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Modified Blair Approach for the Treatment of Mandibular Condyle Fractures

Cem Özer, MD, Yusuf Tamer, DDS, PhD,† Burak Bayram, DDS, PhD,‡ and Zafer Özgür Pektaş, DDS, PhD§*

Purpose: The management of fractures of the condyle of the mandible has been a topic of debate and still no consensus exists in the literature about the most appropriate approach. The objective of this study was to evaluate the efficacy and safety of the modified Blair approach for the open reduction and internal fixation of mandibular condyle fractures.

Methods: A retrospective study was conducted on 18 patients with 20 mandibular condyle fractures from 2014 to 2020. All patients were treated surgically using the modified Blair approach. Postoperative occlusion status and mouth opening were assessed for treatment outcomes. Also, the rate of complications such as facial nerve paralysis, wound infection, hematoma, salivary fistula, Frey syndrome, and greater auricular nerve paraesthesia evaluated.

Results: Seventeen out of 18 patients (94.4%) achieved their original pretraumatic occlusion after the surgery. One patient (5.5%) had postoperative occlusal interference due to premature dental contact. The maximal postoperative interincisal distance was measured with a range between 33 and 41 mm (mean 37.6 mm). One patient (5.6%) had transient facial nerve palsy. Also, salivary fistula developed in 1 (5.6%) patient in the postoperative period.

Conclusion: The results of this study revealed that the modified Blair approach provides satisfactory clinical outcomes with low complication rates and may offer an alternative, safe, and effective method for open reduction and internal fixation of mandibular condyle fracture.

Key Words: Internal fracture fixation, mandibular condyle, mandibular fractures, surgical procedure

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The condyle fractures of the mandible are the most commonly seen type of mandibular fractures and account for more than a third of all fractures of the mandible.[1] If untreated, or improperly treated, condylar fractures have a potential to cause severe functional impairment, poor occlusion, deviation, limited movement, osteonecrosis, facial asymmetry, and ankylosis.[2]

There are 2 main treatment approaches for the management of condylar fractures. The closed reduction and intermaxillary fixation have been accepted as the standard of care for condylar fractures, particularly in pediatric patients, and if the occlusion is minimally disturbed by the fracture.[2,3] On the other hand, open reduction and internal fixation with plates and screws has been used more commonly for displaced condylar fractures in recent years. It allows better stabilization of the fracture ends and rapid healing in an anatomically correct position. Also, the open approach enables restoration of early function, provides adequate stability, and avoids prolonged maxillomandibular fixation.[2,4] However, open surgical treatment of mandibular condyle fractures is technically demanding and carries the risk of facial nerve injury because of the complex anatomy of this region.[2]

A variety of surgical approaches have been described for the open treatment of condylar fractures, such as preauricular, subman-dibular, retromandibular, transparotid, and intraoral approaches.[5] All have specific advantages and disadvantages in terms of direct vision and mobilization of the fractured segments and security of the facial nerve and its branches. However, there is still no consensus on the most appropriate approach.[2,5] Preauricular incision allows perfect lateral and anterior exposure of the mandibular condyle and is most commonly used to access diacapitular fractures. However, it is not suitable for subcondylar fractures because of its high position.[5] The submandibular incision is usually used to approach condylar base fractures. It may be slightly extended in a backward and upward direction to the periangular region to have a better view and safer identification of the facial nerve. Because of its low position, its use is limited for high condylar fractures. Also, it carries the risk of having trauma to the facial vessels and the facial nerve, particularly the marginal mandibular branch.[2,5] The retro-mandibular incision is the most commonly preferred approach by physicians and is used to treat condylar base and neck fractures. It provides better exposure to fracture ends and the posterior edge of the ramus when compared with other conventional techniques. However, it requires dissection of the

From the *Department of Otorhinolaryngology Head and Neck Surgery, Baskent University, Ankara; †Department of Oral Maxillofacial Surgery, Faculty of Dentistry, Baskent University, Adana; ‡Department of Oral Maxillofacial Surgery, Faculty of Dentistry, Baskent University, Ankara; and §Oral Maxillofacial Surgery, Private Clinic, Adana, Turkey.

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Address correspondence and reprint requests to cem Özer, MD, Baskent Universitesi, Adana Uygulama ve Arastirma Merkezi, Kazim Karabekir cad. 59. Sok. No. 91. 01250 Yuregir, Adana, Turkey; E-mail: cemkbb@hotmail.com

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parotid gland to reach the fracture site which increases the risk of facial nerve trauma and salivary fistula.[2,5] Intraoral endoscopic assisted approach has the advantage of avoiding visible facial incision scars and reduces the risk of facial nerve trauma. It offers an alternative approach to subcondylar fractures. However, this technique requires expensive special equipment and a long-term learning curve.[5]

The modified Blair incision, which was described by Blair in 1912 and modified by Bailey in 1941, has been used commonly in parotid gland surgery for years. It offers adequate access to both the parotid gland and the posterior, anterior, and lateral aspects of the temporomandibular joint that may help reduction and fixation of fracture ends. It also allows perfect exposure of the facial nerve and its branches throughout its extracranial course from the stylomastoid foramen to its distal ends.[6]

The aim of this retrospective study was to investigate the safety and efficacy of the modified Blair approach for the open reduction and rigid internal fixation of mandibular condyle fractures. We hypothesized that the modified Blair incision offers an alternative surgical approach for the open treatment of condylar fractures with good results.

METHODS

Study Design and Patients

This study was a retrospective chart review of 18 patients with condylar fractures treated at the Hospital of Baskent University from January 2014 to December 2020. The study was approved by Baskent University Institutional Review Board (Project no: D-KA20/30) and supported by Baskent University Research Fund. This study has also complied with research ethics based on the Declaration of Helsinki.

Patients were included in the study if they had condylar neck or high subcondylar fractures and managed by open reduction and internal fixation using the modified Blair approach. We evaluated treatment outcomes and complications.

Data Collection

The medical records of patients were reviewed and data collected for sex, age, site and cause of fracture, degree of mouth opening, occlusion abnormalities, and perioperative complications. Maximal mouth opening was defined as the distance between the incisal edge of the upper and lower incisors at the midline when the patients open their mouths as wide as possible. The occlusal relationship was evaluated by any cross bite or open bite requiring a surgical correction. Patients were asked if they felt any disturbance compared with before the trauma. All patients were evaluated by orthopantomograms on the day after surgery, and they were asked to return to the clinic for radiologic follow-ups at 1 and 6 months postoperatively.

Facial nerve motor response was graded according to the House Brackman scale nerve grading system for facial nerve injuries.[7] The function of the facial nerve was tested on the first postoperative day and at regular check-ups at 1st and 6th months. If facial nerve palsy was encountered, the patients were asked to return a monthly checkup.

Also, patients' charts reviewed for wound infection, salivary fistula, facial nerve paralysis, the greater auricular nerve paraesthesia, Frey syndrome, and hematoma.

Surgical Technique

Before the operation all patients gave written informed consent. All surgeries were performed with the patients under general anesthesia with nasal intubation. The modified Blair incision was made in the preauricular skin crease beginning anterior and superior to the tragus and carried down to the earlobe. It was extended posteriorly to the postauricular area and then again extends inferiorly to a naturally occurring horizontal crease in the neck (Fig. 1A). The skin flap is elevated anteriorly in the superficial fascial layer. The posterior border of the parotid gland was separated from the cartilaginous ear canal and the anterior border of the sternocleido-mastoid muscle. Basic anatomic landmarks were identified before identification of the facial nerve including the posterior belly of the digastric and the external auditory canal. The main trunk of the facial nerve was identified just inferior to the "pointer" process of the external auditory canal between the mastoid tip and the external auditory meatus (Fig. 1B). When the facial nerve has been identified, dissection is carried out along the branches of the facial nerve. By further blunt and sharp dissection through the deep lobe of the parotid gland, the periosteum of the mandible was exposed. Following localization and reduction of the fracture, fixation by a single 2.0 titanium plate and screws was performed in all cases (single-plate technique; Fig. 1C). The wound was closed in layers and a suction drain left in the surgical field.

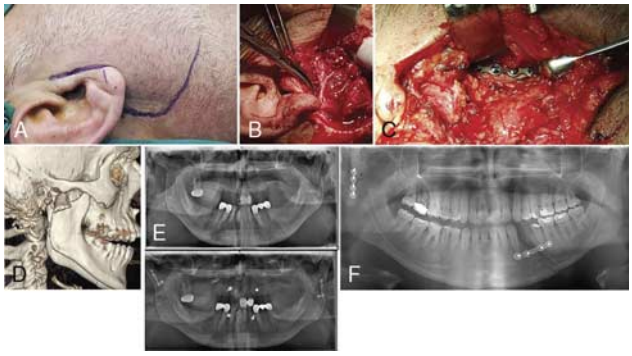

FIGURE 1. A, Intraoperative picture showing the modified Blair incision. B, Intraoperative picture showing the main trunk and branches of the facial nerve. C, Intraoperative picture showing rigid fixation of the fracture of the right mandibular condyle with 2 mm miniplate. D, Preoperative three-dimensional computed tomography image of the fracture of the right mandibular condyle. E, Preoperative and postoperative orthopantomography images of a bilateral fracture case. F, Postoperative orthopantomography image showing reduction of the fracture of right mandibular condyle.

RESULTS

Patient Characteristics

A total of 18 patients with 20 condylar fractures were identified (Fig. 1D). There were 15 (83.3%) male and 3 (16.6%) female patients. The mean age at the time of surgery was 31.2 years (range 15–81 years). Sixteen patients had unilateral condylar fractures, and 2 patients had bilateral condylar fractures (Fig. 1E). The causes of the fractures were: car and motorbike accidents in 11 patients, personal violence in 3 patients, falls in 3 patients, and a sports accident in 1 patient. In all cases, a displacement was found, including lateral displacement in 13 cases and medial displacement in 7 cases. Patient demographics and clinical data are as shown in Supplementary Digital Content, Table 1, http://links.lww.com/SCS/D887.

Treatment Characteristics

In all patients, fractures were treated by open reduction and internal fixation using the modified Blair approach. A

satisfactory alignment of fracture ends was achieved and demonstrated after the surgery by orthopantomography in all patients (Fig. 1F). No maxillomandibular fixation was performed in any of the patients. All patients were able to use their mouths from the first day after the surgery. One patient (5.6%) had postoperative occlusal interference due to premature dental contact, in the remaining 17 patients (94.6%) occlusion was normal. The mean unassisted interincisal opening was measured as 37.6 mm (range 33–41 mm).

Complications

Two patients (11.1%) experienced a postoperative complication. One patient (5.6%) developed a salivary fistula after the surgery. Spontaneous recovery of the fistula occurred in approximately 2 weeks with a pressure dressing. One patient (5.6%) had House-Brackmann grade 3 facial nerve palsy affecting the zygomatic branch. The patient had difficulty in closing his ipsilateral eye and it lasted for 3 weeks postoperatively. Displacement of fracture due to the material used for fixation, such as plates or screws, was not observed. Complications such as wound infection, hematoma, paraesthesia of the greater auricular nerve, and Frey syndrome were not seen in our patient group. The postoperative scar healed well and no subjective complaints were encountered from the patients.

DISCUSSION

This study presents an overview by analyzing patients with condylar fractures treated with open reduction and internal miniplate fixation using the modified Blair incision. It shows that this approach enables quick recovery and provides quite successful functional outcomes. Despite the intrinsic challenges of the surgical field because of its complex anatomy, open reduction and internal fixation by the modified Blair approach has proved to be a safe undertaking.

In recent years, clear evidence exists in the literature that open reduction and internal fixation improve functional outcome in displaced fractures of the mandible condyle.[4,8,9] However, there is a considerable fear among physicians of damaging the facial nerve during this surgical management. In addition to limited access, aggressive retraction of the soft tissues to reach the fracture ends makes the nerve at risk for injury during the surgery.[5,10 12] In the literature, a variety of surgical approaches have been described with the aim of having adequate access to the fracture site while avoiding trauma to the facial nerve. The preauricular approach is generally preferred to high condylar neck fractures and submandibular and retromandibular approaches to low condylar fractures.[2,5] Despite this, transient facial nerve palsy of 4 to 8 weeks has been reported in the literature, ranging between 0% and 46.1%, after open reduction and internal fixation of mandibular condylar fractures.[12,13] The incidence rate of facial nerve palsy has been reported with a range from 3.2% to 42.9% and 5.3% to 18.75% after preauricular and submandibular approaches respectively.[14] Ellis et al[10] observed a temporary facial nerve weakness in 17.2% of 93 patients who were treated by using retromandibular access route. Ebenezer and Ramalingam,[15] in 20 patients, compared commonly used preauricular, submandibular, retromandibular transparotid, and retromandibular transmasseteric techniques for the open reduction and internal fixation of isolated subcondylar fractures based on the rate of complications and could not find the superiority of any approach over the others. They reported facial nerve palsy in 7 cases, of which, 3 in the preauricular, 2 in the submandibular, and 2 in the retromandibular transparotid groups respectively. The authors noted that retromandibular approaches provide a more direct visual field both for the fracture site and the facial nerve. Croce et al[12] performed transparotid approach with partial parotidectomy in 13 patients (bilateral in 5 cases) with the condylar neck and subcondylar fractures. They reported transient facial nerve palsy in 6 cases (bilateral in 1 case) (46.1%) postoperatively. Although the authors attribute the high rate of facial nerve injury in their patient series to the aggressiveness of the surgery, this rate is higher than the rates of facial nerve weakness encountered in standard parotid surgery.[16] The incision used in that study was an incomplete form of modified Blair incision which began with a preauricular incision but did not extend to a skin crease in the neck.

This may have limited the surgical maneuverability during surgery and put the nerve at risk for injury.

Over the last few years, new minimally invasive surgical techniques have been described for the treatment of displaced condylar fractures with the aim of overcoming limitations and complications of the above mentioned conventional open surgical approaches.[17,18] Cortese et al[18] described a novel minimally invasive transoral technique that involves distraction and reduction of fracture fragments with a periosteal elevator, molar occlusal splint, and intermaxillary fixation. The authors stated that their approach avoids the risk of facial nerve injury and can be combined with a preauricular skin incision to improve surgical exposure during the operation in case of instability of the condylar fragment.

Another promising development to improve the outcomes of conventional open surgical techniques has been the use of biomechanical analysis (finite element method) for testing the efficacy of fixation methods. Having a high resolution computerized tomography, 3 dimensional (3D) geometry of fixation materials and 3D reconstruction of the patient's specific anatomy of the fracture site, it is theoretically possible to analyze the stress and displacement of bones, screws, and plates after fracture fixation. This allows physicians to optimize the position of fixation materials, which improves the predictability of surgical treatment.[19] To determine the correct length and positioning of the long screw, Zhang et al[20] applied digital technology for virtual surgery in a patient with condylar sagittal fracture and designed a 3D-printed surgical guide. Postoperative computerized tomography scans of the patient demonstrated that their digital technique provided an accurate positioning of the long screw and was completely consistent with the preoperative design scheme. Zhou et al[21] compared 2D and 3D fixation methods through finite element analysis for the treatment of mandibular symphyseal fracture combined with bilateral condylar intracapsular fractures in a digitally created model of the mandible of a 25 year old male patient. Although both fixation methods were found to provide the basic conditions for fracture healing, the von Mises stress on the screws and mandible displacement were found to be significantly higher in 2D fixation than that in 3D fixation. The authors stated that these findings may indicate the superiority of the 3D fixation method in preventing the fixation materials from loosening and fracture as well as in maintaining the stability of fracture segments.

In our patient group, we used the modified Blair incision which gave us the opportunity to work in a wide surgical field by providing perfect exposure to the entire parotid gland as well as the ramus and the temporomandibular joint. This approach also facilitated identification of the facial nerve and its branches which helped us to retract them with less tension while reducing fracture segments and permitted excellent perpendicular placement of plates and screws.[6] In our series postoperative temporary facial weakness occurred only in 1 (5%) patient who had a fracture with medial displacement. Possibly, forceful maneuvers

during repositioning of the fracture ends cause stretch trauma to the nerve, leading to paresis.

Besides its significant advantages, the modified Blair approach has several disadvantages.[22] Identification of the facial nerve and its branches by this approach requires experience and increases the time of surgery. However, identifying and separating the individual branches of the nerve reduces the probability of paresthesia when performed under direct visual supervision. In recent years, with the increasing use of facial nerve monitoring, the modified Blair approach is safe and reliable, and it can allow safe exposure for open reduction and internal fixation of condylar fractures.[23] Another disadvantage of this approach is that the incision used in this technique is longer than that used in other approaches. However, the periauricular scar is very well camouflaged and can be invisible with a carefully designed incision in a skin crease.[6,22]

Other complications that were noted in our series include postoperative occlusion interference due to premature dental contact which did not require surgical correction in 1 patient (5.5%). This failure rate is in agreement with other series in the literature.[11,24] The grinding of the teeth was performed gradually on consecutive visits over 2 to 3 weeks. The remaining 17 patients (94.5%) had normal occlusion postoperatively. Also, a salivary fistula occured in 1 patient (5.5%) which closed spontaneously after 1 week with a pressure dressing. Penetrating injury of the ductal or glandular parenchyma either by blunt dissection of the salivary tissue or placement of suction drains may have caused a fistula in the postoperative period. In most cases, fistula closure occurs spontaneously and suppression of salivary secretion by pressure dressings contributes healing process and is enough for treatment.[25]

Our study was subject to several limitations. Inherent difficulties of retrospective data collection and bias in selection of cases must be considered. Also, our study contains a few patients and lacks a comparison with other methods. These limitations should be recognized when assessing the generalizability of our results. However, this report presents a detailed explanation of the modified Blair approach which may provide an alternative reliable procedure for maxillofacial surgeons. To evaluate its superiority over other methods, randomized control studies are necessary.

In conclusion, the results of this study showed that the modified Blair approach provides satisfactory clinical outcomes with low complication rates. The main advantage of this approach is that it gives the opportunity to work in a wide surgical field which may facilitate the reduction of fracture ends, the placement of fixation materials and the secure of the facial nerve and its branches. Therefore, the modified Blair approach can be considered an alternative, safe, and effective method for physicians in the management of mandibular condyle fractures. The application of digital techniques in preoperative treatment planning as well as the routine use of facial nerve monitoring during the operation may be helpful in the future to improve the predictability and clinical outcome of this surgical approach.

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