

# Retromandibular transparotid approach to mandibular subcondylar and high ramus fractures: two-point fixation

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## ABSTRACT

**BACKGROUND:** Although the fractures of the mandibular condylar region are very common, the controversies about the treatment of this area is still ongoing. In recent years, general agreement has emerged that open treatment is more effective than closed approaches for extracapsular condylar fractures. However, this time, the method of surgical approach has become controversial. The aim of this study was to evaluate the effectiveness of the retromandibular transparotid approach for the fixation of subcondylar/high ramus mandible fractures.

**METHODS:** Subcondylar/high ramus mandible fractures were operated via the retromandibular transparotid approach with a two-point fixation in 24 patients. The patients were evaluated for bleeding during the operation and for hematoma, infection, Frey's syndrome, salivary fistula, facial nerve damage, occlusion, fracture site stability, chronic pain in the fracture site, hypoesthesia of the ear, and temporomandibular (TME) joint movements in the postoperative period.

**RESULTS:** Only one major complication was encountered in one (4.1%) patient, which was damage to the temporal branch of the facial nerve.

**CONCLUSION:** The retromandibular transparotid approach appears to be a safe and effective method for the internal fixation of extracapsular condylar fractures.

**Key words:** Condyle; retromandibular; transparotid.

## INTRODUCTION

Although fractures of the mandibular condylar region occur at a rate of 20–30%,<sup>[1]</sup> which may be considered high among all mandibular fractures, some controversial issues remain in regard to their treatment.<sup>[2]</sup> These fractures may be treated through intermaxillary fixation followed by physiotherapy and by intraoral or extraoral surgical incisions; rigid fixation may also be used to treat condylar fractures.<sup>[3]</sup>

Traditionally, closed methods have been used to treat condylar and subcondylar fractures, but the open-method treatment has recently begun to replace the closed-method treatment due to reasons, such as the lack of achieving an accurate reduction and the occurrence of occlusion problems.<sup>[4]</sup>

Open surgical intervention is superior to closed-method treatments in terms of the appropriate anatomic fixation of the fracture, early mobilization, fracture healing, and normo-occlusion and in terms of avoiding some of the latter's undesirable complications, such as hematoma, infection, salivary fistula, and problems with facial nerves. Additionally, extraoral surgical interventions also result in scars due to the surgical incision.<sup>[5]</sup> For these reasons, caution is recommended when selecting a method for the treatment of condylar and subcondylar fractures.

Open surgical intervention is preferable in cases in which the angulation between the fracture segments is  $>30^\circ$  and there is a gap  $>4$  mm between the fracture segments and in cases in which the fracture segments laterally overlap, the mandibular ramus is shortened, or there is no contact between the fracture's ends. Furthermore, open reduction and internal fixa-

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tion should be considered in cases of multisegmental inferior mandibular fractures in addition to subcondylar fractures and in maxillary Le Fort fractures requiring the support of the mandibula.<sup>[6]</sup>

The recommended approaches for access to condylar and pericondylar fractures include intraoral, coronal, preauricular, postauricular, endoscopic, endaural, retromandibular, and submandibular approaches and rhytidectomy.<sup>[7]</sup> Easy access to the fracture segment, potential nerve injury, and the length of the incision scar appear to be the most important factors in determining the surgical approach.<sup>[8]</sup>

The present study evaluated the technical details, efficacy, and outcomes of open reduction and internal fixation, which were performed using the retromandibular transparotid approach for mandibular subcondylar and high ramus fractures.

## MATERIALS AND METHODS

The present study included twenty-four patients with subcondylar and high mandibular ramus fractures treated through open reduction and internal fixation using the retromandibular transparotid approach in Izmir Ataturk Training and Research Hospital Plastic Surgery Clinic between March 2012 and April 2014. This study was conducted according to the guidelines of the Declaration of Helsinki, and the study protocol was approved by the Ethics Committee of the Katip Celebi University (Turkey). The patients were diagnosed by radiological examination after collecting the patient's medical history and performing physical examination. The radiological examination combines coronal and axial maxillofacial CTs with any of following, as appropriate: an orthopantomogram, lateral cephalogram, or posterior/anterior mandibular radiograph. Nevertheless, plain radiograms were preferred for the postoperative evaluation.

Patients were intubated nasotracheally and operated on under general anesthesia. The operation was initiated with the planned incision at a length of two cm, placed approximately 0.5 cm posterior to the mandibular border from 0.5 cm inferior to the ear lobule (Fig. 1). A two cm incision was sufficient for favorable superior ramus and subcondylar fractures. However, the incision line was extended distally or proximally

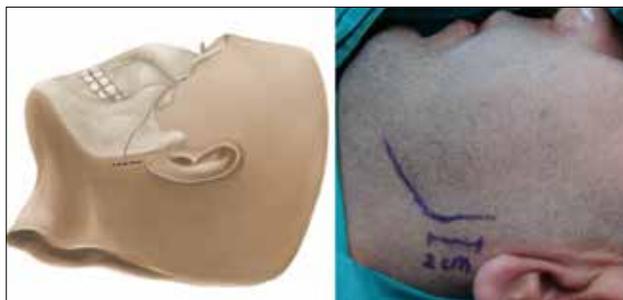


Figure 1. Incision plan.

in cases of more superior fractures or segmental fractures. After passing the cutaneous, subcutaneous, and parotid capsule, the track of the facial nerve branches was identified via a nerve stimulator, and a blunt dissection was performed from both sides of the nerve track through a curved hemostat to access the masseter muscle (Fig. 2). Following the incision of the pterygomasseteric sling, force was exerted on the fracture line by subperiosteal dissection using a periosteal elevator. After having achieved anatomic reduction (Fig. 3), the fracture line was fixated with a short arch-bar combined with a single miniplate (Figs. 4, 5) or two 2-mm titanium miniplates alone (Fig. 6). In cases in which the combination of a single miniplate and arch-bar was used, the arch-bar was removed after two weeks. The pterygomasseteric sling was not restored routinely, but the parotid capsule was restored with 5/0 absorbable sutures in all patients. The sites were not drained, and the skin incisions were covered with 5/0 monofilament sutures.

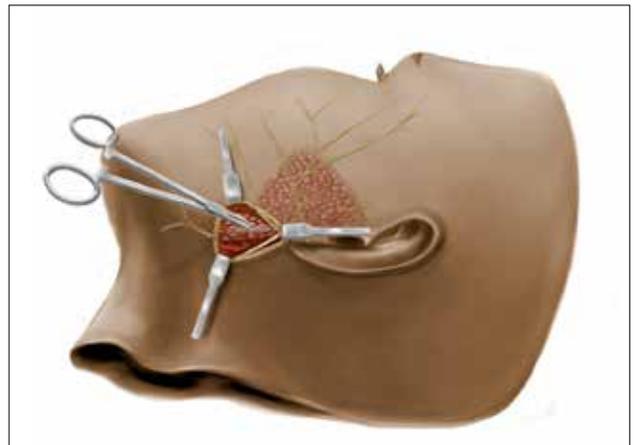
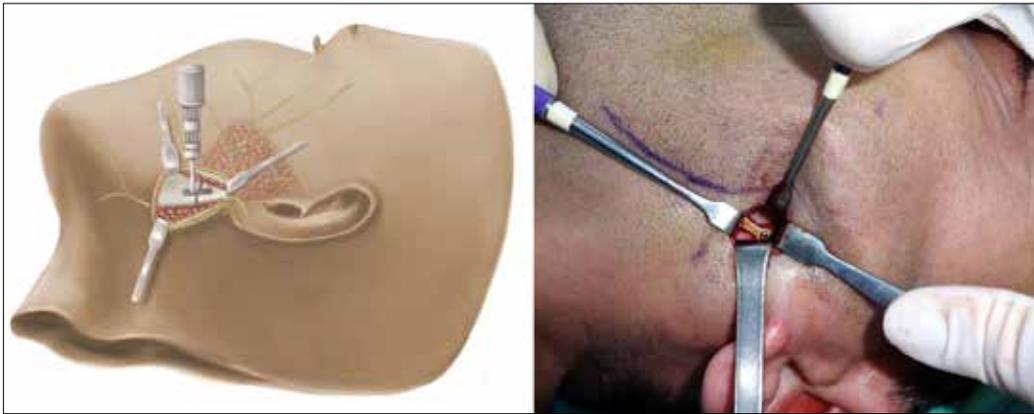


Figure 2. After passing the parotid capsule, the track of the facial nerve branches was identified via a nerve stimulator, and a blunt dissection was performed from both sides of the nerve track through a curved hemostat to access the masseter muscle.



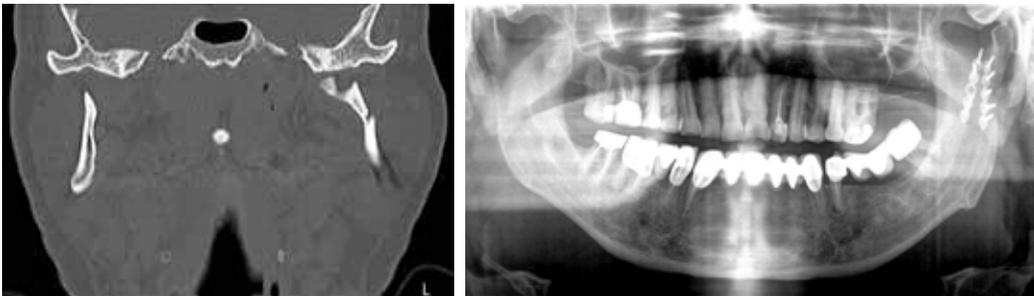
Figure 3. Anatomic reduction of the fracture line.



**Figure 4.** Fracture line fixation with miniplate.



**Figure 5.** Postoperative early (with arch-bars) and late orthopantomogram images of the above patient.



**Figure 6.** Case example. Left subcondylar fracture was fixed with two miniplates.

After surgery, a four week liquid diet was recommended to the patients. The patients were discharged on first postoperative day and were asked to return for follow-up visits at the end of the first and fourth postoperative weeks and at the end of the third and sixth postoperative months. The patients with arch-bars returned for an additional follow-up at the end of the second postoperative week for the removal of the arch-bar. The patients were evaluated for excessive bleeding during the operation and for hematoma, infection, Frey's syndrome, salivary fistula, facial nerve damage, occlusion, fracture site stability, chronic pain in the fracture site, hypoesthesia of the ear, and temporomandibular (TME) joint movements in the postoperative period.

## RESULTS

This study included twenty-four patients aged 18-60 years (mean, 34.57), of whom eight (33.3%) were females and sixteen (66.7%) were males. Eighteen (69.2%) subcondylar

and eight (30.7%) high ramus fractures were operated. Two (8.3%) patients were operated on due to bilateral subcondylar fractures. Fourteen (58.3%) patients had no additional mandibular fractures. One (4.1%) patient had a subcondylar fracture as a component of a panfacial fracture. In ten (41.6%) patients, an arch-bar was used in combination with plates and screws for an intermaxillary fixation. Mean duration of patient follow-up was 25.1 weeks (Table 1).

No serious bleeding problem was experienced during the operation, which could have resulted from an injury to the intermaxillary artery or the retromandibular vein. In the postoperative period, no hematoma, infection, Frey's syndrome, chronic pain in the fracture site, hypoesthesia of the ear, or salivary fistula were observed in any patients. Furthermore, the radiological examinations of the patients did not reveal any significant rotation or angulation in the condyle or fracture line, and no additional surgical intervention was performed.

**Table 1.** Description of fractures in twenty-four patients

Patient	Side	Associated fractures	Approach
1	Left, subcondyle		ORIF
2	Right, subcondyle	Left, subcondyle	ORIF
3	Left, subcondyle		ORIF
4	Left, subcondyle	Right, mandibular body	ORIF
5	Left, high ramus	Right, mandibular body	ORIF
6	Right, subcondyle		ORIF + Arch-bar
7	Left, subcondyle	Left, mandibular body	ORIF + Arch-bar
8	Right, subcondyle		ORIF
9	Right, subcondyle	Left, mandibular body	ORIF
10	Right, high ramus		ORIF
11	Right, subcondyle		ORIF
12	Left, high ramus		ORIF
13	Right, high ramus		ORIF + Arch-bar
14	Right, high ramus	Left, mandibular body	ORIF + Arch-bar
15	Bilateral, subcondyle		ORIF + Arch-bar
16	Bilateral, subcondyle		ORIF + Arch-bar
17	Left, high ramus		ORIF
18	Left, subcondyle	Right, mandibular body	ORIF
19	Left, high ramus		ORIF + Arch-bar
20	Left, subcondyle	Panfacial fracture	ORIF
21	Left, subcondyle	Right, subcondyle	ORIF + Arch-bar
22	Right, high ramus		ORIF + Arch-bar
23	Right, subcondyle		ORIF + Arch-bar
24	Left, subcondyle	Right, mandibular body	ORIF

Any occlusion problem was not observed in the postoperative period and pre-trauma occlusion was achieved in all patients. Complete damage to the facial nerve was not observed in any patients. However, one (4.1%) patient had permanent damage in the temporal branch of the facial nerve.

The interincisal distance was measured at the maximal mouth opening and the mandibular movements to the front and to the sides were evaluated to assess the temporomandibular joint movements. The mouth openings of the patients were not significantly restricted, and the interincisal distance varied between 37–56 mm (mean 47.08). No restrictions were observed in the mandibular protrusive movement to the front or in the mandibular movement to the sides.

## DISCUSSION

No golden standard treatment method has been defined for mandibular condylar fractures. Open surgical treatment is the more preferred treatment modality at the present time as many studies have demonstrated that open reduction and internal fixation are superior to closed-method treatments for unfavorable extracapsular fractures.<sup>[9,10]</sup>

After open surgical treatment has gained prominence, the method of surgical intervention has also become a topic of discussion. Endoscope-assisted intraoral approaches have substantial advantages for both cosmetic purposes and for preserving the facial nerve. However, the use of this approach is limited by requiring specific equipment, such as an endoscope, and by the length of learning interval.<sup>[11]</sup>

Among the techniques for the extraoral approach, the submandibular, preauricular, and retromandibular approaches are used preferentially.<sup>[12]</sup> The submandibular approach provides a wide field of vision, but the length of the incision scar is its most important disadvantage.<sup>[13]</sup> The preauricular approach is generally suitable for intracapsular condylar fractures, and the fracture line must be extended over the inferior of the ear in subcondylar fractures. The retromandibular transparotid approach has significant advantages for accessing subcondylar and high ramus fractures. In this approach, the fracture line may be seen clearly, and if required, the incision may be easily extended over the preauricular region and the mandibular corner. Furthermore, the incision line remains behind the mandibular margin, and 2-cm incisions are sufficient in most cases.<sup>[14]</sup> Kumaran et al.

have argued that even a 1-cm incision is sufficient for the fractures of these sites when used with a 1.5 mm plate.<sup>[15]</sup>

To date, very low rates of complication have been reported with the retromandibular transparotid approach.<sup>[3,16,17]</sup> In the present study, the common complications of surgery, such as hematoma and infection, were not observed in any patient. When considering the retromandibular transparotid approach in terms of complications that may be called method-specific, the primary complications associated with this approach include salivary fistula, Frey's syndrome, restriction and pain in temporomandibular (TME) movements, hypoesthesia of the ear, and facial nerve injury. Ellis et al.<sup>[18]</sup> have reported a rate of 2.3% for salivary fistulas in their study. Bindra et al. have reported that they did not observe any salivary fistulas. In the present study, no salivary fistula was observed. In our opinion, a salivary fistula is likely to result from not restoring the parotid capsule. Patients were also followed for Frey's syndrome, and no cases of Frey's syndrome were observed in this series, which is consistent with the literature.<sup>[3,16]</sup> Sverzut et al.<sup>[19]</sup> have reported that Frey's syndrome developed in one patient treated with the retromandibular approach. No other study reporting that Frey's syndrome might occur due to this approach was identified in the literature.

Considering the temporomandibular joint movements, the mandibular movements to the front and to the sides at the maximal mouth opening were restricted in the early period; however, there were no significant restricted movements in the patients during the follow-up. None of the patients experienced pain in the temporomandibular region in the advanced period. The mean interincisal distance at the maximal mouth opening was 47.08 mm and remained within normal limits. General acceptance for normal limits is between 40–50 mm.<sup>[20]</sup>

In the present study, one (4.1%) patient had permanent damage to the temporal branch of the facial nerve. In that patient, the operation was performed through a two cm incision; we believe that the main reason of the temporal branch injury was excessive traction at the superior border of the incision, near the earlobe. As a general rule, main trunk of the facial nerve divides into two main divisions at the posterior border of the ramus of the mandible, an upper (temporofacial) division and a lower (cervicofacial) division. The upper division gives off temporal, zygomatic and buccal branches, whereas the lower division gives off marginal mandibular and cervical branches.<sup>[21]</sup> But the rules are made to be broken. A lot of studies have shown that branching pattern of the facial nerve is highly variable.<sup>[22,23]</sup> Indeed, it is our belief that that zygomatic and temporal branches are both injured in that patient. Yet, zygomatic branch injury remained asymptomatic because of the buccal branch interconnections. The reported anastomosis among the zygomatic and buccal branches varies 70% to 100%.<sup>[24,25]</sup>

Since that case, we have been extending the incision approximately 1 cm proximally or distally to avoid over-traction

rather than persisting with the 2-cm incision in cases in which it is impossible to adequate exposure of the fracture line. The increase in the incision scar from 2 cm to 3 cm would not be a serious problem in cosmetic terms, but it is clear that facial nerve injury may cause serious problems in both cosmetic and medicolegal aspects. Regardless of the incision length, the retromandibular transparotid approach is very safe in terms of facial nerve injury.<sup>[16–18]</sup>

There were no occlusional defects in any of the patients after the operation. In the retromandibular approach, the fracture line can be accessed with a straight angle, and the force can be exerted on the fracture line in a very clear way. The researchers believe that this facilitates the anatomic fixation of the fracture.

For the fixation of the mandibular fractures, a 2-mm double miniplate is generally recommended.<sup>[26]</sup> Nevertheless, a single plate may be used in cases of more restricted exposure of the subcondylar and ramus regions compared with the other regions to avoid facial nerve damage and if there is a lack of space to place two plates. Yang and Patil<sup>[3]</sup> argue that subcondylar fractures may also be successfully treated by using a single miniplate. In our clinic, the primary choice for fracture fixation is two 2-mm miniplates with four holes. However, if the second miniplate cannot be properly placed into the fracture line or if excessive traction is applied to the facial nerve branches in particular, an arch-bar in combination with a single miniplate is used for fracture fixation. The arch-bar was removed after two weeks, at which time temporomandibular joint movements were initiated. In this manner, two-point fixation (two plates or a single plate and an IMF) provides a complete reduction in the anterior and posterior planes of the condyle. Conversely, in one-point fixations in which restoration with a single plate is preferred, minimal gaps may be observed at the anterior margin even if the reduction is achieved at the posterior margin of the condyle or ramus. In our opinion, this may result in modifications to the contact surface of the cartilage tissue within the temporomandibular joint, thereby causing degeneration in the long term period. Therefore, complete reduction is required in each plane of the mandible for subcondylar and ramus fractures.

Our experience with twenty-four patients suggested that the retromandibular transparotid approach was a safe and effective method. In the present study, no major complications were found, except for damage to the temporal branch of the facial nerve in one patient. We believe that the retromandibular transparotid approach is the most appropriate method for extraoral surgical intervention in subcondylar and high ramus mandibular fractures due to the easy access to the fracture line, ensuring that the scar is located behind the mandible for cosmetic purposes, and a very low complication rate. Additionally, it is our belief that the retromandibular transparotid approach using two-point fixation will reduce the risk of temporomandibular joint degeneration in the following years.

**Conflict of interest:** None declared.

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## ORİJİNAL ÇALIŞMA - ÖZET

### Mandibula subkondil ve yüksek ramus kırıklarına retromandibular transparotid yaklaşım: İki nokta fiksasyonu

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**AMAÇ:** Mandibula kondil bölgesinin kırıkları çok yaygın görülmesine rağmen bu bölgenin tedavisi üzerinde tartışmalar devam etmektedir. Son yıllarda ekstrakapsüler kondil kırıklarının tedavisinde açık cerrahi yöntemlerin kapalı tedavilere göre daha etkili olduğu yönünde genel bir görüş birliği mevcuttur. Ancak, bu sefer de cerrahi yaklaşım tartışmalı hale gelmiştir. Bu çalışmanın amacı, retromandibular transparotid yaklaşımın subkondil/yüksek ramus mandibula kırıklarının onarımındaki etkinliğini test etmektir.

**GEREÇ VE YÖNTEM:** Subkondil/yüksek ramus mandibula kırığı olan 24 hasta retromandibular transparotid yaklaşım ile iki nokta fiksasyonu ile ameliyat edildi. Hastalar operasyon sırasında kanama ve operasyon sonrasında ise hematoma, enfeksiyon, frey sendromu, tükürük fistülü, fasyal sinir hasarı, oklüzyon, kırık stabilitesi, kırık bölgesinde kronik ağrı, kulakta hissizlik ve temporomandibular eklem hareketleri açısından değerlendirildi.

**BULGULAR:** Sadece bir hastada majör bir komplikasyon olarak, fasyal sinirin temporal dal hasarıyla karşılaşıldı.

**TARTIŞMA:** Retromandibular transparotid yaklaşım ekstrakapsüler kondil kırıklarının internal fiksasyonunda güvenli ve etkili bir yöntem olarak görülmektedir.

**Anahtar sözcükler:** Kondil; retromandibular; transparotid.

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