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A COMPARATIVE EVALUATION OF TRANSBUCCAL APPROACH AND STANDARD INTRA ORAL APPROACH IN FIXATION OF MANDIBULAR ANGLE FRACTURE WITH MINIPLATE OSTEOSYNTHESIS

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ABSTRACT

Aim: This study aims to assess the difference in complications between transbuccal approach and standard intraoral approach following fixation of the MAF with miniplate osteosynthesis.

Objectives: The objectives in treatment are to observe and accomplish anatomic reduction by fixation and to reinstate function with minimum disability and complications.

Materials & Methods: Patients with MAF were divided into two groups (Group A, Intraoral approach; Group B, Trans-buccal approach) who underwent ORIF (Open Reduction and Internal Fixation) using miniplate osteosynthesis (One 2.0 mm 4 holed miniplate with a bar using either of the two approaches). Intra-operatively, the surgical time and the ease of surgical access for fixation were evaluated. Patients followed at 1st week, 3rd month, and 6th month postoperatively and evaluated clinically for post-operative complications like infection, scarring, postoperative occlusal discrepancy, malunion, and non-union.

Results: Radiographic interpretation of fracture reduction revealed statistical significance for group B as compared to group A. There were no cases of malunion/non-union. Significantly more occlusal discrepancy was noted in group A compared to group B at 1 week postoperatively. Occlusion and mouth opening was achieved in all patients 1 week after surgery. Lateral cortical plate fixation was seen to be more significant in Group B that is trans-buccal approach than Group A.

Conclusion: Lateral cortical plate fixation via trans-buccal approach concludes as the easier and comparatively better method for the reduction of MAF than intraoral external oblique ridge fixation.

KEYWORDS: Mandibular angle fracture, Standard Intra-oral approach, Transbuccal approach, Marginal mandibular branch of facial nerve (MMBFN)

INTRODUCTION

Human mandible occupies a very important position on the face and is a susceptable target for trauma[1].

The high rates of fractures of the angle of the mandible is confined to a thinner cross-sectional area in relation to the neighbouring areas of the mandibular region[2], and due to the presence of impacted third molars this region gets weakened. Various approaches used for the fixation angle fractures of the mandible which included the traditional extra-oral approach. This technique included disadvantages such as an unaesthetic scar and the risk of facial nerve injury[3]. To overcome these disadvantages, an alternative method called the “transoral or intraoral approach” was proposed. This approach involves operating entirely through an incision made in the oral mucosa. Other disadvantages include placement of miniplate closer to the dentition, which allows an easier and shorter path for infections to move from the periodontium to the fixation hardware and more prevalent loosening of the screw, as there is less bone density on the superior aspect of the mandible and the alveolus.[4]The disadvantages of the intra oral approach prompted surgeons to find an alternative method, namely the trans-buccal approach. This approach involves an intraoral incision alongwith a small stab incision on the facial skin, that facilitates the use of a transbuccal trocar to allow instruments such as a drill or screwdriver to pass through. Advantages include no external scarring, fixation of the plates on the thicker lateral cortical plate of the mandible in a sagittal plane, greater soft tissue coverage, less chance of plate fracture as weakening of plates by over-bending, lower infection rate due to less movement of pathogens from the third molar region[4, 5]. Since miniplate fixation differs for the transoral and trans-buccal approaches, we decided to compare the two approaches in the MAF. Facial skeleton injuries are highly common with respect to the incidence of mandibular fractures.[6] Mandibular angle is second most common site of mandibular fractures ranging from 25-33%.[7] The MAF treatment has evolved gradually from primitive methods to

more recent methods ranging from a single non-compression miniplate, lag screws, two miniplates, locking miniplate, and 3D reconstruction plate with varying levels of success. [8,9]
Despite evolution in the treatment of maxillofacial trauma, no single treatment modality has been revealed to be ideal for mandibular angle fracture. The purpose of all treatment for fractures is the restoration of original form, habitual occlusion and smooth function. Intraoral and trans-buccal using single miniplate osteosynthesis are commonly applied, while limited comparisons were portrayed with regards to outcome and complications.[10]

MATERIALS & METHODS

15 Patients with mandibular angle fractures were divided into Group A: Intraoral approach & Group B: Trans-buccal approach, for Open Reduction and Internal Fixation using miniplate osteosynthesis. Intraoperatively, the surgical time and the ease of surgical access for fixation were noted.The study was ethically approved by Haldia Insitute of Dental Sciences & Research Review Committee. The study area was Oral and Maxillofacial Surgery Department, Haldia Dental College and ICARE Institute of Medical Sciences and Research with B.C. Roy Hospital.We included patients with an age between 15-50 years with MAF on one side and alongwith or without associated other mandibular fractures. Patients with comminuted fractures, associated mid- face fractures and external abrasions on the fractured side were excluded.Fifteenconsecutive patients, for the study were chosen based on the above mentioned criteria.

Pre-operative evaluation of patient:
A trauma case history sheet has been used to gather necessary information regarding every case. Soft tissues & hard tissue examinations were done pre-operatively, intra-operatively and post-operatively. Photographs and records were maintained for all the patients.

Radiographic Examination &Interpretation: The degree of anatomical displacement was studied with digital orthopantomogram(OPG). Radiographically, the interpretation of fracture reduction was performed by tracing the fracture gap following reduction using OPG.**Surgical Protocol:** The patients after were randomly divided into Group A and Group B. In Group A, the fixation was done in the area of external oblique ridge of the mandible, through intraoral approach. In Group B, fixation was done through combined intraoral & transbuccal approach for lateral cortical plate fixation. Erich's arch bar wiring were done preoperatively in all the patients in outpatient department. Cases were treated under general anesthesia. After nasotracheal intubation, throat pack was placed in all the patients. Asepsis & sterilization were maintained with 7.5% Povidone-Iodine (surgical site) & 5% Povidone-Iodine (oral cavity). For both the group of patients, "local infiltration with 2% Lignocaine with 1:80,000 adrenaline" was injected into gingivo-buccal surface of third molar region and along the retromolar region. An incision was placed from 1cm above the occlusal plane over the anterior border of ascending ramus, extending down anteriorly along the external oblique ridge upto second molar region, leaving 5mm of gingiva to allow adequate tissue for closure.
In Group A, Mucoperiosteal flap was reflected and the fracture site was exposed (Fig.3a) & irrigated with normal saline. The fracture segments were mobilized to achieve proper anatomic reduction and also to attain proper occlusion. Temporary mandibulo-maxillary fixation was done using 26 gauge stainless steel wires (Fig.3b). "A single miniplate (2.0mm Four Hole with Gap) was adapted to the external oblique ridge and fixation was done by placing the screws (2.0mm x 8mm)" (Fig.3c). Irrigation of the site was done with normal saline. Closure was done with 3-0 vicryl (Fig.3d) and throat pack was removed. General anesthesia was reversed and the patient was extubated and shifted to the recovery room.
In Group B, Mucoperiosteal flap was reflected and the fracture site was exposed & irrigated with normal saline. For an easily identifiable and "safe zone for trocar placement, a triangle shaped zone created by the following three lines was determined(Fig.4a):**Line1 (Trago-basal line)** ran from the tragus to the groove over the body of the mandible at the antero-inferior angle of the masseter **(the course of the facial artery on the body of the mandible).Line2 (cantho-gonial line)** ran from the outer canthus to the angle of the mandible (gonion). **Line3 (mandibular line)** was the border of the mandible" and for the exact location of the incision in the triangle, a forcep was used where one beak was placed at the fracture site intra-orally and other beak extra-orally on the triangle on cheek. Trocar insertion done into the operative site through the stab incision (Fig.4b) and stabilized using the retractor (Fig.4c). Reduction of fracture segments were done and a single miniplate (2.0mm Four Hole with Gap) was adapted to the lateral ramus. Screw fixation (2.0mm X 8mm) was done through the trocar (Fig.4d). Thorough irrigation was done with normal saline. Intraoral incision was closed with 3-0 vicryl and extraoral stab incision with 4-0 prolene (Fig.4e). Pressure dressing was given and throat pack was removed. General anesthesia was reversed and the patient was extubated and shifted to recovery room.
Intra-operative evaluation:-Patients were evaluated for the ease of surgical access for fixation and the surgical time (time from incision to closure). The ease of surgical access for fixation in either approach were evaluated by the operating surgeon and graded as 1. Good; 2. Fair; and 3. Poor based on the visual analogue scale. Radiographic evaluation of fracture reduction between the two groups was done by calculating the distance between the proximal & distal fractured segments of the mandible in postoperative OPG radiographs. These radiographs were taken within 1 day after surgery. On the radiographs, a line was drawn along the fracture and divided into three equal segments. Perpendicular lines were projected onto the fracture line to create reproducible measuring points. Calculations of inter-fragmentary distance were conducted on these 4 defined points with the help of vernier digital calliper (Fig. 5(a, b)).
Post-operative care:-All patients were kept on routine medication post-operatively as per the department protocol. Patients were advised to maintain the oral hygiene and to perform oral rinses with chlorhexidine solution. Patients were prescribed on soft diet for the first week. Follow-ups were done as per protocol.

RESULTS

In group A, minimum inter-fragmentary distance is 2 mm in 3 patients pre-operatively corresponding the same value at the 1st week and 6th month post operatively for all the 3 patients and maximum inter-fragmentary distance is 7 mm pre-operatively corresponding 3mm at the 1st week and eventually reduced to 2mm at the 6th month post operatively. For 1st week the p value is 0.033 and for 6th month p value is 0.02 which is statistically significant (p value < 0.05). In group B, minimum inter- fragmentary distance is 4mm in 1 patient pre-operatively which reduced to 0mm at the 1st week and 6th month post operatively and maximum inter-fragmentary distance is 7mm which is observed in 3 patients pre-operatively which reduced to 2mm at the 1st week and 6th month for 1 patient and for the other 2 patients the distance reduced to 1mm both at the 1st and 6th month post operatively. For 1st week the p value is 0.00043 and for 6th month p value is 0.00009 which is highly significant (p value < 0.05). P values for both the group are statistically significant but in the current study, group B that is trans-buccal approach by lateral cortical plate fixation is more significant than group A.

DISCUSSION

Maxillofacial trauma is considered as the most important Epidemic of 21st century which affects the society including both young as well as old human beings. The unique position of mandible on the face makes it vulnerable to trauma. Considered as the most commonly fractured facial bones, the commonest site includes mandibular condyle, then mandibular angle fracture which is the most frequent site when only one fracture is present. Mandibular angle fractures account for 25-33% of all mandibular fractures. Presence of 3rd molar weakens the area, thus, fracture line often encompasses the third molar tooth socket. “Mandibular angle fracture was defined as a fracture located posterior to the second molar extending from any point on the curve formed by the junction of the body and ramus in the retromolar area to any point on the curve formed by the inferior border of the body and posterior border of the ramus of the mandible. A fracture of the angle is termed favorable or unfavorable, depending on the direction of the fracture line in the horizontal and vertical plane and the consequent potential for displacement. The goals of mandibular fracture fixation are restoration of normal jaw structure and function. Elements of successful repair include proper immobilization of the fracture site, habitual dental occlusion, perfect bony union, absence of infection, normal nerve function, and normal range of motion.” So placement of the miniplate can be appreciated by 3 Surgical approaches:1) **Extraoral approach**, accessing the fracture site through the submandibular incision 2) the **Intraoral technique** involves operating entirely through an incision made through the oral mucosa/gingiva; and 3) the **Trans-buccal approach** involves an intraoral incision plus a small stab incision on the facial skin. In the present study, a comparison was done between the intraoral and trans-buccal approach for the treatment of MAF. In intra oral group (A), the fracture site was fixed with a single monocortical miniplate at the external oblique ridge via an intraoral approach. The plate was adapted to the external oblique ridge by bending the plate and placing it in frontal direction and screws were placed in the sagittal direction. In trans-buccal group (B), the fracture site was fixed with a single monocortical miniplate at the lateral cortical bone of the ramus, lateral to the external oblique ridge via a trans-buccal approach. In this present study, the same landmarks were followed to place a stab incision extraorally. “The MMBFN is responsible for the motor function of the depressor anguli oris, the depressor labii inferioris, the inferior fibres of the orbicularis oris and the mentalis muscles. Damaging the MMBFN can cause salivary incontinence and aesthetic impairment due to an alteration in the balance of the musculature around the lower lip, preventing lateral and downward movement and lower lip inversion”. In this current study, any injury to MMBFN was not encountered whereas a single stab incision was sufficient to achieve proper adaptation and fixation of miniplate. In this present study, scoring of periosteum was not required because of the proper position of trocar combined with fixation of trocar inside the periosteum. In the present study, mean intra-operative time for trans-buccal group was 39.2 ± 6.59 minutes and in intraoral group was 31.5 ± 6.32 minutes which showed no significant difference between two groups. In this study, the access to the fracture site through intraoral incision was easier in group B due to the better retraction of soft tissues using the retractor in trocar kit and the placement of screws was also easier through the trans-buccal approach using trocar cannula. All unnecessary bending of plate is avoided. Additional advantage is that screws are placed perpendicular to the surface of bone which is the main fracture protocol. In this study, post-operatively, in Group B, where miniplate fixation was done at the lateral cortical plate, the stability of fractured segments was more compared to that in Group A. Post-operatively IMF elastics were needed for extra stability and also to achieve proper occlusion in Group A patients. Lateral cortical plate fixation allowed complete reduction and stabilization of fracture segments and occlusion was maintained. Post-operative stability was good and need for IMF was reduced in Group B patients. In this study paresthesia was seen in one patient, which occurred in immediate post-operative period and reduced gradually and patients had normal sensation within 3 months post-operatively, in Group B. Local wound debridement and regular antiseptic dressings were done and the wound healed secondarily without any need for removal of miniplates. In this present study, neither of the groups required any removal of miniplates. Scar at the operated site was assessed by clinical examination only. The scar was not prominent and was not aesthetically unpleasant in group B and there were no complaints from patients suffering from facial nerve palsy from both the groups. The outcome of this study proves that the trans-buccal lateral cortical plate fixation provides better results when compared to the intraoral external oblique ridge fixation for the treatment of mandibular angle fractures. As the trans-buccal approach uses a trocar kit which consists of a trocar, cannula and a retractor which helps in better retraction of tissues exposing the fracture site, it has advantages over intraoral approach in aspects like direct visualization, increased access and better control for reduction of fracture segments. Thus, a single monocortical miniplate along the lateral surface of the mandible provides excellent stability and eliminates need for postoperative IMF thereby reducing patient morbidity and increasing patient compliance and comfort.

CONCLUSION

The following conclusion can be drawn from this study:

1. Trans-buccal approach is the better method for the treatment of MAF compared to intraoral approach.
2. Elevating the intra-operative time, the transbuccal approach is a safe and reliable process with minimum patient compliance.
3. The use of trans-buccal approach for fixation of the MAF for better stability and outcome.

Hence, it can be concluded that despite of proven good prognosis for intra oral approach by external oblique ridge fixation could not show better result than trans-buccal approach by lateral cortical plate fixation. The current study paves paths for future studies with larger sample size and other variety of etiology in diverse population to solidify accurate prognosis for either of the approaches.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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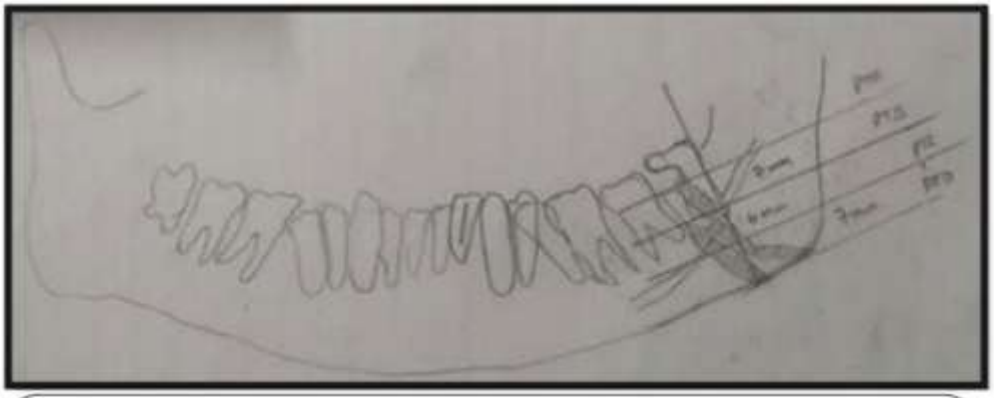


PTA-PTB is 7mm, PTB-PTC is 6mm, PTC –PTD is 7mm

On the Orthopantomogram, a line was drawn along the fracture and divided into three equal parts. Perpendicular lines (PTA, PTB, PTC AND PTD) were projected onto the fracture line to create reproducible measuring points. Measurements of the fracture gap were conducted on these above mentioned points.

Fig 1

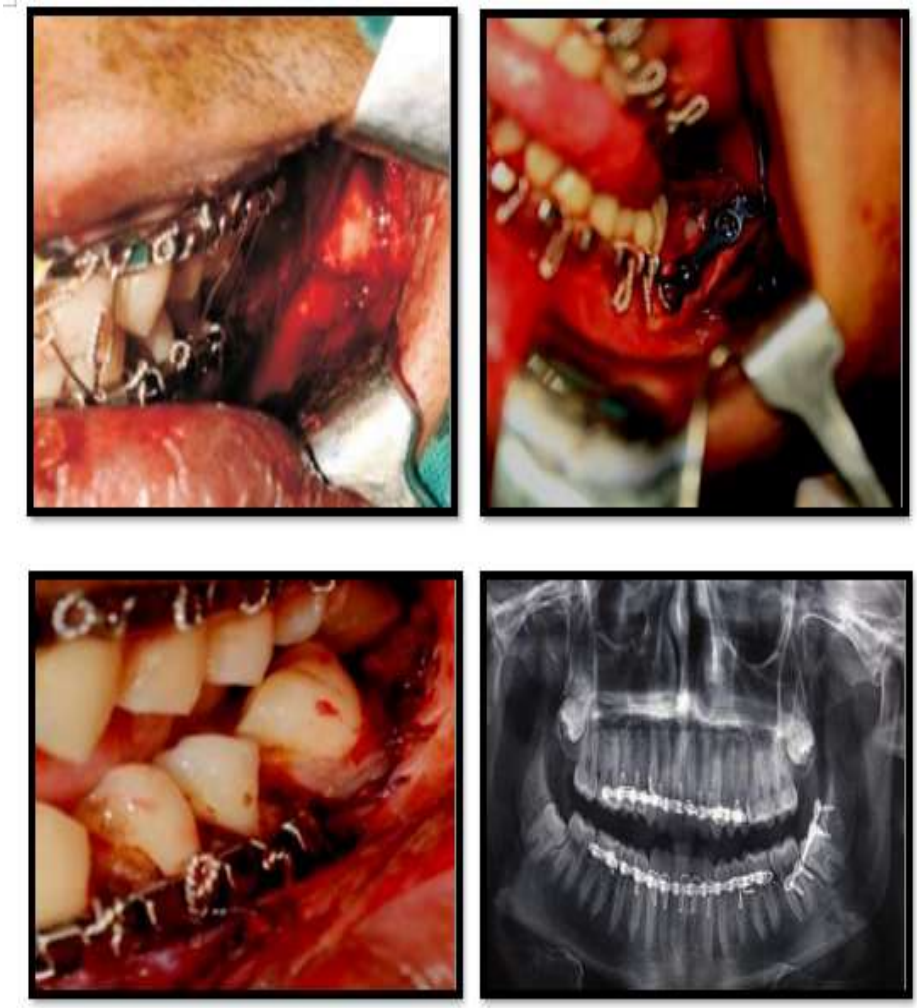


Fig.3 Intra-oral approach.

A. Fracture exposure. B. Fracture reduction and placement of intermaxillary fixation & Placement of miniplate. C. Closure. D. Postoperative radiograph

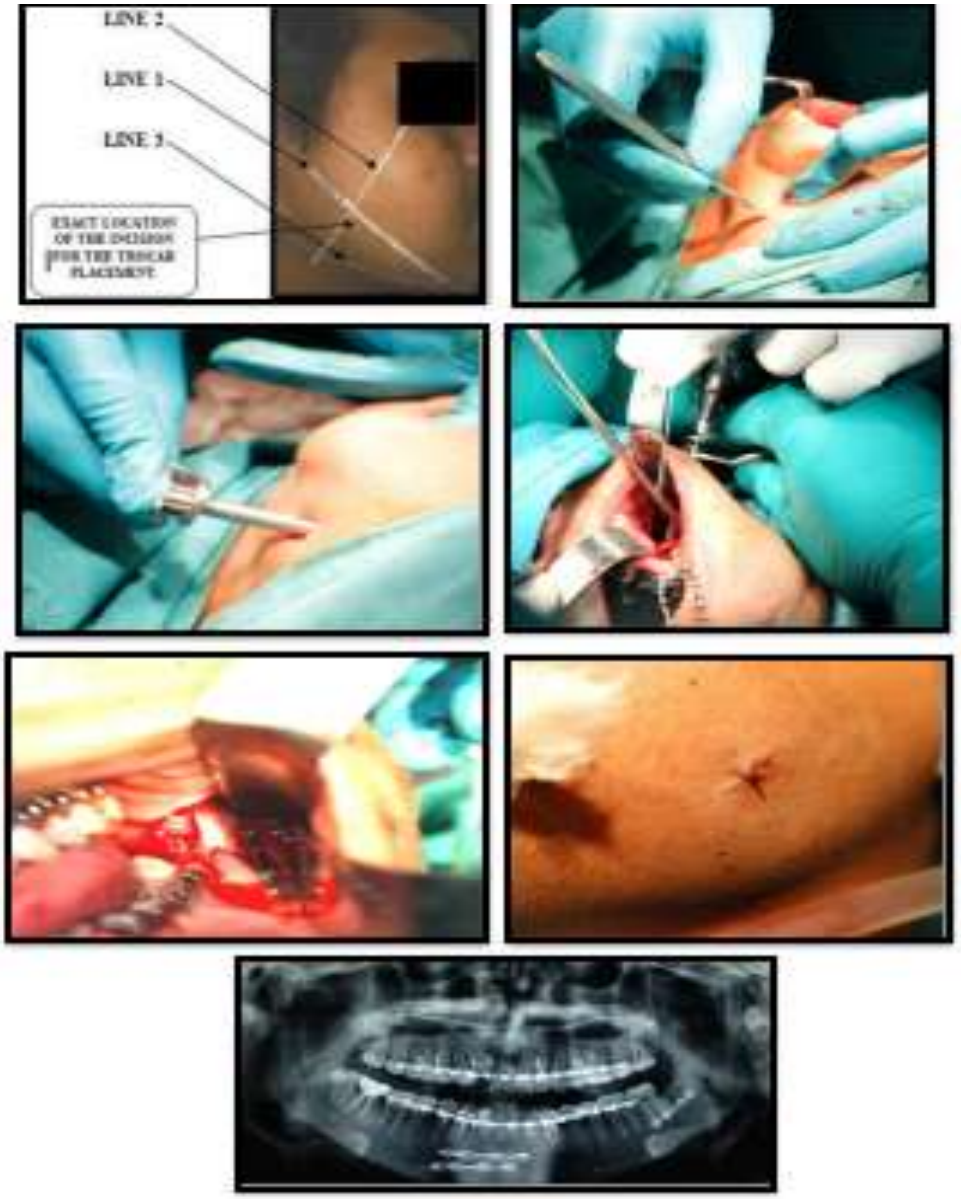


Fig.4 Transbuccal approach. A. Safe location for stab incision marked. B. A trocar was introduced into the operative site through the stab incision. C. Stabilized using the retractor. D. Plate fixation done through trocar. . Stab incision closure done. F. Postoperative radiograh

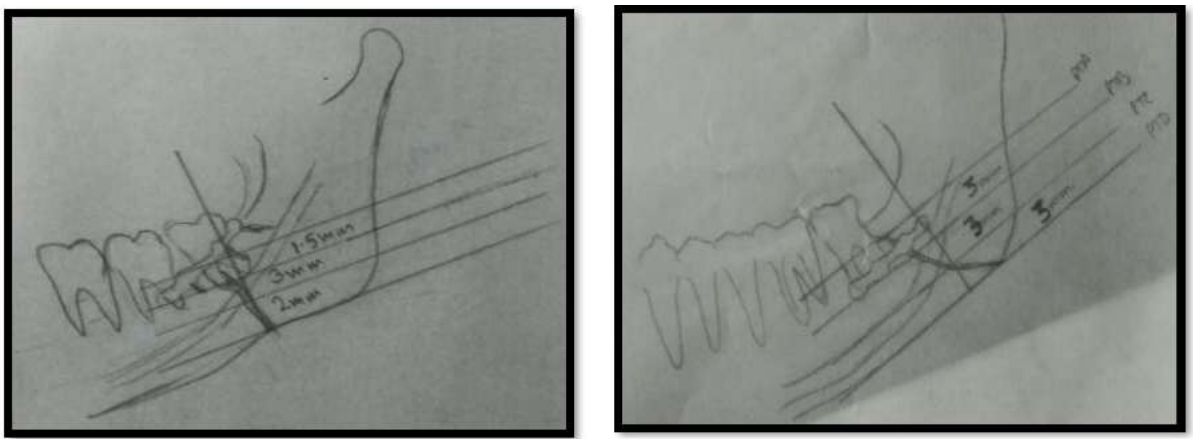


Fig.5a. Postoperative radiographic interpretation of fracture reduction (Group A).

PRE OP MOUTH OPENING

SL NO.	GROUP A	GROUP B
1	22mm	22mm
2	20mm	15mm
3	25mm	26mm
4	26mm	29mm
5	27mm	30mm
6	28mm	28mm
7	24mm	26mm
8	24mm	
Mean ± SD	24.5mm±2.62	25.14mm±5.18

T value : -0.3099 ; P value : 0.76

POST OP MOUTH OPENING

SL NO.	GROUP A			GROUP B		
	1 WEEK	3 MONTHS	6 MONTHS	1 WEEK	3 MONTHS	6 MONTHS
1	35mm	40mm	40mm	34mm	40mm	42mm
2	30mm	32mm	36mm	24mm	28mm	34mm
3	30mm	35mm	36mm	34mm	36mm	38mm
4	38mm	38mm	38mm	34mm	36mm	38mm
5	36mm	38mm	40mm	38mm	40mm	42mm
6	36mm	38mm	40mm	38mm	40mm	44mm
7	32mm	35mm	38mm	34mm	38mm	42mm
8	36mm	38mm	38mm			
Mean±SD	34.125±3.04	36.75±2.55	38.25±1.67	33.71±4.68	36.86±4.3	40±3.46

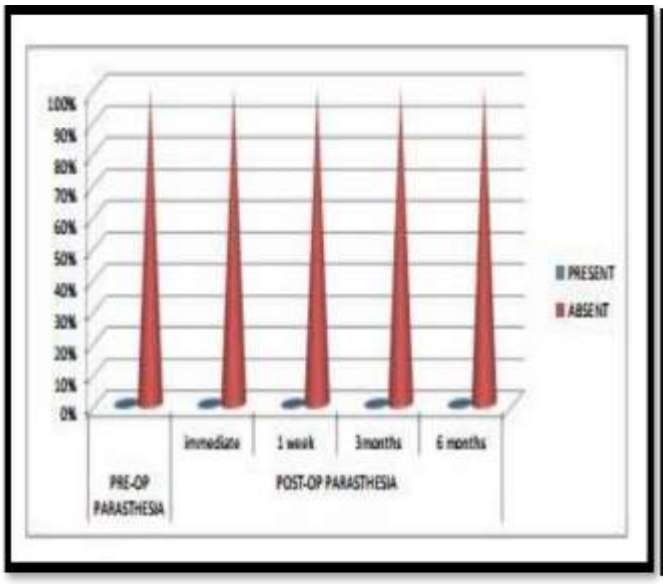
For 1 week (**T value:** 0.20; **p-value:**0.84)

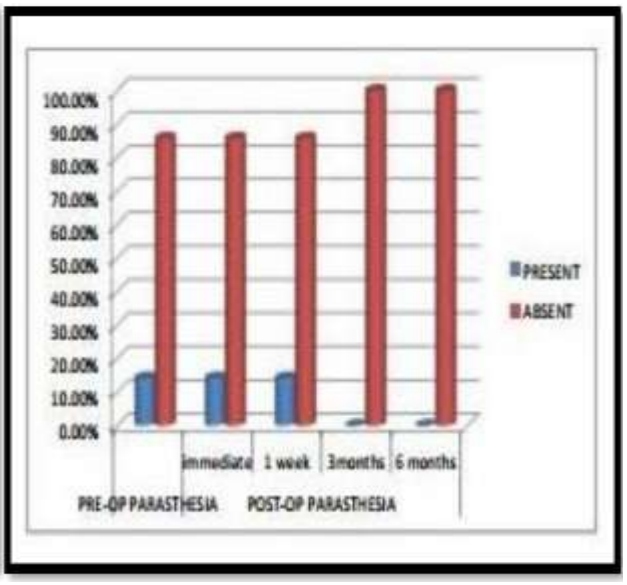
For 3 months (**T value:** -0.06; **p-value:**0.95); For 6 months (**T value:** -1.27; **p-value:**0.22)

For group A, t value is 5.29 and p value is 0.0007; For group B t value is 4.58 and p value is 0.0001

SL.NO.	GROUP A		GROUP B	
	1ST WEEK	3RD WEEK	1ST WEEK	3RD WEEK
1	4	2	3	1
2	5	3	4	2
3	3	1	3	1
4	4	2	5	3
5	4	2	4	2
6	5	3	3	2
7	4	2	3	1
8	3	1		
MEAN ± SD	4 ± 0.76	2.13 ± 0.83	3.57 ± 0.77	1.71 ± 0.76

PRE & POST OP PARESTHESIA GROUP A & B





PRE & POST OP PARESTHESIA GROUP A & B

PRE & POST OP INTERFRAGMENTARY DISTANCE OF GROUP A & B

Sl NO.	PRE-OPERATIVE	POST-OPERATIVE		
		1ST WEEK	3RD MONTH	6th MONTH
1	7mm	3mm	2mm	1mm
2	4mm	3mm	2mm	2mm
3	5mm	2mm	1mm	1mm
4	3mm	2mm	2mm	2mm
5	3mm	2mm	2mm	2mm
6	2mm	1mm	1mm	1mm
7	2mm	1mm	1mm	1mm
8	3mm	3mm	2mm	2mm

For 1st week t value is 2.64 and p value is 0.033; For 3rd month t value is 2.99

P value is 0.02

Sl NO.	PRE-OPERATIVE	POST-OPERATIVE		
		1ST WEEK	3RD MONTH	6th MONTH
1	5mm	2mm	2mm	1mm
2	6mm	4mm	3mm	3mm
3	4mm	2mm	1mm	0mm
4	7mm	2mm	0mm	0mm
5	5mm	2mm	2mm	2mm
6	7mm	3mm	2mm	1mm
7	7mm	5mm	3mm	1mm

For 1st week t value is 6.96, p value is 0.00043; For 3rd month t value is 9.20, p value is 0.00009