Clinical Evaluation of Mandibular Angle Fractures with Teeth in Fracture Line, Treated with Stable Internal Fixation

Guruprasad Yadavalli[1], P Hema Mythily[2], Jayaprasad N Shetty[3]

Abstract

Purpose: The purpose of this study was to evaluate the clinical results of mandibular angle fracture complicated by the presence of teeth in the line of fracture treated with stable internal fixation using locking miniplates .

Patients and methods: Twenty patients reporting to the Department of Oral and Maxillofacial Surgery, Government Dental College and Research Institute, Bengaluru were selected for the study to clinically evaluate mandibular angle fractures with teeth present in fracture line, treated with stable internal fixation using locking miniplates. Patients were evaluated during postoperative follow up for healing of the fracture, infection, occlusion, mobility and tooth vitality.

Results: Teeth in the fracture line were retained in 9 (45%) cases and in 11 (55%) cases**.** Teeth were extracted when absolutely indicated. The postoperative complication rates in retained group (22.2%) are lesser when compared with the extracted group (27.2%). Of the 20 cases, 5 (25%) had developed complications. The proportion of cases which developed complications was found to be statistically significant ($p<0.05$).

Conclusion: Individual decision must be made in every case, whether to retain or extract the tooth involved in line of mandibular angle fracture. The use of locking miniplates obviously has the advantages of not allowing the stripping of screws and prevented movement and loosening of screws. Since the plate did not have to be as precisely adapted to the underlying bone and indeed did not have to be compressed against the bone for stability, the bending of the plates is simplified. Dislocation following osteosynthesis is minimized or eliminated; there is less interference with underlying vascular supply.

Keywords: Locking miniplates, stable internal fixation, maxillomandibular fixation, teeth in the line of fracture, tooth vitality.

Introduction

The end of the 20th century witnessed a revolution in various systems in trauma care and medical emergencies. With Oral and Maxillofacial Surgery achieving new horizons in research and technology, it took large leaps to leave behind the crude, but innovative old fashioned surgery. But till the last quarter of this century, the concepts about the teeth in the line of mandibular fractures were still not clear.

The longstanding concept that teeth in the line of fracture must be removed seems to be changing, leading to a newer concept that such teeth can be preserved.[1] Teeth involved in the fracture line may often be of great value in repositioning of fracture; moreover, the extraction of such teeth may cause further traumatic injury to the bone tissue and also often technical difficulties when the fragments are highly mobile.[2]

Miniplate osteosynthesis, which requires precise anatomic reduction and allows three-dimensional stable fixation, has changed the management of fractures with teeth in the line of fracture. In the angular region, where the mandible is thinner and thus has smaller cross-sectional surfaces, extraction of the tooth further reduces contact between fracture segments.[3] The decrease of contact area reduces stability and causes micro mobility after fixation, which can lead to development of complications.[4] Extraction of tooth further increases the risk of contamination of the fracture through the empty alveolus, which may sometimes be difficult to suture.[5]

This study is aimed to evaluate prospectively the clinical results complicated by the presence of teeth in the line of mandibular angle fracture treated with stable internal fixation and to undertake a clinical and radiological evaluation of mandibular angle fractures with teeth in the line of fracture and to evaluate the healing and associated complications like periapical infection, vitality of involved teeth, periodontal status and the relative incidence of such complications in association with a surgical procedure such as open reduction and internal fixation.

Material and methods

This study was a prospective analysis involving 20 patients with undisplaced or minimally displaced mandibular angle fractures with teeth in line of fracture having insignificant medical history. This study was aimed at evaluating the clinical results of mandibular angle fracture complicated by the presence of teeth in the line of fracture treated with stable internal fixation who are medically fit to undergo the surgical procedure. Inclusion Criteria were undisplaced or minimally displaced mandibular angle fractures with teeth present in the line of fracture. Exclusion Criteria was fractures infected prior to treatment, medically compromised patients, comminuted fractures and fractures associated with complex trauma to the maxilla.

After the routine clinical and radiological examination protocol the fracture site is exposed by intraoral approach with transbuccal trocar using locking miniplates (Figure1, 2) without maxillomandibular fixation. Teeth in the line of fracture were not extracted unless there was an absolute necessity. Antibiotics and analgesic drugs were administered for 7 days following surgery. The patients were followed up for a period of 6 weeks initially on weekly basis, 3 months and for a period of 6 months later to assess the

[1]Asst. Professor, Deptt. of Oral and Maxillofacial Surgery, AME'S Dental College Hospital and Research Center, [2]Asst. Professor, [3] Professor and Head (Retd.), Deptt. of Oral and Maxillofacial Surgery, Government Dental College and Research Institute, Bengaluru India.
Correspondence:Dr. Yadavalli Guruprasad, email: guru_omfs@yahoo.com

Age	N	%
10-20yrs	2	10.00
21-30 yrs	13	65.00
31-40 yrs	3	15.00
41-50 yrs	2	10.00
51-60 yrs	0	0.00
Total	**20**	**100**

Table 1: Age distribution in the study population

Type of fracture	N	%
Favourable	18	90.00
Unfavourable	2	10.00
Total	**20**	**100**

Table 2: Distribution according to type of fracture

Teeth in the fracture line	N	%
Retained	9	45.00
Extracted	11	55.00
Total	**20**	**100**

Table 3: Distribution according to teeth in the line of fracture retained or extracted

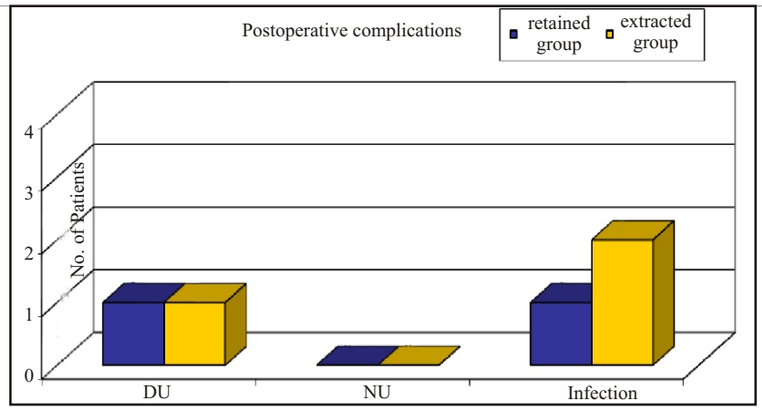
Reason	N	%
Mobile	3	27
Tooth fracture	4	36
Mechanical hindering	2	18
Grossly decayed	1	9
>50% root exposed	1	9
Total	**11**	**100**

Table 4: Distribution of reasons for extracting teeth in the line of fracture

Group	No complications	Complications	Z	P-Value
Retained	7	2	0.26	0.795
Extracted	8	3		

Table 5: Post operative complications

There is no significant difference between the two groups with respect to the post operative complications developed (p>0.05)



Graph 1: Distribution of postoperative complications

radiographic evidence of healing. Patients were evaluated during postoperative follow up for degree of healing of the fracture, infection, occlusion and tooth vitality. The vitality of these teeth was checked using electric pulp tester and these teeth were also examined for the degree of mobility; and associated complications of healing of the fracture site were recorded during follow up. (Figure 3, 4, 5, 6).

Results

Among 20 patients, 10% were in 10-20 years age group, 65% were in 21-30 years age group, 15% were in 31-40 years age group and 10% were in 41-50 years age group (Table 1). Majority of patients were in the age group of 21-30 years, 19 (95%) were males and 1 (5%) was female. According to the distribution of cause of injury of the 20 patients in the study group, road traffic accident (RTA) being the most common cause of injury 12 (60%), assault 5 (25%) and work related or self fall 3 (15%).

In 13 (65%) cases the fracture site was left angle and the remaining were 7 (35%) right angle. Out of 20 patients selected in the study group 11 (55%) presented with isolated angle fracture while rest of the patients were having fractures at two sites- parasymphysis and angle 7 (35%), symphysis and angle 1 (5%), body and angle 1 (5%). Parasymphysis and angle was the most common combination of fracture. In 18 (90%) cases the fracture was horizontally favourable and in 2 (10%) cases the fracture was horizontally unfavourable (Table 2).

Teeth in the fracture line were retained in 9 (45%) cases and in 11 (55%) cases teeth were extracted when absolutely indicated (Table 3). Teeth were extracted due to the following reasons: tooth fracture 4 (37%), mobility 3 (27%), mechanical hindrance during reduction 2 (18%), grossly decayed 1 (9%) and more than 50% exposure of the root surface 1 (9%), the most common reason for extraction being tooth fracture (Table 4).

In 9 (45%) cases the fracture site was approached using combination of both intraoral and extraoral because of two fracture sites, 5 (25%) cases using extra-oral approach, 4 (20%) cases by intraoral approach and in 2 (10%) cases the laceration was used to approach the fracture site with combination being the most common approach in this study .

All the 11 teeth which were retained were checked with electric pulp tester for vitality status, one tooth was non vital at regular follow up visits and two teeth were giving delayed response at six weeks and the rest of the six teeth were vital at regular follow up visits. The regular follow up visits were at 6 weeks, 3 months and 6 months. P-value was 0.492. Since $p>0.05$, we conclude that there is no significant association between vitality status and time intervals i.e. the changes in vitality status is independent of time.

Mobility status of retained teeth were examined at regular follow up visits one tooth was mobile at 6 weeks follow up which was extracted later due to periodontal involvement the rest of the eight teeth were firm when examined at 6 weeks interval ,one tooth which was non vital in this firm group was extracted due to development of pain. The rest of the seven teeth were firm at regular follow up visits. P-value was 0.646. Since $p>0.05$, we conclude that there is no significant association between the mobility status and time intervals i.e. the mobility status is independent of time.

Postoperative complications in relation to healing of fracture were also assessed in both retained and extracted group. In the retained group two complications developed one was delayed union and the other was secondary infection. Where as in the extracted group three complications developed one was delayed union and two were secondary infection. P-value was 0.709. Since $p>0.05$, we conclude that there is no association between the group (response) and delayed union or non union.

The postoperative complication rates in retained group (22.2%) are lesser when compared with the extracted group (27.2%) (Table-5). Of the 20 cases 5 (25%) had developed complications. The proportion of cases which developed complications was found to be statistically significant ($p<0.05$).

Discussion

Fractures of the mandibular angle present a clinical challenge because their treatment is plagued with the highest post surgical complication rate of all mandibular fractures.[6,7] The treatment of these fractures has evolved over a period of time from old methods of bandaging and splinting which is a part of closed reduction to recent time methods of open reduction .[8-10]

Miniplate locking system has the advantage of not allowing the stripping of screws and prevented movement and loosening of screws. The plates do not have to be

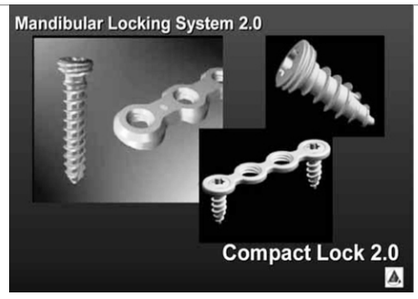


Figure 1: Locking miniplate system

Figure 2: Locking miniplates used in this study

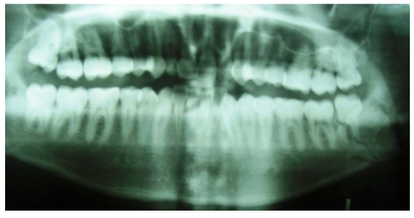


Figure 3: OPG showing left mandibular angle fracture with tooth in the line of fracture

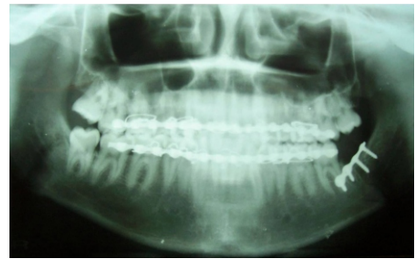


Figure 4: OPG showing internal fixation with tooth in the line extracted

Figure 5: OPG showing right parasymphysis and left mandibular angle fracture with tooth in the line of fracture

Figure 6: OPG showing internal fixation of right parasymphysis and left mandibular angle fracture with tooth in the line of fracture retained

precisely adapted to the underlying bone and indeed did not have to be compressed against the bone for stability. Dislocation following osteosynthesis was minimized or eliminated with less interference with underlying vascular supply.[11,12]

The longstanding concept that teeth in the line of fracture must be removed seems to be changing and leading to a newer concept that such teeth can be preserved.[1] Teeth in the fracture line may often be of great value in repositioning of fracture; moreover, the extraction of such teeth may cause further injury to the bone tissue and also often difficult to reduce anatomically when the fragments are highly mobile.[13-15]

The use of locking miniplate osteosynthesis, which requires precise anatomic reduction and allows three-dimensional stable fixation, has changed the management of fractures with teeth in the line of fracture. In the angular region, where the mandible is thinner and thus has smaller cross-sectional surfaces, extraction of the tooth in the line of fracture further reduces contact between fracture segments.[16,17] The decrease in contact area reduces stability of osteosynthesis and causes micromobility after fixation, which is an important factor in the development of complications. Extraction of tooth also increases the risk of contamination of the fracture through the empty alveolus, which may sometimes be difficult to suture.

The indications for extraction of tooth/teeth in the fracture line, as well as the prognosis of such tooth/teeth which are retained, have been the subject of many papers in recent years and the management of tooth/teeth positioned in the line of mandibular fractures have in recent years become more and more conservative. The possibility to control an infection by the use of antibiotic drugs has made the prophylactic extractions of tooth/teeth situated in the fracture line unnecessary.[18,19]

Tooth/teeth involved in the fracture line may often be of great value in repositioning of fracture moreover, the extraction of such tooth/teeth may cause further traumatic injury to the bone tissue and often cause technical difficulties in manipulation of fragments when the fragments are highly mobile. Most studies concerning tooth/teeth in the fracture line have dealt with the outcome of fracture healing and effect of tooth/teeth on fracture healing, where as the types and frequency of complications among tooth/teeth involved in jaw fractures have been given less attention.[20-23]

The criteria for whether a tooth in the line of fracture was removed at the time of surgery were fractured teeth, pericoronal/periodontal infection, gross caries, extensive periapical lesion, tooth mobility, exposure of the apical half or more of the root (including the apex), and inability to reduce the fracture without tooth removal.

In this study we have clinically evaluated mandibular angle fractures with teeth present in the fracture line, treated with stable internal fixation using locking miniplates and correlated the frequency and character of complications among teeth in the fracture line and the complication of healing. The parameters taken in this study were occlusion, mobility and vitality of the teeth in the line of fracture and general complications of healing like delayed union, non-union, malunion and infection.

Teeth in the line of fracture can be conservatively treated only when the fracture has a favourable prognosis and optimal reduction of displacement between the fragments reduced anatomically. A long-term observation period for the tooth in fracture line and adjacent teeth is advisable with regard to pulpal condition for a minimum of 6 months, as trauma and displacement of fracture fragments may sometimes cause disruption of vessels in these teeth. Our results do correlate with the observations of the studies made by Ralf Gutwald et al., Chan DM et al., and Gustav.O Kruger. Results of this study do not conform with the results of A.H.Kamboozia and Punnia-Moorthy in respect to tooth vitality, degree of displacement of the fracture and time interval between trauma and treatment.[4,8,12,24]

In the present study 11 teeth which were retained was checked with electric pulp tester for vitality status, one tooth was non vital at regular follow up visits and delayed response was observed in two teeth at 6 weeks and the rest of the six teeth were vital at regular follow up visits. Mobility status of retained teeth were examined at regular follow up visits, one tooth was mobile at 6 weeks follow up which was extracted later due to periodontal involvement the rest of the 8 teeth were firm when examined at 6 weeks interval. However one of them was nonvital and had to be extracted as the patient developed pain. Our findings do confirm with the observations of the studies made by Gerbino G, Tarello F, M. Fasolis, and PP. De.Gioanni.[25]

Postoperative complications in relation to healing of fracture were also assessed in both retained and extracted group. In the retained group two complications developed one with delayed union and the other secondary infection. However, in the extracted group three complications developed one was delayed union and two were secondary infection. Our data do confirm with the observations of the studies made by N.A. Amaratunga.[26]

Present study indicates the incidence of postoperative complications between retained and extracted cases though statistically insignificant ($p>0.05$) the overall complications were comparatively less in retained cases, but individual decision must be made in every case, whether to retain or extract the tooth involved in line of mandibular angle fracture. Of the 20 cases 5 (25%) had developed complications. The proportion of cases which developed complications was found to be statistically significant ($p<0.05$).

In the present study, a sincere attempt have been made to clinically evaluate mandibular angle fractures with teeth present in fracture line treated with stable internal fixation using locking miniplates and the results of this study are in accordance with the studies conducted by various authors.

References

1. Amaratunga NA. The Effect of Teeth in the Line of Fractures on Healing. J Oral Maxillofac Surg 1987;45:312-14.
2. Kahnberg KE, Ridell A. Prognosis of teeth involved in the line of mandibular fractures. Int J Oral Surg 1979;8(3):163-72.
3. Ellis E 3rd. Outcomes of Patients with Teeth in the Line of Mandibular Angle Fractures Treated With Stable Internal Fixation. J Oral Maxillofac Surg 2002;60:863-65.
4. Kamboozia AH, Punnia-Moorthy A. The Fate of Teeth in Mandibular Fracture Lines- A clinical and radiographic follow up study. Int J Oral Maxillofac Surg 1993 Apr;22(2): 97-01.
5. Alpert B, Gutwald R, Schmelzeisen R. New innovations in craniomaxillofacial fixation: the 2.0 lock system. Keio J Med 2003 Jun;52(2):120-27.
6. Mukerji R, Mukerji G, McGurk M. Mandibular fractures: Historical Perspective. Br J Oral Maxillofac Surg 2006 Jun; 44(3):222-28.
7. Chuong R, Donoff RB, Guralnick WC. A Retrospective analysis of 327 mandibular fractures. J Oral Maxillofac Surg 1983;41:305-09.
8. Gutwald R, Alpert B, Schmelzeisen R. Principle and Stability of Locking Plates. Keio J Med 2003;52(1):21-24.
9. Archer H. Oral and maxillofacial surgery. Vol.2, 5thed^{n}, Philadelphia : Saunders,1975;399-05.
10. Beckers HL. Treatment of Initially Infected Mandibular fractures with Bone plates. J Oral Surg 1979May;37(5): 310-13.
11. Theriot BA, Van Sickels JE, Triplett RG, Nishioka GJ. Intraosseous wire fixation versus rigid osseous fixation of mandibular fractures: a preliminary report. J Oral Maxillofac Surg 1987; 45(7):577-82.
12. Chan DM, Demuth RJ, Miller SH, Jastak JT. Management of Mandibular Fractures in Unreliable Patient Populations. Ann Plast Surg 1984;13(4):298-03.
13. Lindqvist C, Kontio R, Pihakari A, Santavirta S. Rigid internal fixation of mandibular fractures- An analysis of 45 patients treated according to the ASIF method. Int J Oral Maxillofac Surg 1986;15:657-64.
14. Neal DC, Wagner WF, Alpert B. Morbidity Associated with Teeth in the Line of Mandibular Fractures. J Oral Surg 1978; 36:859-62.
15. Dierks EJ. Management of associated dental injuries in maxillofacial trauma. Otolaryngol Clin North Am 1991;24 (1):165-79.
16. Fgnatius LT, Oikaviness KS, Silvennoinen U. Frequency and Type of Dental Traumas in Mandibular Body and Condyle Fractures. J Endod Traumatol 1992;8(6):235-40.
17. Edward Ellis III. Treatment Methods for Fracture of the Mandibular Angle". Int J Oral Maxillofac Surg 1999;28: 243-52.
18. Feller KU, Schneider M, Hlawitschka M, Pfeifer G, Lauer G, Eckelt U. Analysis of complications in fractures of the mandibular angle- a study with finite element computation and evaluation of data of 277 patients. J Craniomaxillofac Surg 2003;31:290-95.
19. Finn RA. Treatment of Comminuted Mandibular Fractures by Close Reduction. J Oral Maxillofac Surg 1996;54(3): 320-27.
20. Finnegan BM. Periodontal Complications Associated with Teeth Involved in the Line of Mandibular Fractures.

Quintessence Int 1983;14(9):919-22.
21. Fischer-Brandies E, Dielert E. The Infected Mandibular Fractures. Arch Orthop Trauma Surg 1984;103(5):337-41.
22. Freitag Y, Landau H. Healing of Dental or Edentulous Mandibular Fractures Treated With Rigid Or Non-Rigid Plate Fixation An Experimental Study In Dogs. J Cranio-maxillofac Surg 1996;24(2):83-87.
23. Giordano AM, Foster CA, Boies LR, Maisel RH. Chronic Osteomyelitis Following Mandibular Fractures And Its Treatment. Arch Otolaryngol 1982;108(1):30-33.
24. Gustav.O Kruger. Treatment of Mandibular Fracture. Text book of Oral and Maxillofacial Surgery. 6th edn. C.V. Mosby Company,1984;385-18.
25. Gerbino G, Tarello F, Fasolis M, De Gioanni PP. Rigid fixation with teeth in the line of mandibular fractures. Int J Oral Maxillofac Surg 1997 Jun;26(3):182-86.
26. Amaratunga NA. Mandibular fractures in Srilankan children; a Study of Clinical Aspects, Treatment Needs and Complications. ASDC J Dent Child 1992;59(2):111-14.

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