



Clinical outcomes of endoscopic vs retromandibular approach for the treatment of condylar fractures—a randomized clinical trial

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Objective. Condylar fractures remain the most controversial topic in maxillofacial trauma. Open reduction and internal fixation (ORIF) with use of an extraoral approach has certain benefits over the nonsurgical treatment. Concerns, however, remain about the risk of facial nerve injury, postoperative facial nerve weakness, and facial scarring when operating in this region despite the various extraoral approaches that have been developed. The recently popularized endoscope-assisted open reduction and internal fixation (EAORIF) is claimed to provide better results because it is minimally invasive, provides excellent visibility, and eliminates surgical scarring and the risk of facial nerve injury. This study, therefore, aims to compare the retromandibular (extraoral) approach and EAORIF for the treatment of condylar fractures.

Study Design. A prospective analysis of 32 cases of condylar fractures that reported to the SDM Craniofacial Centre (Dharwad, India) was carried out. Sixteen patients had been treated with the retromandibular (RM) approach, and 16 had undergone EAORIF in the period from 2012–2017. Patients were evaluated for clinical parameters, such as fracture site, displacement, and surgical duration, as well as for functional parameters, such as occlusion, maximum interincisal opening, deviation of mouth on lateral movements, temporomandibular joint (TMJ) pain and clicking, and facial nerve weakness. Statistical significance was elicited with $P < .05$.

Results. The patients subjected to either approach had suffered fractures of the low condylar neck and the subcondyle. Maximum interincisal opening, mandibular deviation, occlusion, and TMJ function at postoperative month 6 were comparable between the groups. Although no permanent facial nerve injury was seen in this study, the incidence of transient facial nerve weakness was higher in the RM group (56.25%) compared with the EAORIF group (6.25%) ($P = .036$). The surgical time was longer in the EAORIF group (RM: 107 ± 19.7 minutes and EAORIF: 155 ± 18.2 minutes) ($P = .04$). The rest of the parameters were comparable between both groups.

Conclusions. Although there is consensus on closed reduction in pediatric and adult condylar head fractures, the role of a surgical approach to treatment of displaced condylar neck and subcondylar fractures remains controversial. In our study, both surgical approaches were found to be suitable for the treatment of these fractures. (Oral Surg Oral Med Oral Pathol Oral Radiol 2019;128:479–484)

Condylar fractures still remain one of the most controversial and discussed topics in the field of maxillofacial trauma. The literature suggests that condylar fractures account for approximately 25% to 35% of all mandibular fractures.¹ Although traditionally closed treatment methods were used in the management of condylar fractures, open reduction and internal fixation (ORIF) has been proved to yield improved and more predictable outcomes. Surgical extraoral approaches, such as the submandibular, preauricular rhytidectomy¹⁻³ or the retromandibular (RM) approach are associated with difficulty in manipulation of the fractured fragments

within a small area and also pose a risk for facial nerve damage.

Ellis and Dean¹ stated that the RM approach is superior to other approaches because of the better access provided to the posterior border of the mandible and sigmoid notch, shorter working distance from the skin incision, and easy reduction; however, this is associated with transient/permanent facial paralysis and facial scarring.¹

Endoscope-assisted open reduction and internal fixation (EAORIF), a technique that has the advantages of ORIF while avoiding its associated complications, has now emerged as an alternative. Since its introduction, EAORIF has been accepted as one of the mainstays in the management of condylar

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Statement of Clinical Relevance

Condylar fracture is one of the most controversial topics in maxillofacial practice. This article compares the clinical outcomes of 2 clinically relevant approaches for treating such fractures.

fractures. This study aimed to compare the clinical outcomes of both these approaches.

MATERIALS AND METHODS

This prospective study was carried out at our center in India. Informed written consent was obtained from all of the participants in the study. Ethical approval for this study was issued by the institutional review board of our institute (IRB No. 2017/P /OS/47). All patients presenting to the SDM Craniofacial Centre (Dharwad, India) with unilateral condylar process fractures needing ORIF were placed into 1 of 2 groups according to the process described below.

The cases were randomly allocated to either group (group 1: RM approach; group 2: EAORIF approach) by using the pseudo random number generator (MS Excel, Microsoft Corp., Redmond, WA) by a senior resident, who was not involved in the study and kept a record of the same. Two investigators (second and third authors) performed all the clinical examinations separately, before and after surgery, to avoid any bias over the outcome. The patient details were revealed to the chief surgeon (first author) before the surgery. He performed all 32 surgeries. The feasibility of a particular approach in a particular case was ultimately determined by the chief surgeon, and the cases that could not be randomized were excluded from the study.

Patients in both groups were evaluated in the preoperative, immediate postoperative, and 1-month, 3-month, and 6-month postoperative periods for various primary clinical and functional parameters, such as occlusion, assessed with maximum intercuspation of molars and premolars and described as normal or malocclusion. Mouth opening by maximum interincisal distance, was measured by using a caliper, and abnormal interincisal opening was defined as an average maximum opening of less than 35 mm. Deviation of mouth on lateral movements and facial asymmetry were assessed with respect to maxillary stable dental midline and was quantified as present or absent. Temporomandibular joint (TMJ) pain and clicking were assessed by using a visual analogue scale and a stethoscope, respectively. Facial nerve weakness was evaluated by using the Hause-Brackmann Facial Nerve Grading System. Secondary parameters, such as total intraoperative time taken and various postoperative complications (e.g., infection and morbidity) were also assessed. Patients who had additional mandibular fractures were treated first with rigid internal fixation. After a stable occlusion was attained, the condylar fractures were treated by using either approach. Patients with associated midface or panfacial fractures were excluded from the study.

Sample size

The sample size was estimated by using G*power software.⁴ The effect size was 0.50, the alpha error was 5%, and power was significantly 95% for both the groups.

Statistical analyses

Student's *t* test and Wilcoxon's matched-pairs test were used to compare the parameters of both the groups. Statistical significance was elicited with scores where $P < .05$.

RESULTS

A total of 32 patients with unilateral condylar fractures, all with indication for ORIF, were included. The study was carried out from July 2012 to July 2017. Of the cases included, in group 1, 16 patients were treated with the RM approach (Figures 1 and 2) (12 males and 4 females; mean age 31.68 years) and in group 2, 16 patients underwent EAORIF (Figures 3 and 4) (16 males; mean age 26 years). The overall male/female ratio was 7:1. An equal (50%) predilection for both left-sided and right-sided condylar fractures was seen in our study. The period between the trauma and surgery ranged from 7 to 12 days.

The EAORIF group had 2 patients with low condylar neck fractures, whereas the other 14 had subcondylar fractures. In the RM Group, 7 patients had low condylar neck fractures, and 9 had subcondylar fractures, out of which 7 were isolated condylar fractures.

Table I shows the comparison of clinical parameters along with statistical values. Assessed by the maximum intercuspation of the molars and premolars, preoperatively and during postoperative follow-up, occlusion was satisfactory in both groups. Although in the EAORIF group there was deviation in the immediate postoperative occlusion, it settled over 4 weeks after surgery, which was statistically significant.



Fig. 1. Retromandibular approach.



Fig. 2. After rigid internal fixation of the fracture by using the retromandibular approach.

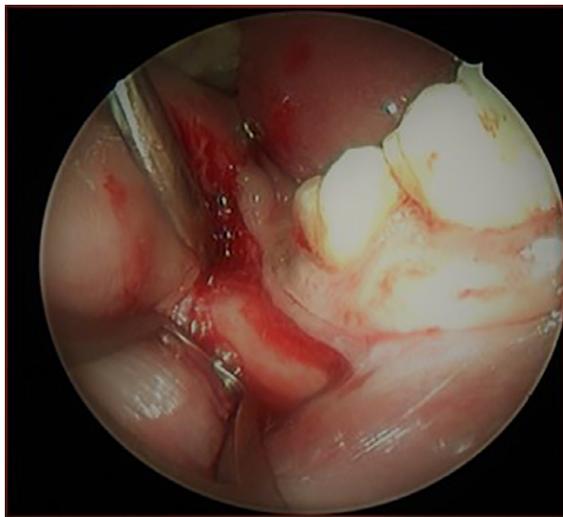


Fig. 3. An intraoral "S"-shaped curvilinear incision placed along the anterior border of ramus of the mandible to create an optical cavity.

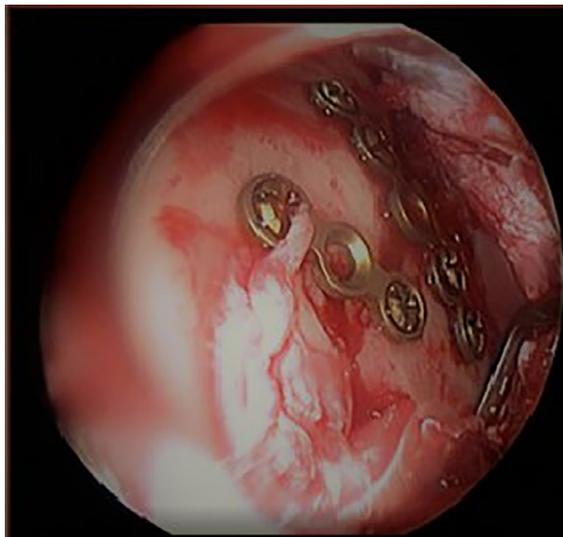


Fig. 4. Endoscopic visualization after rigid fixation by using an angulated screwdriver.

Altered mandibular deviation on the opening pathway, seen in both groups, resolved by 6 months postoperatively.

TMJ pain, which was noted 1 month after surgery in both groups, resolved by 3 months, whereas TMJ clicking, which was also noted at 1 month, persisted 6 months after surgery in both groups.

Maximum interincisal opening was greater in the RM group than in the EAORIF group in the immediate postoperative period and 2 weeks after surgery, but it became comparable over the follow-up period.

No permanent facial nerve injury was seen in the study. Transient facial nerve weakness was compared by using the House-Brackmann Facial Nerve Grading System by 2 residents separately for all patients. Preoperatively, all 32 patients had no deficits (grade I). Postoperatively, in the EAORIF group, one patient reported grade III weakness at 4 weeks' follow-up, which came down to grade II at 3 months but remained the same, that is, grade II, at 6 months (6.25%). In the RM approach group, of the 16 patients, 9 were found to have varying degrees of transient facial nerve weakness at the 4-week follow-up and resolved over 6 months (56.25%).

The average surgical time was about 107+/- 19.7 minutes for the RM group and 155 +/- 18.2 minutes for the EAORIF group.

DISCUSSION

Management of condylar fractures is the most debated topic worldwide in the maxillofacial forum. Ever since the specific, absolute, and relative indications were first described by Zide and Kent, there has been paradigm shift in the debate concerning the morbidity and functional assessment of subcondylar fractures.⁵ The management of these fractures has remained controversial ever since. Both open and closed reduction methods are widely used, to date, for the treatment of condylar fractures. Baker et al. reported that 57% of surgeons opt for ORIF in the presence of displaced condyle (>45-degree displacement) and occlusal disturbance.⁶ The existence of this controversy is based on the positive and negative aspects of open reduction and closed reduction (maxillomandibular fixation) for these kinds of fractures. You et al.⁷ have specifically enumerated the complications of nonsurgical management as open-bite deformity, deviation during mouth opening, disk displacement, habitual subluxation of the TMJ on the contralateral side, and malocclusion caused by shortening of the ascending ramus. Mueller et al.⁸ have mentioned that a significant percentage of adults managed conservatively experienced long-term aesthetic and functional problems.

ORIF can be achieved by using either the intraoral approach or the extraoral approach, in accordance with the level of condylar fracture. However, with the extraoral approaches (preauricular, RM, and

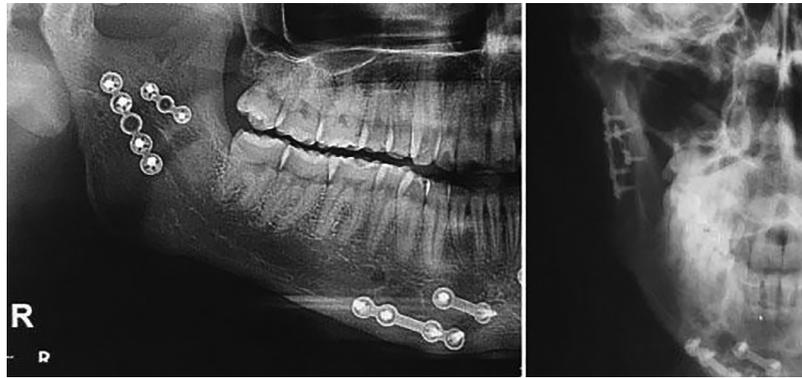


Fig. 5. One-year follow-up radiograph of the endoscope-assisted open reduction and internal fixation (EAORIF) approach.

submandibular), salivary fistulas, postoperative scars, and temporary or permanent facial nerve damage have been reported. To avoid such complications, the transoral approach has been described. The intraoral approach minimizes the risk of facial nerve injury and visible scars, but the disadvantage with this approach is that visibility of the fracture site is limited. Therefore, it is difficult to achieve good anatomic reduction. EAORIF offers a better view.⁹

Boehle et al.¹⁰ mentioned that an important advantage of the transoral approach is the avoidance of any facial nerve injury. In our study, one of the patients in the EAORIF group had transient facial nerve paresis postoperatively (6.25%). The reasons may be that the optical cavity prepared for EAORIF is a closed and restricted space, it can offer resistance to manipulation of the displaced fracture segments, and the traction of tissues can cause transient facial nerve weakness. Facial nerve weakness observed 1 month postoperatively was greater in the RM group (56.25%) compared with the EAORIF group. This weakness resolved over the 6-month follow-up period (as determined by using the Hause-Brackmann Facial Nerve Grading System). The main reason for this is that facial nerve weakness in the early postoperative period in the RM group can be attributed to the retraction of tissues and postoperative edema.^{10,11}

Lo and Cheung¹² stated, "In cases of condylar fracture with medially dislocated condyle, intraoral reduction is considered very difficult or virtually impossible." In a similar study, Mueller⁸ recommended first reducing the medial overrides to the lateral override category and then stabilizing them. We had a similar experience in this study.

Schmelzeisen et al.¹³ recommended obligatory intensive training in endoscopic techniques and handling of instruments that increased the operating time for the Endoscopic approach. In our study we also found that the time consumption was greater with the EAORIF approach compared with the RM approach.

TMJ pain and clicking were more or less comparable between both groups. Meyer et al. and Lee et al.¹⁴⁻¹⁶

recommended the use of 2 plates to fix mandibular condyle fractures because of the force exerted on the condyle during normal mandibular movements. In this study, we used 2 plates in 13 of the RM cases and 1 plate in the remaining 3 cases, whereas in the EAORIF group, 6 patients (4 with subcondylar fractures and 2 with condylar neck fractures) were treated with single plates, and 9 with 2 plates. Of these, 1 patient in the EAORIF group, presented with operative site infection, at the preauricular stab incision site, which could have been caused by the formation of a fistula from the pre-existing stab incision used for the trocar. For this case, plate removal was undertaken at a later date.

The RM approach has demonstrated the best results in the treatment of lower neck and subcondylar fractures. However, the intraoral EAORIF approach yielded equally satisfactory results [Figure 5](#).¹⁷⁻¹⁹ Colletti et al.,²⁰ in a series of 100 condylar fractures, used the mini-RM approach and demonstrated that the technique was reliable and enabled the safe management of condylar fractures at all levels, with no facial nerve injury.

A similar comparative study by Nogami et al.²¹ suggested that both these approaches were suitable for treating fractures of the lower neck and the subcondylar regions of the mandible because both procedures had good functional results. In our study, both surgical approaches were used only for treating fractures of the lower neck and of the subcondyle. Because the study patients were randomly assigned to either group, the EAORIF group had 2 patients with low condylar neck fractures, and the other 14 had subcondylar fractures; and in the RM group, 9 patients had subcondylar fractures, and the rest had low condylar neck fractures.

It is often difficult to define exactly which structural and functional factors influence the final outcome because differences exist in the patient's biologic characteristics (i.e., neuromuscular, dental, and skeletal) and the adaptive capability of the masticatory system, which can contribute to results that are not always easy to predict for both approaches.

Table I. Comparison of clinical parameters with statistical values

	RM approach (n = 16)			EAORIF (n = 16)			P value
	Pre-op	1 month post-op	6 months post-op	Pre-op	1 month post-op	6 months post-op	
1 Occlusion (deranged)	13/16	7/16	0/16	12/16	4/16	0/16	.0079*
2 Mean maximum interincisal opening (mm)	28.63 (9.82 SD)	36.77 (5.8 SD)	43.63 (7.5 SD)	27.53 (9.72 SD)	33.07 (5.64 SD)	42.53 (7.4 SD)	.256
3 Deviation of mouth on lateral movements (present)	12/16	8/16	0/16	11/16	5/16	0/16	.0042*
4 Mean facial asymmetry (mm)	2.5 (0.31 SD)	1.52 (0.49 SD)	1.00(0.47 SD)	2.80 (0.41 SD)	1.67 (0.49 SD)	1.00 (0.47 SD)	.202
5 TMJ pain (present)	11/16	5/16	0/16	12/16	3/16	0/16	.320
6 TMJ clicking (present)	6/16	4/16	0/16	5/16	3/16	0/16	.320
7 Mean facial nerve weakness (over 6-month follow-up)	56.25%			6.25%			.0065*
8 Mean operating time (min)	107+/- 19.7			155 +/- 18.2			.0024*

*P < .05 = statistically significant.

EAORIF, endoscope-assisted open reduction and internal fixation; min, minutes; mm, millimeters; post-op, postoperative; pre-op, preoperative; RM, retromandibular; SD, standard deviation; TMI, temporomandibular jaw.

To summarize, both surgical treatments were suitable for treating fractures of the lower neck and of the subcondyle and yielded good results in both clinical and functional parameters. With the introduction on minimally invasive procedures in other surgical specialties, EAORIF should be one of the considered methods for the treatment of low condylar neck fractures and subcondylar fractures. The RM approach, when carefully performed, can produce postoperative results comparable with those of EAORIF, but it is associated with the risks of facial nerve damage, postoperative paresis, and facial scarring. It is important to highlight the importance of intensive training in endoscopic techniques, proper handling of the instruments, and increased time consumption in EAORIF, all of which are associated with an obvious “learning curve,” with the acquisition of equipment and related hardware and their maintenance being additional challenges.

CONCLUSIONS

Although there is consensus with regard to the use of closed reduction in pediatric and adult condylar head fractures, the role of a surgical approach in the treatment of displaced condylar neck and subcondylar fractures remains controversial. On the basis of the clinical outcome of this study, we would suggest that both surgical approaches are suitable for treating fractures of the lower neck and subcondyle because both demonstrated good results in clinical as well as functional parameters, although further studies with larger sample sizes should be undertaken to reach consensus over this controversial issue.

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DISCLOSURE

There are no conflicts of interest to declare.

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