Salient Visionary Publications

Management of Mandibular Angle Fractures: Investigating Outcomes of Transbuccal vs Traditional Approaches

Tate Naylor MD[1], Rachel Jones BS[2], Abdulla Memon BS[2], Jazzmyne Adams DrPH[2], Ryan Puccia MD[2*]

[1]Henry Ford Health Department of Otolaryngology

[2]Department of Otolaryngology, Medical College of Wisconsin, Milwaukee, WI, USA

Citation: Ryan Puccia. Management of Mandibular Angle Fractures: Investigating Outcomes of Transbuccal vs Traditional Approaches. Annal of Otol Head and Neck Surg. 2025;4(5):1-9.

Received Date: 14 November, 2025; **Accepted Date:** 18 November, 2025; **Published Date:** 11 December, 2025

***Corresponding author:** Ryan Puccia, Department of Otolaryngology, Medical College of Wisconsin, Milwaukee, WI, USA

ABSTRACT

Mandibular angle fractures are of the most common facial fractures and present with a variety of complexities and management strategies. They also have one of the highest rates of complications given the watershed area of vascularity and differential forces on the mandible at this location. A retrospective analysis over ten years at a single institution was performed yielding 134 cases of mandibular angle fractures. These cases were evaluated for mechanism, complexity, concomitant injuries, approach, use of interdental fixation, and plating strategy. We found that the lowest rate of complications were seen with non-displaced fractures treated with maxillomandibular fixation and simple fractures treated with geometric plates. Higher rates of complications were seen with open approach, reconstruction plates, Champy plates, and gunshot induced fractures.

Keywords: Facial trauma; Mandible trauma; Facial fracture; Fracture management

INTRODUCTION

Mandibular fractures are one of the most common facial bone fractures that present due to diverse trauma mechanisms such as motor vehicle accidents (MVAs), falls, assault, and gunshot wounds [1]. Operative intervention is relatively common given the complex nature of these fractures, anatomy involved, and functional use of the mandible, which demands meticulous preoperative planning and the use of a variety of approaches [1]. The different mechanisms of trauma are associated with different patterns of mandibular fractures; notably, assaults and physical altercations are associated with a higher incidence of mandibular angle fractures (MAFs) given the common lateral blow to the mandible, whereas MVAs are more commonly associated with body, symphyseal, and parasymphyseal fractures due to a generally more anterior point of impact [2].

The posterior positioning, complex biomechanics, and vascular watershed of the mandibular angle often challenges the reconstructive surgeon in terms of approach and management of mandibular angle fractures. These difficulties give mandibular angle fractures the highest rate of complications among all the subsites of the mandible[3]. Initially in the 1970s, dual plates were used to generate rigid fixation at the superior and inferior border of the mandible for maximal stabilization[4]. However, Michelet FX et al. 1973 and Champy et al. 1978 both questioned this method and they postulated that rigid fixation was not required for fracture healing[5,6]. They proposed that MAFs are better treated with excellent reduction and stabilization with a strategically placed non-compression miniplate. This technique required plates to be placed along lines of osteosynthesis for optimal healing without the use of rigid plating, thus leading to the creation of the widely known Champy miniplate technique and lines of osteosynthesis. This method allowed for safe plate implantation without harming dentition roots given plate placement and fixation in monocortical fashion.4 Since the adoption of both rigid and non-rigid plating strategies are supported in the literature, a number of means of stabilization of MAFs has been described which include open reduction internal fixation (ORIF) with various hardware plating systems, closed reduction, and combination surgical approaches in conjunction with intraoperative and postoperative maxillomandibular fixation (MMF).[7]

The absence of comprehensive prospective clinical trials has contributed to a lack of standardization within the field of craniomaxillofacial trauma & reconstruction for the management of MAFs [8]. In the era of the broad surgical landscape moving towards minimally invasive approaches, techniques like the transbuccal (percutaneous) approach via the use of trocar systems have garnered attention for their potential to mitigate complications and enhance long-term outcomes [9]. Other methods include the transcervical approach or open approach, which requires a large incision and violation of the platysma for mandibular angle access but allows for excellent visualization and easier manipulation of the fracture segments. The intraoral approach prevents external scarring and maintains cosmesis while minimizing risk of injury to the marginal mandibular nerve, however is associated with higher rates of infection.9 Our study aims to gain clarity within the management of MAFs by examining complication rates associated with the various surgical approaches, as well as the efficacy of different plating and reconstructive methods.

METHODS

Our study conducted a single institution review under the OTO Clinomics Institutional Review Board (PRO 0045896) at the Medical College of Wisconsin. To identify patients for this study, we interrogated the clinical research data warehouse (CRDW) for all patients with a confirmed radiographic diagnosis of at least one MAF, between the years 2014 and 2024. A total of 295 adult patients were identified to have had reconstructive surgery coded as one or more of the following CPT codes: 21445, 21440, 21470, 21465, 21452, 21454, 21453, 21462, 21451, 21450, or 21461 by the Department of Otolaryngology in this 10-year timeframe. Patients experiencing other fractures along with MAF, namely: parasymphyseal, symphyseal, body, condylar/subcondylar were kept in for analysis. Exclusion criteria included patients with other associated mandibular fractures but no MAF and patients who did not undergo the planned procedure or abortion of the procedure intraoperatively for any reason. All imaging was independently reviewed to confirm presence of a MAF, as well as to categorize the complexity of the fracture. After implementation of the exclusion criteria and review of imaging to confirm diagnosis of a MAF, the final cohort of 134 patients was established.

A thorough chart review was performed and relevant demographic data as well as smoking status, alcohol use, BMI on day of surgery, and case length was collected. Each patient's initial imaging was analyzed and fracture complexity, comminution, as well as any other concomitant craniomaxillofacial injury requiring reconstruction was collected. Plating strategies were subdivided by size and plate characteristics: miniplate including champy, load bearing plate (2mm or greater), geometric or ladder plate, or no plate/maxillomandibular fixation only. We also evaluated the role of maxillomandibular fixation in our cohort. Patients were characterized as having had no use of MMF, MMF intraoperatively only, or MMF intraoperatively as well as post operatively. The surgical approach used for each patient was classified as either transoral including trochar cases, transcervical/open, or MMF alone. The patient's postoperative status was assessed for malocclusion, plate failure, infection, non-union, hardware failure, plate exposure, other complications, as well as the need for a revision procedure and if so, the type of revision procedure was also noted. The monitoring of the postoperative course and collection of complication data was not restricted to a specific length of follow up period. Patients who were lost to follow up or did not have post operative data were kept in the initial data set, under the assumption that those who presented with a complication would have returned for further care. Due to the overall small sample size and lack of statistical power, detailed statistical analysis was omitted.

RESULTS

A total of 134 patients were included, with 107 males and 27 females. In our cohort the most common mechanism for sustaining a mandibular angle fracture was assault with 77 (57.5%) cases. This was followed by motor vehicle accident 21 (15.7%), fall 14 (10.4%), other 12 (8.9%), and gunshot 10 (7.5%). The "Other" category included accidents secondary to work related incidents, horse kicks, following dental extraction, mastication injuries, and sports injuries. The complexity of fractures in our cohort was described as simple isolated angle 26 (19.4%), simple angle with other mandible fracture 59 (44.0%), comminuted 19 (14.2%), gunshot/other 9 (6.7%), and non-displaced 21 (15.7%). Other associated craniomaxillofacial traumatic injury was identified in 96 (71.6%) cases and in 38 (28.4) cases the trauma was limited to the mandible alone. The overall complication rate was 19.4% (26 cases), and in total 11.2% (15) required revision surgical procedures. Revision surgery was performed for non-union, hematoma/infection, plate failure, malocclusion, and hardware exposure. A total of 13 (9.7%) patients were lost to follow-up.

Maxillomandibular fixation was utilized in 121 (90.0%) cases and in 13 (10.0%) cases it was not used at all. In 54 (40.3%) cases it was used only intraoperatively and removed at the conclusion of the case. Of these cases where MMF was used intraoperatively alone there were 13 (24.1%) complications, and 7 (13.0%) of these complications required revision surgery. In 67 (50.0%) cases it was used intraoperatively as well as post operatively for functional therapy. Of these cases there were 12 (17.9%) complications and 6 (8.9%) required revision surgery. Lastly, in 13 (9.7%) cases it was not used at all, resulting in 1 (7.7%) complication and 0 (0.0%) revision surgeries (Table 1).

Table 1: Describes how MMF was utilized in the reduction of mandibular angle fractures regardless of method of stabilization, even if MMF was the sole means of stabilization.

Maxilliomandibular fixation	Not Used	Intraoperatively alone	Intraoperatively and post operatively
Cases	13	54	67
Complication Rate	7.7% (1)	24.1% (13)	17.9% (12)
Revision Rate	0.0% (0)	13.0% (7)	8.9% (6)

Approach was classified as observation alone, MMF alone, transoral/trochar, or transcervical/open. Observation alone was used in 2 cases, MMF alone in 33 cases, transoral/trochar in 74 cases, and transcervical/open in 25 cases.
Observation alone was used in 2 (1.5%) cases, and in 2 cases they were non-displaced. There were no complications or revision surgeries in this subset. No patients were lost to follow-up for observation alone.
MMF alone was used in 33 (24.6%) cases. The complexity in this subset was described as 8 simple angle + other, 2 comminuted, 5 GSW, 18 non-displaced. There were a total of 5 (15.2%) complications with 1 (3.0%) revision surgery. No patients were lost to follow-up with MMF alone, presumably for removal of hardware.
The transoral/trochar approach was used in 74 (55.2%) cases. The complexity in this subset was described as 25 simple angle, 39 simple angle + other, 8 comminuted, and 2 non-displaced. There were a total of 15 (20.3%) complications with 9 (12.2%) requiring revision surgery. A total of 11 patients were lost to follow-up.
The transcervical/open approach was used in 25 (18.7%) cases. The complexity in this subset was described as 1 simple angle, 12 simple angle + other, 8 comminuted, and 4 GSW. There were a total of 7 (28.0%) complications with 6 (24.0%) requiring revision surgery. A total of 2 patients were lost to follow-up (Table 2 and 3).

Table 2: Describes the complication and revision rates when cases were divided by the approach used, regardless of hardware choice and use of MMF.

Approach	Observation	MMF Alone	Intraoral/Trochar	Transcervical/Open
Cases	2	33	74	25
Complication Rate	0% (0)	15.2% (5)	20.3% (15)	28.0% (7)
Revision Rate	0% (0)	3.0% (1)	12.2% (9)	24.0% (6)

Table 3: Demonstrates the rates of fracture complexity for each approach used to treat mandibular angle fractures, regardless of plating technique or use of MMF.

Fracture Complexity	Non-Displaced	Simple	Simple+ Other	Comminuted	GSW
Observation	100.0% (2)	0% (0)	0% (0)	0% (0)	0% (0)
MMF alone	57.1% (20)	0% (0)	24.2% (8)	6.0% (2)	15.1% (5)
Transoral/Trochar	2.7% (2)	33.8% (25)	52.7% (39)	10.8% (8)	0% (0)
Transcervical/Open	0% (0)	4.0% (1)	48.0% (12)	36.0% (8)	16% (4)

Plating was subclassified as none/MMF alone, miniplate/champy, load bearing (greater than 2mm), or geometric plates. All plating modalities were near equally represented in this cohort with none/MMF alone in 33 cases, miniplates in 34 cases, geometric plates in 34 cases, and load bearing plates in 31 cases.
In 35 (26.1%) cases where was no plate used or MMF was used alone. There were 5 (14.3%) complications in this subset with 1 (2.9%) revision surgery and 0 lost to follow-up. Notably there were only 20 cases of non-displaced fractures in the subset, along with 8 simple angle + other, 5 GSW, and 2 comminuted cases.
In 34 (25.4) cases miniplates or champy plates were used. There were 8 (23.5) complications in this subset with 5 (14.7%) requiring revision surgery and 1 lost to follow-up. Fracture complexity was noted to be 14 simple angle, 14 simple angle + other, 5 communited, and 1 non-displaced.

In 31 (23.1) cases load bearing plates were used. There were 8 (25.8%) complications in this subset with 7(22.6%) requiring revision surgery and 1 lost to follow-up. Fracture complexity was noted to be 2 simple angle, 17 simple angle + other, 8 communited, and 4 GSW cases.

In 34 (25.4) cases geometric or ladder plates were used. There were 5 (14.7%) complications in this subset with 3 (8.8%) requiring revision surgery and 8 lost to follow-up. Fracture complexity was noted to be 10 simple angle, 20 simple angle + other, and 4 comminuted cases (Table 4 and 5).

Table 4: Describes the complication and revision rates when cases were divided by the plating strategy used, regardless of approach and use of MMF.

Plating	None/MMF	Miniplate/Champy	Load-Bearing	Geometric
Cases	35	34	31	34
Complication Rate	14.3% (5)	23.5% (8)	25.8% (8)	14.7% (5)
Revision Rate	2.9% (1)	14.7% (5)	22.6% (6)	8.8% (3)

Table 5: Demonstrates the rates of fracture complexity for each plating/stabilization strategy used to treat mandibular angle fractures, regardless of approach or use of MMF

Fracture Complexity	Non-Displaced	Simple	Simple+ Other	Comminuted	GSW
None/MMF	57.1% (20)	0% (0)	22.9% (8)	14.3% (5)	5.7% (2)
Miniplate/Champy	2.9% (1)	41.2% (14)	41.2% (14)	14.7% (5)	0% (0)
Load Bearing	0% (0)	6.5% (2)	54.8% (17)	25.8% (8)	12.9% (4)
Geometric	0% (0)	29.4% (10)	58.8% (20)	11.8% (4)	0% (0)

DISCUSSION

There were a number of different variables that were evaluated during our study for the management of MAFs including the use of maxillomandibular fixation, fracture complexity, approach to the fracture, and plating strategy. Due to the limited sample size, lack of statistical power, and wide variability in the patient presentations, formal statistical analysis was omitted. This was felt to be the most prudent choice to avoid making unsubstantiated statements about the different management strategies. However, we did feel there is enough data to highlight some of the trends noted in our study.

Concerning the use of maxillomandibular fixation, this technique was used in 90% of our cohort. The patients who did not have placement of MMF were predominantly treated with some form of plate and in only 2 cases were observed without intervention. These patients were almost all edentulous or lacked sufficient dentition for establishment of occlusion. There was only 1 complication in this subset, secondary to hardware exposure.

The complication rate and revision surgery rate for intraoperative MMF was higher in our cohort than for patients treated with intra- and post operative MMF (Table 1). Notably in the post-operative functional therapy category there were 6 patients that presented with concomitant subcondylar fractures that were presumably treated closed with maxillomandibular fixation. The lower rate complications in the post-operative MMF group may be explained by its ability to help guide occlusion following mandibular surgery. It is not unreasonable to suggest that, even in cases with excellent reduction and stabilization, the exposure of the angle and nature of the injury could lead to temporary malocclusion. This functional malocclusion may be masked by the use of post operative maxillomandibular fixation by providing occlusal guidance. Use of maxillomandibular fixation intraoperatively alone also likely decreases the margin for error in the reduction and fixation of the fracture. Should there be any instability of the fixation or inadequacy of the reduction it will be immediately challenged by early mobilization. Other studies have analyzed this and have found no statistical significance in the rate of complications between the use of MMF intraoperatively alone vs MMF with post operative functional therapy, such as the work by Kaplan et al. [15] This is in contrast to Certa et al who noted in a similar retrospective review that a short course of post operative maxillomandibular fixation decreased complications in all mandible fractures [16].

The complication and revision rate were lowest for none/MMF alone. Geometric plates appeared to outperform miniplates and load bearing constructs in our cohort (Table 4).

The low rates of complications seen in the none/MMF category could be attributed to this modality mostly being used in non-displaced cases, which represented 57.1% of this subset. Interestingly, it was used for other levels of complexity such as GSW, simple fractures, and comminuted cases. Again, the low rate of complications likely reflects minimal displacement of the fractures and their amenability to heal with dental stabilization alone. Avoiding dissection of the fractures also helps preserve periosteal blood supply and minimizes the chances of inoculation of the fracture with bacteria. While this modality performed well in our cohort we would not recommend its use for all fractures, especially in those with significant displacement

Miniplates or champy plate method was used predominantly for simple or simple other mandible fractures that represented 82.4% (28) of these cases. It was also employed in cases that were non-displaced and comminuted with less frequency. The relatively high rate of complication and revision surgery lends credence to the difficulties of this technique. Plates must be optimally positioned at the lines of osteosynthesis, the reduction must be sufficient for establishment of a load sharing system, and overdissection of the periosteum can lead to vascular compromise and ultimately infection.

Load bearing constructs presented with a similar rate of complications to mini-plates but a higher rate of revision surgery. In general, this modality was employed for higher complexity, with 39.0% of the cases representing GSW or comminuted fractures. The similar rate of complication but higher rate of revision surgery reflects the nature of the cases this strategy is chosen for. Increased comminution, ballistic fragments, and soft tissue injuries associated with high impact trauma can increase the risk of complication despite the plating strategy chosen. Load bearing plates in this cohort were also commonly locking plates. Despite these plates providing excellent rigid fixation, if there are any inadequacies in the reduction a dead space develops increases the risk for non-union and/or infection. It also must be considered that the use of a load bearing plate requires significantly more exposure. This is not only necessary to accommodate the larger plate, but also to reduce displaced or comminuted fracture segments. Providing wide exposure via intraoral or transcervical approach leads to significant periosteal elevation and potential devascularization of an already tenuously supplied region of the mandible. These factors could represent why there is a similar amount of complications, but higher rates of revision.

Geometric plates performed superiorly to miniplates and load bearing plates with lower compication and revision surgery rates. The level of complexity these plates were used for were predominantly simple fractures (Table 5), but was also employed in some comminuted cases. The geometric cohort was similar in level of complexity to the miniplate category but ultimately appeared to perform better. This suggests that this plating strategy is likely superior to the miniplate/champy technique. This plate is commonly utilized through a transoral approach with a trochar for orthogonal placement of screws. While the approach is wider than the champy approach it may allow for better visualization of the fracture and reduction of the segments. The cross stabilized nature of the geometric plate also resists torsional forces and provides significantly more rigidity to simple plates of similar size [17]. The geometric plate is also designed to be implemented in between the inferior border and the superior ridge. This location is much easier to visualize and access allowing for more consistent stabilization of the fracture segments [17]. In a metaanalysis, Wusiman et al. evaluated eleven studies that demonstrated decreased instances of hardware failure and malunion in patients with ladder plates compared to standard miniplates [13]. Similarly, Al-Morasissi et al. analyzed six studies that also exhibited decreased instances of hardware failure, favoring the use of ladder plates [14]. Neither study demonstrated a significant difference between the plate types in regards to other complications such as infection, malocclusion, nonunion, wound dehiscence, or paresthesia.

In our cohort, the observational and maxillomandibular fixation approaches performed best, followed by the Transoral and Open approaches (Table 2). This seems to be a reflection of the complexity the less invasive approaches are used for. The majority of cases treated with observation or maxillomandibular fixation alone were non-displaced (Table 3). It should be noted that MMF alone was successfully employed to treat cases that were displaced, comminuted, and even for GSW's. These cases, however, represent the minority for the less invasive approaches. Transoral and transcervical performed similarly, with a tendency for higher complications in the transcervical cohort. Patients undergoing the transcervical approach were more likely to present with comminuted fractures and GSW related injuries. The high energy involved in these fractures brings an increase in complications from soft tissue deficits, increasing the difficulty of reduction, increasing the amount of exposure, and introduction of foreign materials into the wound. The transoral approach demonstrated a higher rate of complications and revisions than one would expect for being used in mostly simple fracture patterns. Other groups have demonstrated that transoral plates have a tendency to be placed in an unideal location at the superior border of the mandible and thus are more prone to breaking at this location [10]. In comparing transcervical and transoral approaches, a retrospective cohort study by Chen et al. found that there is no statistically significant difference in the rate of complications between the two [11]. However, this study only included noncomminuted, bicortical, and unilateral single angle fractures. A possible limitation of our study is that we did not differentiate between the transoral and trocar approaches. The trocar approach was adopted to avoid some of the complications associated with the transoral approach. This approach uses both a transoral incision and a small external incision to allow a trocar for instruments to be passed through. The transbuccal approach offers greater soft tissue coverage and decreased chance of plate breaking due to less need for manipulation. Khandeparker et al. found the transbuccal approach to be superior to the transoral with fewer postoperative complications [12].

Our study is limited by retrospective design and modest sample size. Additionally, our study only included those patients treated by the Otolaryngology - Head & Neck Surgery service and did not include cases handled by Plastic and Reconstructive Surgery or Oral and Maxillofacial Surgery. Facial trauma call is largely split between the three in most institutions given availability of the respective services, and different training styles could shed light on more variation in the surgical approaches and methods used, not captured by this study.

CONCLUSION

Mandibular angle fractures have been shown to be one of the most common craniomaxillofacial injuries and are proposed to be the most common of fracture patterns seen in the mandible. Over time there have been several methods developed to manage, approach, and stabilize these fractures. Our study and review of the literature suggests a few trends in management of these fractures. First, that the non-displaced and minimally displaced fractures may be best treated with observation or maxillomandibular fixation alone. Simple fractures appear perform best with a transoral or trochar approach and employment of a geometric plate. Lastly, load-bearing hardware and the transcervical approach tend to be used in comminuted and ballistic trauma cases and thus present higher rates of complications and need for revision surgery. That is not to say that miniplates, load-bearing plates, and open approaches should be avoided. Every maxillofacial trauma case is unique and there will always be indications for these techniques. Finally, it is of upmost importance that the craniomaxillofacial trauma surgeon be well versed in several approaches and stabilization techniques in order to offer the best and most complete care.

REFERENCES

1. Lee JH. Treatment of Mandibular Angle Fractures. Arch Craniofac Surg. 2017;18(2):73-75.
2. Pickrell B, Serebrakian A, Maricevich R. Mandible Fractures. Semin Plastic Surg. 2017;31(02):100-107.
3. Karagah A, Tabrizi R, Pourahmadali F, Alizadeh A, Tofangchiha M, Patini R. Correlation of radiomorphometric indices of the mandible and mandibular angle fractures. Heliyon. 2022;8(9):e10549.
4. Chatterjee A, Gunashekhar S, Karthic R, Karthika S, Edsor E, Nair RU. Comparison of Single Versus Two Non-Compression Miniplates in the Management of Unfavourable Angle Fracture of the Mandible Orginal Research. J Pharm Bioallied Sci. 2023;15(Suppl 1):S486-S489.
5. Michelet FX, Deymes J, Dessus B. Osteosynthesis with miniaturized screwed plates in maxillo-facial surgery. J Maxillofac Surg. 1973;1(2):79-84.
6. Champy M, Loddé JP, Schmitt R, Jaeger JH, Muster D. Mandibular osteosynthesis by miniature screwed plates via a buccal approach. J Maxillofac Surg. 1978;6(1):14-21.
7. Ellis E, Walker L. Treatment of mandibular angle fractures using two noncompression miniplates. J Oral Maxillofac Surg. 1994;52(10):1032-1036.
8. Perez R, Oeltjen JC, Thaller SR. A Review of Mandibular Angle Fractures. Craniomaxillofac Trauma Reconstr. 2011;4(2):69-72.
9. Kritika Sehrawat, Bhavna Malik, H V Vallabha, Amrutham Bhavya Vaishnavi, Siva Kumar Pendyala, Mohammed Ibrahim, et al. A comparative evaluation of transbuccal versus transoral approach for the

management of mandibular angle fractures: A prospective, clinical, and radiographic study. J Pharm Bioall Sci. 2021;13(6):1295.

10. Wan K, Williamson RA, Gebauer D, Hird K. Open Reduction and Internal Fixation of Mandibular Angle Fractures: Does the Transbuccal Technique Produce Fewer Complications After Treatment Than the Transoral Technique? J Oral Maxillofac Surg. 2012;70(11):2620-2628.
11. Chen CL, Zenga J, Patel R, Branham G. Complications and Reoperations in Mandibular Angle Fractures. JAMA Facial Plast Surg. 2018;20(3):238-243.
12. Khandeparker PVS, Dhupar V, Khandeparker RVS, Jain H, Savant K, Berwal V. Transbuccal versus transoral approach for management of mandibular angle fractures: a prospective, clinical and radiographic study. J Korean Assoc Oral Maxillofac Surg. 2016;42(3):144.
13. Wusiman P, Nie B, Li WD, Moming A. Management of mandibular angle fractures using 3- dimensional or standard miniplates: A systematic review and meta-analysis. J Craniomaxillofac Surg. 2019;47(4):622-628.
14. Al-Moraissi EÀ, El-Sharkawy TM, El-Ghareeb TI, Chrcanovic BR. Three-dimensional versus standard miniplate fixation in the management of mandibular angle fractures: a systematic review and meta-analysis. Int J Oral Maxillofac Surg. 2014;43(6):708-716.
15. Kaplan BA, Hoard MA, Park SS. Immediate mobilization following fixation of mandible fractures: a prospective, randomized study. Laryngoscope. 2001;111(9):1520-4.
16. Certa M, Chapple AG, Khalifa A, Christensen BJ. Does a Short Period of Maxillomandibular Fixation Decrease Complications in Open Reduction Internal Fixation of Mandibular Angle Fractures? J Oral Maxillofac Surg. 2023;81(4):406-412.
17. Hochuli-Vieira E, Ha TK, Pereira-Filho VA, Landes CA. Use of rectangular grid miniplates for fracture fixation at the mandibular angle. J Oral Maxillofac Surg. 2011;69(5):1436-41.