

## A Comparative Study on Evaluation of the Effect of Different Intraoral Incisions on Postoperative Outcome in the Management of Mandibular Fractures using Rigid Internal Fixation

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### Abstract

### Original Research Article

Aim of this study is to compare the outcome of various intraoral incisions in the management of isolated mandibular fracture using miniplates as means of rigid internal fixation and to analyze the advantages and disadvantages of one over the other. Its a prospective study and carried out in patients with well-defined inclusion and exclusion criteria. Patients suffering from symphyseal, parasymphiseal and body fractures were selected and randomly taken for crevicular incision (study group-1), crevicular incision with a vertical release (study group-2) and vestibular incision(control group) for open reduction and rigid internal fixation (ORIF). Operative time and postoperative complications including pain, infection, dehiscence, sensory disturbance and need of plate removal were recorded at intervals of 1st, 3rd and 7th day of surgery with 12 weeks of postoperative follow up and compared with the control group. It was noticed that postoperative pain was significantly reduced in the study groups in comparison to control group at different intervals of treatment. It was also observed that the incidence of dehiscence and infection were also less in cases of crevicular approach as compared to the vestibular incision. With this study we can conclude that crevicular incision is a more favourable incision over the vestibular one with the lesser degree of postoperative complications.

**Keywords:** Mandible fracture, Crevicular incision, Vestibular incision, Complications, Open reduction and internal fixation.

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### INTRODUCTION

The maxillofacial skeleton fractures are common of which mandible fractures are a frequent injury because of the mandible's prominence and relative lack of support. [1,2 ] Their incidence is rising due to the increase in the number of road traffic accidents[3] and is one of the common cause of associated morbidity and mortality. Treatment of these injuries is important to maintain proper function and esthetics of the lower jaw. Different treatment modalities [4,5] are now available for fractures of the mandible of which preferred technique is ORIF. In 1888, Schede was the first to use a solid steel plate held by 4-screws for fixation.[6].In 1970s the technique of rigid internal fixation was developed and popularized by Arbeitsgemeinschaft für Osteosynthesefragen/ Association for the study of internal fixation

(AO/ASIF). The basic principles of the AO outlined by Spiessl [7]. Michelet *et al.*[8] in 1973 introduced the miniplate osteosynthesis and Champy *et al.*[9] further developed Champy's concept and described ideal lines of osteosynthesis for placement and fixation of plates in various regions for mandibular fracture.

ORIF can be done both by extraoral and intraoral approach. Transoral approaches for ORIF bear the advantages that it ensures safe access and easy placement and fewer chances of postoperative complications. This approach also provides constant access the dental occlusion during surgery. The greatest advantage of this approach is the hidden intraoral scar [10].In the intraoral approach for ORIF, a vestibular incision is commonly used. The major concern with using vestibular incision for mandibular fracture is lower lip numbness from injury to the mental nerve

[11]. Various incision designs are developed to combat the mental nerve injury [10]. Other complications with vestibular incision have been noted by various studies that include infection, wound dehiscence, implant failure [11-13]. In search of a new incision for ORIF in order to minimize postoperative complications, we came with the idea of using a crevicular incision in ORIF. The crevicular incision is a very simple type of intraoral incision. Crevicular incision is indicated when preservation of gingiva is critical as in esthetic areas or areas of minimal keratinized tissue, and in guided tissue regeneration procedures (GTR). It is also indicated in the shallow vestibule and also where tense mentalis posture occurs [14,15]. Other applications of this incision are periapical surgery, surgical tooth extraction, removal of bony prominences, and almost all surgical procedures in the palate are done using this type of access [16]. Keeping this in view we framed this study in order to find out a new application of this incision. So we planned this study and compared the outcome of the crevicular incision and its modification with the vestibular incision in isolated mandibular fractures and evaluated them on the basis of certain postoperative complications (wound infection, dehiscence, neurosensory disturbance and need for implant removal). The operative time period was also compared among different groups.

## MATERIALS AND METHODS

### Study sample collection

A prospective study was done which included a total of 45 patients (36 male and 9 female) between 20-45 years of age who reported with an isolated fracture in symphysis or body region of the mandible. Inclusion criteria consisted of patients with undisplaced or minimally displaced fractures, without any periodontal diseases and adverse oral habit. Cases with pan facial fractures or comminuted and displaced fractures of the mandible, signs of mental nerve injury due to trauma, poor dental hygiene and gross infection at the site of fracture and medically compromised patients were excluded from the study. Informed consent was duly signed by all patients after explaining the procedure. Ethical approval was also obtained from the institutional ethical committee.

For analyzing the data, samples were randomly divided into three groups as follows:

- Study group 1: consisted of 15 patients treated with ORIF via a crevicular incision for symphyseal/ parasymphyseal/body fractures.
- Study group 2: consisted of 15 patients treated with ORIF via a crevicular incision with a vertical release for symphyseal/ parasymphyseal/body fractures.
- Control group: consisted of 15 patients treated with ORIF via a vestibular incision for symphyseal/ parasymphyseal/ body fractures.

Patients were followed through 12 weeks to record the incidence of postoperative complications in different groups. To control the selection bias, every alternate patient was treated by the respective surgical technique.

### Surgical technique

The fractures were taken up for surgery under general anaesthesia. All the surgeries were performed by one surgeon with a standardised technique and assessment of different parameters were also done by the same investigator. All the patients were kept under appropriate antibiotic cover pre-operatively and up to 5 days postoperatively. The surgical site was disinfected with 7.5% povidone-iodine solution. An inferior alveolar nerve block was given along with local infiltration with lignocaine 2% and adrenaline 1:100000 in relation to the surgical area.

In group 1, a crevicular incision was used. The incision was given in region of fracture depending on the need of exposure from the base of the gingival sulcus to the bone to detach connective tissue from the bone. (Fig.1a). To avoid stretching of tissue larger crevicular incisions were given.

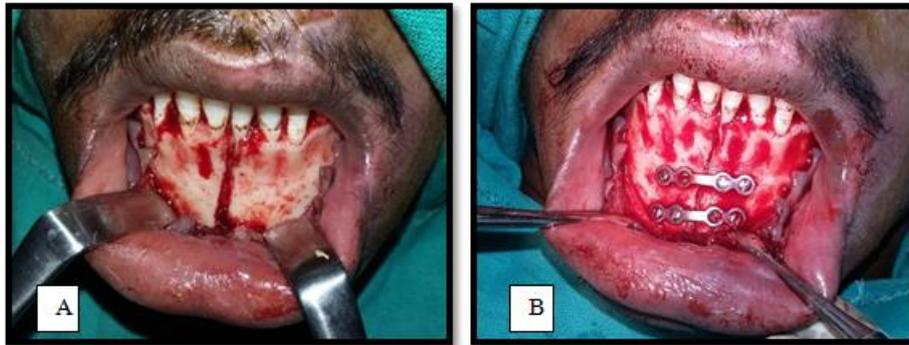
In group 2 crevicular incision with an additional vertical release was used (Fig.2a). Releasing incision was made along the line angle of tooth either to include the papilla in the flap or to avoid it completely.

After giving the crevicular incision the periosteal elevator was inserted and the flap was separated from the bone by direct elevation of the underlying periosteum without involving mucosa, submucosa, muscle & periosteal layer. Wound healing was excellent without visible scarring. With this incision chances of wound dehiscence is avoided and it offers enhanced healing due to the immunological defence mechanism of the peridontium [17].

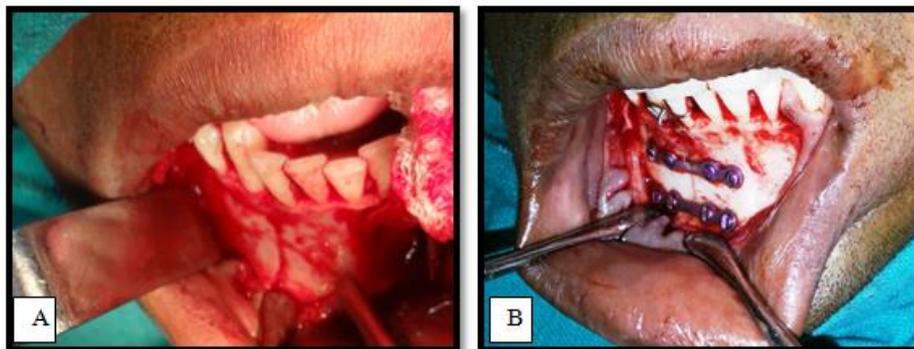
In the control group, a vestibular incision was given in midsymphysis; parasymphysis and body region depending on the site of fracture line with No.15 blade on Bard Parker handle No. 3. The incision was made on oral mucosa 4-5mm below the level of attached gingival to provide adequate exposure of fracture site. (Fig.3a) It was extended parallel to the alveolar process and was slightly superiorly placed near the premolar region to prevent injury to the mental nerve. Firstly the incision was carried only through the mucosa. The following second incision was made at right angles to the underlying bone and carried down through the submucosa, muscles, and periosteum, Mucoperiosteal flap was raised. The mental nerve was separated through blunt dissection in the vicinity of mental foramina. When the nerve was found, it was made along its main branch with fine forceps and dissection scissors.

Rest of the procedures of ORIF were same for all the three groups of patients. For fixation, 2.0 mm Titanium plates and self-tapping screws were used (Fig.1b,2b,3b). After plate fixation, surgical site was copiously irrigated with 5% povidone-iodine and followed by normal saline in 1:1 concentration. Haemostasis was achieved. In case of the vestibular incision closure of the wound was done with interrupted sutures by using 3-0 vicryl and 3-0 silk in layers. The crevicular incision was closed with interdental sutures by 3-0 silk. The releasing incision was not closed in

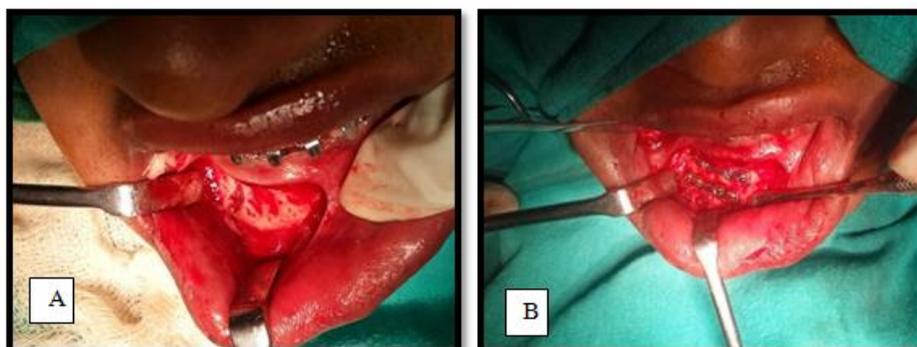
order to allow discharge of inflammatory exudate. Pressure pack was applied. In all the 3-groups, preoperative medications were continued for 5 days. The patients were advised to maintain oral hygiene and to perform oral rinses with Chlorhexidine mouth wash. The patients were also advised for a soft diet for the first week. All the patients were evaluated on the 1<sup>st</sup>, 3<sup>rd</sup> and 7<sup>th</sup> postoperative day with the follow up of 12weeks. All data were collected in SPSS version 20. Data were reported descriptively and analysed using paired t-test and unpaired t-test.



**Fig-1:(a)Intraoperative photograph showing exposure of fracture site by a crevicular incision.(b) showing plate fixation of the fracture site**



**Fig-2:(a) Intraoperative photograph showing exposure of fracture site by a crevicular incision with a vertical release.(b) showing plate fixation of the fracture site.**



**Fig-3(a): Intraoperative photograph showing exposure of fracture site by a vestibular incision. (b) Showing plate fixation of the fracture site**

### OBSERVATIONS AND RESULTS

It was a prospective study and done to evaluate various intraoral incisions in ORIF and their

postoperative outcome. The clinical parameters- operative time, pain, infection, wound dehiscence; implant failure, plate removal, and neurosensory deficit

were assessed. Patients were reviewed at 1<sup>st</sup>, 3<sup>rd</sup> and 7<sup>th</sup> day of operation and followed for 3 months. Their observational values have been presented in the following tables.

The operative time period was recorded for each patient by the time of incision to completion of suturing (last suture) in minutes. Table 4(a). On comparison mean of the difference of operating time

between the groups 1 and 2, 1 and Control group, and 2 and control group, a non-significant difference with ( $p > 0.05$ ) was observed. Table 4(b).

Postoperative Pain was measured in terms of a pain scale-Visual Analog Scale. The patients were asked to estimate the intensity of pain by selecting the score on VAS (0, 1, 2, 10). A score of 0 represented no pain and 10 represented extremely severe pain



**Visual analogue scale**

On comparison mean of the difference of pain level, Table (5(a,b)) between the groups 1 and 2, a significant difference with ( $p < 0.05$ ) was observed at 1<sup>st</sup> postoperative day and the non-significant difference with ( $p > 0.05$ ) was observed at 3<sup>rd</sup> and 7<sup>th</sup> postoperative day. Between the groups 1 and control group, a significant difference ( $p < 0.05$ ) was observed at 1<sup>st</sup> and 3<sup>rd</sup> postoperative day and a non-significant difference ( $p > 0.05$ ) was observed on the 7<sup>th</sup> postoperative day. Between the groups, 2 and control group a non-significant difference ( $p > 0.05$ ) was observed at 1<sup>st</sup>, 3<sup>rd</sup> and 7<sup>th</sup> postoperative day.

(20%) showed a sign of wound dehiscence within duration of 12 weeks of follow-up.

The neurosensory assessment was done by a pin-prick pain by using a sharp probe by an independent surgeon who was blinded to the groups. Patients were made to close their eyes during the assessment. In Group 1 no patient showed any sign of postoperative neurosensory disturbance within duration of 12 weeks of follow-up. While in Group 2 out of 15 patients only 1 patient (6.67%) and in Control group two patients (13.33%) showed sign of neurosensory disturbance within a duration of 12 weeks follow-up.

Postoperative infection in Group 1 out of 15 patients showed no sign of infection in any patient in 12 weeks of follow-up. While in both Group-2 and in Control Group two patients (13.33%) showed sign of infection within duration of 12 weeks follow-up.

In Group 1 out of 15 patients, only one patient (6.67%) underwent plate removal within duration of 12 weeks of follow-up. While in Group 2, one patient (6.67%) and in Control group three patients (20%) undergone plate removal within a duration of 12 weeks of follow-up.

There was no case of wound dehiscence observed in Group 1 within duration of 12 weeks follow-up. While in Group-2 out of 15 patients 2 patients (13.33%) and in Control group 3 patients

Postoperative outcome of Infection, Dehiscence, Neurosensory disturbance and Plate removal is shown in Graph

**Table-1: Distribution of patients according to age**

Age group in years	No of patients	Percentage
20-30	25	55.55%
31-40	17	37.77%
41-50	3	6.66%
Total	45	100%

**Table-2: Comparison of Mean age in three groups**

Variable	Group-1	Group-2	Control Group
Age in years	26.40± 6.34	29.20± 8.21	27.93± 6.00

**Table-3: Distribution of patients in three groups on the basis of diagnosis**

Diagnosis	No of patients		
	Group 1	Group 2	Control Group
Midsymphyseal fracture	4	4	5
Parasymphyseal fracture	5	7	5
Body fracture	6	4	5
Total	15	15	15

**Table-4(a): Operating time Mean and SD**

	Group 1	Group 2	Control Group
Operating time(min)	48.1 ± 9.4	53.8 ± 8.6	54.3 ± 11.9

**Table-4(b): Comparison of operating time between the groups**

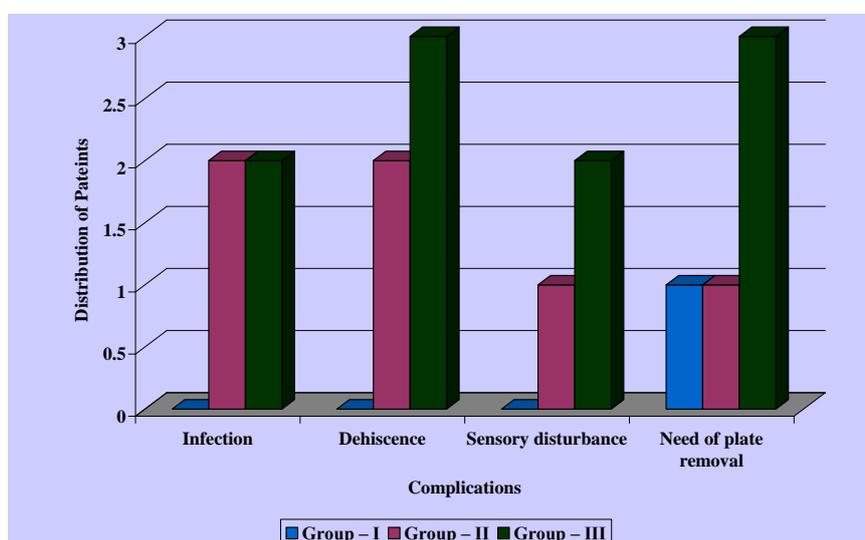
Group 1 Vs Group 2	t =1.7 [NS]
Group 1 Vs Control group	t =1.6 [NS]
Group 2 Vs Control group	t =0.13 [NS]

**Table-5(a): Pain (VAS) Mean and SD**

Groups	1 <sup>st</sup> Postoperative Day	3 <sup>rd</sup> Postoperative Day	7 <sup>th</sup> Postoperative Day
Group 1	3.6±2.2	1.9±1.3	1.1±0.8
Group 2	5.2±2.1	2.5±1.5	1.4±1.2
Control group	5.7±2.0	3.1±1.9	1.7±1.2

**Table-5(b): Comparison of pain (VAS) between the groups**

Groups	1 <sup>st</sup> Postoperative Day	3 <sup>rd</sup> Postoperative Day	7 <sup>th</sup> Postoperative Day
Group 1 Vs Group 2	t =2.1 p <0.05	t =1.2 NS	t =0.3 NS
Group 1 Vs Control Group	t =2.8 p <0.05	t =2.1 p <0.05	t =1.6 NS
Group 2 Vs Control Group	t =0.67 NS	t =0.98 NS	t =0.69 NS



**Graph-1: Distribution of postoperative complications among the three groups**

## RESULTS

There was significantly less postoperative pain in group 1 and group 2 as compared to the control group. The incidence of postoperative infection, wound dehiscence, nerve injury, implant removal was all less in group 1 and group 2. Operative time showed no significant difference among the three groups.

## DISCUSSION

Mandibular fractures are very common among the maxillofacial injuries and its incidence accounts for 36-70% [18,19] of all maxillofacial fractures. Common etiological factors of mandibular fracture are road traffic accidents, falls, assaults sports etc [20]. Although various methods are there to treat such fractures. Open reduction and internal fixation for fracture mandible is

the most frequently performed major surgical procedure but demands a sound understanding of surgical principles. The surgical approach to mandible may be extraoral or transoral.

Extraoral route causes scar formation, and there is also a possibility of injuring branches of the facial nerve and associated anatomic structures. Advantages are that the application of fixation devices is facilitated by the direct visual exposure and lightning associated with the extraoral route[21].

Intraoral open reduction and internal fixation is preferably used technique since it causes no external scar, very fewer chances of nerve damage and opportunity to confirm the ultimate occlusion intraoperatively, and often can be performed under local anaesthesia[10]. For fracture mandible management vestibular incisions are commonly utilized[22].

Mucoperiosteal flaps can be raised by different intraoral incisions. For this different horizontal incisions can be made like vestibular, sulcular & its modifications, marginal and paramarginal. The crevicular incision is the simplest type of incision[23]. Crevicular incision also known as sulcular incision and in periodontal incisions termed as the second incision. Crevicular incision modifications are made by giving releasing incisions. This incision is indicated in esthetically relevant regions especially in various periodontal surgeries. Other indications of this incision are Periapical surgery, surgical tooth extraction, almost all surgical procedures on the palate, grafting [16].

The use of crevicular incision to expose fracture mandible is a new use of crevicular incision. Crevicular incision can provide wider exposure, lesser bleeding, muscle is not severed and also minimizes the chances of nerve damage. By this incision, vestibular scar and its depth obliteration are avoided. The potential problems of the sulcular incision include damage to the Periodontal ligament. As the crevicular incision has a number of advantages over the vestibular incision, it should also be made in case of fracture mandible for ORIF. Keeping this in view we framed this study in order to find out the new application of this incision.

This study compared the efficacy of crevicular incision with or without releasing incision and vestibular incision in respect to postoperative complications- pain, infection, wound dehiscence, neurosensory disturbance and plate removal to arrive at conclusion pertaining to healing and advantages and disadvantages of the technique.

To know the effect of the incision on time of surgery [24,25] the operating time is recorded from the time of incision to the end of surgery (end of the last suture). On comparing the operating time taken in different groups it was noticed that there was an

insignificant difference among the groups. This confirms that depending upon the critical situation surgeons may freely use any incision of their convenience.

We studied the pain threshold using VAS. There was a significant difference between group 1 and the control group. There was less postoperative pain in group 1 and in group 2 in comparison to the control group. This may be due to less surgical trauma to the soft tissues which is more when the vestibular incision is used. In the case of the vestibular incision, the incision is made through mucosa, submucosa, muscle and periosteum, causes more surgical severance to the tissues. While crevicular incision allows direct elevation of the underlying periosteum without involving incisions into the underlying periosteum, overlying mucosa, submucosa, muscle and periosteal layer. In vestibular incision a large number of muscle fibres are severed and also mobility of the severed tissues after suturing cannot be eliminated. While in crevicular incision the flap rests comparatively on a stable base and is immobile.

On comparing the incidence of postoperative infection in study groups none of the patients suffered from a postoperative infection in group 1, while two patients (13.33%) suffered from an infection in group 2 and control group. This finding is almost the same as reported by other researchers as far as group 2 and the control group are concerned [26]. However, absence of infection in group 1 highlights the clinical significance of crevicular incision. This may be due to its relatively atraumatic technique.

The most important complication associated with vestibular incision is wound dehiscence [15]. This can be because of the friable nature of the tissue of the alveolar mucosa. Misch and Misch have observed that the pulling action of the surrounding musculature tends to cause some separation of the wound edges, even after suturing has been completed [27]. Considering the postoperative wound dehiscence in all the three groups we noticed that there was no wound dehiscence in group 1. There was wound dehiscence in few patients of group 2 and control group. This possibility of wound dehiscence in group 2 and control group may be due to placement of incisions in close relation to bone plates which is totally avoided in group 1 that is why there was no such dehiscence in the first group.

Neurosensory deficit or postoperative neurosensory disturbance was also analysed to assess the efficacy of incision pattern in different study groups. The results of our study indicated that there was no sign of postoperative neurosensory disturbance in group 1 patients while very little neurosensory deficit was seen in rest two groups. This is possible because of direct manipulation of the nerve during surgical procedures which are almost totally avoided in group 1

or in case if encountered mental nerve could be safely protected. Mental nerve injury is another complication of the vestibular incision [28,29] So care must be taken to avoid injury. The nerve has to identify during the subperiosteal dissection. While crevicular incision avoids mental nerve injury.

We correlated the incidence of postoperative infection, wound dehiscence and need of plate removal in all the three study groups and it was noticed that in all the cases whenever there was an infection, postoperative dehiscence of wound leads to ultimate removal of the bone plate. In group 1 only one patient underwent plate removal within duration of 12 weeks follow up. As the commonest cause of bone plate removal is infection we presume that infection must have infiltrated through the periodontal route thereby causing severe infection and ultimate removal of plate following the standard protocol of treatment as done in similar clinical situations. Thus overall we can say that crevicular incision is a better one for transoral fixation of bone plates in symphyseal and body fractures of the mandible. This is possibly due to less tissue/muscle trauma which is seen in other incisions. However, a larger flap is needed to expose the surgical site which is obviously less in vestibular approach.

## CONCLUSION

On the basis of our study, we conclude crevicular approach in ORIF provides adequate visibility and access. It was preferable over the vestibular approach on the basis of the lesser degree of postoperative complications. In addition, the periodontal conditions, bone loss, amount of keratinized gingiva, local musculature are some of the clinical parameters that must be assessed to select the type of incision design. However, there is a need for doing additional studies to confirm the proposed technique.

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