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Original Article

Surgery Section

Transoral versus Extraoral Approach in the Management of Mandibular Angle Fracture: A Retrospective Study

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ABSTRACT

Introduction: Mandibular fractures are the most common of all maxillofacial fractures and almost one third of these have mandibular angle fractures. Restoration of anatomic form and the union of bone fragments is of utmost important during the management of mandibular angle fractures and several methods have been discussed in the literature.

Aim: To compare the transoral and extraoral approaches for the management of mandibular angle fractures in terms of postoperative outcomes including the incidence of postoperative pain, infection, scarring mouth opening and facial nerve injury.

Materials and Methods: This retrospective study was performed in the Department of Plastic Surgery, Father Muller Medical College and Hopsital, Mangalore, Karnataka, India, from January 2019 to December 2021. A total of 21 patients were divided into two groups; transoral (n=12) and extraoral (n=9), based on the type of approach used for surgery. The outcomes were assessed in both groups in terms of postoperative outcomes including the incidence of postoperative pain, infection, scarring, mouth opening and facial nerve injury. Data were statistically analysed using appropriate statistical tests.

Results: Out of the 21 patients studied, one patient in the extraoral group developed postoperative surgical site infection. There was a statistically significant difference in duration of surgery and postoperative mouth opening (p-value=0.006) and a highly significant difference in postoperative pain (p-value <0.001) and scar (p-value <0.001) between the two methods, proving transoral approach as effective method.

Conclusion: The transoral approach is a better approach for fixation and management of mandibular angle fractures, as compared to the extraoral approach.

Keywords: Facial nerve, Intermaxillary fixation, Maxillofacial fractures, Occlusion

INTRODUCTION

Mandibular fractures are known to represent 70% of all maxillofacial fractures and out of these, 26-35% are mandibular angle fractures [1,2]. The mandible due to their prominence, thin cross-sectional area and the presence of the third molar tooth is frequently involved in facial bone fractures especially, secondary to traumatic etiology [1,2]. The biomechanical consideration of the angle as a lever of the mandible helps us understand the reason for the displacement of the fractured segments of the angle of the mandible inferiorly due to a pull by the suprahyoid muscles and superiorly due to the muscles of mastication [3]. This often mandates the need for open reduction and internal fixation which is usually done by three approaches namely transbuccal, extraoral and transoral approach [4].

The traditional approach employed was the extraoral approach wherein an incision is placed on the skin and the mini plates are secured on the outer aspect using screws [5]. With this method, the visualisation and ease of plating were supposed to be better but at the cost of an unaesthetic scar, increased incidence of postoperative infection and marginal mandibular nerve palsy. As an alternative, the transoral approach was devised where the incision is placed on the oral mucosa/gingiva. This method is supposed to be associated with difficulties in visualisation and placement of the plate in an anatomically favourable position, with an aesthetically better scar and lesser incidences of postoperative infection and facial nerve palsy [4].

A previous study by kumar S et al., which compared both the treatment modalities mainly for ease of accessibility, time taken for surgery and difficulty level of fixation. No similar study was conducted in Mangalore, Karnataka, India. Hence, the present retrospective study was planned to assess and compare the transoral and extraoral approaches for the management of mandibular angle fractures in terms of postoperative outcome including the incidence of postoperative pain, infection, scarring, mouth opening and facial nerve injury in a tertiary care setup.

MATERIALS AND METHODS

This retrospective study was conducted in the Department of Plastic Surgery, Father Muller Medical College and Hospital, Mangalore, Karnataka, India. Patient data from January 2018 to December 2020 were chosen and were assessed between January 2019 to December 2021 after taking approval from Institutional Ethical Committee (IEC no FMIEC/CCM /457/2021).

Inclusion criteria: Patients aged >18 years, with either unilateral or bilateral mandibular angle fractures even if associated with other facial fractures were included in the study.

Exclusion criteria: Edentulous patients, immunocompromised patients, and patients in whom surgery was delayed for more than 10 days due to concomitant brain injury or haemodynamic instability were excluded from the study.

A total of 21 patients, out of which 12 patients underwent transoral approach and 9 patients underwent extraoral approach for management of mandibular angle fractures, within the study duration, were included in the study. Data was collected retrospectively from the Medical Records Department. The data collected includes demographic parameters like age, sex, clinical parameters like pain, scar, mouth opening, occlusion, signs of palsy and surgical details like type of approach, time for surgery, OPD follow-up records and periodic photograghs taken during subsequent follow-up visits.

Surgical Techniques

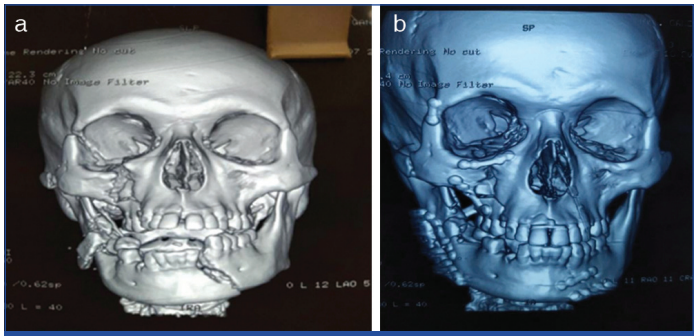
All patients were operated under general anaesthesia.

1. **Extraoral approach:** Risdon submandibular incision was placed 2-3 cm below lower mandibular border and the underlying platysma and cervical fascia were dissected taking care to

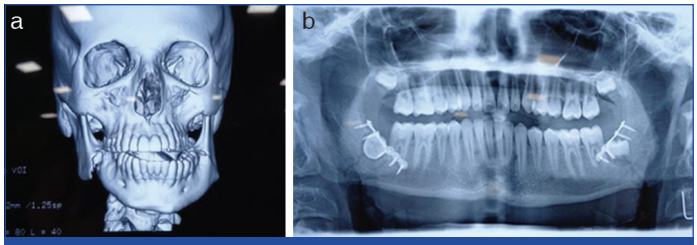
preserve the marginal mandibular nerve. The bone with the fracture segment was then completely exposed after cutting the masseter below lower mandibular border and elevating the periosteum. The fractured bone fragments were then aligned and the mouth was occluded. Fixation was done with two plates 2.5 mm mini plate along the inferior border and a 2 mm miniplate along the mid mandible. Intermaxillary fixation was done intraoperatively for patients where satisfactory manual occlusion could not be achieved manually, which was released after fixation and occlusion was checked. Finally, the incision was closed in layers with absorbable sutures for the muscle and subcutaneous tissue and non absorbable sutures for the skin [5].

2. **Transoral approach:** A retromolar incision was placed extending to the first molar or premolar. Then dissection of the underlying tissue and periosteal stripping of muscles was done to expose the fracture segment adequately. Then fracture reduction was done and the mouth was maintained in occlusion either manually or with the help of intermaxillary fixation. After attaining proper occlusion fracture segment was fixed via unicortical fixation with 5 holes with a gap 2 mm plate system and 8/10 mm screws while taking care to mold the plate as per the body or ramus of the mandible. The plate was placed along Champy's line of osteosynthesis [6]. After fixation, intermaxillary fixation was released and occlusion was checked. Finally, the incision was closed in layers with absorbable sutures. Postoperatively, if there is no intermaxillary fixation, the patient can be asked to do mouth opening exercises and occlusive exercises which helps in early adaptation and reduces the chances of trismus. Oral intake of clear liquids was started from day 1 and the patients were discharged after four days and advised for a weekly follow-up.

The patient details are shown as in [Table/Fig-1,2] and [Table/Fig-1a] shows 3-dimensional (3D) Computed Tomography (CT) image from a case of multiple facial bone fractures with comminuted fracture of angle, [Table/Fig-1b] shows 3D CT post fixation by extraoral approach, [Table/Fig-2a] shows 3D CT image of a case with bilateral angle fracture as a result of road traffic accident and [Table/Fig-2b] Orthopantomogram (OPG) shows bilateral angle fracture fixed by intraoral approach.



[Table/Fig-1]: A case of 45-year-old male, of RTA with face avulsion injury due to road traffic accident sustained multiple facial bone displaced and comminuted fractures. Right mandibular angle was a comminuted fracture with left body fracture. a) 3D CT image showing comminuted facial bone fracture (preoperative); b) 3D CT showing facial bone fixation with plates fixed by extraoral approach (postoperative).



[Table/Fig-2]: 16-year-old male with history of RTA sustained bilateral mandibular angle fracture. a) 3D CT image showing bilateral angle fracture with displacement of right angle; b) Orthopantomogram after fixation with plates, intraoperative image showing left side plate post fixation with inter maxillary fixation, intraoperative image showing occlusion postfixation.

All patients were examined for postoperative mouth opening, scar, infection, facial nerve injury, at each follow-up weekly for two weeks and biweekly till six weeks. Pain was assessed after one week of surgery. Evaluation of scarring was done with periodic photographs in the postoperative follow-up using vancouver scar scale [7]. Pain was assessed using visual analog scale. House and Brackman classification was utilised for assessing marginal mandibular nerve function [8].

STATISTICAL ANALYSIS

Statistical Analysis was done using Statistical Package for the Social Sciences (SPSS) software IBM SPSS statistics for Windows version 22.0 (IBM Corp., Armonk, N.Y., USA). The results are given using descriptive statistics like frequency, mean and percentages. Statistical significance was determined using Mann-Whitney U test and Chi-square test. A p-value <0.05 was considered statistically significant.

RESULTS

Twenty-one patients were studied out of which 17 (81%) were males and 4 (19%) were females. The age group ranged from 18-60 years with a mean age of 32.5±8.09 years. Out of the total patients studied 13 (61.9%) had isolated mandibular angle fractures and 8 (38.1%) patients had other associated facial bone fractures. The mean duration of surgery was 83.28±10.1 minutes.

In the present study, intermaxillary fixation was required in only 2 (9.5%) of the patients, as manual occlusion was difficult. In the rest of the patients (n=19), occlusion was attained by manual reduction during the surgery. All patients had preserved preoperative facial nerve function and none had any preoperative infection [Table/Fig-3].

Parameters	n (%)
Co-morbidities	
Diabetes	2 (9.5)
Hypertension	3 (14.3)
Preoperative parameters	
Preserved preoperative facial nerve function	21 (100)
Preoperative infection	0
Intraoperative parameters	
Intraoperative intermaxillary fixation	2 (9.5)
Postoperative parameters	
Postoperative infection	1 (4.8)
Preserved postoperative facial nerve function	21 (100)

[Table/Fig-3]: Clinical profile of patients.

Only one patient in the extraoral group developed postoperative surgical site infection which was managed conservatively with antibiotics and dressing [Table/Fig-4]. Out of 21 patients, a scar

Parameters		Extraoral (N=9, 42.9%)	Transoral (N=12, 57.1%)	p-value
Age (Mean±SD)		34.3±14 years	31.2±15 years	0.01*
Sex	Male, n (%)	7 (33.33)	10 (47.61)	0.04*
	Female, n (%)	2 (9.5)	2 (9.5)	0.071
Type of fracture	Isolate, n (%)	4 (19)	9 (42.85)	0.02*
	Associated, n (%)	5 (23.8)	3 (14.28)	0.05
Average surgical time (minutes) (Mean±SD)		90±10.1	79±10.1	<0.001*
Postoperative pain (out of 10)# (Mean±SD)		5.6±1.6	4.7±1.1	0.0116*
Infection (n)		1	0	0.02*

[Table/Fig-4]: Comparative analysis of clinicodemographic profiles of patients among extraoral and transoral group.
*p-value <0.05 was considered statistically significant; #Pain was assessed postoperatively 1st week follow-up using visual analog scale

was seen only in nine patients operated by extraoral approach. The mean postoperative scarring score was 8.11±1.76.

In the preoperative period, the patients experienced a higher degree of pain (7.52±1.07) and the extent of mouth opening was also less (22.66±3.65), due to the displaced bone fragments following the trauma. There was a greater degree of reduction in the pain (3.09±1.7) and increase in the mouth opening (39.28±4.76) after the displaced fragments were aligned postoperatively [Table/Fig-5]. Maximum mouth opening was observed at 6th post operative week.

Parameters	Preoperative (Mean±SD)	Postoperative (Mean±SD)	p-value
Pain assessment by visual analogue scale# (out of 10)	7.52±1.07	3.09±1.7	<0.001*
Mouth opening (in mm)	22.66±3.65	39.28±4.76	<0.001*

[Table/Fig-5]: Comparison of mean values of pain assessment by the visual analogue scale and mouth opening.
*p-value <0.05 was considered statistically significant; #Pain was assessed postoperatively 1st week follow-up

There was a statistically significant difference in duration of surgery and postoperative mouth opening and a highly significant difference in postoperative pain and scar between the two methods with the transoral method being better than the extraoral [Table/Fig-6].

Parameters	Approach	Mean rank	Sum of ranks	p-value
Duration of surgery	Transoral (n=12)	7.79	93.50	0.006*
	Extraoral (n=9)	15.28	137.50	
Postoperative pain assessment: Visual analogue scale#	Transoral (n=12)	6.88	82.50	<0.001*
	Extraoral (n=9)	16.50	148.50	
Postoperative surgical scar: Vancouver scar scale	Transoral (n=12)	6.50	78.00	<0.001
	Extraoral (n=9)	17.00	153.00	
Postoperative mouth opening: Inter incisal opening	Transoral (n=12)	14.25	171.00	0.005*
	Extraoral (n=9)	6.67	60.00	

[Table/Fig-6]: Comparison of postoperative outcomes by transoral and extraoral.
*p-value <0.05 was considered statistically significant; #Pain was assessed postoperatively 1st week follow-up

DISCUSSION

The mandibular angle is subjected to opposite muscular forces between the muscles of mastication and the hyoid group of muscles which results in instability between the distal and proximal bony fragments [3]. The fractures can be either anterior or posterior to the third molar tooth and the presence of the same further complicates the accuracy of fixation [3]. Rigid internal fixation must attempt to neutralise all forms of opposing forces on the bone to allow adequate postoperative function while minimising complication rates and disability. The ideal approach in the management of mandibular angle fractures has been an ongoing debate with different schools of thought as to which method is to be chosen.

One of the dictum as concluded from previous studies stated that fracture lines anterior to the third molar tooth and ending at the anteroinferior border of insertion of masseter muscle can be approached intraorally as it gave better access and visualisation of fracture segments with optimal control of occlusion, ease of removing the third molar, lesser operative time and minimal tissue edema. On the other hand, the extraoral approach held good for fractures posterior to the third molar tooth and high in the ramus with an excellent direct visual exposure and achievement of a good anatomical contour and occlusion of the mandible [4].

Kazanjian VH popularised the extraoral approach as the traditional approach for fracture fixation and the advantages cited were that the visualisation of the fracture was better and theoretically provided a cleaner wound with a separation between the sterile skin and the contaminated oral cavity [9]. Another advantage is the use of two mini plates however, these findings were refuted in studies by Ellis III E and Walker LR who advocated the use of a single superior border plating in the transoral approach being sufficient since the placement of a second plate involved increased periosteal stripping and bacterial contamination which increased rates of complications [6,10,11]. Champy M et al., recommend single mini plate fixation on the superior border of the angle of the mandible [12].

In the present study with 21 patients, the mandibular angle fractures were seen with the peak incidence of fractures in the second and third decades of life with a definite predilection in males (n=17). Road traffic accident was the most common etiological factor and these findings were in unison with a study conducted by Kumar GBA et al., which reported the pattern of maxillofacial fractures in 2,731 patients [13].

Toma VS et al., performed a study in which it was reported that there was no statistically significant difference in the complication rates between the transoral and extraoral approaches although the transoral is a difficult approach for the fixation of mandibular angle fractures [14]. Moreno JC et al., opined that the rates of complications were related to the severity of the fracture than to the approach of treatment used [15]. The principal advantage of the transoral approach over the extraoral is the avoidance of an external unaesthetic scar which is also confirmed in our study, transoral had no visible scar v/s an average Vancouver score of 8.1/13 in the extraoral group. The surgical time is defined as the time taken from incision and exposure of the fractured site to closure and it was noted that the transoral approach had a shorter surgical time (mean=79 minutes) as compared to the extraoral approach (mean= 90 minutes). The transoral approach is better with lesser operating time, better access to the mandibular angle, less manipulation of the surrounding soft tissues and no aesthetic concern. Toma VS et al., stated that the postoperative infection could be attributed to the increased operation time in a contaminated field with greater manipulation of tissues which was also seen in the present study where one patient in the extraoral group developed postoperative surgical site infection [14]. They also mentioned that infections are often due to improper oral hygiene [10]. They were managed conservatively with antibiotics and daily wound dressings and did not require any additional surgical intervention.

There were no significant occlusion discrepancies in either group and both groups had similar mouth opening during the postoperative period. Patients attained their maximum mouth opening by the end of the 6th week postoperatively and this was achieved by regular and adequate mouth opening exercises. The pain assessment done using the visual analogue scale showed increased pain scores in the extraoral group (5.6/10) probably due to injury to the masseter muscles. The extraoral approach has an increased risk of damaging the branches of the facial nerve i.e the marginal mandibular nerve due to soft tissue retraction and dissection. However, no temporary or permanent facial nerve palsies were noted in the present study.

Limitation(s)

The major limitation of the study is small sample size. A study with a larger number of subjects would probably give a better insight into the pros and cons of the different surgical approaches used. The type of surgical approach usually depends on the preference of the operating surgeon which might lead to some bias in the study results.

CONCLUSION(S)

The results of the present study found the transoral approach to be much simpler with shorter surgical duration, lesser number of

postoperative complications, and minimal morbidity, patients also have an early masticatory function and shorter hospital stay. The transoral approach is more versatile with no risk of damage to the branches of the facial nerve or any visible external scar. Transoral approach also has much less intensity of pain postoperatively as compared to the extraoral approach. However, the extraoral approach provides better fixation in case of comminuted mandibular angle fracture. Further studies including more parameters and probably larger sample size can be taken up which can aid the surgeons in making an informed decision.

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