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CASE STUDY

A NOVEL TECHNIQUE FOR REDUCTION OF FRACTURE FRAGMENTS PRIOR TO INTERNAL FIXATION IN MANDIBLE

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ABSTRACT

Introduction: Mandibular fractures are most common in maxillofacial region. Intermaxillary fixation followed by open reduction and internal fixation is the choice of treatment. Elastic internal traction replaces intermaxillary fixation as it is a simple and effective means to reduce mandibular fractures into anatomical alignment for internal fixation reducing the overall operating time.

Aim: The aim of the study was to compare the effectiveness of elastic internal traction over the conventional method of inter maxillary fixation in open reduction of mandibular fractures prior to internal fixation.

Materials and Methods: The study was conducted on 14 patients with clinical and radiological evidence of isolated parasymphysis fracture mandible. Open reduction of fracture was done in group A by elastic internal traction and in group B by intraoperative inter maxillary fixation.

Results: The difference in the time required for anatomical reduction of the fracture was statistically significant in both the groups of the patients. There were no significant differences between both the groups in relation to the anatomical reduction of fracture, stability of the post reduction occlusion, the need for post operative intermaxillary fixation and mental nerve paresthesia.

Conclusion: Elastic internal traction technique is a simple and effective method of fracture reduction. It provides a stable primary fixation of the bone before the final fixation. It is a viable alternative to open reduction of fracture mandible by intermaxillary Fixation.

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INTRODUCTION

Maxillofacial injuries in specific mandibular fractures are the most common of all the trauma cases. The presence of teeth in the maxillofacial region marks the management of maxillofacial trauma unique as compared to long bones. The aim of all forms of treatment therapy is restoration of form and function of the face and jaws to near normal. Anatomical reduction of the fracture segments and achievement of occlusion are the fundamental requirements in the management of maxillofacial trauma (Gregory Arthur *et al*., 1989). The treatment of these fractures traditionally begins with reapproximating the pretraumatic occlusion through the use of intermaxillary fixation (Gibbons *et al*., 2003). Open reduction and rigid internal fixation allows prompt recovery and early oral rehabilitation, thus avoiding the need for inter-maxillary fixation (Ashraf F Ayoub and John Rowson, 2003). A new technique for reduction of the maxillofacial fractures, "elastic internal traction" is used which is based on the elastic action of the rubber bands/e-chains, stretched between screws placed on both sides of fracture line (Fig. 1). One or two screws are fastened 0.5 to 2 cms on each side of the fracture line and the rubber bands/e-chains are looped around each screw in order to apply a force perpendicular to the screws closing the bone fragments. After performing the reduction of the fracture and occlusal assessment internal fixation is carried without

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removing the elastic internal traction, thus avoiding displacement of the bone fragments during the plating of the bone (Taglialatela Scafati *et al*., 2004). In the present study 14 cases of isolated fractures of mandible, involving symphysis or parasymphysis were included. In 7 cases elastic internal traction and in the other 7 cases inter maxillary fixation was done. The aim of the study was to compare the effectiveness of elastic internal traction as a method of fracture reduction over the conventional method of inter maxillary fixation prior to internal fixation in open reduction of mandibular fractures. The cases were followed for a period of 2months.

MATERIALS AND METHODS

This study was conducted on 14 patients with clinical and radiological evidence of isolated symphysis or parasymphysis fracture of mandible. Group A consists of 7 cases where open reduction of mandibular fracture was done by elastic internal traction (Fig. 2, 3) and other 7 cases were group B where open reduction of mandibular fracture was done by intraoperative inter maxillary fixation (Fig. 10, 11). Isolated fractures of the mandible anterior to the mental foramen are included in the study. Average age of the patients was between 18-40 years. No sex predilection. Medically compromised patients are excluded in the study. Orthopantomographs, occlusal views of mandible, intraoral periapical radiographs are taken for evaluating of fracture site and teeth adjacent to fracture. Pre-operative antibiotics and analgesics were given.

Group B

After adequate anesthesia, arch bars were secured to the teeth using circumdental wiring. Exposure of the fracture site was done. Intermaxillary fixation was done to achieve occlusion. Two 2.0-mm stainless steel locking 4 hole plate was fixed using 2 x 8 mm locking screws. After the procedure intermaxillary fixation was removed (Fig. 12). Patients were followed on 1st post-operative day, 3rd day, 5th day, 7th day and at weekly intervals for 8weeks (Fig. 8, 9). They were followed up radiographically with orthopantomographs in the immediate postoperative period and at the end of 2nd month. Intraoral periapical radiographs were taken when required to evaluate the status of the teeth around the fracture site.

RESULTS

Of the 14 cases, 13 cases (92.86%) were male patients and 1case (7.14%) was a female patient. The cause of injury was self-inflicted in 8 cases (57.14%), road traffic accident in 4 cases (28.57%) and assault in 2 cases (14.28%). Highest incidence of fractures occurred in the age group of 21-30yrs of age (42.86%). All the 14 patients selected in group A and group B were with isolated parasymphysis fracture of the mandible of which 9 cases (64.28%) were of right parasymphysis and 5 cases (35.71%) were of left parasymphysis of the mandible. In all the patients of both the groups mild to moderate occlusal derangement was present.

Table 1. The following parameters were assessed to assess the effectiveness of the elastic internal traction over intermaxillary fixation in reduction of the fracture mandible

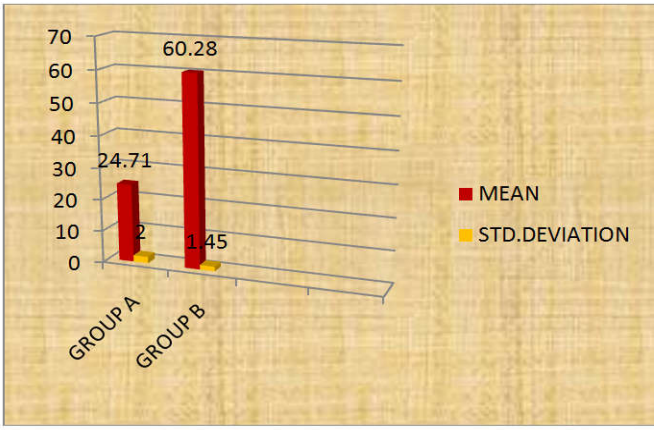
Clinical parameters	Radiographic parameters
1. Time period for the surgery was recorded from the start of the procedure till the reduction was achieved.	1. Presence or absence of root perforations
2. Satisfactory/Non satisfactory anatomical reduction of fracture fragments.	2. Satisfactory/non satisfactory anatomical reduction of fracture
3. Satisfactory/ non satisfactory based on status of the occlusion	3. Satisfactory/ non satisfactory based on status of the adjacent teeth
4. Any abnormality based on status of the adjacent teeth	4. Presence/absence of secondary infection
5. Presence or absence of mental nerve paresthesia/anesthesia	5. Presence/absence of loosening of the screws if any
6. Presence/ absence of wound dehiscence	
7. Presence/absence of infection	
8.Requirement for postoperative intermaxillary fixation.	
9. Percutaneous punctures (in control group)	

Surgical exposure

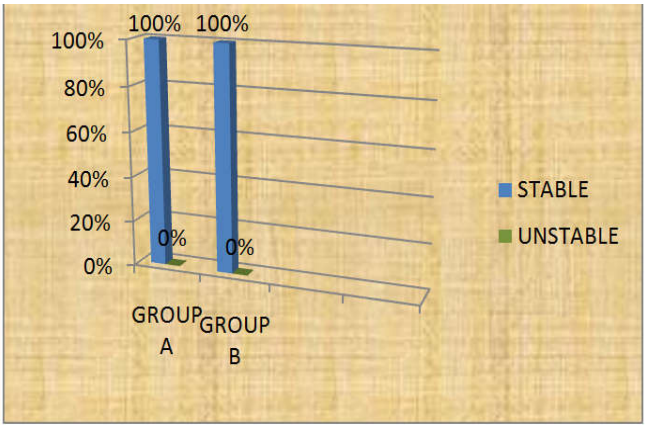
Group A

Adequate local anesthesia was given. Using intra oral vestibular incision the fracture site was exposed (Fig. 4). One screw on either side of the fracture line was fastened 1-2cm away. The heads of the screws were protruded 5mm, and the axis of the screws form an acute angle opposing the fracture line. The elastomeric orthodontic chain was looped around each screw and an elastic force perpendicular to the screws was applied for reduction of the bone fragments (Fig. 5). Once the reduction of the fracture fragments was done and occlusion achieved, rigid internal fixation was done. Primary stability of the fracture was obtained by placing a 4 holed self-locking stainless steel miniplate across the fracture line and fastened it with screws into the proximal holes. The elastic orthodontic chain was then removed and the screws were reutilized to secure the miniplate by fastening them into the other two remaining holes. A second miniplate was fastened across the fracture line at an inferior position using the same procedure (Fig. 6). The mucosa was then closed with 3-0 black silk (Fig. 7).

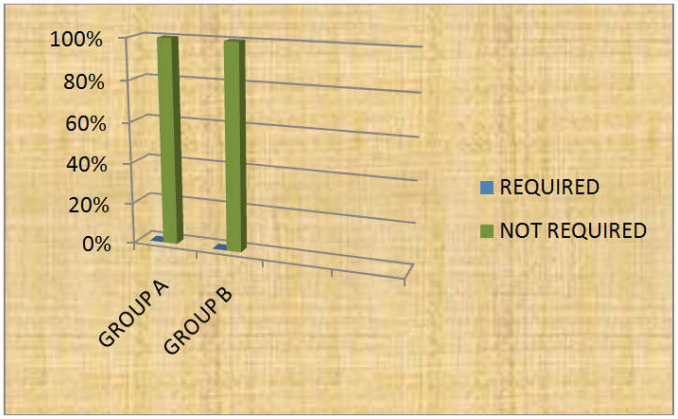
All the fractures, in both the groups appeared to be well reduced and stable. There were no intraoperative difficulties associated with placement of hardware. Postoperative radiographs taken within the first 2 days showed satisfactory reduction in all cases. In group A time taken for exposure of the fracture site, placement of the supporting screws and elastic chain for traction to achieve the fracture reduction was recorded. The mean time required was 24.71 minutes and in group B the mean time taken was 60.28minutes (Graph 1). Satisfactory reduction of the fracture fragments was achieved in both A and B groups (Graph 2). The premorbid occlusion was achieved and was also maintained postoperatively in both the groups. There were no cases of postoperative malocclusion that resulted in the entire study. Of all 14 cases in both the groups, no case required postoperative intermaxillary fixation as postoperative occlusion was stable (Graph 3). Mild paresthesia of mental nerve was noticed in 1 case (14.28%) in group A due to manipulation of the mental nerve during adjustment of the supporting screws at the time of surgery. No such paresthesia observed in group B cases (Graph 4). Percutaneous wire punctures were observed in 1 case (14.28%) in Group B patients. Wound dehiscence was not seen in both the groups.



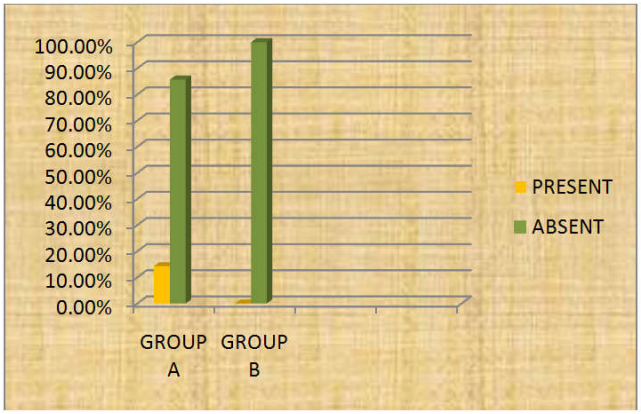
Graph 1. Time taken for anatomical reduction of fracture



Graph 2. Comparision of postoperative occlusion



Graph 3. Need for postoperative intermaxillary fixation



Graph 4. Occurrence of postoperative mental nerve paresthesia in both groups

Fig.1. Elastomeric orthodontic chain, 4 hole locking plates and screws

Fig.2. Right parasymphysis fracture mandible

Fig.3. Preoperative OPG

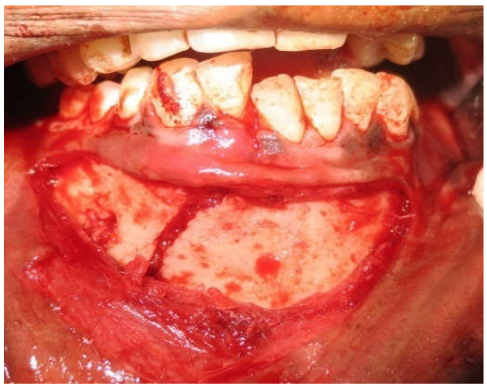


Fig.4. Surgical exposure of fracture site

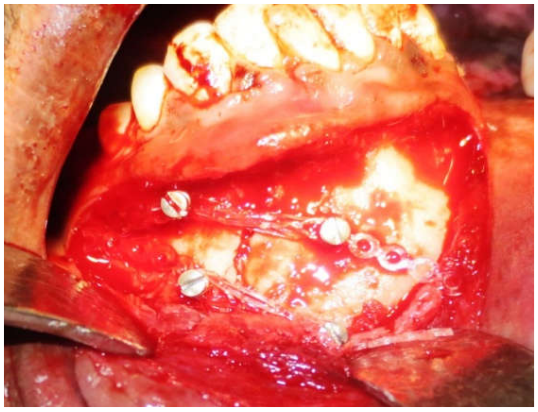


Fig. 5. Placement of e- chain for reduction of fracture

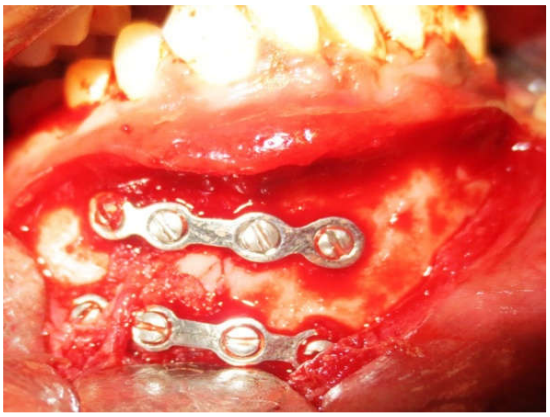


Fig.6. Fracture fixation with locking bone plates

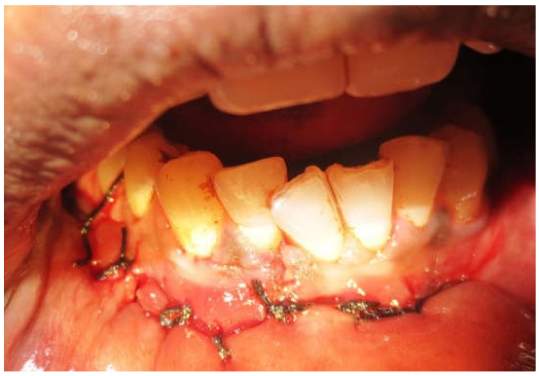


Fig.7. Surgical wound closure with 3-0 black silk

Fig.8. Post-operative occlusion after 1 month

Fig.9. Post-operative OPG at the end of 2nd month

Group B: Fracture Reduction by Intermaxillary Fixation

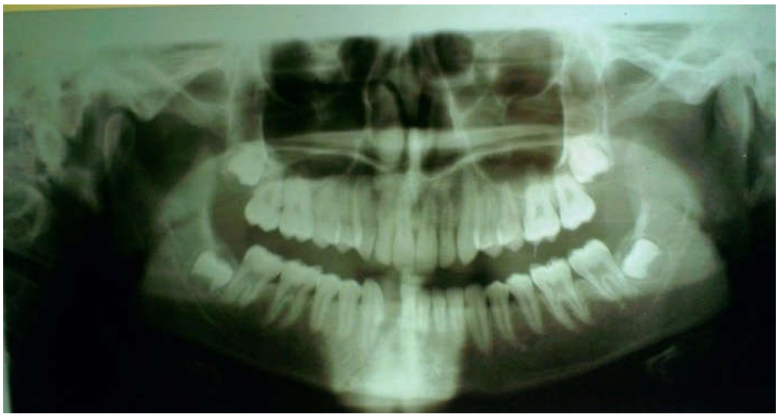


Fig.10. Pre-operative OPG

Fig.11. Fracture right parasymphysis

Fig.12. Intermaxillary fixation and fixation with locking plates

The healing process of the soft tissue was normal in all the patients. No iatrogenic damage was recorded in both the groups of the patients. No infection in any case was reported postoperatively in both the groups. Clinically and radio graphically, no abnormal changes were detected during the process of healing.

DISCUSSION

Mandibular fractures are the most common type of fractures in maxillofacial injuries which may be isolated or may be associated with other fractures of the maxillofacial bones. Treatment options for mandible fractures can be divided into rigid fixation, semi rigid fixation, and non-rigid or closed reduction. Methods considered for rigid fixation are compression plating, reconstruction plates, lag screw technique and external pin fixation. Miniplate fixation and wire fixation are types of semi rigid fixation. Maxillomandibular fixation, gunning splints are considered non-rigid fixation (Francis B Quinn *et al*., 2004). The main goal in successful treatment of mandibular fractures is reduction and stabilization of the fracture allowing bony union with achievement of functional occlusion (A John Vartanian and Aijaz Alvi, 2000). Open reduction of mandibular fractures before internal fixation is most commonly performed by one of the methods: intermaxillary fixation or manual reduction or forceps assisted maneuvers. Arch bars are placed initially to establish occlusion followed by open reduction and fixation. In the process of fully satisfying these criteria, it is also advantageous to use technique of reduction that reduces the following: surgeon's operating time on the table, avoiding the hardware thereby reducing the risk to both the clinician and the patient, a clear surgical field free of many assistant's hands and surgical instruments to lock the reduction (Taglialatela Scafati *et al*., 2004). Scafati *et al* in 2004 described the method of simple and effective method of fracture reduction by using 2mm monocortical screws and elastic rubber bands and the procedure being called as elastic internal traction (Johnathan D Mcginn and Fred G Fedok, 2008; Ashraf F Ayoub and John Rowson, 2003; Taglialatela Scafati *et al*., 2004). Vikas sood *et al* in 2009 modified this technique by using elastomeric orthodontic chain instead of elastic rubber bands (Vikas Sood and Terrence Lowe, 2010) which is similar to our study where 2mm monocortical screws and elastic orthodontic chain was used for reduction of the fracture fragments. In our study, the time taken from surgical exposure of the fracture site to reduction of the fracture took 20 - 30 minutes with elastic traction. It reduces the operating time in comparison with intermaxillary fixation which is in accordance with the study conducted by Taglialatela Scafati, Faccuitoetal (2004), Gargiulo, Aveta *et al*. (2008).

Post reduction occlusion was compared in both the groups. Normal premorbid occlusion was achieved in isolated fractures of the mandibular parasymphysis with minimal to moderate displacement in both groups. The results obtained were in contrast with the studies conducted by Taglialatela, Scafati (2004) where 2% cases with malocclusion were found in mandibular body fractures. No case required postoperative intermaxillary fixation as the anatomical reduction done was stable. The results were similar with the studies conducted by Singh, Kumar (Singh *et al*., 2011). Mental nerve paresthesia, post operatively was noticed in one case with elastic internal traction technique. The results were in accordance with the studies conducted by Matos, Amez (2010), where 28% of cases had complication of postoperative mental nerve paresthesia. The reason for mental nerve paresthesia in elastic traction group may be due to the manipulation of the nerve slightly for adjusting the space in placing plates and screw. The paresthesia observed in 1 case was also mild and the patient regained his normal sensation within 2months which was observed during follow period. In our present study, 14.28 % cases resulted in percutaneous wire punctures with intermaxillary fixation technique whereas there were no such injuries in the elastic internal traction cases. The results correlate with the studies conducted by Jonathan E Carlton (1997) Ashraf Ayoub (2003) in which intermaxillary fixation technique had more chances of percutaneous transmission of blood borne infections and as well as increased trauma to the tissues during the use of the hardware. In our study, there was no case that was recorded with iatrogenic damage to the adjacent teeth in both the groups of the patients. The results were not in accordance to the study conducted by Taglialatela, Scafati (2004) where1% of case with root perforation was reported. No case was reported with postoperative complications like wound dehiscence and secondary infection of bone plates. The results were not in accordance with the study conducted by Taglialatela, Scafati (2004) where they reported 2% of cases with secondary infection due to the poor oral hygiene maintenance by the patients. In the present study and the study done by Scafati (2004), Alberti (2008), Vikas sood, Terrance Lowe (2010) it is evident that elastic internal traction is a simple and effective method for fracture reduction. It provides a stable primary fixation of the fragments before the rigid fixation. It makes the surgical field clear of the assistant's hands and surgical instruments used to fix the reduction increasing the visibility and good accessibility of the field to the surgeon. Resulting operative time is also shortened.

Conclusion

Elastic internal traction for open reduction of mandibular fractures is a viable alternative to intermaxillary fixation. It is a simple and effective procedure with no additional costs since the screws used in elastic traction can be reutilized to fix the bone plate. The procedure had the advantage that there is considerable reduction in the operatory time for reduction of the fracture by elastic traction than with reduction by intermaxillary fixation. It is technique sensitive procedure as correct placement of the supporting screws with a proper preoperative surgical planning is required. However, larger samples and longer follow-up period may be required for a better evaluation.

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