



Comparative Evaluation of Modified Tragus Edge Approach and Retromandibular Approach to Mid- or Low-Level Mandibular Condylar Fractures

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Abstract

Objectives To compare and evaluate the modified tragus edge approach (MTEA) with retromandibular approach for surgical access to mid-level or low-level mandibular condylar fractures.

Materials and Methods This study comprised of 22 patients with mid-level or low-level condylar fracture. Patients with clinical and radiological evidence of mid-level or low-level condylar fracture are included only in this study. Patients were randomly divided into two groups: group A includes 11 patients, in which modified tragus edge approach was used, and group B includes 11 patients treated with retromandibular approach. Patients were evaluated clinically after first week, second week, fourth week, third month, and sixth month radiographically.

Results The mean age of the study subjects in group A was 32.45 ± 8.98 years, while in group B, the mean age was 26.91 ± 5.79 years. Post-operatively, no significant difference was seen in relation to pain, occlusal relationship, mouth opening, and deviation of jaw during opening and closing movements. In terms of post-operative complication, only significant difference found between two groups is post-operative scar visibility, which is higher in retromandibular incision group as compared to MTEA.

Conclusion Thus, we can conclude that MTEA provides ease of operation as a good exposure of mandibular mid- or

low-level condylar fracture as retromandibular approach but with less visibility of post-operative scar as compared to retromandibular approach.

Keywords Mandibular condylar fracture · Modified tragus edge approach · Retromandibular approach · Mid- or low-level condylar fracture

Introduction

Fractures of the mandibular condyle are one of most common mandibular fractures accounting for 9–50% of all maxillofacial fractures reported in the literature [1, 2]. Condylar fractures can occur as unilateral or bilateral condylar fractures, and they may occur together with fractures of the mandibular symphysis or corpus, or with dentoalveolar injuries. The management of these fractures with open reduction and internal fixation in most of the condylar and subcondylar fractures gives better anatomic and functional results as compared to closed reduction [1, 2]. Closed reduction is mainly indicated in cases of condylar head and undisplaced condylar or subcondylar fractures [3, 4]. With recent developments in medical imaging and internal fixation materials technology, open reduction and internal fixation (ORIF) has become the main treatment of condylar fractures. Surgical repair of condylar fractures must follow 3 rules: precise reduction, reliable fixation, and minimal damage, but the choice of approach is the first issue [1, 2]. There are many complex anatomic structures around the condyle, such as the parotid gland, facial nerve, superficial temporal vessels, and maxillary vessels [1, 5, 6]. As a result, several different approaches for the treatment of dislocated condylar fractures have been used, including the preauricular approach

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as described by Thoma in 1945, the submandibular approach by Perthes, the intraoral approach, and the retromandibular approach by Hinds and Girotti. In general, the preauricular, retromandibular, and submandibular approaches provide very good results and are useful for condylar fractures [1]. Meanwhile, they also have some disadvantages, such as injury of the facial nerve, visible scars, salivary fistula, and a large amount of surgical trauma. Thus, there is still a need to design a new and better approach for condylar fractures [5–10].

The surgical approach—the modified tragus edge approach (MTEA) given by Li et al—is used for mid-level or low-level condylar fractures with minimal complications, which is being assessed in this study. The aim of this study is to compare and evaluate the modified tragus edge approach (MTEA) with retromandibular approach for surgical access to mid-level or low-level condylar fractures.

Materials and Methods

This study comprised of 22 patients with mid-level or low-level condylar fracture who reported to our Oral and Maxillofacial Surgery O.P.D. and OMFS Trauma Unit, King George's Medical University, Lucknow, from 1 September 2016 to 30 September 2018.

Detailed history of each patients was recorded on a set proforma designed for this study, and then, patients were diagnosed on the basis of clinical and radiological examination. Routine investigations and standard protocol were observed for each patient undergoing this study.

Patients with clinical and radiological evidence of mid-level or low-level condylar fracture are only included in this study. And those patient having displaced unilateral/bilateral condylar fractures with occlusal derangement, having angulation of fractured condyle > 10 degree, ramal shortening > 2 mm, patient's those wants open reduction and fixation, and age > 18 years and < 60 years are only included in this study.

The ethical clearance was obtained from institutional ethical committee prior to study, and an informed consent was obtained from all patients for participation in the study. Patients with immunocompromised status and patients who are not willing to give consent or participate for open reduction are not included in this study. A total of 22 patients with mid-level or low-level condylar fractures were included and randomly divided into two groups. In group A, 11 patients were included, in which modified tragus edge approach was used, and group B includes 11 patients, in which retromandibular approach was used.

Surgical Technique

Modified Tragus Edge Incision

The incision started at mid-tragus region and extended along the tragus edge, downwards to the inferior margin of the ear lobe, and then, incision is curved upwards behind the auricle maximum up to 2–3 cm. Then, the skin flap is raised forwards along the superficial temporal fascia. After raising the skin flap anterior to the parotid over the parotid fascia, a large space got created between the parotid duct and the lower buccal branch of the facial nerve. Then, blunt dissection is performed in layers to enter between the anterior edge of the parotid and the posterior edge of the masseter muscle. This creates exposure of posterolateral mandibular ramus. Then, parotid is retracted posteriorly and masseter is retracted anteriorly to reach mandibular condylar neck and sigmoid notch region. If required to reach more high level of mandibular condyle, ramus can be pulled inferiorly by engaging Langenbeck instruments on the sigmoid notch (Fig. 1).

In group B patients, standard retromandibular incision was used as explained by Ellis. All of the condylar neck fractures were fixed with 2-mm titanium miniplate system. The attachment of the lateral pterygoid muscle to the condylar process was carefully preserved as best as possible in every patient (Fig. 2). Post-operatively, intermaxillary fixation (IMF) for 2 week was done in case of malocclusion. Mouth opening physiotherapy and guiding elastics were adopted at 2 week post-surgery if needed.

Clinical and Radiological Evaluation

Patients were evaluated clinically pre-operatively and post-operatively after first week, second week, fourth week, third month, sixth month using VAS scale for pain; mouth opening measurement, deviation of jaw during opening mouth, and interocclusal relationship were observed clinically. Post-op complications like post-operative infections, scarring using certain scarring scale, parotid fistula, and facial nerve dysfunction using House–Brackmann scale were observed. Scar can be classified broadly into three types—thin and linear scar, wide scar, and hypertrophic scar. So we have measured using this classification and used as scarring scale for grading scar (Table 1). Scarring in all patients was measured by single resident doctor. Patients were evaluated radiographically using PA mandible, Reverse Towne's view, OPG, CT scan.

Fig. 1 **I** Modified tragus edge incision, **II** retromandibular incision



Fig. 2 **I** Accessibility achieved using MTEA and fixation of mandibular mid-level condylar fracture, **II** accessibility achieved using retromandibular and fixation of mandibular mid-level condylar fracture

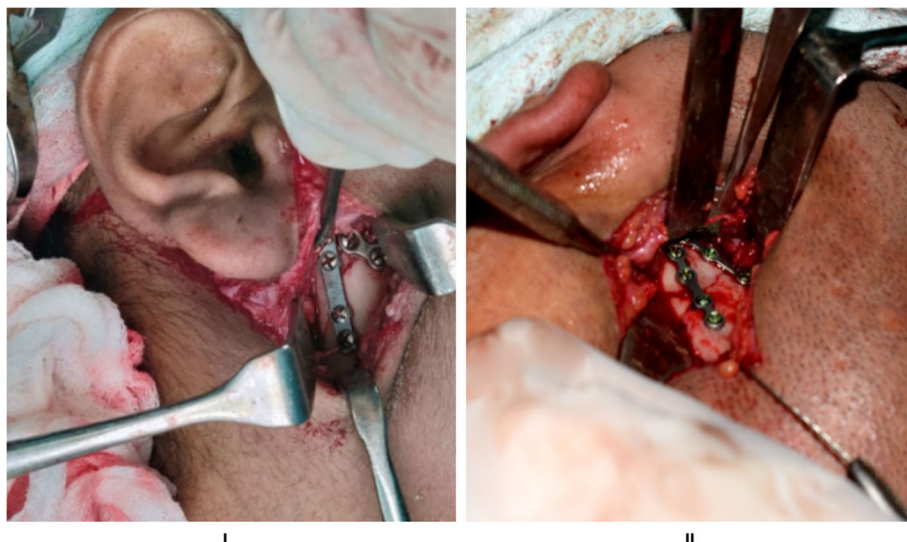


Table 1 Grading of post-operative surgical scar

Assessment of surgical scar	
1	No perceptible scar
2	Visible but thin and linear scar
3	Wide scar
4	Hypertrophic scar

Results

The mean age of the study subjects in group A was 32.45 ± 8.98 years, while in group B, the mean age was 26.91 ± 5.79 years. No significant difference was seen in mean ages between the groups. The female male ratio in group A was 1:10, while in group B, this ratio was 3:8. No

significant difference was found in male–female proportion between the groups. Also no significant difference was found in distribution of associated fractures between the groups. The intergroup comparison of pain (VAS) status revealed that no significant difference was found in mean VAS between the groups pre-operatively, after first week, second week, fourth week, third month, and sixth month. Pre-operatively, occlusion relationship was found deranged in all the cases of both groups. Post-operatively, the occlusion relationship was found deranged in 2 (18.2%) cases of group A and 3 (27.3%) cases of group B at 1 week. However, no significant difference was found in deranged/intact proportion at 1 week (*p* = 0.611). After that, at successive follow-up, occlusion relationship was found intact in all the cases in both the groups. The intergroup comparison of mouth opening revealed that post-operatively after first week, second week, fourth

week, third month, sixth month, no significant difference was found in mean mouth opening between the groups at this time (Table 2). Pre-operatively, deviation on mouth opening was found in all the cases of both groups. Post-operatively, the deviation on mouth opening was present in 1 (9.1%) case of group A and nil cases of group B at 1 week. However, no significant difference was found in the presence of mouth opening deviation at 1 week ($p = 0.306$). After that, at successive follow-up, deviation on mouth opening was absent completely in both the groups (Fig. 3).

The infection was present in 1 (9.1%) case of group A and 2 (18.2%) cases of group B at 1 week. However, no significant difference was found in the presence of infection at 1 week ($p = 0.534$). After that, at successive follow-up, infection was absent completely in both the groups.

The parotid fistula was present in 3 (27.3%) cases of group A and nil cases of group B at 1 week. However, no significant difference was found in the presence of parotid fistula at 1 week ($p = 0.062$). After that, at successive follow-up, parotid fistula was absent completely in both the groups.

At 4 week, scarring was visible and thin and linear scar was seen in all the cases in both the groups. At 3 month, wide and hypertrophic scar was seen in 2 cases of the group B. At 6 month, wide and hypertrophic scar was seen in 1 case of the group B and only one linear thin scar was found in group A (Table 3; Fig. 4).

Pre-operatively, facial nerve function was found normal in all the cases of both groups. Post-operatively, the facial nerve function was found mild dysfunction in 1 (9.1%) case and moderate in 1 (9.1%) case of group A and nil cases of group B at 1 week. Among remaining cases, the facial nerve function was found normal. No significant difference was found in proportion of facial nerve function dysfunction between the groups at 1 week ($p = 0.333$). At 2 week, the facial nerve function was found mild dysfunction in 2 (18.2%) cases of group A and nil cases of group B. At 4 week, the facial nerve function was found mild dysfunction in 2 (18.2%) cases of group A and nil cases of group B. At 3 month, the facial nerve function was found mild dysfunction in 1 (9.1%) case of group A and nil

cases of group B. After 6 months, facial nerve function was found normal in all the cases of both groups.

Discussion

Mandibular condylar fracture management is very controversial and depends upon particular cases and experience of the surgeon [1]. Non-surgical treatment was the sole method of treating such fractures for many years. Inter-maxillary fixation, with or without functional rehabilitation, is the basis of this treatment. Non-surgical management is indicated in edentulous patients and those with general contraindications to anaesthesia, and for comminuted fractures. The reason for adopting a less aggressive non-surgical approach was the difficulty in manipulating the fragments in a small area with the risk of damaging the facial nerve or vessels [3, 4]. But surgical treatment of condylar fractures shows better anatomical reduction in terms of angulation of fractured condyle and shortening of ascending ramus in the patients undergoing open reduction and fixation as compared to the non-surgical treatment. Open reduction and internal fixation ideally returns the condylar process to its pre-traumatic position, restoring skeletal continuity, re-establishing normal mandibular position, and bringing the teeth into their proper relationship [2, 11–15]. Thus, open reduction is the treatment of choice in cases of absolute indications as well as patients' wish. We have assessed and compared modified tragus edge approach MTEA with the retromandibular approach for mid-level or low-level condylar fractures.

The mode of injury in all our cases was road traffic accidents. In group A, there were 8 (72.7%) associated symphysis/parasymphysis fractures, 1(9.1%) angle fracture, and 2(18.2%) involved with bilateral condyle fracture. In group B, there were 10(90.9%) associated symphysis/parasymphysis fracture, 2(18.2%) angle fracture, and 3(27.3%) bilateral condyle fracture. Our study was in correlation with Kshirsagar et al. [16], in which most common mode of injury was road traffic accidents (16 out of 20 patients) and 16 (80%) patients had associated fractures of the mandible (symphysis/parasymphysis 10, body

Table 2 Intergroup comparison of mouth opening in millimetres (mm)

Mouth opening	Group A		Group B		<i>t</i> value	<i>p</i> value
	Mean (mm)	SD (mm)	Mean (mm)	SD (mm)		
Pre-Op.	15.00	5.12	17.55	7.62	− 0.92	0.369
1 week	19.73	4.84	22.00	6.91	− 0.89	0.382
2 week	23.27	3.93	25.73	6.42	− 1.08	0.292
4 week	27.91	4.57	30.73	4.84	− 1.40	0.176
3 month	35.27	2.97	36.00	4.07	− 0.48	0.638
6 month	39.91	2.39	39.36	3.11	0.46	0.649

Fig. 3 I Post-operative picture of incision given site using MTEA showing thin and linear scar after 6 month, and also half of the scar got hidden behind ear, **II** post-operative scar obtained after using retromandibular incision, after 6-month follow-up



Table 3 Post-operatively intergroup comparison of scarring

Scarring	Group A		Group B	
	Number of patients	%	Number of patients	%
4 week				
Visible but thin and linear scar	11	100.0	11	100.0
3 month				
Visible but thin and linear scar	4	36	9	82.00
3 month				
Visible, wide and hypertrophic scar	0	0.00	2	18.00
6 month				
Visible, wide and hypertrophic scar	0	0.00	1	9.00
6 month				
Visible but thin and linear scar	1	9.00	5	45.00

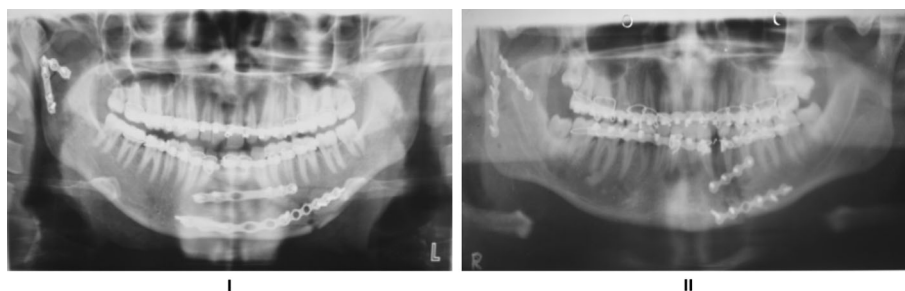


Fig. 4 I Post-op orthopantomogram X-ray of a patient, in which modified tragus approach was used showing good anatomic reduction of fractured fragments, **II** post-op orthopantomogram X-ray of a patient, in which retromandibular approach was used

2, and angle 4). In our study, pre-operatively, occlusion relationship was found deranged in all the cases of both groups. Post-operatively, the occlusion was found deranged in 2 cases (18.2%) of group A and in 3 cases (27.3%) of

group B at first week which was managed by guiding elastics for 2 weeks. Our study correlates with Eckelt et al. [17] who reported 3 out of 36 (9%) cases of occlusal derangement. Also, our study correlates with Li et al. [1]

who reported occlusal derangement in 4 (8.9%) patients of MTEA group and in 3(7.3%) patients of retromandibular group. Ideal occlusion was achieved eventually for all of these patients following 2 weeks of IMF. Post-operatively, we observed no significant difference ($p > 0.05$) in the mouth opening between both the groups at successive follow-up. Intragroup comparison of mouth opening from pre-operative to successive follow-up in both groups revealed significant differences ($p < 0.05$), and mean mouth opening was gradually increased to 39.91 in group A and 39.36 in group B at 6-month follow-up. This is due to the resolution of pain and haematoma which interferes with mouth opening and active physiotherapy adopted by the patient. The significance of post-operative physiotherapy has been documented in various studies such as Worsaae and Thorn [18], Schneider et al. [14], and Li et al. [1], and our finding is similar to these authors. In our study, pre-operatively deviation on mouth opening was found in all the cases of both groups. Post-operatively, the deviation on mouth opening was present in 1 (9.1%) case of group A which was managed by guiding elastics for 2 week and nil cases of group B at 1 week. After that, at successive follow-up, deviation on mouth opening was absent completely in both the groups. Our study was in correlation with Li et al. [1] who reported nil cases of deviation in both groups. In our study, infection was present in 1 (9.1%) case of group A and 2 (18.2%) cases of group B at 1 week. They were managed by meticulous dressing and IV antibiotics, and in all 3 infected cases, infection was resolved within 1 week. Our study was correlated with Chossegras et al. [19] who reported 1 case of infection out of 19(5.3%). Also, our study correlates with Li et al. [1] who reported nil cases of infection in their study. The parotid fistula was present in 3 (27.3%) cases of group A and nil cases of group B at 1 week. They were managed by pressure dressing, and inj. glycopyrrolate (I.M.) antisialogogue was given alternate day for 1 week which resolved uneventful. Our study was correlated with Ebenezer et al. [11] who reported 3 (15%) cases who developed parotid fistulae which responded well to occlusive pressure dressings and antisialogogues. Also, our study was in correlation with Hou et al. [12] who reported 2 (6.67%) cases out of 30 patients treated with retromandibular approach. Also, Kshirsagar et al. [16] reported 2 (10%) cases of parotid fistulae out of 20 patients treated with retromandibular approach. Also, our study correlates with Li et al. [1] who reported nil cases of parotid fistulae in MTEA group and 4(6.3%) cases in retromandibular group. At 6 month, wide and hypertrophic scar was seen in 1 of the group B cases and only one linear thin scar was found in group A. Our study correlates with Kshirsagar et al. [16] who reported that 2 (10%) out of 20 patients were not happy with the scars but they declined second surgery for scar

improvement. Also, our study correlates with Li et al. [1] who reported that surgical scars were unnoticeable and not prominent in the MTEA group, but in retromandibular approach, the scar was found to be more prominent and also found patient self-evaluation score for scarring was lower than in the MTEA group. Our study results also show that scar is visible more in retromandibular approach as compared to MTEA group patients because half of the scar gets hidden behind pinna of the ear which improves the patient's quality of life higher than retromandibular approach. In our study, facial nerve injury or transient facial nerve weakness was 2 (18.2%) out of 11 in modified tragus edge approach and nil (0%) out of 11 patients in retromandibular approach. The 2 patients were managed conservatively by medication and physiotherapy. The transient facial nerve weakness was resolved within 3 months in 1 patient and at 6 months in other patients. In both the patients, the buccal branch was involved as the operation boundaries are between the parotid duct and the lower buccal branch of the facial nerve; the marginal mandibular branch and other branches of the facial nerve are spared during the surgery. Our study was consistent with Biglioli and Colletti [20] and Kshirsagar et al. [16] who reported the incidence of facial nerve injury or transient facial nerve weakness to nil (0%) in retromandibular group. Also, Li et al. [1] reported 2 patients (3.4%) in MTEA group, in which temporary facial nerve damage was present.

The surgical scar was thin and linear, inconspicuous and is always hidden behind the ear in group A as compared to group B. Thus, we can conclude that MTEA provides good ease of operation as a good exposure of mandibular mid- or low-level condylar fracture as retromandibular approach but with less scar as compared to retromandibular approach.

Authors Contribution GS helped in conception and design of study/ review/case series; PKS, GS, UV, DM contributed to acquisition of data, laboratory or clinical/literature search; GS, SM, RKS, DM helped in analysis and interpretation of data collected; PKS, GS, UV contributed to drafting of article and/or critical revision; GS contributed to final approval and is the guarantor of manuscript.

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Compliance with Ethical Standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical Approval This study was approved by the Institutional Ethics Committee of the King George's Medical University. (Ethical Approval Number is 2045/Ethics/R.cell-17.)

Informed Consent Proper informed consent has been obtained from the patient regarding their participation in this study pre-operatively.

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