A Prospective Study on Management of Mandibular Angle Fracture

Pradeep Pattar · Sujith Shetty · Saikrishna Degala

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Abstract

Purpose To evaluate the results of management of mandibular angle fracture by open reduction and internal fixation using single non compression miniplate via transbuccal, intraoral or extraoral approaches.

Patients and Methods In this prospective study, 30 patients were randomly selected regardless of age, sex requiring open reduction and internal fixation of non comminuted angle fracture with/or without other associated fractures of the mandible. All the patients were operated under general anaesthesia following routine haematological, biochemical, general physical examination and routine radiographic examination. Patients were randomly distributed into 3 groups namely: (1) intraoral, (2) transbuccal, and (3) extraoral groups depending on the surgical approach used for open reduction and internal fixation of fracture of the angle of mandible. In the intraoral group (12 patients), angle fracture was approached through the intraoral vestibular incision similar to sagittal split incision. In the transbuccal group (8 patients), angle

fracture was approached through the intraoral vestibular incision and transbuccal stab incision for screw fixation via trochar. In the extraoral group (10 patients), angle fracture was approached through the Risdon's submandibular incision. In all the patients, fractures were reduced with upper and lower Erich's arch bar fixation as means for IMF intraoperatively. In all the patients, fracture of the angle of the mandible was fixed with single non compression 2.5 mm, 4 holed with gap stainless steel miniplate and 6/8 mm monocortical screws. All patients were followed up for minimum of 6 months to maximum of 24 months.

Results Complications were relatively minor such as paresthesia (on average 26.7 % first post-operative day which was gradually improved and on average after 1 month was 3.3 %), mild to moderate occlusal discrepancies (on average 36.7 %) which needed the post-operative intermaxillary fixation with elastics for 1–2 weeks, infection (20 % on average) was mild to moderate which was managed with antibiotic therapy and/or incision and drainage except in one case, plate removal was done under general anaesthesia (extraoral group) because of recurrent infection. Post-operative pain was mild to moderate (mean VAS score pre operative–6.17, post-operative 1 week–1.63) which was managed with analgesics. Mouth opening was recorded in all patients which was on average 20.98 mm preoperatively which improved to 40.57 mm after 1 month.

Conclusion The use of a single non compression miniplate for fractures of the angle of the mandible is a simple, reliable technique with relatively rare major complications and few minor complications irrespective of the surgical approach used for the open reduction.

Keywords Angle fracture · Extraoral · Intraoral · Miniplate · Transbuccal

P. Pattar (✉)
Department of Oral and Maxillofacial Surgery, MGV's KBH
Dental College and Hospital, Mumbai-Agra Road, Panchavati,
Nashik 422003, India
e-mail: drpattarpradeep@gmail.com

S. Shetty · S. Degala
Department of Oral and Maxillofacial Surgery, JSS Dental
College and Hospital, S.S Nagar, Mysore 570015, India
e-mail: shettymaxfax@gmail.com

S. Degala
e-mail: degalasaikrishna@gmail.com

Introduction

The angle of the mandible is commonly associated with fractures because of (1) the presence of third molars [1, 2]; (2) a thinner cross-sectional area than the tooth-bearing region and (3) biomechanically the angle is a “lever” area. All successful treatment of mandible fractures depends on undisturbed healing in the correct anatomic position under stable conditions. The use of either an extraoral open reduction and internal fixation with the AO/ASIF reconstruction plate or intraoral open reduction and internal fixation, using a single miniplate, was associated with the fewest complications [3]. The treatment of angle fracture is plagued by the highest complication rates among mandible fractures; no consensus exists regarding optimal treatment [3, 4].

The objectives of our study were to evaluate our results in the management of mandibular angle fracture by open reduction and internal fixation using single non compression miniplate via transbuccal, intraoral or extraoral approaches.

In this study, 30 patients were randomly selected regardless of age, sex requiring open reduction and internal fixation of mandibular angle fracture with or without other associated fractures of mandible. Edentulous patients, patients with comminuted angle fractures, patients with systemic problems and patients with osteoporosis and osteopetrosis and patients on chemotherapy and/or on radiotherapy were excluded from the study.

In all patients fractures were reduced with upper and lower arch bar fixation as a means for intermaxillary fixation intraoperatively. All patients were operated under general anaesthesia following routine hematological, biochemical, general physical examination and routine radiological examination.

In all patients, fractures were fixed with 2.5-mm, non-compression stainless steel miniplates and 6/8-mm monocortical screws. Stainless steel plates and screws were prepared over the titanium plates to reduce the treatment cost.

Patients were randomly distributed into 3 groups depending upon the surgical approach (for fracture of the angle of the mandible) used for fixation of miniplate namely:

Extraoral group (10 patients) where the fracture site was approached through the Risdon’s submandibular incision (Fig. 1a–d).

Intraoral group (12 patients) where the fracture site was approached through the intraoral vestibular incision similar to sagittal split incision (Fig. 2a–d).

Transbuccal group (8 patients) where the fracture site was approached through the intraoral vestibular and transbuccal stab incision for screws fixation via trochar (Fig. 3a–d).

All cases have been followed-up for minimum of 6 months to a maximum of 24 months. Initially patients were followed-up on weekly basis for the first month, then once in 15 days for the next 2 months, then once in 3 months.

All cases have been evaluated for the following parameters:

- The type of fracture:
Assessed with OPG, PA view of mandible and intra-operative clinical examination.
- Need for the intermaxillary fixation, duration of intermaxillary fixation.
- Fate of the tooth in line of fracture.
Tooth is extracted if there is fracture of the tooth itself or if it interferes with fracture reduction or if associated with infection or any periodontal problems.
- Any damage to the adjacent roots of the teeth after plating.
Assessed by post-operative radiograph, preoperative and post-operative vitality tests of the adjacent teeth (immediate and after 2 weeks).
- Paresthesia/neurosensory changes (preoperative and post-operative).
Neurosensory testing was done in a quiet room with the patient and examiner relaxed and comfortable. Tests were performed with the patient’s eye closed. Detection of a stimulus was indicated to the examiner by the subject by raising a finger. The results of each test were compared with those obtained from the normal (unoperated/uninjured) side.
Neurosensory dysfunctions were assessed using the following simple tests:
Light touch sensation: This test was performed using a wisp of cotton wool. An area of unpleasant sensation if present was mapped applying the stimulus within this area and then moving it outward in small steps until a sensation is felt. This position was marked on the skin and the test was repeated at a series of different sites until the region is outlined. The area of the skin mapped out was taken as the baseline value and during subsequent follow-up the values were compared and postoperative recovery analyzed.
Brush directional strokes: Brush stroke direction was examined using fine camel hair brushes. The test site (the lower lip and chin on the operated side) was stroked from right to left or from left to right for a 1 cm length. The patient had to correctly identify the direction in 12 of 15 times or it was recorded as decreased sensibility.
- Occlusal discrepancies:
The changes in occlusion over the 4 weeks were noted. The occlusion was scored as follows:
 1. Normal occlusion/functional occlusion.
 2. Moderate derangement—reasonable but not exact contact bilaterally.

Fig. 1 Extraoral approach (open reduction and internal fixation of angle fracture): **a** surgical exposure of the fracture. **b** Fracture fixed with miniplate and screws. **c** OPG reveals fracture right angle (pre op.) and left body. **d** Open reduction and internal fixation (post op.)

3. Gross derangement—no contact or contact in one or two teeth or open bite.
- Evaluation of pain:
Evaluating using visual analogue scale which was given to patients as printed proforma during follow-up days:
Visual analogue scale: score (0–10)

No pain ----- pain can not be worse.

0 1 2 3 4 5 6 7 8 9 10

- Evaluation of trismus:
Trismus is measured as the maximal inter-incisal width (mesioincisal angle of the right upper and lower central incisors) using a divider and a calibrated ruler and the value recorded. If incisors are missing, adjacent teeth are considered.
- Infection at the fracture site:
Assessed by any swelling, pain, tenderness, wound dehiscence or pus discharge at the operated site.
Mild to moderate infection—managed with post-operative antibiotic therapy and/or incision and drainage.

Fig. 2 Intraoral approach (open reduction and internal fixation of angle fracture): **a** surgical exposure of the fracture site. **b** Open reduction and internal fixation (post op.). **c** OPG reveals fracture left angle and left parasymphysis (pre op.). **d** Open reduction and internal fixation (post op.)

Severe/recurrent infection—managed with antibiotic therapy and plate removal.

- Any need for the removal of the plates and screws:
In case of severe or recurrent infection at the fracture site, or if the plate/screws become loose or dislodged were managed with antibiotic therapy and plate removal and scored as : (1) No, (2) Yes.
- Scar at the operated site: assessed by clinical examination only.

Statistical Methods Applied

Following statistical methods were applied in the present study

- Contingency coefficient test (cross tabs procedure)
- Analysis of variance (ANOVA-one way)
- Repeated measure ANOVA

The statistical operations were done through SPSS (Statistical Presentation System Software) for Windows, version 10.0 (SPSS, 1999. SPSS Inc: New York).

Results

	Extraoral (10 patients)	Intraoral (12 patients)	Transbuccal (8 patients)
Paresthesia	Noted in 3 patients	Noted in 2 patients	Noted in 2 patients
Occlusion discrepancies	4 patients, corrected with IMF elastics for 1 week.	3 patients, corrected with IMF elastics for 1 week.	1 patient, corrected with IMF elastics for 1 week.
Pain	Mild to moderate	Mild to moderate	Mild to moderate
Maximum mouth opening	Post op. day 1: 22.60 mm after 1 month: 40.10 mm	Post op. day 1: 23.17 mm after 1 month: 40.83 mm	Post op. day 1: 22.88 mm after 1 month: 40.75 mm
Recurrent infection	Noted in 1 patient	Nil, mild infection in 2 patients.	Nil, mild infection in 1 patient.
Tooth in line fracture	Not extracted in any patients	Not extracted in any patients	Extracted in 1 patient because of mobility.
Scar	Scar improved in all, except 1 patient where plate removal was done.	Not significant	Not significant
Need for plate removal	In one patient because of recurrent infection.	Nil	Nil

Discussion

Treatment of angle fractures is plagued by the highest complication rates among mandible fractures, and no consensus exists regarding optimal treatment [3] and the optimal treatment for mandibular angle fracture remains controversial. Historically, treatment of mandible fractures included intraoperative maxillomandibular fixation along with rigid internal fixation. More recently, non compression plate miniplates, which produce only relative stability, have gained popularity [4].

A single miniplate plate on the superior border of the mandible has become the preferred method of treatment among AO faculty. When using large, inferiorly based plates more surgeons are now favoring neutral rather than eccentric screw placement [4]. Ellis and Walker [5] showed that the treatment of mandibular angle fractures using two non compression miniplates, was found to be relatively easy, but resulted in an unacceptable rate of infection.

Ellis and Walker [6] showed that the use of a single miniplate for fractures of the angle of the mandible was a simple, reliable technique with a relatively small number of major complications.

It has been shown that, when a comparison was made of intraoral approach to extraoral approach in the treatment of mandibular angle fracture, there were three advantages viz., cutaneous scar was minimal, visualization of occlusion was maintained throughout the procedure, and injury to branches of the facial and other anatomic structures was reduced [7, 8]. Also monocortical miniplate fixation is a reliable method of providing rigid fixation and it offers a reasonable alternative to bicortical plating in most

mandible fractures [8]. Also the open reduction of the mandibular angle associated with teeth removed from the fracture line produced the greatest incidence of complications both quantitatively and qualitatively [9]. Although study samples were less in our study, complications were relatively minor such as paresthesia (on average 26.7 % first post-operative day which was gradually improved and on average after 1 month was 3.3 %), mild to moderate occlusal discrepancies (on average 36.7 %) which needed post-operative intermaxillary fixation with elastics for 1–2 weeks, infection (20 % on average) was mild to moderate which was managed with antibiotic therapy and/or incision and drainage except in one case where plate removal was done under general anaesthesia (extraoral group) because of recurrent infection. Post-operative pain was mild to moderate (mean VAS score pre operative–6.17, post-operative 1 week–1.63) which was managed with analgesics. Mouth opening was recorded in all patients which was on average 20.98 mm preoperatively which improved to 40.57 mm after 1 month. These results could establish a strong reference for clinical practice.

Conclusion

The use of a single non compression stainless miniplate for fractures of the angle of the mandible is a simple, reliable technique with the relatively rare major complications and few minor complications irrespective of the surgical approach used for the open reduction. Favourable results in the management of angle fracture depend on proper assistance, adequate armamentarium, knowledge of

Fig. 3 Transbuccal approach (open reduction and internal fixation of angle fracture): **a** drilling through the trochar and canula. **b** Screw placement through trochar and canula. **c** OPG reveals fracture left angle and right body of mandible. **d.** Open reduction and internal fixation (post op.)

surgical anatomy and essential skill in treating fractures. In female patients, young patients and when patients were concerned about the extraoral scar, intraoral approach is prepared over the extraoral approach.

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