RESEARCH PAPER

Evaluation of Teeth in Line of Mandibular Fractures Treated with Stable Internal Fixation

K. O. Bang¹ · P. K. Pandilwar² · S. R. Shenoi¹ · N. J. Budhreja¹ · P. Ingole¹ · V. S. Kolte¹ · A. Garg¹

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Abstract

Purpose To determine whether retention or removal of teeth in line of mandibular fractures affects the incidence of postoperative complications. To evaluate the fate of teeth retained in mandibular fractures based on location of fracture line in relation to apical foramen and lateral periodontium of retained tooth.

Method 51 mandibular fracture sites in 39 patients were treated by open reduction and internal fixation using miniplates. Teeth in line of fracture were removed if showed extensive caries, excessive mobility of tooth, or root fracture. Accordingly patients were divided into two groups, group I tooth removed (15 sites) and group II tooth retained (36 sites). Teeth retained in fracture line were classified based on position of the fracture in relation to apical foramen and the lateral periodontium of involved tooth estimated from preoperative panoramic radiograph into four types. Postoperative periodic follow up done for 1 year and seen for incidence of postoperative complications and fate of tooth in line of fracture.

Results Out of 36 fracture sites in which teeth were retained 5 (13.89%) showed postoperative complications, and out of 15 fracture sites in which teeth were removed 3 (20%) showed postoperative complications. Out of 36 fracture sites in which tooth was retained we found in 3 cases fracture line passed through 2 adjacent teeth. Thus we had in total 39 teeth in fracture line out of them 26

required no treatment 9 required endodontic treatment and 4 teeth required extraction. Need for extraction and endodontic treatment was found more in type I and type III relation.

Conclusion There is an increased risk for postoperative complications when a tooth is removed, although it is not statistically significant. Evaluation of fate of retained teeth showed better prognosis of teeth in type II cases than type III and type I cases. Results of this study leads to conclusions that teeth associated with mandibular fractures need not be removed on prophylactic basis.

Keywords Mandibular fracture · Open reduction and internal fixation · Teeth in line of mandibular fracture

Introduction

Traumatic injuries have always been associated with human race. The unique position of the mandible makes it extremely vulnerable to injury. Incidence of mandibular fractures ranks first among all fractures of the bones of facial skeletal. Teeth in line of fractures of mandible have always posed a dilemma to the Maxillofacial Surgeon. Such fractures are considered open and are always in communication with oral cavity because of presence of periodontal ligament. Teeth involved may get devitalized as a result of traumatic severance of their vascular communications or thrombosis of feeding vessels. Such teeth have been considered foreign bodies and source of infection that might complicate satisfactory healing of the fracture. Historically in the preantibiotic era, teeth in line of fractures generally were condemned for extraction because of the increased potential for untoward sequel such as osteomyelitis, nonunion, delayed union. Since the

✉ K. O. Bang
kbang27@yahoo.com

¹ VSPM's DCRC, Digdoh Hills, Hingna Road, Nagpur, Maharashtra 440019, India

² GDC, Nagpur, India

advent of antibiotics, surgeons have been bolder with respect to retention. Indeed, some consider that retention is indicated if it helps in reduction by providing posterior stop, by permitting proper alignment of the arch or by preventing collapse or telescoping of segments [1]. Moreover with the advent of open reduction internal fixation in the management of fractures, obtaining anatomic reduction and three-dimensional fixation is easily achieved, which has seen radical transformation in the management of fractures with teeth in line of fractures [2]. It has been suggested in recent literature that an individual decision need be made in each case whether the tooth in fracture line can be left in place.

Objective

To determine whether retention or removal of teeth in line of mandibular fractures affects the incidence of postoperative complications. To evaluate the fate of teeth retained in mandibular fractures based on location of fracture line in relation to apical foramen and lateral periodontium of retained tooth.

Material and method

51 mandibular fracture sites in 39 patients were selected as study sample. Teeth in line of fracture were removed if showed extensive caries, excessive mobility of tooth, or root fracture. Thus patients were divided into two groups, group I tooth removed (15 sites) and group II tooth retained (36 sites). Teeth retained in line of fracture were classified as per Kamboozia's [3] classification based on position of the fracture in relation to apical foramen and the lateral periodontium of involved tooth estimated from preoperative panoramic radiograph into four types (Fig. 1).

Type I: Fracture line which follows the root surface from apical region to gingival margin with denudation of root surface.

Type II: Fracture line which follows the root surface from gingival margin but does not cross apical region.

Type III: Fracture line passing only through apical region.

Type IV: Fracture line crossing the root without passing through apical region or without producing denudation of root surface.

That means apical foramen is involved in Type I and Type III and is not involved in Type II & Type IV.

Clinical and radiological examination protocol and treatment were same for all cases. Open reduction and

Fig. 1 Schematic representation of fracture types based on relationship of fracture line to tooth apex and periodontium

internal fixation (ORIF) using stainless miniplates and monocortical screws via intraoral or extraoral approach under suitable anesthesia. Intermaxillary fixation was done in some cases for 1–4 weeks to obtain greater stability and to treat concomitant condylar fractures. Standard regimen of anti-microbial and anti-inflammatory drugs was administered postoperatively. Chlorhexidine mouth wash was prescribed for maintenance of oral hygiene. Periodic follow up was carried out for 1 year in which the patient was assessed clinically and radiographically. Teeth which were symptomatic i.e. showing presence of mobility, tenderness or radiographic changes were subjected to further treatment either root canal treatment or extraction [4, 5].

Observations and Results

Out of 36 fracture sites in which teeth were retained 5 (13.89%) showed postoperative complications, and out of 15 fracture sites in which teeth were removed 3 (20%) showed postoperative complications. Percentage of postoperative complications was observed to be more in teeth removed fracture sites (Fig. 2) in comparison to the teeth retained fracture sites though not statistically significant (Table 1).

Out of 36 fracture sites in which tooth was retained we found in 3 cases fracture line passed through 2 adjacent teeth. Thus in total of 39 teeth in fracture line, 26 required no treatment, 9 were subjected root canal treatment and 4 teeth required extraction.

Fig. 2 Showing tooth in fracture line removed

Fig. 3 Showing type I relationship of tooth in fracture line

While observing the association between relationship of fracture line to teeth and fate of teeth none of the type II relationship cases required extraction, whereas 2 cases in each type I and type III needed extraction. We did not encounter any case of type IV relationship in our series. Teeth not necessitating any treatment were more in type II (83.33%), followed by type III (63.64%) and type I (40%). Thus type II relation teeth were found to have better prognosis followed by type III and type I. However there was no significant statistical association between relationship of fracture line to teeth and fate of teeth (Table 2).

Discussion

In this study the parameters which we assessed were postoperative complications and fate of teeth in line of fracture. The incidence of postoperative complications was noted to be higher in tooth removed situations (20%) than in tooth retained situations (13.89%). Literature indicates similar result where incidence of postoperative complications was higher in tooth removed situations (37.3%) than tooth retained (29.5%) [1]. Another study also demonstrated higher incidence of complications in tooth removed situations (25%), compared to tooth retained situations (10%) [2].

However results of this study was in contradiction to some of the studies in which incidence of postoperative

complications was higher in tooth retained situations (16.1%) than in tooth removed situations (13.7%) [6]. Study by Ellis III [7, 8], Rai [9] had also reported higher incidence of complications in tooth retained situations than in tooth removed situations. Some of the studies exhibited little difference in the outcome of fracture management, whether the teeth were routinely extracted or retained as long as rigid fixation was employed for stabilization of the fracture segments [10, 11].

Conserving the tooth facilitates fracture reduction in many cases making correct repositioning quicker and easier. On the other hand, extraction of tooth reduces contact between fracture segments which reduces stability of osteosynthesis and results in micromobility after fixation, an important factor in development of complications. Extraction of tooth also increases the risk of contamination of fracture through an empty alveolus which may sometimes be difficult to suture [12]. Also, extraction sometimes presents technical difficulty and may result in additional trauma to the bone while conserving the tooth could avoid such problems [2].

In this study, 4/39 (10.26%) teeth retained in fracture line needed extraction. Percentage of secondarily extracted teeth during postoperative period ranged from 0 to 20% in different studies [13].

9/39 (23.07%) teeth required endodontic treatment during follow up. Most common reason behind carrying out endodontic treatment was tenderness of tooth. Teeth

Table 1 Association between management of tooth in fracture line and postoperative complications

Management of tooth in fracture line	Postoperative complications		Total	Chi-Sq value	P value	Result
	Absent	Present				
Retained	31	5 (13.89%)	36	0.298983	0.584521	P value >0.05 Not significant
Removed	12	3 (20%)	15			

Table 2 Association between Relationship of fracture line to teeth and Fate of teeth

Relationship of fracture line to teeth	Fate of teeth			Total	Chi-Sq value	P value	Result
	Not required	Extraction	RCT				
Type I	4	2	4	10	6.953	0.138	Not significant
Type II	15	0	3	18			
Type III	07	2	2	11

Fig. 4 Showing type II relationship of tooth in fracture line **Fig. 5** Showing type III relationship of tooth in fracture line

which were not responding to vitality test but were asymptomatic were kept on follow up without any treatment. The variable root morphology of mandibular third molars precludes itself to endodontic therapy. These teeth if got symptomatic at any point of time during follow up were extracted.

Teeth requiring endodontic treatment in different studies were 13/59 (22.03%) [1, 13] 9/78 (24.35%) [2] and 23/34 (67.64%) [3].

When assessed relationship of fracture line to teeth we found 40% type I teeth (Fig. 3), 83.33% type II teeth (Fig. 4), 63.64% type III (Fig. 5) teeth did not require any treatment. Root canal treatment was required in 40% of type I, 16.67% of type II, and 18.18% of type III teeth. Extraction was required in 4 cases, 2 cases each to type I and type III. None of the cases of type II needed extraction. It would be informed that type II retained teeth have best prognosis followed by type III and lastly type I which is in harmony with literature [3].

Prognosis of tooth in line of mandibular fracture is dependent on the course of the fracture line in relation to apex of the tooth [14]. Highest frequency of pulpal necrosis occurs when the fracture line runs through the apex, as observed in this study (type I and III). This could be speculated as the apical vessels get torn apart in the accident. Pulpal vessels pass through a narrow foramen and any small change in either the position of the apex or the integrity of the surrounding bone can cause tearing of vessels and permanent changes in vascularity of pulp.

Conclusion

There is an increased risk for postoperative complications when a tooth is removed, though increase is not statistically significant. Evaluation of fate of retained teeth showed better prognosis of teeth in type II cases than type III and type I cases. However these relations were statistically not significant.

Results of these study indicates that teeth associated with mandibular fractures need not be removed on prophylactic basis. Non infected sound teeth in line of fracture can be preserved. However retained teeth should be followed for at least 1 year and should be treated endodontically if indicated. Conservation of dentition as an adjunct to the surgical treatment of mandibular fractures can benefit many patients.

Compliance with Ethical Standards

Conflict of interest All Authors declares that they have no conflict of interest.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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