

Postoperative Complications after Surgical Management of Mandibular Angle Fracture

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ABSTRACT:

Introduction: Mandibular angle fractures represent a high percentage and an important clinical challenge because of their treatment pattern and the highest postsurgical complication rate among all mandibular fractures. **Materials and methods:** The objectives of this cross-sectional observational study were to observe the postoperative complications after surgical management of a mandibular angle fracture and to facilitate early detection of complications and reduction of patients' morbidity. This study was carried out among forty patients with mandibular angle fractures who were managed by open reduction and internal fixation by miniplate osteosynthesis. All the study patients were evaluated clinically pre- and postoperatively for various parameters at the 1st week, 2nd week, 1st month, and 4th month. Radiographs (OPG, PA skull, lateral skull, and CT scan of the oral and maxillofacial region) were taken pre- and postoperatively to assess complications. The infection was detected by culture and sensitivity test. Nerve injury was evaluated by the "tactile test", the brush directional stroke test by using a '00' camel hair brush, and the pinprick test performed by using a sterile 27-gauge syringe needle. Occlusion and chewing were evaluated postoperatively according to the Treatment Scoring System developed by V. Uglesic in 1993. The data was analyzed using SPSS version 20 statistical software. **Results:** In this study, most of the patients (85%) were male, and the mean age was 24.5 years. In the fracture line, the third molar was present in 55% of cases. The most common complication of this study is postoperative nerve injury, which occurs in 30% of cases. Infection in 10% of cases, malocclusion in 7.5% of cases. Slight restricted mouth opening in 5% cases. Other complications such as malunion,, delayed union, and non-union were absent. **Conclusion:** The most common complication after surgery is nerve injury, followed by infection and malocclusion. A careful preoperative assessment, early surgical intervention, meticulous surgical technique, postoperative care, and appropriate rehabilitation are the main concerns to prevent neurological and other complications.

KEYWORDS:

Mandibular fracture, surgical management, nerve injury, infection

INTRODUCTION:

Maxillofacial injuries occur quite commonly following trauma. In facial skeleton mandibular fractures are one of the most common fracture. The pattern of mandibular fractures varies with geographic location, physical activity, social, cultural and environmental factors.¹ According to Molla et al.² the incidence of mandible fracture in Bangladesh on the basis of anatomic distribution were symphysis-25.3%, body- 30.2%, and angle-18.5%. In India the distribution was in parasymphysis-23.25%, body-12.74% and angle-17.44%³ and in Pakistan it was parasymphysis-27.4%, body-22.2% and angle-23.3%.⁴

In third world countries, road traffic accident is the leading cause of mandibular fracture while in developed countries interpersonal violence is the leading cause.⁵ The most common causes of mandibular fracture in Bangladesh: RTA-58.4%, fall-13.6%, work related-12.8%² whereas in India: RTA-48.83%, assault-26.74%, sports-13.95%³ and in Pakistan: RTA-42.6%, fall-28%, firearm injures-16.6% and assault-4.6%.^{4,5} Fractures in the mandible causes disfigurement and severe loss of function as it is the only movable bone of the facial

skeleton which plays an important role in mastication, speech and deglutition.⁶The angle of the mandible fracture is common for some reasons include the presence of third molars, a thinner cross-sectional area than the tooth-bearing region and biomechanically the angle, considered a lever area.⁷

Mandibular angle fracture treatment is important for the restoration of anatomical structure and function with re-establish the occlusion and facial esthetics. Fractures of the mandibular angle represent a high percentage and an important clinical challenge because their treatment has the highest post-surgical complication rate among all mandibular fractures.⁸

Many treatment options are suggested but the treatment of mandibular angle fracture is subject to many controversies. The treatment of mandibular angle fracture has undergone a gradual evaluation ranging from closed reduction to open reduction - transosseous wiring, lag screw and plate fixation.⁹ The closed reduction technique is unacceptable for many patients due to prolong restricted mouth opening, difficulty in maintaining oral hygiene and nutrition, social embarrassment and in case of children chances of ankylosis etc.¹⁰ Intraoral miniplate fixation has become possible to perform at any site, which does not need additional IMF due to their stability.¹¹

Ellis, E et al. in 1993 described the angle of mandible is more prone to complications among all the mandibular fractures which ranging from 0% to 32% depending upon the technique utilized.¹² Open reduction and internal fixation using a single miniplate, follows fewest complications. The major complication rates are higher in comminuted fractures (17%) than that in simple mandibular fractures (2.3%). In case of transoral and extra oral treatment approaches for the angle fracture the complication, rate were found similar. According to previous study similar osteo-synthesis failure rates were shown for one miniplate and two miniplates used to treat the mandibular fracture.¹³ To reduce post-operative complications the fracture part, need three-dimensional stability. This study observes the postoperative complications of surgically managed mandibular angle fractures. As mandibular angle fracture is treated by open or closed reduction either through intraoral or extra oral approach is always prone to have complications. This ranges from mild swelling to severe infection, delayed union to nonunion. The results of this study may facilitate early detection of postoperative complications and focus on its etiology and effective management. So that the complications can be reduced.

General objective: To observe the postoperative complications after surgical management of mandibular angle fracture and to facilitate early detection of complications and reduction of patients' morbidity.

MATERIALS AND METHODS:

This cross-sectional observational study was conducted in Oral and Maxillofacial Surgery Department, Dhaka Dental College

Hospital in the period between 01/02/2017 to 31/01/2018. This study was carried out among forty patients with mandibular angle fracture. The patients were managed by open reduction and internal fixation by miniplate osteosynthesis. A postoperative follow-up was given on regular interval to observe various complications. In this study the inclusion criteria of our patient were unilateral or bilateral mandibular angle fracture requiring open reduction with rigid internal fixation for treatment and age group between 15 – 50 years. Our exclusion criteria were patients with mandibular fractures other than angle, patients with pan facial fracture and comminution, patients with systemic disease contraindicated for general anesthesia. All the study patients were evaluated preoperatively and postoperatively for various parameters such as Infection, malunion, nonunion, delayed union, Malocclusion and Nerve injury. Postoperative clinical evaluation was done at 1st week, 2nd week, 1st month and 4th month respectively. Radiographs (OPG, PA skull, lateral skull and CT scan of oral and maxillofacial region) were taken pre and postoperatively to check complications. Infection was detected by culture and sensitivity test. Nerve injury was evaluated by tactile test: performed by using cotton wool. Brush directional stroke test by using a '00' camel hair brush and Pinprick test performed by using sterile 27-gauge syringe needle. Occlusion and Chewing postoperatively evaluated according to Treatment Scoring System developed by V. Uglesic in 1993. The data was analyzed using the SPSSV 20 statistical software.

RESULTS AND DISCUSSION:

Management of mandibular fractures should be guided by several principles such as, reduction of the fractures to its correct anatomical position, restoration of pre-morbid occlusion and rigid immobilization. These facilitate proper healing, early restoration of function, prevention of infection, malunion or nonunion of fracture.^{14,15} Mandibular angle fracture ranges from 23-42% of all mandibular fractures.^{16,17} For the biomechanics of the mandible these fractures show highest incidence of postsurgical complications.¹⁸

In this study the mean age of the patients was 24.5 years and age range were from 15 to 50 years. But more commonly affected age group was 15-30 years (50%). Various studies done on angle fracture had similar mean age.^{19,20,21} The sex distribution in our study was male (85%) and female (15%) ratio (5.6:1). The relatively high number of males to female is due to the fact that male is engaged more in outdoor activities than female. These finding is similar with results of previous studies.^{22,23} In (55%) cases 3rd molar was present in the line of fracture. Patients who developed infection all had a tooth in the fracture line. Several studies show similar result.^{18,31} In this study most of the patients (87%) were treated by double miniplate and single miniplate was used in 13% cases. Ellis E, 1999. showed that postoperative complications were higher

when patients were treated with two miniplate and it was less when single miniplate was used.⁷ In this study sample, 50% (n=20) mandibular fracture was having moderate displacement, 25% (n=10) were with severe displacement and 25% (n=10) were with minimal displacement. The severity of displacement in mandibular fracture signifies the unfavourability of the fracture and subsequently effects healing outcome. Juergen and Guimond reported 46% to 80% of their study subjects to have minimally displaced mandibular fracture.^{19,24}

Table 1: Preoperative observation of the patients

Variables	n	%
Age(years)		
15-30 years	20	50%
31-40 years	14	35%
41-50 years	6	15%
Total	40	100%
Sex		
Male	34	85%
Female	06	15%
Total	40	100%
Frequency of presence of 3rd molar in fracture line (n=40)		
Present	22	55%
Absent	18	45%
Total	40	100%
Type of fixation		
Single miniplate	5	12%
Double miniplate	35	88%
Total	40	100%
Degree of fracture displacement		
Minimal	10	25%
Moderate	20	50%
Severe	10	25%
Total	40	100%

In this study evaluation of postoperative complications were done at regular interval in 1st week, 2nd week, 1st month and 4th month. Out of 40, 36 patients had no experience of postoperative infection, only 4 cases (10%) developed infection in the form of swelling, pus discharge and wound dehiscence. Results in this study regarding post-operative infection are comparable with that of international data according to several researchers where Infection in miniplate use was 8%, 9%, and 7.5%.^{25,26,27} The results of our study also show similarity with the results of other studies on two-miniplate fixation of mandibular angle fracture that showed infection rate ranged from 2.9% to 28%.^{28,29}

The result of postoperative occlusion by patient and surgeon's evaluation at 1st week, out of 40, 37 patients had normal occlusion as before injury and 3 patients (7.5%) had postoperative occlusal discrepancy which was corrected by giving IMF for 10 days. In 1st month 1 patient (2.5%) had mild

occlusal discrepancy which was corrected by selective occlusal grinding. Studies on two-miniplate fixation system reported malocclusion ranged from 4% to 9.5%.^{12,30} In 4th month's follow up, no occlusal disharmony was detected in surgeons and patient's self-evaluation. Any reduction in mouth opening postoperatively was considered as trismus. In this study among 40 patients, most of our patients 38 (95%) mouth opening were between 30-40mm and only two patients

Table 2: Post-operative weekly evaluation of the patients (n=40)

Post-operative infection				
	1 st week	2 nd week	1 st month	4 th month
Present	10%	5%	0%	0%
Absent	90%	95%	100%	100%
Malocclusion (evaluated by surgeon) n=40				
	Pre-operative	1 st week	1 st month	4 th month
Present	100%	7.5%	2.5%	0%
Absent	0%	92.5%	97.5%	100%
Malocclusion (evaluated by the patient) n=40				
Present	100%	10%	5%	0%
Absent	0%	90%	95%	100%
Evaluation of occlusion by patient(n=40)				
Occlusion	1 st month after surgery		4 th month after	
Same as before injury	36(90%)		40(100%)	
Adequate on both sides but not the same as before injury	4(10%)		40(100%)	
Total	40		100%	

(5%) had slight restricted mouth opening that is 20-30mm. Our results of restricted mouth opening in miniplate osteosynthesis are comparable with the results of previous study.^{10,31} Post-operative mouth opening exercises (Wooden stick exercises) were advised to these patients. Malunion is a less common complication in case of miniplate osteosynthesis. Benjamin showed malunion was less in open reduction (5.13%) then in close reduction technique (8.33%).³² In our study none of our patients faced this complication. Delayed union was defined as excessive mobility of the fracture site three to four weeks post-treatment. None of our patients faced delayed union. Our findings regarding delayed union are similar to those of Renton.³³ Non-Union means the lack of osseous union between the fracture segments after the usual healing period. Radiograph shows rounding off and sclerosis of the bone ends called eburnation. Fortunately, none of our patients faced this complication. This finding is matching with that study of Abbas.³⁴ In this study postoperative nerve injury such as hypoesthesia or paresthesia was found at 1st week 30% cases, at 1st month 20% cases and 10% cases at 4th month. The results of our study are similar with the results of other researchers.^{35,36} They showed postoperative hypoesthesia rates around 30% cases. Recovery rates of the inferior alveolar nerve between 33% to 100%.^{37,38} In our study recovery rate at

4th month was 90%. Literature shows 12 months follow up is required for complete recovery.³⁹

Table 3: Post-operative weekly evaluation of the patients(n=40)

Evaluation	Malunion	Delayed union	Nonunion
Present	0%	0%	0%
Absent	100%	100%	100%
Nerve injury			
Evaluation	1 st week	1 st month	4 th month
Present	30%	20%	10%
Absent	70%	80%	90%
Mouth opening at 4th post-operative month			
Opening in mm	No of patients	percentage	
0-10 mm	0	0%	
10-20mm	0	0%	
20-30mm	2	5%	
30-40mm	38	95%	
Total	40	100%	

CONCLUSION:

Open reduction and internal fixation by miniplate osteosynthesis are a good option for displaced mandibular angle fracture. Nerve injury is one of the common postoperative complication along with infection and malocclusion. As the study sample were only 40 patients, studied within short period of time in a single hospital by several surgeons, so there were limitations for analysis. In order to overcome those limitations, a large sample size with longer duration is important and extensive clinical study is recommended including different treatment centers in Bangladesh and long-term follow-up for better evaluation of postoperative complications after surgical management of mandibular angle fracture.

A careful preoperative assessment, early surgical intervention, meticulous surgical technique, high quality postoperative care and appropriate rehabilitation are the main concern to prevent neurological and other complications.

ETHICAL CONSIDERATION:

The protocol was approved by the "Research Review Committee" of the Department of Oral and Maxillofacial Surgery of Dhaka Dental College and Hospital. Finally, ethical clearance was taken from the "Ethical Committee" of Dhaka Dental College Hospital. Patients, included in the study, were explained about the procedure and outcome of the research in details and written consent was obtained.

CONFLICT OF INTEREST:

The authors declares that there is no conflict of interest regarding the publication of this article.

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REFERENCES:

- Amin M, Babar A, Ibrahim MW, Awan MU. Postoperative complications in mandibular fracture management comparison of three different treatment modalities. Pakistan Armed Forces Medical Journal. 2016 Oct 31;66(5):720-25.
- Molla MR, Shaheed I, Bhuiyan RA, Shrestha P, Ahmed A. Prevalence of mandibular fracture in Bangladesh: an analysis with 125 cases. Journal of Bangladesh Dental Society. 1989;5:10-3.
- Malik s, singh g. Incidence, aetiology and pattern of mandible fractures in sonapat, haryana (India). International Journal of Medical Dentistry. 2014 Jan 1;18(1)
- Khan A, Salam A, Khagab U, Khan MT. Pattern of mandibular fractures: A study. Pakistan Oral and Dental Journal.2009:221-4.
- Sakr K, Farag IA, Zeitoun IM. Review of 509 mandibular fractures treated at the University Hospital, Alexandria, Egypt. British Journal of Oral and Maxillofacial Surgery. 2006;44(2):107-11 <https://doi.org/10.1016/j.bjoms.2005.03.014> PMID:15896887
- Subhashraj K, Nandakumar N, Ravindran C. Review of maxillofacial injuries in Chennai, India: A study of 2748 cases. British Journal of Oral and Maxillofacial Surgery. 2007;45(8):637-9. <https://doi.org/10.1016/j.bjoms.2007.03.012> PMID:17524534
- Ellis III E. Treatment methods for fractures of the mandibular angle. International journal of oral and maxillofacial surgery. 1999 Aug 1;28(4):243-52. [https://doi.org/10.1016/S0901-5027\(99\)80152-0](https://doi.org/10.1016/S0901-5027(99)80152-0) PMID:10416889
- Bukhari SN, Liaquat A, Warraich RA, Riaz N, Siddique K. Comparison of postoperative complications in mandibular angle fractures treated by single versus two miniplates. Pakistan Oral & Dental Journal. 2015 Mar 1;35(1),33-35.
- Mukerji R, Mukerji G, McGurk M. Mandibular fractures: Historical perspective. British Journal of Oral and Maxillofacial Surgery. 2006;44(3):222-8. <https://doi.org/10.1016/j.bjoms.2005.06.023> PMID:16112261
- Moreno JC, Fernández A, Ortiz JA, Montalvo JJ. Complication rates associated with different treatments for mandibular fractures. Journal of Oral and Maxillofacial Surgery. 2000;58(3):273-80. [https://doi.org/10.1016/S0278-2391\(00\)90051-X](https://doi.org/10.1016/S0278-2391(00)90051-X) PMID:10716108
- Uglešić V, Virag M, Aljinović N, Macan D. Evaluation of Mandibular Fracture treatment. Journal of Cranio-Maxillofacial Surgery. 1993;21(6):251-7. [https://doi.org/10.1016/S1010-5182\(05\)80042-3](https://doi.org/10.1016/S1010-5182(05)80042-3) PMID:8227374
- ELLIS 3rd E. 1993. Treatment of mandibular angle fractures using the AO reconstruction plate. J Oral Maxillofac Surg, 51(3), 250-4. [https://doi.org/10.1016/S0278-2391\(10\)80166-1](https://doi.org/10.1016/S0278-2391(10)80166-1) PMID:8445465
- Shah A, Qureshi ZU. Post management complications of fracture mandible at the angle-an analysis. Pakistan Oral & Dental Journal. 2011 Dec 1;31(2).
- Champy M, Loddé JP, Schmitt R, Jaeger JH, Muster D. Mandibular osteosynthesis by miniature screwed plates via a buccal approach. Journal of Maxillofacial Surgery. 1978;6:14-21. [https://doi.org/10.1016/S0301-0503\(78\)80062-9](https://doi.org/10.1016/S0301-0503(78)80062-9) PMID:274501
- Tu HK, Tenhulzen D. Compression osteosynthesis of mandibular fractures: a retrospective study. Journal of oral and maxillofacial surgery. 1985 Aug 1;43(8):585-9. [https://doi.org/10.1016/0278-2391\(85\)90125-9](https://doi.org/10.1016/0278-2391(85)90125-9) PMID:3859607

Website: <https://www.banglajol.info/index.php/UpDCJ>

16. Pape HD, Herzog M, Gerlach KL. Der Wandel der Unterkieferfrakturversorgung von 1950-1980 am Beispiel der Kölner Klinik. *Dtsch Zahnärztl Z.* 1983;38:301
17. Wald Jr RM, Abemayor E, Zemplyeni J, Mannai C, Lesavoy MA. The transoral treatment of mandibular fractures using noncompression miniplates: a prospective study. *Annals of plastic surgery.* 1988 May 1;20(5):409-13
<https://doi.org/10.1097/0000637-198805000-00002>
PMid:3377417
18. Lizuka T, Lindqvist C, Hallikainen D, Pauku P. Infection after rigid internal fixation of mandibular fractures a clinical and radiological study. *J Oral Maxillofac Surg.* 1991;49(6):585-93.
[https://doi.org/10.1016/0278-2391\(91\)90340-R](https://doi.org/10.1016/0278-2391(91)90340-R)
PMid:2037914
19. Guimond C, Johnson JV, Marchena JM. Fixation of mandibular angle fractures with a 2.0-mm 3-dimensional curved angle strut plate. *Journal of oral and maxillofacial surgery.* 2005 Feb 1;63(2):209-14
<https://doi.org/10.1016/j.joms.2004.03.018>
PMid:15690289
20. Hussain SS, Ahmad M, Khan MI, Anwar M, Amin M, Ajmal S, Tariq F, Ahmad N, Iqbal T, Malik SA. Maxillofacial trauma: current practice in management at Pakistan Institute of Medical Sciences. *Journal of Ayub Medical College Abbottabad.* 2003;15(2).
21. Cheema SA, Cheema SS. An analysis of etiologies, patterns and treatment modalities of fracture mandible. *Annals of King Edward Medical University.* 2004;10(4).
22. Shuja Riaz A, Umar K, Zahur Q, Asmatullah K. Retrospective analysis of 268 cases of fractures of mandible. *Pakistan Oral & Dental Journal,* 24, 135.
23. Edwards TJ, David DJ, Simpson DA, Abbott AA. Patterns of mandibular fractures in Adelaide, South Australia. *Australian and New Zealand journal of surgery.* 1994 May;64(5):307-11.
<https://doi.org/10.1111/j.1445-2197.1994.tb02216.x>
PMid:8179524
24. Zix J, Lieger O, Lizuka T. Use of straight and curved 3-dimensional titanium miniplates for fracture fixation at the mandibular angle. *Journal of oral and maxillofacial surgery.* 2007 Sep 1;65(9):1758-63.
<https://doi.org/10.1016/j.joms.2007.03.013>
PMid:17719394
25. De Matos FP, Arnez MF, Sverzut CE, Trivellato AE. A retrospective study of mandibular fracture in a 40-month period. *International journal of oral and maxillofacial surgery.* 2010 Jan 1;39(1):10-5
<https://doi.org/10.1016/j.ijom.2009.10.005>
PMid:19914802
26. Barry CP, Kearns GJ. Superior border plating technique in the management of isolated mandibular angle fractures: A retrospective study of 50 consecutive patients. *Journal of Oral and Maxillofacial Surgery.* 2007;65(8):1544-9.
<https://doi.org/10.1016/j.joms.2006.10.069>
PMid:17656281
27. Paza AO, Abuabara A, Passeri LA. Analysis of 115 mandibular angle fractures. *Journal of oral and maxillofacial surgery.* 2008 Jan 1;66(1):73-6.
<https://doi.org/10.1016/j.joms.2007.05.025>
PMid:18083418
28. Danda AK. Comparison of a single noncompression miniplate versus 2 noncompression miniplates in the treatment of mandibular angle fractures: A prospective, randomized clinical trial. *Maxillofacial Surgery.* 2010 Oct 1;38(7):501-4.
<https://doi.org/10.1016/j.joms.2010.01.011>
PMid:20430504
29. Yazdani J, Talesh KT, Motamedi MH, Khorshidi R, Fekri S, Hajmohammadi S. Mandibular angle fractures: comparison of one miniplate vs. two miniplates. *Trauma monthly.* 2013;18(1):17
<https://doi.org/10.5812/traumamon.9865>
PMid:24350144 PMCID:PMC3860651
30. Choi BH, Kim KN, Kang HS. Clinical and in vitro evaluation of mandibular angle fracture fixation with the two-miniplate system. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology.* 1995 Jun 1;79(6):692-5.
[https://doi.org/10.1016/S1079-2104\(05\)80301-4](https://doi.org/10.1016/S1079-2104(05)80301-4)
PMid:7621024
31. Anderson T, Alpert B. Experience with rigid fixation of mandibular fractures and immediate function. *Journal of oral and maxillofacial surgery.* 1992 Jun 1;50(6):555-60
[https://doi.org/10.1016/0278-2391\(92\)90432-Y](https://doi.org/10.1016/0278-2391(92)90432-Y)
PMid:1593314
32. Benjamin A, Olushola AI, Sara KE. Analysis of complication of mandibular fracture. *African Journal of Trauma.* 2014;3(1):24.
<https://doi.org/10.4103/1597-1112.139452>
33. Renton TF, Wiesenfeld D. Mandibular fracture osteosynthesis: A comparison of three techniques. *British Journal of Oral and Maxillofacial Surgery.* 1996;34(2):166-73.
[https://doi.org/10.1016/S0266-4356\(96\)90372-1](https://doi.org/10.1016/S0266-4356(96)90372-1)
PMid:8861293
34. Abbas I, Ali K, Mirza YB. Spectrum of mandibular fractures at a tertiary care dental hospital in Lahore. *Journal of Ayub Medical College Abbottabad.* 2003;15(2).
35. Schultze-Mosgau S, Erbe M, Rudolph D, Ott R, Neukam FW. Prospective study on post-traumatic and postoperative sensory disturbances of the inferior alveolar nerve and infraorbital nerve in mandibular and midfacial fractures. *Journal of Cranio-Maxillofacial Surgery.* 1999 Apr 1;27(2):86-93.
[https://doi.org/10.1016/S1010-5182\(99\)80019-5](https://doi.org/10.1016/S1010-5182(99)80019-5)
PMid:10342144
36. Renzi G, Carboni A, Perugini M, Giovannetti F, Becelli R. Posttraumatic trigeminal nerve impairment: A prospective analysis of recovery patterns in a series of 103 consecutive facial fractures. *Journal of Oral and Maxillofacial Surgery.* 2004;62(11):1341-6.
<https://doi.org/10.1016/j.joms.2004.05.212>
PMid:15510354
37. Marchena JM, Padwa BL, Kaban LB. Sensory abnormalities associated with mandibular fractures: Incidence and natural history. *Journal of Oral and Maxillofacial Surgery.* 1998;56(7):822-5.
[https://doi.org/10.1016/S0278-2391\(98\)90003-9](https://doi.org/10.1016/S0278-2391(98)90003-9)
PMid:9663571
38. Mayrink G, Moreira RW, Araujo MM. Prospective study of postoperative sensory disturbances after surgical treatment of mandibular fractures. *Oral and Maxillofacial Surgery.* 2012;17(1):27-31.
<https://doi.org/10.1007/s10006-012-0328-7>
PMid:22552789
39. Schenkel JS, Jacobsen C, Rostetter C, Grätz KW, Rücker M, Gander T. Inferior alveolar nerve function after open reduction and internal fixation of mandibular fractures. *Journal of Cranio-Maxillofacial Surgery.* 2016;44(6):743-8.
<https://doi.org/10.1016/j.jcms.2016.03.001>
PMid:27085984

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<https://www.banglajol.info/index.php/UpDCJ/article/view/61836>