve and is graded in severity according to the House-Brackmann facial nerve grading system measurement scale) [Table 10 and 11]
5. Scar formation was assessed by Vancouver scar assessment chart and patient acceptability, assessed using verbal rating scale
6. The surgical site was assessed on 1 day, 1 week, and 1 month postoperatively for the presence or absence of:
    a. Wound dehiscence
    b. Infection
    c. Sialocele or salivary fistula (Was confirmed by aspiration and salivary amylase test)
    d. Any other complications.

Patients were systematically followed up at an interval of day 1, week 1, 1 month, and 3 months' postoperatively. As a part of the record, a printed report including patient data, details of surgery, and pre- and post-operative photographs and radiographs [Figure 1 and 6] were maintained.

Procedure

All the patients who were included in the study, retromandibular transparotid approach was chosen for the reduction and fixation of condylar fractures.

Under general anesthesia using the technique described by Ellis, by taking the surgical approach 1 cm posterior to the posterior border of the ramus of the mandible, the incision begins 0.5 mm below the lobe of the ear and continues inferiorly 3–3.5 cm [Figure 2]. The initial incision was carried out through skin and subcutaneous tissue to the level of platysma muscle. Undermining the skin with scissor dissection in all directions allow ease of the retraction and facilitates closure. Hemostasis was achieved with electrocoagulation of bleeding subdermal vessels. After retraction of the skin edges, the scant platysma muscle is sharply incised in the same plane as the skin incision. At this point, the superficial musculo aponeurotic layer (SMAS) and parotid capsule are incised and blunt dissection begins within the gland in an anteromedial direction toward the posterior border of the mandible [Figure 3]. A hemostat is repeatedly inserted and spread open parallel to the anticipated direction of the facial nerve branches.

The marginal mandibular branch of the facial nerve is often, but not always, encountered during the dissection. A useful adjunct in retracting the marginal mandibular branch involves dissecting it free from surrounding tissues proximally for 1 cm and distally for 1.5–2 cm.[19] Dissection then continues until the only tissue remaining on the posterior border of the mandible is the periosteum of the pterygomasseteric sling. One should also be cognizant of the retromandibular vein, which runs vertically in the same plane of dissection and is commonly exposed along its entire retromandibular course. The posterior border of the mandible with the overlying pterygomasseteric sling is visualized. The pterygomasseteric sling is sharply incised

Table 1: Mouth opening distribution of patients studied

Mouth opening	Preoperative	Postoperative	Percentage change
1-10	5 (50)	0 (0)	−50.0
11-20	2 (20)	0 (0)	−20.0
21-30	2 (20)	7 (70)	50.0
31-40	1 (10)	3 (30)	20.0
Total	10 (100)	10 (100)	-

**P<0.001, significant

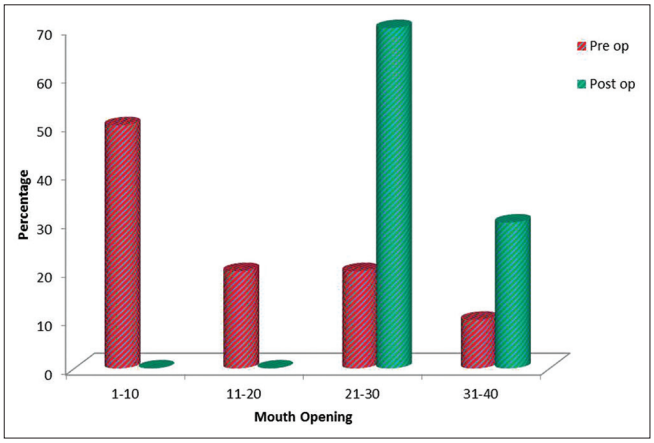


Table 2: Mouth Opening of patients studied

Mouth opening	Minimum-Maximum	Mean±SD	t	P
Pre	5.00-33.00	14.70±9.17	-	-
Post	23.00-37.00	28.60±4.81	−4.614	0.001**

SD=Standard deviation

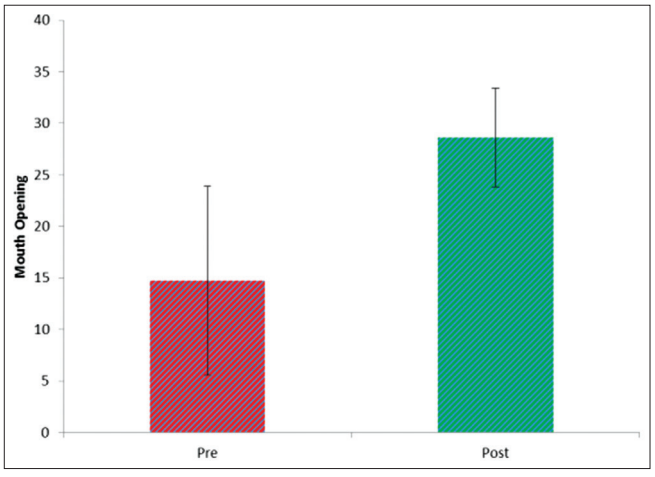


Table 3: Facial nerve injury of patients studied

Facial nerve injury	24 h (%)	1 week (%)	1 month (%)	3 months (%)	Percentage change
Grade I	6 (60)	8 (80)	8 (80)	10 (100)	40.0
Grade II	2 (20)	0 (0)	0 (0)	0 (0)	−20.0
Grade III	2 (20)	2 (20)	2 (20)	0 (0)	−20.0
Total	10 (100)	10 (100)	10 (100)	10 (100)	-

**P<0.001, Significant

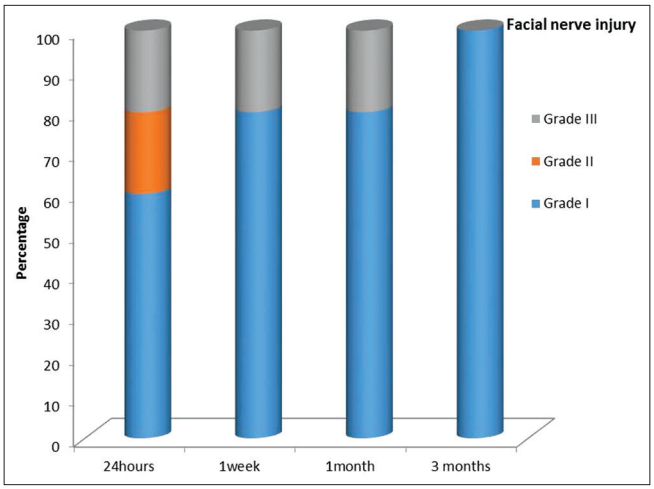
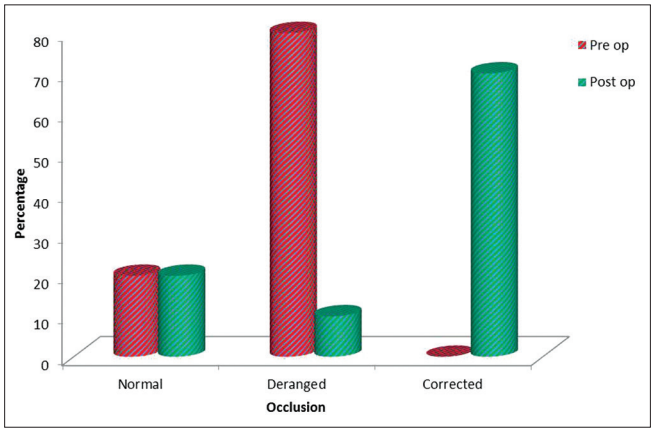


Table 4: Occlusion of patients studied

Occlusion	Preoperative (%)	Postoperative (%)	Percentage change
Normal	2 (20)	2 (20)	0.0
Deranged	8 (80)	1 (10)	−70.0
Corrected	0 (0)	7 (70)	70.0
Total	10 (100)	10 (100)	-

**P<0.001, significant



with a scalpel. Moreover, masseter muscle is stripped from the lateral surface of the mandible using periosteal elevators. The entire lateral surface of the mandibular ramus to the level of the TMJ capsule as well as the coronoid process can be exposed. The reduction of the displaced condylar segment was done with Howarth's periosteal elevator. Condylar fracture reduction was done with the teeth in occlusion, and fixation was done by miniplate osteosynthesis [Figure 4]. The masseter and medial pterygoid muscles are sutured together with interrupted resorbable sutures [Figure 5]. Closure of the parotid capsule/SMAS and platysma layer is important to avoid salivary fistula. The placement of subcutaneous sutures is followed by skin closure with 4-0 proline.

Patients were systematically followed up at an interval of day 1, week 1, 1 month, and 3 months postoperatively. Parameters of maximal interincisal mouth opening, facial swelling, occlusal discrepancy, facial nerve injury [Figure 8], scar formation [Figure 7], and acceptability and complications including wound dehiscence, infection [Figure 9], and sailocele/salivary fistula were assessed and measured preoperatively and postoperatively.

Statistical methods

Results on continuous measurements are presented on Mean ± standard deviation (Min-Max), and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance (**Strongly significant [$P \leq 0.01$]).

Student's t-test (two-tailed, dependent) has been used to find the significance of study parameters on a continuous scale with in each group. Paired Proportion test has been used to find the significance of proportion in paired data.

Results

The present observational clinical study was carried out among 10 patients to evaluate the ease of access and outcomes encountered on using the retromandibular transparotid

approach to access the fracture site for the ORIF of condylar and sub-condylar fractures.

The age of the patients ranged from 22 to 55 years. Out of 10, only one patient was female (10%) and nine were male (90%).

Out of 10 patients, seven patients were having condylar neck fractures, and three patients having subcondylar fractures. Four patients had bilateral neck fractures (40%), three patients had left side condylar neck fractures (30%), and three patients had right side condylar neck fractures (30%). Nine patients had associated fractures of the mandible, of which three had symphysis fracture and six had parasymphysis fractures.

The mean preoperative mouth opening was 14.70 mm. Five patients (50%) had mouth opening ranging between 1 and 10 mm, two patients (20%) had mouth opening ranging between 11 and 20 mm, two patients (20%) had mouth opening ranging between 21 and 30 mm and one patient (10%) had mouth opening ranging between 31 and 40 mm. Preoperatively, the minimum mouth opening of the patients studied was 5 mm, and the maximum mouth opening was 33 mm. The mean preoperative mouth opening was 14.70 mm. The mean postoperative mouth opening was 28.60 mm. Seven patients (70%) had mouth opening ranging between 21 and 30 mm, and three patients (30%) had mouth opening ranging between 31 and 40 mm. Postoperatively, the minimum mouth opening of the patients studied was 23 mm and the maximum mouth opening was 37 mm. There was no reduction in the mouth opening noted in the patients studied during the follow-up period. There was a statistically significant change in the mouth opening, postoperatively ($P = 0.001$) [Tables 1 and 2].

Marginal mandibular nerve weakness was noted in four patients postoperatively. 2 patients out of 10 had Grade III (moderate dysfunction) score, and the other two had Grade II (slight dysfunction) score, all the other patients had a Grade I score through the follow-up period. The weakness completely resolved within a month review in two patients (Grade II), and in the other two patients (Grade III) it took 3 months to resolve completely. The $P < 0.001$, which showed there was a significant improvement in the facial nerve weakness [Table 3].

Preoperatively, the occlusion was deranged in 8 (80%) out of ten patients studied. 2 (20%) patients did not have deranged occlusion preoperatively. Postoperatively, one patient had discrepancy in the occlusion (10%). Postoperative intermaxillary fixation was done with selective patients who had discrepancy in their occlusion [Table 4].

Out of the 10 patients operated, the operating time was < 60 min in two patients (20%); for seven patients the operating time was in between 60–90 min (70%). And, in one patient with bilateral condylar fracture the operating time was more than 90 min (10%) [Table 5].

The acceptance of the postoperative scar was done using Vancouver Scar Scale. The mean score for 1 week, 1, and 3 month was 5.10, 3.0, and 1.6, respectively. With a standard deviation of 0.88, 0.67 and 0.69 respectively. The comparison of *P* value for between 1 week and 1 month is <0.001 and between 1 week and 3 month is <0.001 which shows there is a significant improvement in scar over the follow-up period.

Of 10 patients, one patient (10%) had a visible but thin and linear scar and one patient (10%) had a wide scar [Table 6].

Table 5: Operating time of patients studied

Operating time (min)	Number of patients (%)
<60	2 (20.0)
60-90	7 (70.0)
>90	1 (10.0)
Total	10 (100.0)

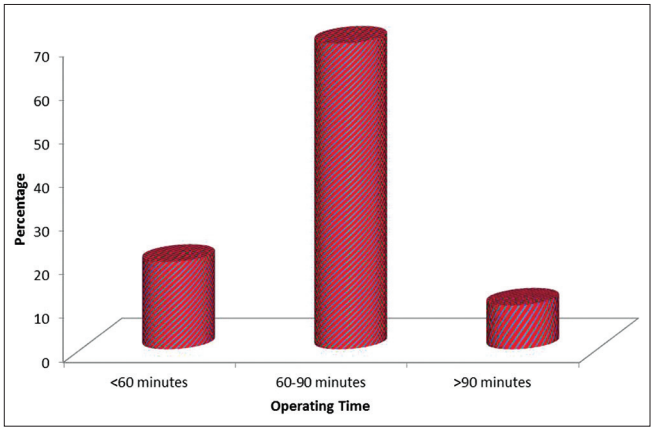
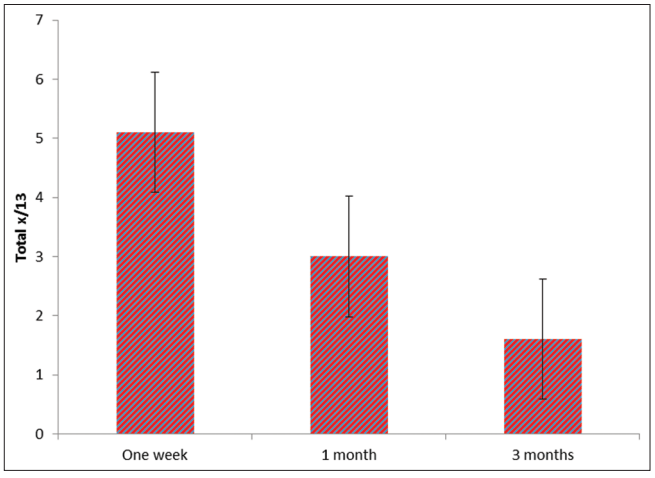


Table 6: Scar assessment at one week, 1 month and 3 months

Total x/13	1 week	1 month	3 months
Min	4	2	1
Max	6	4	3
Mean±SD	5.10±0.88	3.00±0.67	1.60±0.69

1 week - 1 months difference=2.10; ***P*<0.001, 1 week - 3 months difference=3.50; ***P*<0.001. SD=Standard deviation

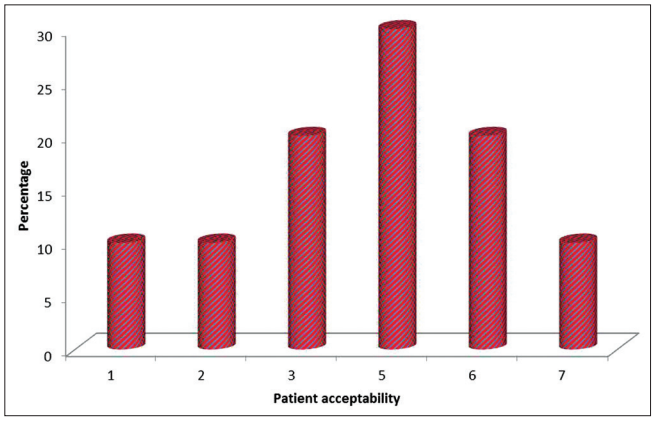


Out of 10 patient, one patient gave a score of 1 (10%), one patient gave a score of 2, two patients gave a score of 3 (20%), three patients gave a score of 4 (30%) and one patient gave a score of 6 (10%) [Table 7].

Table 7: Patient acceptability

Patient acceptability	Number of patients (%)
1	1 (10.0)
2	1 (10.0)
3	2 (20.0)
5	3 (30.0)
6	2 (20.0)
7	1 (10.0)
Total	10 (100.0)

Mean±SD: 4.30±1.95. SD=Standard deviation



Preoperatively, swelling was present in 4 patients (40%) out of 10 patients studied. All the patients had postoperative swelling on the immediate postoperative day and by the end of 1-week follow-up no patients had any notable swelling or gross asymmetry. The $P < 0.001$, which shows there was significant change [Table 8].

Out of 10 patients studied, wound dehiscence was present in one patient (10%) on the first postoperative day for whom suturing was done using 3-0 silk. At the end of 1-week follow-up, no patients had any wound dehiscence. The $P = 0.411$, showing it is nonsignificant [Table 9]. The presence of postoperative infection was present in one patient (10%) which resolved with antibiotic therapy. There was no incidence of sialocele/salivary fistula in any of the cases studied.

Discussion

Over the years, number of surgical approaches to TMJ has been developed to attain the goal of successful reduction, fixation, and adequate function. Retromandibular approach was used in our study because it provides good access and allows direct visual alignment of the fracture fragments,[20] It exposes the entire ramus from behind and is therefore useful for procedures involving the area on or near the condylar neck/head, or the ramus itself.[21,22] The other advantages of this approach include reduced distance from the skin incision to the area of interest.[23,24]

Nevertheless, an increasing number of articles report better results for surgically treated condylar fractures in terms of occlusion, bone morphology, and articular function. Only

Table 8: Swelling

Swelling	Preoperative (%)	POD 1 (%)	POD 2 (%)	1 week (%)	Percentage change
Absent	6 (60)	0 (0)	4 (40)	10 (100)	40.0
Present	4 (40)	10 (100)	6 (60)	0 (0)	−40.0
Total	10 (100)	10 (100)	10 (100)	10 (100)	-

**P<0.001, significant.

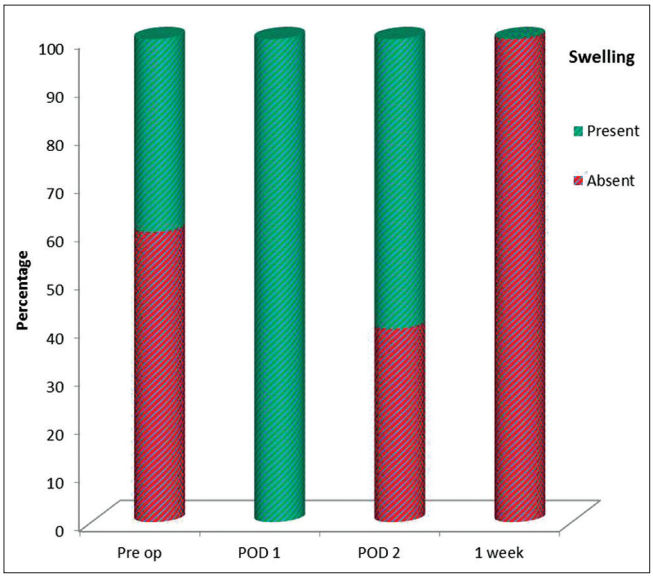


Table 9: Wound dehiscence

Wound dehiscence	1 day	1 week	1 month	Percentage change
Absent	9 (90)	10 (100)	10 (100)	10.0
Present	1 (10)	0 (0)	0 (0)	−10.0
Total	10 (100)	10 (100)	10 (100)	-

P=0.411, not significant

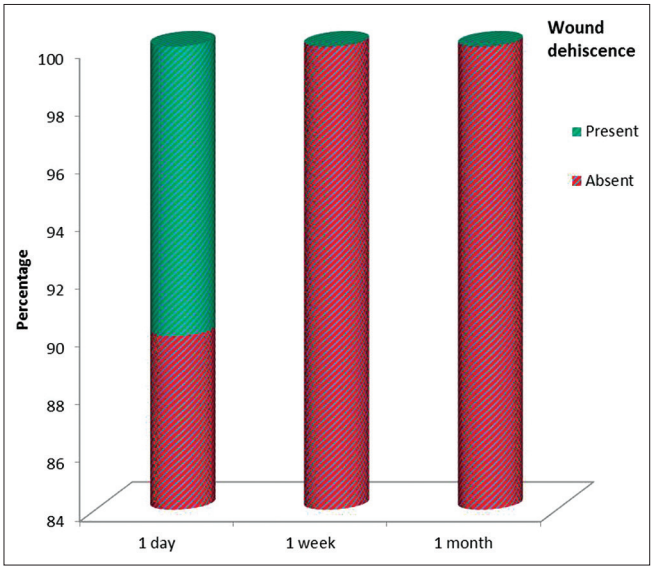


Table 10: Facial nerve injury assessment (House-Brackmann facial nerve grading system measurement scale)

Branches of facial nerve	24 h	1 week	1 month	3 months
Temporal				
Zygomatic				
Buccal				
Marginal mandibular				
Cervical				

Table 11: House-Brackmann facial nerve grading system

Grade	Appearance
Grade I - normal	
Grade II - slight dysfunction	Motion: Forehead - moderate to good function Eye - complete closure with minimum effort Mouth - slight asymmetry
Grade III - moderate dysfunction	Motion: Forehead - slight to moderate movement Eye - complete closure with effort; Mouth - slightly weak with maximum effort
Grade IV - moderate severe dysfunction	Motion: Forehead - none; eye - incomplete closure Mouth - asymmetric with maximum effort
Grade V - severe dysfunction	Motion: Forehead - none; eye - incomplete closure Mouth - slight movement mouth - slight movement
Grade VI - total paralysis	No movement

the intraoral approach (Silverman, 1925; Jacobovicz *et al*., 1998), which does not necessitate transcutaneous incisions, is really free from these potential pitfalls.[25] The intraoral approach requires special instruments and training to utilize the endoscope (Loukota 2006), which is often difficult, relatively uncommon, and time-consuming while training.[26]

The most commonly used extraoral approaches comprise the submandibular, retromandibular, and preauricular methods.[27] The retromandibular transparotid approach consistently provides an excellent exposure even if the patient has marked edema associated with pan facial fractures.[28] Other benefits include good cosmesis and adequate exposure for manipulation and reduction of the fracture and for placement of fixation in condylar neck and subcondylar fractures.[29,30] Retromandibular approach is an effective and safe technique, especially for displaced subcondylar fractures.[31]

A study conducted by Bindra *et al*.[32] in 2010 suggested retromandibular approach for open reduction of mandibular condylar fractures as it is associated with low morbidity and adequate exposure in the fracture site. Ebenezer and Ramalingam[33] in 2011 compared the various approaches for rigid fixation of the subcondylar fractures and concluded that retromandibular approach provides a more direct visual fields and an almost straight line access for the fixation of the fracture. Yang and Patil[19] and Mohan *et al*.[34] in 2012 also gave similar results.

A good quality of reduction and fixation was achieved in all cases using the retromandibular transparotid approach. The scar was slightly less conspicuous. Facial nerve injury was minimal in this approach,[35] and all patients showed 100% recovery at the end of the follow-up period.[36] Closing the parotid fascia tightly is the key to prevent any sialocele.[37]

In our study, the duration of surgery ranged from minimum of 55 min to maximum of 110 min. The maximum operating time of 110 min was in a patient with bicondylar fracture. Mean operating time in 10 patients was 78 min, which is in accordance with the study conducted by Kanno *et al*.[38,39] and Biglioli and Colletti.[28]

There is general consensus in literature that the retromandibular approach allowed direct visual alignment of the fragments, and this was true in our clinical study as well. The application of the plates was found to be easy using the approach.[40]

In our study, scar formation was seen in all patients after the surgery. All ten patients in our study were Asians of the south Indian subset. The skin tone in all but three patients was dark. All the other patients had a satisfactory result, and the patient had no complaints of the scar whatsoever. The incidence of wound dehiscence was found in one patient in our study, which required re-suturing. Moreover, it healed without any further complications within 1 week. In our study, there was no incidence of salivary fistula, owing to the tight suturing of the parotid capsule during surgery. There was no incidence of salivary fistula, owing to the tight suturing of the parotid capsule during surgery.

Conclusion

The procedure using retromandibular transparotid incision is technique sensitive and thorough knowledge about the retromandibular area is must for good results and minimal morbidity.

The exposure and access were satisfactory in all cases for reduction and rigid fixation of condyle and sub condylar fractures. The cosmetic results are good in this approach, as well as the facial nerve injury was less in this approach without any permanent damages. The wound dehiscence and infection could have been prevented by proper skin closure.

Since the sample size was small in this study, larger sample size is required to prove the statistical significance.

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Conflicts of interest

There are no conflicts of interest.

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