



RESEARCH ARTICLE

FIXATION OF MANDIBULAR ANGLE FRACTURES WITH A MINIPLATE BY INTRAORAL APPROACH AND BY A COMBINATION OF TRANSBUCCAL AND INTRAORAL APPROACH -A COMPARATIVE STUDY

^{1,*}Dr. Asish Kumar Das, ²Dr. Ajoy Kumar Gupta, ³Dr. Virendra Kumar Prajapati and ⁴Dr. Monimoy Bandopadhyay

¹ Associate Professor, Department of Oral & Maxillofacial Surgery, Burdwan Dental College & Hospital, Burdwan, West Bengal

² Sr. Lecturer, Purbanchal Institute of Dental Sciences, Gorakhpur, UP

³ Professor, Department of Dentistry, RIMS, Ranchi, Jharkhand

⁴ Professor, Department of Oral & Maxillofacial Surgery, Dr. R. Ahmed Dental College & Hospital, Kolkata-14, West Bengal

ARTICLE INFO

Article History:

Received 14th December, 2014

Received in revised form

06th January, 2015

Accepted 14th February, 2015

Published online 31st March, 2015

Key words:

Fracture,
Angle of mandible,
Mini bone plate,
Transbuccal,
Intraoral

ABSTRACT

The mandibular angle is a frequent site of fracture and has a high rate of complication. In order to minimise complications a functionally stable fixation is required. Different methods of internal fixation have been advocated with varying degrees of success. The use of mini bone plate helps in immobilising the fractured bony fragments and thereby maintaining quality of life. The objective of this study is to evaluate the effectiveness of mini bone plate to immobilise the fractured fragments in the region of the angle of the mandible by two different approaches-intraoral technique only and transbuccal with intraoral technique. Patients were randomly divided in two groups, A and B. In Group A one non-compression 2.0 mm miniplate was used on the lateral surface of mandible, in the region of the angle approached both intraorally and transbuccal. In Group B one non-compression 2.0 mm miniplate was placed on external oblique ridge of mandible intraorally. Peak incidence of isolated mandibular angle fractures was seen in males within the age group of 21-30 years. Mean age was 29.75 years; males had a higher incidence than females. Most common aetiology of the trauma was RTA (45%) followed by assaults (35%). Stability of fracture fragments; tooth damage, facial nerve weakness and hardware failure have been found with statistically no significant difference. Scar became invisible at the end of 6 months in all patients of Group A. 1 patient of Group B had gross displacement between the fractures fragments for which paresthesia did not recover till the end of 6 months. The intra-operative time was significantly higher in Group A patients compared to Group B. The combined use of transbuccal & intraoral technique produces excellent results as screws are placed perpendicular to stress across the fracture line and the provision for placement of a second plate, if required, still remains. It is possible to maintain better reduction, with minimal or no plate bending with the clinical impression of better stability.

Copyright © 2015 Dr. Asish Kumar Das et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

The mandibular angle is the most frequent site of mandibular fracture and also has the highest rate of complications (Prein, 1998). Several methods of internal fixation have been studied with great variation in rate of complications. The possible disadvantages of the use of plates according to the AO/ASIF philosophy for the treatment of the mandibular angle were the need for an extra-oral approach increasing the risk of injury to important anatomic structures, the formation of scars and greater difficulty in plate adaptation (David et al., 2008).

Champy used mini bone plates with monocortical screws in the most mechanically advantageous areas along the ideal lines of osteosynthesis without damaging the teeth (Champy et al., 1978). The transbuccal approach was advocated which results in minimal external scarring with direct visualization and conformation of the desired occlusion during placements of the bone plates (Sugar et al., 2009).

Aims and Objectives

The aim of this study is to compare the outcomes following the fixation of mandibular angle fractures with single miniplate on the external oblique ridge through an intra-oral approach with

*Corresponding author: Dr. Asish Kumar Das

Department of Oral & Maxillofacial Surgery, Burdwan Dental College & Hospital, Burdwan, West Bengal

a combined transbuccal and intraoral approach. Subsequently the usefulness of the transbuccal approach to address the lateral surface of the mandible in angle region is analyzed. The efficacy and stability of single miniplate over the angle region by placing at two different anatomical locations is evaluated and the different postoperative parameters are compared and corroborated. The objective is to define which approach will deliver better management with ease and less complication.

MATERIALS AND METHODS

Patients diagnosed on the basis of clinical and radiographic evaluation to be having isolated mandibular angle fracture (single) without pre-existing infection and comminution and otherwise not medically compromised were selected for this study with informed consent. Those found to be having foreign body sensitivity, metal allergy and associated fracture of mandible other than angle fracture were excluded from this study. Patients were randomly divided in two equal groups. Group A consisted of patients who underwent osteosynthesis by one non-compression 2.0 mm miniplate on lateral surface of angle region of mandible approached both intraorally and transbuccally. Group B consisted of patients who underwent osteosynthesis by one non-compression 2.0 mm miniplate on external oblique ridge of mandible approached intraorally. All the cases have been operated under general anaesthesia. The standard transbuccal kit (trocar, cannula with handle, drill sleeve, handle retractor) with 2.0mm four hole titanium miniplate with bar, 2x6mm, 2x8mm screws and 1.5 mm diameter drill bit were used. Maxillomandibular fixation was done to achieve centric occlusion with the help of Erich arch bar. In Group A where there is no third molar present or where one is present but is to be left in place, a vestibular incision approximately 5mm away from the attached gingiva is used and mucoperiosteal flap along with muscle was reflected to expose the fracture fragments.

Extra-oral incision (5mm. in length) is marked just anterior to masseter muscle and one finger breadth above the lower border of the mandible and blunt dissection is done to the depth of bone. The cannula with trocar is then introduced through the facial tissue down to the bone. The trocar is then removed to open the cannula for insertion of screws. The U-shaped cheek retractor is applied by placing the forked inner end of the retractor around the cannula intra-orally. Immobilisation of fracture fragments was done by 2.0mm four hole titanium miniplate with bar adapted on the lateral surface of angle region following Champy's Ideal lines of osteosynthesis. In Group B a combination of vestibular and envelop incisions is used.

When an erupted third molar is to be removed, the incision must incorporate the attached gingiva around the buccal side of the tooth and mucoperiosteal flap along with muscle was reflected to expose the fracture fragments. A drill guide is used to ensure the perpendicular nature of the drill hole to the plate. Drill bit used for drilling has stop for which there is no chance of extra penetration. Follow-up of treated cases were done on 1st week, 3rd week, 3rd month and 6th month post-operatively as per laid down parameters. Postoperative orthopantomograms were taken to assess any malunion, non-union or osteomyelitic changes.

RESULTS

A total number of 20 patients with isolated mandibular angle fractures (single) without pre-existing infection and comminution and otherwise not medically compromised were selected. Follow up of treated cases were done on 1st week, 3rd week, 3rd month and 6th month postoperatively. This study was done to evaluate and compare between the two techniques for the management of angle fractures taking into account different parameters like swelling, infection, occlusal stability, wound dehiscence (plate exposure), hardware failure, tooth damage, paresthesia, facial nerve weakness, intra operative time and extraoral scar. Fully prepared history-sheets and proformas were filled up for every patient in this study. A total number of 20 patients met our inclusion criteria. It was divided into two groups A and B.

In this study a peak frequency of 10 patients (50%) was found during the 3rd decade of life with a male preponderance of about 90% (Table 1 & 2). Road traffic accident was the cause of fracture in 9(45%) patients followed by cases of assault 7(35%) (Table 3) Pre-operatively all the patients had occlusal derangement. Postoperatively there was normal occlusion in all except 1 case of derangement in Group B after 21 days (Table 4). At 3 months follow up, in group B, 1 patient presented with infection and none in group A. At 6 months follow up none of the patients were found to be having any infection at the operative site (Table 5). Preoperatively patients with gross infection at the site of fracture were excluded from the study. Paresthesia was noted pre-operatively in 4 patients in Group A and 3 patients in Group B. At the first follow up the same finding was noted. In the second follow up 2 patients in each group were noted with paresthesia. At 3 months follow up 1 patient was noted in Group B which persisted for 6 months. 1 patient of Group B had gross displacement between the fractures fragments for which paresthesia did not recover till the end of 6 months (Table 6).

Table 1. Age distribution of the patients

Age(Years)	Frequency	Percentage
<= 20	2	10
21-30	10	50
31-40	5	25
41-50	2	10
51-60	1	5
Total	20	100

Table 2. Sex distribution of the patients

Sex	Frequency	Percentage
Male	18	90
Female	2	10
Total	20	100

Table 3. Different etiologies of mandibular fractures

Etiology	Frequency	Percentage
RTA	9	45
Assault	7	35
Fall	3	15
Others	1	5
Total	20	100

Table 4. Occlusion of patients

	Pre-operative		Post-operative									
			0 day		7days		21days		3months		6months	
	A	B	A	B	A	B	A	B	A	B	A	B
Deranged	10	10	0	0	0	0	0	1	0	0	0	0
Normal	0	0	10	10	10	10	10	9	10	10	10	10
P value	NS		NS		NS		0.3		NS		NS	

Table 5. Comparison of infection in Group A & B

Follow up	Group A		Group B		P value
	Present	Absent	Present	Absent	
7days	0	10	0	10	NS
21days	0	10	0	10	NS
3months	0	10	1	9	>0.05(NS)
6months	0	10	1	9	NS

Table 6. Comparison of paresthesia in Group A & Group B

	Pre-operative		Post-operative									
			7 days		21days		3months		6months			
	A	B	A	B	A	B	A	B	A	B		
Present	4	3	4	3	2	2	0	1	0	1		
Absent	6	7	6	7	8	8	10	9	10	9		
p-value	0.639		0.639		NS		0.305		0.305			

Swelling on 3rd post operative day was severe in 30%, moderate in 60%, mild in 10% of cases in group A, severe in 20%, moderate in 70%, mild in 10% in Group B. On 7th day of post-operative follow up 90% of the cases had only mild swelling in Group A and 80% cases had only mild swelling in Group B.

No patients of both the groups presented with severe swelling (Table 7&8). No tooth damage, facial nerve weakness or post-operative mobility between the fracture fragments was noted in either group. No wound dehiscence was observed up to second follow up (21 days) in both the groups. At 3 months of follow up wound dehiscence was noticed in 1 patient in group B (p =0.305), Statistically it is insignificant. At 6 months follow up another patient was noted with wound dehiscence in both group A and group B and was insignificant (Table 9). The range of intraoperative time in group A was 55min-110 min, mean time = 76.5min, standard deviation of ±4.9. The range of intraoperative time in group B was 45 - 85 min, mean time= 62.5 min, standard deviation of ± 3.7min.

The intra-operative time was significantly higher in Group A patients compared to Group B (Table 10). In Group B only intra-oral incision was placed for which there was no scar on face. All patients of group A were noted with scar at 21 days of follow up (p =0.006). At 3 months of follow up 4 patients were noted with scar which was also statistically significant (p =0.025). Scar became invisible at the end of 6 months in all patients of Group A (Table 11, 12 & 13).

Table 7. Comparison of 3rd day post-operative swelling between Group A & B

Swelling	Group A	Group B
Mild	1(10%)	1(10%)
Moderate	6(60%)	7(70%)
Severe	3(30%)	2(20%)
Total	10	10

Table 8. Comparison of 7th day post-operative swelling between Group A & B

Swelling	Group A	Group B
Mild	9(90%)	8(80%)
Moderate	1(10%)	2(20%)
Severe	0	0
Total	10	10

Table 9. Comparison of wound dehiscence (plate exposure)

Follow up	Group A		Group B		X ²	p
	Present	Absent	Present	Absent		
7 days	0	10	0	10		
21days	0	10	0	10		NS
3months	0	10	1	9	1.05	>0.05(NS)
6months	0	10	1	9	1.05	>0.05(NS)

Table 10. Intra-operative time (in minutes)

Patients	1	2	3	4	5	6	7	8	9	10
Group A	110	90	80	70	75	80	75	70	55	60
Group B	75	85	60	65	70	55	70	55	45	50

Table 11. Evaluation of extra-oral scar after 21 days in Group A

Scar	Frequency	Percentage
Visible	9	90%
Barely visible	1	10%
Invisible	0	0%

Table 12. Evaluation of extra-oral scar after 3 months in Group A

Visible	Frequency	Percentage
Barely visible	1	10%
Invisible	3	30%
Invisible	6	60%

Table 13. Evaluation of extra-oral scar after 6 months in Group A

Visible	Frequency	Percentage
Barely visible	0	0%
Invisible	0	0%
Invisible	10	100%

**Figure 1. Orthopantomogram showing fracture mandible**



Figure 2. Incision marking



Figure 5. Closure of wound



Figure 3. Exposure of fracture site



Figure 6. Post operative Orthopantomogram



Figure 4. Placement of mini-plate

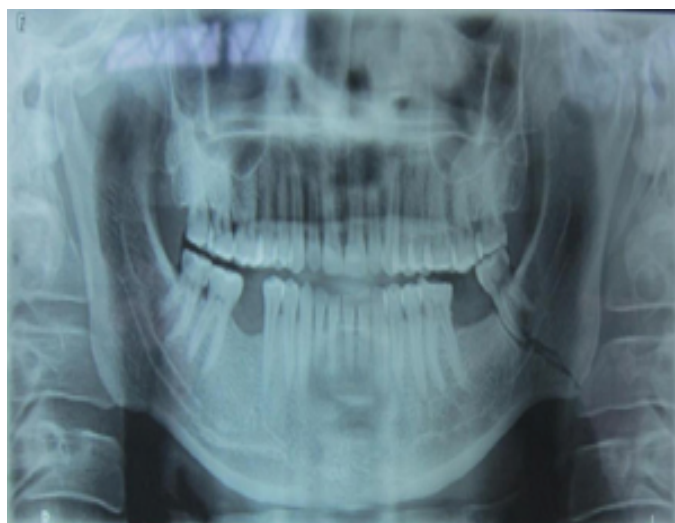


Figure 1. Orthopantomogram showing fracture mandible



Figure 2. Intraoral incision marking



Figure 5. Drilling bone



Figure 3. Skin incision marking

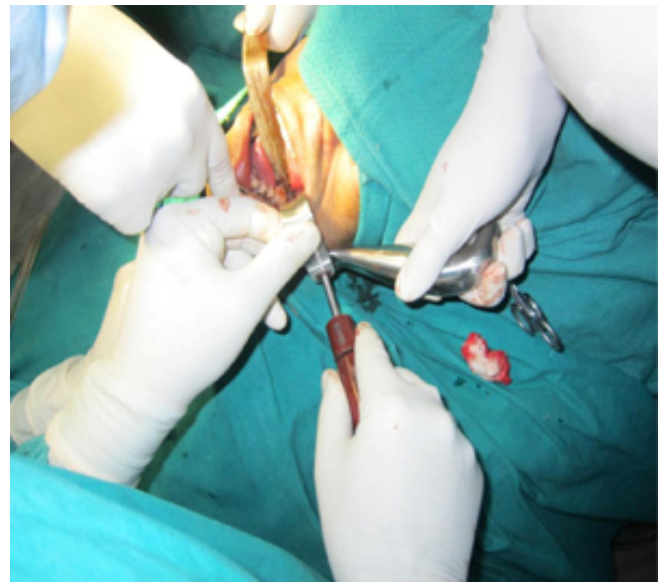


Figure 6. Insertion of screw



Figure 4. Insertion of cannula with trocar



Figure 7. Bone plate across the fracture line

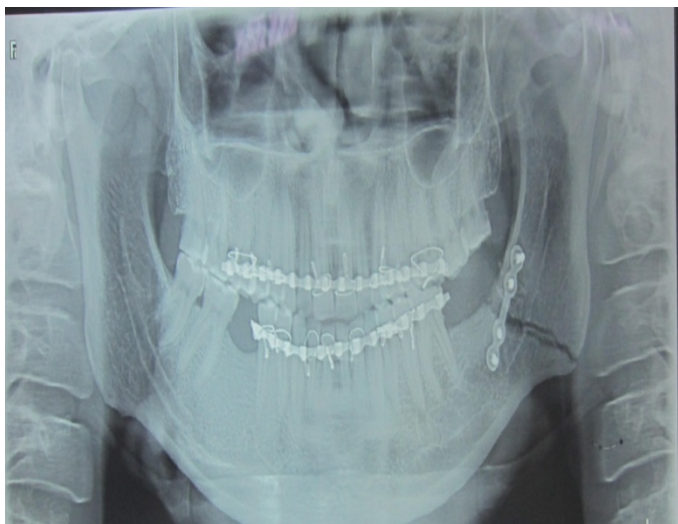


Figure 8. Post Operative Orthopantomogram showing plate in position

DISCUSSION

Bayat *et al.* (2010) studied prospectively 19 patients of isolated angle fractures, 18 males (94.7%) and 1 female (5.3%). They ranged in age from 15 to 41 years with a mean of 27.4 years. The principal cause of fracture was alteration (12 patients, 63%) followed by motor vehicle accident related trauma (7 patients, 37%). In this study age of the patients were within the range of 15 to 60 years. Incidence of mandibular angle fracture was comparatively higher in between the age of 21 years to 30 years with a mean value of 29.75 years. Out of the total 20 patients, there were 18 (90%) male and 2(10%) female patients (M: F = 9:1). Fractures occurred from road traffic accident in 09(45%), fall in 03(15%), assault in 07(35%) and others in 01(5%) patients. This is in close conformity with the observations of A K Danda (2010) who studied 54 patients with unilateral mandibular angle fractures, divided in two groups and found a male preponderance with a mean age of 32.4 and 29.6 years and the etiology being assaults and RTA.

Mehra (2008) compared between the two techniques for management of angle fracture, postoperatively. He did maxilla-mandibular fixation (MMF) for two weeks and found no occlusal discrepancy and minimal complication rate. In this study arch bar was used for MMF. Intra operatively MMF was done and it was continued for one week postoperatively, further elastic traction for correction of mild deranged occlusion was required in one patient.

Sugar *et al.* (2009) compared outcomes following fixation of 140 simple non comminuted mandibular angle fractures with a combined transbuccal and intraoral technique in which a single 2.0-mm, 4 hole miniplate was fixed to the lateral aspect of the mandible, with the standard intraoral technique in which a single miniplate was fixed to the anterior aspect of the mandibular external oblique ridge. There was a higher incidence of wound dehiscence in the intra-oral group (16%) than in the transbuccal group (12%) at the first review. This had increased to 25% in the intra-oral group and 15% in the transbuccal group by the second review. At the third review, 21% of the intra-oral group had wound dehiscence and/or

granulation tissue as did 9% of the transbuccal group ($p = 0.05$). A similar pattern was demonstrated for frank localised infection. Plate exposures were rarely observed in transbuccal group 4%, 2%, 5% at first review, second review and third review respectively. In group B intraoral group 4%, 4%, 7% at first, second, third review. Presence of infection with sinus and pus was observed in the combined approach 4% , 15%, 9% at first ,second and third reviews respectively, in intraoral approach 4% ,23%,20% at first ,second, third follow up respectively. Fewer plates were removed in the combined transbuccal intervention group ($n = 17$, 20%) than in the intra-oral control group ($n = 20$, 36%, $p = 0.042$).

Laverick (2012) found that the transbuccal plate had a significantly lower postoperative infection rate (6/124, 5%) than the ridge plate (28/137, 20%) ($p = 0.001$). In this study infection was noted in 1 patient (10%) of intra oral (Group B) and none in the combined intraoral and transbuccal approach (Group B). Wound dehiscence (plate exposure) was seen in 1 case (intra oral approach, Group B) at three months interval. The hardware was removed later on. However statistically it was insignificant. No further exposure of the plate was seen at the end of 6 months. He further observed that there was no significant differences between the groups in the incidence of damage to the inferior dental and facial nerves, occlusion after reduction of the fracture, or method of reduction.

David *et al.* (2008) observed that for simple angle fractures, the Champy(1978) technique is an elegant and effective method of internal fixation that reduces surgical time and dissection, minimizes the risk of damage to the facial and inferior alveolar nerves, and allows early return of function with acceptable complication rates. In our study we found no facial nerve palsy in Group A, (transbuccal and intra oral) or Group B (intra oral). Paresthesia was observed at 7 days and 21 days follow up in both groups and it had no significant difference. Paresthesia in 1 case (Group B, intra oral) persisted after injury up to the end of 6 months. We found the scar in group A (intraoral and transbuccal) at 21 days follow up in all patients which is significant. At 3 months follow up scar was seen extra orally in 4 patients (3-barely visible scar, 1-visible scar), which was significant in comparison to group B. The scar became invisible within 6months.

Laverick et al(2012) observed that the transbuccal approach (median 60, range 7 min to 180 min) did not require a significantly longer operating time than the conventional ridge plate (median 55 min, range 15 min to 180 min) ($p = 0.87$). Sugar et al (2009) compared outcomes following fixation of 140 simple non- comminuted mandibular angle fractures and found the mean length of surgery in the combined transbuccal intervention group was 64.9 min, and 59.6 min in the intraoral group ($p = 0.85$; not significant). In the present study the intra-operative time in Group A (combined transbuccal and intraoral) had a mean value of 76.5 ± 4.9 minutes (range 55 to 110 minutes). In Group B (intraoral alone) a mean value of 62.5 ± 3.7 minutes (range 45 to 85 minutes) was recorded, $p = 0.035 (<0.05)$. Intra operative time was significantly higher in group A compared to group B.

Siddiqui *et al.* (2007) used one miniplate at external oblique ridge in Group one, used two miniplates in Group second, patients had a second plate inserted transbuccally, as near as possible to the mandibular angle, but they did not observe any tooth damage in both the groups. Edward Ellis *et al.* (1996) found in their study that the use of single non compression miniplate for treating non comminuted fractures of the mandibular angle is a simple, reliable technique with minor complication. In the present study no mobility was found between the fracture fragments after immobilisation with no cases of malunion. Kroon *et al.* (1996) developed a three dimensional in vitro model to test stability of miniplate osteosynthesis in the mandible. Four clinically relevant fracture situations were simulated by osteotomies in polyurethane mandibles. The results showed that upper border miniplate fixation is not sufficient to counteract bending and torsional forces in angle.

Summary and Conclusion

Peak incidence of isolated mandibular angle fractures was seen in males within the age group of 21-30 years. Mean age was 29.75 years; males had a higher incidence than females. Most common aetiology of the trauma was RTA (45%) followed by assaults (35%). The common clinical presentation was deranged occlusion. Post operative wound healing was uneventful in majority of the cases. Stability of fracture fragments, tooth damage, facial nerve weakness and hardware failure have been found with statistically no significant difference. Extra oral scar visible after three weeks remained inconspicuous after six months in group A. In terms of scar & paresthesia there was no statistically significant difference. One patient was noted with wound dehiscence and infection (10%) in group B, for which the mini bone plate was removed later on. Intra operative time was higher in group A (mean 76.5 min) due to placement of transbuccal set and extra oral stab incision compared to Group B (mean 62.5 min) and was statistically significant. To conclude the combined use of transbuccal & intraoral technique produces excellent results owing to its ease of use. It is possible to maintain better reduction, with minimal or no plate bending with the clinical impression of better stability as screws are placed perpendicular to stress across the fracture line. The provision for placement of a second plate, if required, still remains. Moreover this technique provides the opportunity to facilitate the placement of the plate in neutral midpoint area of the mandible along with good soft tissue coverage. Transbuccal plates need not require removal for infection & with fewer complications than the intraoral technique.

REFERENCES

- Anil Kumar Danda, 2010. Comparison of a single non-compression miniplate versus 2 non-compression miniplates in the treatment of mandibular angle fractures; A prospective randomized clinical trial 2010: American Association of Oral & Maxillofacial Surgeons; *J.Oral & Maxillofacial Surg*; 68:1565-1567.
- Bayat M, Garajei A, Ghorbani K, Motamedi MH: Treatment of mandibular angle fractures using a single bioresorbable mini plate. *J.Oral & Maxillofacial Surg*:68:1573-1577,2010.
- Champy, M., Lodde, JP., Schmitt, R., Jaeger, JH. and Muster, D. 1978. Mandibular osteosynthesis by miniature screwed plates via buccal approach. *J Maxillofacial Surgery*, 6:14-19
- David, M. S., MD., Andrew, H. Murr and MD., FACS. 2008. Internal fixation of mandibular angle fractures with the Champy technique: Operative techniques in Otolaryngology. 19, 123-127.
- Ellis E, Walker LR: Treatment of mandibular angle fractures using one non-compression miniplate. *J.Oral &Maxillofacial Surg* 1996;54:864-71.
- Kroon, FHM., Mathisson, M. and Cordey, JR. 1991. The use of miniplates in mandibular fractures: An in vitro study *J. Craniomaxillofacial Surgery*. 19: 1991.
- Laverick S. *et al.* 2012. Intra-oral external oblique ridge compared with transbuccal lateral cortical plate fixation for the treatment of mandibular angle: prospective randomized trial. *British J of Oral & Maxillofacial Surg*; 50, 324-34.
- Mehra P, Murad H: Internal fixation of mandibular angle fractures: a comparison of 2 techniques; *J.Oral & Maxillofacial Surg.*, 66:2254-2260, 2008.
- Siddiqui, A., Markose, G., Moos, KF., McMahon, J. and Ayoub, AF. 2007. One mini plate versus two in the management of mandibular angle fractures: a prospective randomized study., *Br. J. Oral Maxillofacial Surgery*. 45: 223-225.
- Sugar, AW., Gibbons, AJ., Patton, DW., Silvester, KC., Hodder, SC., Gray, M., Snooks, H. and Watkins, A. 2009. A randomised controlled trial comparing fixation of mandibular angle fractures with a single mini plate placed either transbuccally and intra-orally or intra-orally alone. *Int.J.Oral & Maxillofac Surg*. 38:241-245.
