ÖZGÜN ARAŞTIRMA ORIGINAL RESEARCH

Med J SDU / SDÜ Tıp Fak Derg ▶ 2023:30(3):544-550 doi: 10.17343/sdutfd.1349794

THE RELATIONSHIP BETWEEN THE TREATMENT APPROACHES AND COMPLICATIONS IN MANDIBULAR SUBCONDYLAR FRACTURES

MANDİBULAR SUBKONDİLER KIRIKLARDA TEDAVİ YAKLAŞIMLARI İLE KOMPLİKASYONLAR ARASINDAKİ İLİŞKİ

Mehmet TAPAN[1], Hasan Murat ERGANİ[2]

[1] Akdeniz University, Faculty of Medicine, Department of Plastic, Reconstructive and Aesthetic Surgery, Antalya, TÜRKİYE

[2] Health Science University, Ankara Bilkent City Hospital, Plastic, Reconstructive and Aesthetic Surgery, Ankara, TÜRKİYE

Cite this article as: Tapan M, Ergani HM. The Relationship Between the Treatment Approaches and Complications in Mandibular Subcondylar Fractures. Med J SDU 2023; 30(3): 544-550.

Öz

Amaç

Mandibula kondil kırıkları, mandibulada en sık görülen kırık türlerinden biri olmasına rağmen tedavisi tartışmalıdır. Bu çalışmanın amacı tedavi yönteminin güvenliğini belirlemek, postoperatif komplikasyonları azaltmak ve klinik deneyimimizi anlatmaktır.

Gereç ve Yöntem

Subkondiler mandibular kırığı olan 53 hasta dahil edildi. Hastalar kapalı redüksiyon (KR) veya açık redüksiyon ve internal fiksasyon (ARIF) ile tedavi edildi. Tüm hastalarda intermaksiller fiksasyon (IMF) için arch bar veya intermaksiller vidalar ve lastik kullanıldı. Ardından istatistiksel analiz yapıldı.

Bulgular

Çalışmaya toplam 37 erkek hasta ve 16 kadın hasta dahil edildi. Çalışmada mandibula kırıklarının en sık nedeni düşmelerdi (n=23; %43,3). Ameliyat sonrası komplikasyonlar arasında maloklüzyon, temporomandibular disfonksiyon (ağız açıklığının 30 mm'den az olması), fasiyal sinir nöropraksisi ve enfeksiyon yer alıyordu. Ameliyat sonrası maloklüzyon komplikasyonu açısından KR ve ARIF grupları arasında istatistiksel olarak anlamlı bir fark yoktu.Maloklüzyona sahip hastaların tamamında (n=8) eşlik eden kırıklar (n=23) mevcuttu. Ameliyat sonrası maloklüzyon komplikasyonu açısından alt gruplar (eşlik eden kırığı olan grup ve eşlik eden kırığı olmayan grup) arasında istatistiksel olarak anlamlı fark vardı. Ortalama 21 günlük bir süre de her zaman temporomandibular disfonksiyon ile ilişkilendirilmiştir

Sonuç

Bu çalışma, uygun tedavi seçiminin belirlenmesinde avantaj ve dezavantajları dengelemenin gerekliliğini ortaya koymuştur. ARIF'in birçok avantajı vardır; ancak ameliyat sonrası komplikasyonlar da eşlik edebilir. IMF'nin kullanım süresi fonksiyonel bozukluklara yol açabileceğinden hastaların tedavi kararında hekimlerle iş birliği yapması gerekmektedir.

Anahtar Kelimeler: İntermaksiller fiksasyon, Kapalı redüksiyon, Maloklüzyon, Mandibular subkondil kırığı

Sorumlu yazar ve iletişim adresi / Corresponding author and contact address: H.M.E. / dr.hasanmrt_06@hotmail.com
Müracaat tarihi/Application Date: 25.08.2023 • Kabul tarihi/Accepted Date: 05.09.2023
ORCID IDs of the authors: M.T: 0000-0002-9796-6375; H.M.E: 0000-0002-0305-7032

Abstract

Objective
Although mandibular condylar fractures represent one of the most frequent types of fractures in the mandible, their treatment remains controversial. This study aimed to determine the safety of treatment method, reduce postoperative complications, and describe our clinical experience.

Material and Method
Fifty-three patients with subcondylar mandibular fractures were included. The patients were treated with closed reduction (CR) or open reduction and internal fixation (ORIF). Arch bar or intermaxillary screws, and rubber were used for intermaxillary fixation (IMF) in all patients. Statistical analysis was subsequently performed.

Results
A total of 37 male patients and 16 female patients were included in this study. Falls were the most common cause of mandibular fractures in the study (n=23; 43.3%). Postoperative complications included malocclusion, temporomandibular dysfunction (mouth opening less than 30 mm), facial nerve neuropathy, and infection. There was no statistically significant difference between the CR and ORIF groups in the postoperative complication of malocclusion.All patients with malocclusion (n=8) had concomitant fractures (n=23). There was a statistically significant difference between the subgroups (group with concomitant fracture and group without concomitant fracture) in terms of postoperative malocclusion complications. A mean duration of 21 days was also always associated with temporomandibular dysfunction.

Conclusion
This study demonstrated the need for balancing the pros and cons in determining the proper treatment choice. ORIF has several advantages; however, it can be accompanied by postoperative complications. The duration of IMF can lead to functional disorders, and patients should cooperate with consultants in the treatment decision.

Keywords: Closed reduction, Intermaxillary fixation, Malocclusion, Mandibular subcondyl fracture

Introduction

Condylar fractures are among the most common fractures of the mandible and account for at least one-third of mandibular fractures (1). The subcondylar region is the most common site for condylar fracture in the mandible (2). Despite the high prevalence of these fractures, the management of subcondylar fractures remains a highly contentious topic in mandibular surgery (3).

The two basic treatment procedures for subcondylar fractures are closed reduction (CR) and open reduction and internal fixation (ORIF) (4). However, the controversy surrounding how to best treat subcondylar fractures persists, and which fractures should be treated surgically remains unclear (5). Anatomic reduction and early mobilization of the jaw after ORIF have recently been regarded as crucial for temporomandibular joint functional rehabilitation (6).

This study aimed to determine the safety of the treatment method, reduce postoperative complications, and describe our clinical experience.

Material and Method

Fifty-three patients with subcondylar mandibular fractures were included in the study. These patients underwent CR or ORIF.

The indication for our treatment approach in the ORIF group corresponded to the absolute indication in the Zide and Kent classification. The indications for treatment in the CR group included all other fracture types. The classification by Zide and Kent, who established relative and absolute indications for mandibular condylar fractures in 1983 (7), has gained worldwide acceptance. The absolute indications are as follows:

a) Displacement to the middle cranial fossa;b) Inability to achieve adequate closure by closed reduction; c) lateral extracapsular displacement; and d) penetration of a foreign body.

In the ORIF group, open reduction was performed using a hockey-stick incision or the Risdon approach (Figure 1). We performed the hockey-stick and Risdon incisions randomly for the absolute indications, except

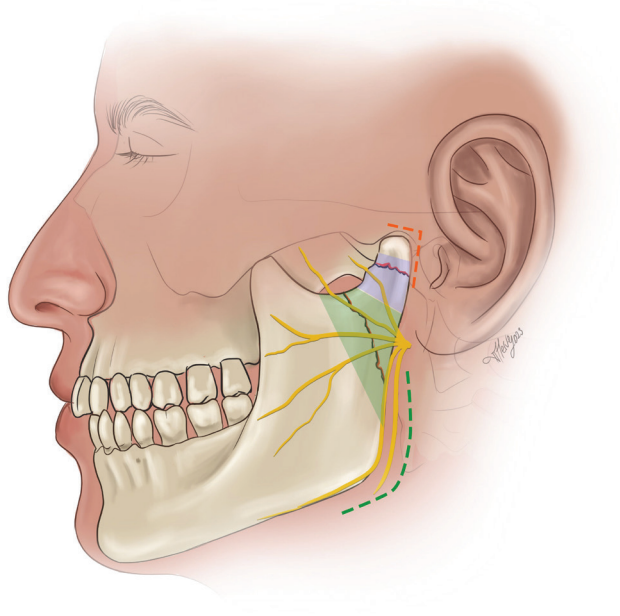

Figure 1
The subcondylar area of the mandible is depicted as the blue and green areas. In the ORIF group, we used two approaches. The Risdon approach is shown as the green dotted line, and the hockey-stick incision is shown as the orange dotted line. The dissection level is more important in Risdon approach. However, the incision length is more important in hockey-stick incision. The incisions have close relationship with the nerves. This should be kept in mind during traction intraoperatively and the traction should be interrupted from time to time. The facial nerve and its branches are depicted in yellow. If necessary, we used the trochars to guide for the screws.

in group a (displacement to the middle cranial fossa). In the absolute indication “a”, a hockey-stick incision was preferred due to access to the bone fragment.

In the ORIF group, internal fixation was performed using miniplates with screws or only screws. Rubber and arch bars or intermaxillary screws were used as intermaxillary fixation (IMF) to ensure proper occlusion in both the CR and ORIF groups. As a known maladaptive behavior of patients with mandibular fractures, some of these patients came late to the outpatient clinic for control. We investigated the outcomes related to the duration of IMF. Consistent with a known maladaptive behavior in patients with mandibular fractures, some patients delayed appointments to the outpatient clinic for control. We investigated outcomes related to the duration of the IMF. The follow-up period was at least three months. The following variables were examined: age, sex, cause of fracture, location of the mandibular fracture, presence of other fractures associated with subcondylar fracture, duration of intermaxillary fixation, and postoperative complications.

Results

A total of 37 male and 16 female patients with an average age of 32.9 years (range, 15-68 years) were enrolled in this study. The main cause of mandibular fractures was falls (n=23; 43.3%). Other causes of mandibular fractures included assault (n=16; 30.1%) and traffic accidents (n=14; 26.4%). Before surgery, all the patients signed a complete informed consent form. Each patient was informed about all possible complications. The patient characteristics are shown in Table 1.

The postoperative complications, including malocclusion, temporomandibular dysfunction (mouth opening less than 30 mm), facial nerve neuropraxia, and infection, are listed by treatment method as shown in Table 2. There was no statistically significant difference between the CR and ORIF groups regarding the postoperative complication of malocclusion (p=0.2335).

Based on the absolute indications of Zide and Kent, 10 patients were treated with the hockey- stick incision and nine patients with the Risdon approach. Neuropraxia of the temporal branch occurred in six patients when the hockey-stick approach was chosen. Neuropraxia of the marginal mandibular branch was noted in two patients when the Risdon approach was selected. There was no statistically significant difference between the subgroups (hockey-stick incision and Risdon approach) in facial nerve neuropraxia (p=0.4625). However, all the neuropraxic complications healed spontaneously in three months.

All patients with malocclusion (n=8) had concomitant fractures (n=23). There was a statistically significant difference between the subgroups (the group with concomitant fractures and the group without concomitant fractures) in the postoperative complication of malocclusion (p=0.0005). However, there was a statistically significant difference in the number of patients with concomitant fractures (n=23) in the CR (n = 11) and ORIF (n = 12) groups (p =0.0094). All the patients with temporomandibular dysfunction (n=3) had concomitant fractures (n=30).

There was no statistical difference between the subgroups (the group with concomitant fractures and the group without concomitant fractures) in the

Table 1 Characteristics of patients with closed reduction (CR) and open reduction internal fixation (ORIF)

Variables	CR	ORIF
Sample Size	34	19
Sex Male Female	 26 8	 11 8
Age (years)	32(15-68)	36(18-62)
Cause of Injury Fall Traffic accident Battery	 14 11 9	 9 3 7
Site of the mandible subcondylar injury Right Left -Both **Subcondylar fracture** With concomittant fracture Without concomittant fracture	 15 11 8 11 23	 8 9 2 12 7

Table 2 Postoperative complications of patients with closed reduction (CR) and open reduction internal fixation (ORIF)

Postoperative Complications	CR	ORIF
Malocclusion (including cross-bite, open-bite)	7(20,5%)	1(5,2%)
Temporomandibular dysfunction	3(8,8%)	0
Facial nerve neuropraxia Temporal branch Marginal mandibular branch	 0 0	 6(31,5%) 2(10,5%)
Infection	0	1(5,2"%)

postoperative complication of temporomandibular dysfunction (p=0.2489).

Regardless of the technique, IMF durations were also evaluated. Temporomandibular dysfunction was always observed in all patients (n=3) whose IMF duration exceeded 20 days and more. In 8 patients with malocclusion, the shortest IMF period was 9 days and the longest was 15 days. The duration of IMF in the patient groups is shown in Table 3.

Discussion

The decision to treat subcondylar fractures through closed or open is one of the most controversial issues in mandibular surgeries. Both conservative and surgical strategies have been developed (8). Closed treatment has been favored for nondisplaced condylar and isolated intracapsular fractures of the condylar head in which the condylar height is preserved (9-11). In recent years, ORIF has become more common

Table 3 Characteristics of patients related with the duration of intermaxillary fixation (IMF)

	Mean duration of IMF(days)
Treatment Method	
CR	14(10-21)
ORIF	10(9-17)
Fracture	
One-sided subcondylar fracture	14(10-21)
Bilateral subcondylar fracture	15(12-17)
Subcondylar fracture(s) and concomittant fracture	14(9-19)
Postoperative maloclussion	
Patients with open-bite	12(10-15)
Patients with cross-bite	10(9-12)
Patients with temporomandibular dysfunction	21(20-21)
Patients without malocclusion	14(10-19)

because of the introduction of plate-and-screw fixation devices that allow the stabilization of such injuries (3).

Intracapsular fractures are generally treated through closure because rigid fixation is difficult, and postoperative scarring in this area is problematic for temporomandibular joint movements (12). For extracapsular fractures, ORIF should be considered in patients with dislocated and deviated fractures, according to the MacLennan classification (13-15). The main indication for extracapsular fractures in patients with dislocation and displacement, which is not uncommon in subcondylar and concomitant fractures, is also controversial.

In this study, malocclusion was the most common postoperative complication, especially in the CR group. Approximately one-fifth of patients (n=7) in the CR group experienced complications with malocclusion. However, no statistically significant differences in malocclusion were observed between the CR and ORIF groups. This study explored the relationship between malocclusion and the IMF duration, on which there is no consensus. Romagnoli et al. showed that patients treated with the IMF for less than 15 days had better jaw function than patients treated with the IMF for more than 25 days (16). However, this is not always the case, because patients with mandibular fractures are usually young, male patients who are notorious for their lack of compliance (17). Because of this well-known situation, some of our patients were uncooperative as regards to their treatment and delayed their appointments too much to finish their IMF treatment, or they completed the IMF treatment by themselves,

which led to complications. The results of this study showed that regardless of the type of treatment and fracture type, patients with mandibular subcondylar fractures may have malocclusion problems when IMF is applied for a minimum of 9 and a maximum of 15 days. In contrast, a mean duration of 21 days was also always associated with temporomandibular dysfunction, including limited mouth opening. In patients without malocclusion or temporomandibular dysfunction, the mean duration of IMF was 14 days.

In the literature, the treatment of concurrent mandibular fractures through ORIF is recommended (4, 18). In this study, all the patients with malocclusion (n=8) had concurrent fractures. Seven patients were treated with CR, and one was treated with ORIF. Statistical analyses of the current study results showed that malocclusion was associated with concurrent fractures and CR.

Fractures in the subcondylar region are close to the parotid and facial nerves, and visualization of the surgical area is limited (19). Nam et al. emphasized that the Risdon approach is simple to perform and easy to learn (20), although the hockey-stick incision has the advantage of allowing the visualization of the surgical area in the subcondylar region. Neuropraxia of the marginal mandibular nerve is associated

with the Risdon approach, and neuropraxia of the temporal nerve is associated with the hockey-stick incision. In our experience, the main reason for this is intraoperative traction damage, and neuropraxia of the temporal nerve is a more likely complication than neuropraxia of the marginal mandibular nerve because of its location in the subcondylar region. However, in this study, there was no statistically significant difference between the ORIF subgroups (Risdon approach and hockey-stick incision) in terms of facial nerve neuropraxia.

According to a study about the relation between temporomandibular joint surgery and facial nerve branches, Jose et al. showed that surgeons should remain no closer than 1 cm from the anterior concavity of the external auditory meatus to avoid iatrogenic injury to the temporalis branch of the facial nerve. They also pointed out that the preauricular incision should be as short as possible and should not exceed the level of the earlobe. In the same anatomical study, they also suggested that a subplatysmal flap is safer above the inferior boundary of the jaw, but a subfascial flap is safer below it to prevent damage to the marginal mandibular nerve. They also concluded that the submandibular incision should be kept 2 cm below the mandibular boundary (21). This study recommends surgeons follow these rules when making incisions and dissection. In conclusion, this study showed that balancing the pros and cons is required when deciding on the correct treatment. ORIF has advantages; however, it may be accompanied by postoperative complications. The IMF duration may be a reason for the dysfunction, and patients should work together with their physicians to achieve the best results. The risk in concomitant fractures is malalignment, and the results of this study strongly recommend ORIF in these cases.

Acknowledgment
This study was conducted retrospectively with the patients treated in Ankara Numune Training and Research Hospital between January 2012 and February 2016. We would like to thank Ramazan Erkin Ünlü and Murat İğde for their scientific support.

Conflict of Interest Statement
The authors have no conflicts of interest to declare.

Ethical Approval
Ethical approval of the 2nd Clinical Investigations Ethics Committee of Ankara Bilkent City Hospital was taken (09/08/2023, E2-23-4865). The study was performed in accordance with the Declaration of Helsinki.

Consent to Participate and Publish
Written informed consent to participate and publish was obtained from all individual participants included in the study.

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Availability of Data and Materials
Data are available on request due to privacy or other restrictions.

Authors Contributions
MT: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Validation; Visualization; Writing-original draft.

HME: Conceptualization; Formal analysis; Investigation; Methodology; Project administration; Resources; Supervision; Validation; Writing-review & editing.

References

1. Ellis E III, Dean J. Rigid fixation of mandibular condyle fractures. Oral Surg Oral Med Oral Pathol 1993;76:6–15
2. Lindahl L. Condylar fractures of the mandible. I. Classification and relation to age, occlusion, and concomitant injuries of teeth and teeth-supporting structures, and fractures of the mandibular body. Int J Oral Surg 1977;6:12-21
3. Lee HC, Kang DH, Koo SH, et al. The outcome of open reduction via retromandibular approach for mandibular subcondyle fracture. J Korean Soc Plast Reconstr Surg 2005;32:739- 743
4. Kim SY, Ryu JY, Cho JY, et al. Outcomes of open versus closed treatment in the management of mandibular subcondylar fractures, J Korean Assoc Oral Maxillofac Surg 2014; 40(6):297-300
5. Zide MF, Kent JN. Indications for open reduction of mandibular condyle fractures. J Oral Maxillofac Surg 1983;41:89-98
6. Lee W, Kang DH. Study of the plating methods in the experimental model of mandibular subcondyle fracture. J Korean Cleft Palate-Craniofac Assoc 2011;12:12-16
7. Zide MF, Kent JN. Indications for open reduction of mandibular condyle fractures. J Oral Maxillofac Surg 1983;41:89–98
8. Sugamata A, Yoshizawa N, Jimbo Y. Open Reduction of Subcondylar Fractures Using a New Retractor, Plast Surg Int 2011;2011:421245
9. Rutges JP, Kruizinga EH, Rosenberg A, et al. Functional results after conservative treatment of fractures of the mandibular condyle. Br J Oral Maxillofac Surg 2007;45:30–34
10. Hlawitschka M, Loukota R, Eckelt U. Functional and radiological results of open and closed treatment of intracapsular (diacapitular) condylar fractures of the mandible. Int J Oral Maxillofac Surg 2005;34:597–604
11. Landes CA, Day K, Lipphardt R, et al. Prospective closed treatment of nondisplaced and nondislocated condylar neck and head fractures versus open reposition internal fixation of displaced and dislocated fractures. Oral Maxillofac Surg 2008;12:79–88
12. Ellis III E, McFadden D, Simon P, et al. Surgical complications with open treatment of mandibular condylar process fractures. J Oral Maxillofac Surg 2000;58:950–958

13. Manisali M, Amin M, Aghabeigi B, et al. Retromandibular approach to the mandibular condyle: a clinical and cadaveric study. Int J Oral Maxillofac Surg 2003;32:253–256
14. Narayanan V, Kannan R, Sreekumar K. Retromandibular approach for reduction and fixation of mandibular condylar fractures:a clinical experience. Int J Oral Maxillofac Surg 2009;38:835–839
15. Biglioli F, Colletti G. Transmasseter approach to condylar fractures by mini- retromandibular access. J Oral Maxillofac Surg 2009;67:2418–2424
16. Romagnoli R, Bernardi M, Tagliente F, et al. Effect of immobilization after treatment of mandibular fractures, Minerva Stomatol 1999;48:203-208
17. Larry H. Soft tissue and Skeletal Injuries of the Face. In:Harry Hollier JR, Kelley Patrick. Grabb, Smith Plastic Surgery (6th Ed.) Philadelphia, Lippincott Williams and Wilkins, 2007; 315-332.
18. Theologie-Lygidakis N, Chatzidimitriou K, Tzerbos F, et al. Nonsurgical management of condylar fractures in children: A 15-year clinical retrospective study. J Craniomaxillofac Surg 2016;44:85-93
19. Kempers K.G, Quinn PD, Silverstein K. Surgical approaches to mandibular condylar fractures: a review. J Craniomaxillofac Trauma 1999; 5:25–30
20. Nam SN, Lee JH, Kim JH. The application of the Risdon approach for mandibular condyle fractures. BMC Surg. 2013;13:25
21. Jose A, Yadav P, Roychoudhury A, et al. Study of Topographic Anatomy of Temporal and Marginal Mandibular Branches of the Facial Nerve in Relation to Temporomandibular Joint Surgery. J Oral Maxillofac Surg 2021; 79:343.e1-343.e11