

A prospective study examining the effects of treatment timing in the management of mandible fractures

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Abstract. The ideal timing for treatment of mandible fractures has not been well established. The objective of this study was to analyse the effects of treatment timing in the surgical management of mandible fractures. A prospective evaluation of 215 continuous patients with a total of 359 mandible fractures was undertaken. Nine outcome variables were analysed in relation to treatment delay by logistic regression modelling: wound dehiscence, hardware exposure, local postoperative infection, malocclusion, trismus, nerve damage, fracture non-union, return to theatre, and radiographic outcome. Nineteen additional variables were included in the analysis to adjust for potential confounding. Delay was measured in days and ranged from 0 to 41 days, with a mean delay of 4.6 days. The incidence of wound dehiscence, hardware exposure, local postoperative infection, trismus, nerve damage, fracture non-union and return to theatre was 6%, 4%, 11%, 8.5%, 47%, 2% and 8%, respectively. Objective malocclusion and poor radiographic outcomes were evident in 13% and 4.5% of cases, respectively.

No statistically significant association was found between treatment delay and treatment outcomes.

The findings of this study suggest it may be safe to delay the definitive treatment of mandible fractures. Treatment delay may allow for improved resource distribution and prioritization of more time-dependent interventions.

Key words: trauma; assault; mandible; fracture; timing; delay; surgery.

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The ideal timing for the treatment of mandible fractures has not been well established^{1,2}. The relevance of delay from injury to treatment is commonly disputed amongst surgeons and in the literature,

particularly with respect to traditional outcome measures such as postoperative infection, wound dehiscence, fracture non-union, and malocclusion^{1,2}. A systematic review of the literature in 2013 examined

the effects of treatment timing in the management of facial fractures². Thirty studies were identified over a 34-year period, of which 21 involved treatment of the mandible in isolation. Of the 21 studies, one

was a systematic review¹, two were prospective case series^{3,4}, and 18 were retrospective case series^{5–22}. Fourteen of the 21 studies found no significant relationship between treatment delay and treatment outcome^{3–7,10–12,14,15,17,19–21}, six found a statistically significant relationship between treatment delay and worse treatment outcomes^{8,9,13,16,18,22}, and one, a systematic review by Hermund et al.¹ found inconclusive results. A great deal of inconsistency was found between the 21 studies, in particular with respect to variables collected, outcome measures, statistical methods, validity, and findings. The review concluded that with the evidence available, definitive conclusions could not be drawn regarding the timing of treatment for facial fractures. More recently, a study by Gazal in 2015 did not clearly define any findings in relation to treatment delay²³, and a study by Lee et al. in 2016 found no clear association between treatment delay and an increased rate of complications²⁴. The aim of this study was to resolve the conflict that exists in the literature, by carefully identifying and measuring all available variables in the management of mandible fractures in a prospective and appropriately validated manner. It was hypothesized that treatment delay would not significantly affect the outcomes of definitive mandible fracture treatment.

Materials and methods

Study design

This study used a prospective design and involved the collection of predetermined variables as identified from a systematic review of the literature in 2013¹. Over an 18-month period, data was collected from a continuous sample of patients meeting specific criteria as outlined below. This study was undertaken in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement²⁵.

Setting

This study was undertaken in the oral and maxillofacial unit of the study hospital in Brisbane, Australia. Patients who received active treatment for mandible fractures during the period 27 January 2014 to 26 July 2015 were included in the study. The oral and maxillofacial unit of the study hospital provides a tertiary referral service for facial trauma for a large metropolitan and regional area. Patients with mandible fractures commonly present via the study hospital's

emergency department or through an inter-hospital transfer from a regional centre without a suitable surgical service. Occasionally, patients are referred from a general medical or dental practitioner.

Except for patients with non-displaced fractures for whom conservative management is deemed appropriate, definitive assessment and management of mandible fractures at the study unit is generally undertaken in an inpatient setting in a semi-urgent manner. Reasons for delay are multifactorial, but commonly include geographic isolation and inter-hospital transfer, and drug and alcohol intoxication. To minimize treatment delay, patients requiring surgical management are often added to the hospital theatre emergency board. When available, an elective list is sought to minimize uncertainty and unnecessarily long periods of fasting for the patient. Patients usually receive surgical treatment within 4 days of injury. Consultant surgeons and registrars undertake the surgeries. Different operators employ their preferred techniques, but generally an open reduction and internal fixation (ORIF) technique is employed. Both intraoral and extraoral approaches are used. Arch bars, intermaxillary fixation (IMF) screws, and intermaxillary elastics are utilized when required, as is endoscopic assistance. Patients with isolated mandible fractures are usually discharged within 24 h of surgery with oral antibiotics, chlorhexidine-containing mouthwash, analgesia and postoperative instructions.

Unless patient limitations or unforeseen complications arise, postoperative review of all routine maxillofacial trauma surgeries is undertaken at approximately 1 and 6 weeks post-surgery. Review at 1 week allows for the removal of sutures where required and allows the identification and rectification of early complications. Review at 6 weeks allows the assessment of healing and restitution of function, and allows the identification of later complications. Additional review appointments are made when clinically warranted.

Participants

All patients who required active treatment for a fracture or fractures of the mandible, and who were treated in the oral and maxillofacial unit at the study hospital between 27 January 2014 and 26 July 2015, were included in the study.

Variables

The following outcome variables were collected for each patient: local postoper-

ative infection, wound dehiscence, malocclusion, fracture non-union, hardware exposure, nerve damage, trismus, return to theatre, and radiographic outcome.

Factors considered potential confounders were collected as follows: date of injury, date of operation, delay (days), age, gender, dental status, American Society of Anesthesiologists (ASA) physical status classification, alcohol use, cigarette use, illicit drug use, prior mandible fracture, number of mandible fractures, fracture location, tooth in line of fracture, fracture comminution, operation type, fracture aetiology, local preoperative infection, associated maxillofacial injury, associated other injury, operator experience level, and length of surgery.

Data sources/measurement

Data was collected and recorded on a preplanned data collection sheet. Information was obtained from patients at admission and at routine postoperative appointments, from medical records, from pre- and postoperative radiographs, and from the hospital's Operating Room Management Information System (ORMIS).

Bias

The first author was not a member of the oral and maxillofacial unit at the study hospital and as such had no conflict of interest in reporting the unit's surgical results. The second author, a biostatistician from the School of Population Health at the University of Queensland, who had no professional connection with the oral and maxillofacial unit or the first or third author, conducted the statistical analysis independently. The third author, who conducted the radiographic outcome review, was the primary operator for only two of the 215 patients. For the radiographic review, only the hospital identification number of each participant was made available to minimize bias.

Study size

The number of cases in the area during the study period determined the sample size. A total of 215 consecutive patients with 359 mandible fractures were included.

Quantitative variable handling

Primary independent variable

Delay was measured in days from date of injury to date of operation, as this was the smallest and most practical increment of time that could be reliably measured from injury to surgery. It was determined that

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