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RESEARCH ARTICLE

OUR CLINICAL EXPERIENCE OF TRANSALVEOLAR SCREWS IN MAXILLOMANDIBULAR FIXATION

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ABSTRACT

Introduction: Transalveolar screws for achieving maxillomandibular fixation have been in clinical usage for the past three decades. Thisprospective clinical study aims to analyze the efficacy and potential complications of transalveolar screws in the management of mandibular fractures. **Material and Methods:** A prospective interventionalclinical study with 40 adult patients with minimally displaced mandibular fractures effecting the occlusion and requiring open reduction and internal fixation were selected. Maxillomandibular fixation was achieved using 2.0 mm diameter, 10-12 mm long, titanium transalveolar screws. The time required to achieve Maxillomandibular fixation using transalveolar screws was recorded. Intraoperative complications (glove perforation, screw breakage, screw redirection, soft tissue injury) and post-operative complications (iatrogenic root damage, tooth non-vitality, soft tissue injury) were recorded during follow up. The results were statistically evaluated using the Mean and Percentage tool. **Results:** The average time taken to achieve Maxillomandibular fixation was found to be 16.43 minutes, with three screw breakage out of 163 screws used. No glove perforation was observed. Iatrogenic dental damage was found to be 6.62% with additional soft tissue injury. Occlusal stability of the device was found to be satisfactory, though screw loosening in a few cases was observed. **Conclusion:** The overall incidence of intraoperative and postoperative complications with their sequelae were minimal and can be further decreased by taking appropriate precautions.

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INTRODUCTION

Literature has a vast number of studies discussing the indications, limitations and comparison of the use of transalveolar screws to conventional methods such as arch bars for achieving Maxillomandibular fixation.[1,2,3,4,5] Although conventional wiring techniques as Arch bars, Ivy eyelet have proved to be effective and versatile but carry the risk of percutaneous injuries to the operator, trauma to patients periodontium and are time consuming.[1,2,3]These potential complications of conventional dental wiring can be minimized to a great extend by replacing them with transalveolar screws in suitable cases.[2,4,5] The objective of this clinical prospective study is to analyze the benefits, efficacy, complications and possible limitations of self-drilling self-tapping transalveolar screws in achieving MMF in treatment of mandibular fractures.

MATERIAL AND METHODS

The prospective clinicalstudy group comprised of 40 adult male and female (age range 18- 56 years) patients of mandibular fractures treated in Department of Oral and Maxillofacial Surgery between July 2014 to March 2016. Patients with minimally displaced favorable mandibular fractures effecting the occlusion and requiring open reduction and internal fixation (ORIF) were included in the study. However, the patients with comminuted, unfavorable, dentoalveolar, fractures with impacted teeth other than third molars, patients with underlying disease (American Society of Anesthesiologists III and IV), dental crowding and fractures requiring prolonged MMF period were excluded. Diagnosis was made on the basis of the history, clinical and radiographic examination using Orthopentogram (OPG) and accordingly

Figure 1. Intraoral periapical radiograph showing iatrogenic root damage in relation to maxillary second premolar and transalveolar screw inserted at the new site

Figure 2. Orthopentogram showing itrogenic root damage in relation to left mandibular first premolar observed after the removal of transalveolar screws at fourth week

Figure 3. Intraoral clinical picture of the patient showing mucosal coverage of three transalveolar screws as marked by the arrow maxillary left screw has no mucosal coverage

decision was made whether the patient will be operated under local anesthesia or general anesthesia (LA/GA). Written informed consent was obtained from all individual participants included in the study. Institutional ethical clearance was obtained prior to the study. The predetermined site for the insertion of the screw was decided after thoroughappropriate radiographic and clinical evaluation.

Figure 4. Intraoral clinical picture of the patient showing mucosal ulcer on the ventral surface of the lower lip due to the impingement of the head of the transalveolar screw

Prior to the placement of transalveolar screws, the teeth present adjacent to the determined screw site were tested for vitality using electronic pulp tester (EPT) pre-operatively. Under LA/GA, maxillomandibular fixation was done using 2.0 mm diameter, 10-12 mm long Titanium, self-tapping, self-drilling transalveolar screws (Orthomax India, Baroda). Screws used in maxilla and mandible were placed preferably below the mucogingival junction, with a minimum of one screw in each quadrant, however, the number and sites of the screws were dependent on the fracture site.In case resistance was felt during the screw insertion, its path was redirected. The tactile feel and comparative greater resistance encountered during screw placement were considered as the clinical signs of screws being in close approximation to denser root structure.The screws were inserted using a universal screw driver.The screws used in this study were self-drilling and self-tapping, the motorized drill was not used to avoid any kind of thermal necrosis. MMF was done in all the cases of transalveolar screws with 26 gauge pre-stretched wire prior to ORIF. Intraoperatively, time taken for the screw placement and achievement of MMF (in minutes) was noted along with occlusal stability and any other complication(such as screw breakage, screw redirection, soft tissue injury). The gloves of the operator and the assistant were removed after the achievement of MMF and checked for any glove perforation by checking for any leak after filling with tap water (till the glove was completely bloated). All the cases were performed by single operator while the assistant varied. New pair of gloves were subsequently used for ORIF using miniplates (2mm 4 hole Titanium plates with gap) according to Champy's (1978) principle, while closed reduction (CR) was achieved for minimally displaced unilateral condylar fractures (U/L). Maxillomandibular fixation was released in all the patients after ORIF, however, MMF was maintained in cases of condylar fractures for three weeks or till stable occlusion was achieved. Immediate postoperative radiograph was done after ORIF. Post -operative observations and complications (iatrogenic root damage, tooth vitality, soft tissue injury) were noted clinically, radiographically and by performing EPT of the teeth adjacent to the screw site during subsequent follow up visits at first, second, fourth week.Transalveolar screws in all the patients were removed after four weeks using universal screw driver.After the removal of the transalveolar screws at fourth week, relation of site of insertion of transalveolar screw with adjacent radicular portion of tooth was noted radiographically (OPG).

The radicular contact was noted as major if more than 50% of the screw diameter impinged on the adjacent tooth root and minor if the radicular contact was less than 50% of the screw diameter.[6]Descriptive statistical tools as Mean and Percentage were used for data and results evaluation.

RESULTS

There were 37 (92.5%) males and three (7.5%) females in the study. The distribution of sites of mandibular fractures and treatment performed is given in table 1. The meantime taken for the placement of MMF screws was found to be 16.43 minutes with a range of 10-28 minutes.

the last follow only four (1.20%) teeth were found to be negative during EPT thus leading to non-vitality. One patient developed ulcer on the ventral surface of lower lip by the end of the second week. Complications observed (intra and post-operative follow up) are compiled in table II. Occlusion was satisfactorily maintained till the last follow up in all the cases.

DISCUSSION

To overcome the potential complications and limitations of the conventional dental wiring, predrilled and self-tapping bone screws were introduced for achieving MMF almost three decades ago.[1,2,3]

Table 1. Distribution of mandibular fracture sites and treatment performed

Fracture sites	No. of patients	Treatment done
Symphysis	4	ORIF ↓ LA, MMF released
Symphysis, U/L condyle head	3	ORIF ↓ LA, MMF maintained
Parasymphysis	8	ORIF ↓ LA, MMF released
Parasymphysis, U/L condyle head	5	ORIF ↓ LA, MMF maintained
Parasymphysis, U/L Angle	3	ORIF ↓ GA, MMF released
U/L Body	5	ORIF ↓ LA, MMF released
U/L Body, U/L Angle	2	ORIF ↓ GA, MMF released
U/L Angle	6	ORIF ↓ GA, MMF released
U/L Condyle head	4	CR ↓ LA, MMF maintained
Total= 53	Total= 40	

U/L = Unilateral
↓ LA = Treated under local anesthesia
↓ GA = Treated under general anesthesia
ORIF = Open Reduction Internal Fixation
CR = Closed Reduction
MMF = Maxillomandibular Fixation.

Table 2. Intra and post-operative complications

Total no. screws used 163	Iatrogenic dental damage =22(6.62%) Total teeth evaluated n= 332			Soft tissue injury			Stability of device			
				Intra -operatively	Post -operatively					
Screw Breakage= 3 (1.84%)	Major contacts	Minor contacts	Non vitality	Mucosal Lacerations (15)	Mucosal coverage (partial/ complete)		Total Loose screws = 9		Lost	Displaced
Maxilla (1) Mandible (2)	8 (2.40%)	14 (4.21%)	4 (1.20%)	Improper retraction = 7	2nd week	4th week	2nd week	4th week	_	_
				Broken screw heads = 3	5	17	Maxilla = 1 Mandible = 2	Maxilla = 4 Mandible = 5		
				Redirected screws = 5						

A total of 160 gloves (operator and assistant) were used for the achievement of MMF and none were found to be perforated. One screw was used per quadrant, except in three cases, where additional one screw per case was used due to screw breakage, making the total number of screws used in the study to 163.Intraoperatively five screws were redirected to avoid the radicular contact. A total of three screws (1.84%) out of 163 screws used broke (one in maxilla and two in mandible) intra-operatively. A total of 15 mucosal tears occurred during the placement of MMF screws. Intraoperatively, a satisfactory occlusal stability was achieved in all the cases. At the time of screw removal at fourth week, a total of 17 (10.42%) screws had mucosal coverage and a total of nine(5.52%) screws were found to be loose. The total number of teeth evaluated for iatrogenic injury were 332 (includes teeth adjacent to the transalveolar screws insertion sites). Iatrogenic dental damage was found in 22 (6.62%) teeth with eight major and14 minor root contacts out of a total of 332 teeth evaluated. However, till

In the present study, the time taken for MMF screws placement and achievement of MMF was on an average of 16.43 minutes. Authors have reported the achievement of MMF using screws as a quick method with an approximate time frame of 10-23 minutes.[2,3,4] Screws were placed above the mucogingival junction transmucosally and were slowly tapped into the alveolar bone. However, site of five screws was changed after it was felt that screws might have come in contact with adjacent root. For all the redirected screw positions intra oral periapical radiograph was taken after the procedure. However, out of five redirected screws, radiographic confirmation of screw contact was found in only one case (fig 1). Intraoperatively, in our study,three screws in three patients (one in maxilla and two in mandible) broke out of a total of 163 screws used. These screws broke after being fully inserted in the bone from the screw head level. They were left in situ (removed later during the follow up) and different site was used for the insertion of the new screw.

Holmes and Hutchison had advised the use of screws with caution as the removal of broken screws takes longer time than ORIF.They suggested a technique of two forward turns accompanied by one backward turn to exclude the swarf from the pitch of the screw.[3]Scribante et al in their in vitro study on the reliability of bending and maximum load for titanium and stainless steel mini screws concluded that 2.0 mm diameter mini screws irrespective of the material showed higher bending and fracture resistance than 1.5mm diameter. They also mentioned that the collar region is considered a weak point of the whole screw from where it can fracture mostly during clinical usage.[7]In our study, all the screws experienced only single number of bone insertion but underwent repeated sterilization cycles. Screw breakages occurred in patients who were treated under local anesthesia. Therefore, we personally felt that the control and the direction of instrument is quiet dependent on the comfort level of the patient as well as the operator. As all the cases were done by the single operator, a definite learning curve was experienced for the usage of bone screws till the time the study was completed. Sekar K et al in their comparative study on usage of transmucosal screw versus conventional maxillomandibular fixation techniques found a requirement of special armamentarium and a course of acclimation to adapt this advanced technique which may also not prove to be convenient for treatment of all fractures.[8] We feel that the complications of screw breakage, and working manipulation might have prolonged the average time consumed for MMF.

In the present study a total of 15 mucosal lacerations occurred intraoperatively in 11 patients which were a result of improper retraction of soft tissues in three patients, due to broken screws heads in three patients and because of redirected screws in five patients. There were greater chances of mucosa getting entangled during screw insertion to the cutting edge of the screws, therefore, a proper tight retraction of the soft tissues was required to avoid such complications. Gloves used by the operator and assistant for the achievement of MMF were not found to be perforated when filled with water. Bone screws requires only two MMF wires (if one screw per quadrant is used), thus decreasing the risk of needle stick injury. Studies have proved a statistically significant difference of glove perforations with the use of bone screws as compared to arch bars for the achievement of MMF.[2,4,5]Similar findings of no wire stick injury during screw placement have been reported.[9] Iatrogenic root damage is one of the most common potential complication of the intracortical bone screws .[2,10,11,12,13] In our study a total of 22 (6.62%) radiographic contacts (major eight and minor 14) of the roots of adjacent teeth were found on the radiographic examination done immediately after screw removal in respect to 332 teeth adjacent to the site of placement of screws (fig 2). The assessment of root area contact was based on study by Fabbroni et al .[6] A total of four (1.20%) teeth out of 332 teeth were found to be non-vital on their subsequent follow up visits. Qureshi et al found accidental root perforation as a limitation of intermaxillary screws when inserted through predrilled holes and attributed to the fact that these occurred due to improper angulation of drill bit and overcrowding of teeth in areas of insertion.[11] A comparative study by Widar et al found no injury to dental roots in patients that received drill free transalveolar screws than the patients who received pre-drilled screws. They suggested that tactile feedback allows the surgeon to sense that whether the tip of the screw was entering the alveolar bone or touching the dental root which was also followed by us.[13]

In our study non vitality after EPT in mandibular premolar in one patient and maxillary premolar in another patient was due to the process of retrieval of the fractured screw using straight fissure bur and coupland elevator thus causing damage to the apical root. The retrieval of broken screws was easier in maxilla than mandible due to less denser bone. We suggest that a broken screw may be left in situ than attempt removal as the latter may cause more iatrogenic damage. In the other two patients the mandibular premolars had suffered a major contact with the screw. These teeth continued to give response on EPT till the fourth week after which they became non vital. These non-vital teeth were treated endodontically during the further follow up. Rest of the teeth with major and minor contacts continued to give response on EPT till the last follow up of threemonths. Widar et al described the dental damage as unpredictable. A damage most probably heals with cementum layer or is superseded by alveolar growth.[13]Moreover, parallax error on the radiographs could also give a false positive result thus showing root contact when clinically it is not present .[6] In present study, a total of 17 screws were found to have a mucosal coverage (partial or complete), where a small incision had to be placed for their removal (fig 3). The screws without any mucosal cover were removed comfortably with only topical local anesthesia. Most of the teeth with mucosal cover were those whose site had been changed during insertion which led to a mucosal tear or which were placed near the incision site for fracture exposure. Many studies show that soft tissue coverage is frequently encountered with bone screws .[4,5,9,] We felt that this adverse effect can be decreased by proper soft tissue retraction, avoiding entanglement of mucosa during insertion, placement of screws at a safe distance from fracture site and not placing the screws deep in the vestibule in loose alveolar mucosa.

One patient developed mucosal ulcer on the ventral side of lower lip due to the impingement of the screw head (fig 4). On the end of second week it was observed that the screw was mobile and was present more buccal than its original position. Ulcer healed uneventfully once the screw was removed. At the time of removal of MMF screws on fourth week, nine (5.62%) screws (four in maxilla, five in mandible) out of a total of 160 screws used for MMF were found to be loose. Patients treated with CR for condylar fracture maintained adequate occlusal stability till third week (MMF released). Rothe et al reported difficulty in maintaing occlusal stability using intermaxillary fixation screws beyond six weeks due to chance of screw loosening.[14] All the patients in our study were fully complaint as we did not encounter any complaints from patient's attendants regarding screw or MMF wire manipulations. However, a caution is stated for the achievement of MMF with screws in case of noncompliant patients as it is easier to release MMF when using bone screws than arch bars and the presence mucosal injury, root injury and screw loosening makes their usage doubtful .[15,16]

Conclusion

MMF of minimally displaced mandibular fractures in complaint patients were successfully managed using 2.0 mm self- tapping self -drilling titanium transalveolar screws. The mean time taken of 16.43 minutes and no glove perforation while doing MMF were the main benefits of the usage of these screws. The overall incidence of complications and their sequelae with the use of these screws was minimal and can be further reduced by taking appropriate measures like careful site

selection, appropriate soft tissue retraction, careful screw insertion and maintaining comfort of the patient and operator.

Limitation

Only favorable, undisplaced mandibular fractures were included in the study and the results were found to be satisfactory, however the efficacy of the transalveolar screws could not be predicted for unfavorable facial fractures, thus being the limitation of the study.

REFERENCES

1. Arthur G, Berardo N. A simplified technique of maxillomandibular fixation. J Oral Maxillofac Surg. 1989; 47:1234.
2. Fernandes I.A, Lopes A.B.S, Fonseca P.G, Rodrigues A.B, Galvao E.L, Falci S.G.M. Comparison between Erich arch bars and intermaxillary screws in maxillofacial fractures involving the dental occlusion: Ameta-analysis. Int J Oral and Maxillofac Surg. Aug 2020 (In press)
3. Holmes S, Hutchison I. Caution in use of bicortical intermaxillary fixation screws. Br J Oral Maxillofac Surg. 2000;38:574
4. Sandhu YK, Padda S, Kaur T, Dhawan A, Kapila S, Kaur J. Comparison of Efficacy of Transalveolar Screws and Conventional Dental Wiring Using Erichs Arch Bar for Maxillomandibular fixation in Mandibular Fractures. Journal of Maxillofacial and Oral Surgery. 2018;17:211-217
5. Balihallimath L, Jain R, Mehrotra U, Rangnekar N. To compare the efficiency of maxillomandibular fixation screws over erich arch bar in achieving intermaxillary fixation in maxillofacial trauma. A clinical study. J Int Clin Dent Res Organ. 2018;10:27-31
6. Fabbroni G, Aabed A, Mizen K, Starr DG. Transalveolar screws and the incidence of dental damage: a prospective study. Int J Oral and Maxillofac. 2004; 33:442-446
7. Scribante A, Montasser MA, Radwan ES, Bernardinelli L, Alcozer R, Gandhi P, Sfondrini MF. Rliability of Orthodontic Miniscrews: Bending and Maximum Load of Different Ti-6Al-4V Titanium and Stainless steel Temporary Anchorage Devices (TADs). Materials. 2018,11,1138; doi:10.3390/ma11071138
8. Sekar K, Natarajan P.M, Kapasi A. Comparison of arch bars, eyelets and transmucosal screws for maxillomandibular fixation in jaw fracture. Biomed Pharmacol J. 2017;10:497-508
9. Schneider AM, David LR, DeFranzo AJ, Marks MW, Molnar JA, Argenta LC. Use of specialized bone screws for intermaxillary fixation. Ann Plast Surg. 2000;44:154-7.
10. Hartwig S, Boettner A, Doll C, Voss JO, Hertel M, Preissner S etal. Drill-Related Root Injury Caused by Intraoperative Intermaxillary Fixation: An Analysis of 1067 Screw Applications. Dent Traumatol. 2017;33:45-50
11. Qureshi A.A, Reddy U.K, Warad N.M, Badal S, Jamadar A.A, Qurishi N. Intermaxillary fixation screws versus Erich arch bar in mandibular fractures: Acomparative study and review of literature. Ann Maxillofac Surg. 2016;6:25-30
12. Vatsa P, Siddaraju A. A comparative clinical study on self-drilling screws and Erich arch bar in mandibular fractures. International Journal of Applied dental sciences. 2018;4:212-217
13. Widar F, Kashani H, Kanagaraja S, Dahlin C, Rasmusson L. A retrospective evaluation of iatrogenic dental root damage with predrilled vs drill free-bone anchor screws for intermaxillary fixation. Dent Traumatol. 2012; 28:127-31.
14. Rothe T.M, Kumar P, Shah N, Shah R, Kumar A, Das D. Evaluation of efficacy of intermaxillary fixation screws versus modified arch bar for intermaxillary fixation. National Journal of Maxillofacial Surgery. 2018;9:134-139.
15. West GH, Griggs JA, Chandran R, Precheur HV, Buchanan W, Caloss R. Treatment Outcomes With Use of Maxillomandibular Fixation Screws in the Management of Mandible Fractures. J Oral Maxillofac Surg. 2014;72:112-120
16. Jain A, Rai A. Is the Use of Intermaxillary Fixation screws an Alternative to Erich Arch bar for Maxillomandibular Fixation during Management of Maxillofacial Fractures? A Systemic Review and Meta-Analysis. Craniomaxillofacial Trauma and Reconstruction. 2021;14(3):236-245

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