ORIGINAL ARTICLE

ISOLATED MANDIBULAR FRACTURES TREATED WITH CONVENTIONAL TECHNIQUES VS. RIGID OSSEOUS FIXATION: A RETROSPECTIVE STUDY IN DAMMAM, SAUDI ARABIA

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تعالج كسور الفك السفلي منذ سنوات عديدة بالطرق التقليدية .
أصبحت في السنوات الأخيرة بعض الطرق الحديثة مثل التثبيت العظمي المغلق من الطرق الشائعة .
هدفت هذه الدراسة الاسترجاعية إلى اجراء مقارنة بين نتائج العلاج المغلق والعلاج المفتوح وبين النتائج المشاهدة عند استعمال الأسلاك العظمية الاصطناعية مقارنة بالتثبيت الداخلي الصلب ، المطبق لمعالجة كسور الفك السفلى في ٧٩ مريضاً يعانون من ١٠١ كسر في الفك السفلي .
تدل النتائج على وجود مزايا عديدة للتثبيت الداخلي الصلب (القاسي) حيث يفوق الطرق التقليدية على الرغم من انخفاض معدل حدوث الإنتان .
يمكن الاستنتاج على أن الاختلاطات بشكل عام كانت قليلة ويمكن الإقلال منها بالإختيار الدقيق للمرضى واستعمال المضادات الحيوية ومهارة وخبرة الجراح بالإضافة إلى إنجاز التقنية بإسلوب بارع .

Mandibular fractures were managed by conventional techniques for many years. New techniques like rigid internal fixation became more popular in recent years. The purpose of this retrospective study was to compare results seen with closed reduction versus open reduction and those seen with wire osteosynthesis versus rigid internal fixation for the management of mandibular fractures in seventy-nine patients with 101 mandibular fractures. The results suggest that rigid internal fixation offers many advantages to the patient and is superior to more conventional techniques inspite of a minor infection rate. It was concluded that the overall complication rate was low and can further be reduced by careful selection of patients, use of antibiotics, surgeon's skill and experience as well as meticulous performance of the technique.

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Introduction

Mandibular fractures are common facial injuries accounting for 36-59% of all maxillo-facial fractures and their treatment is one of the most frequent forms of therapy provided by maxillofacial

surgeons.[1,2]

Traditionally, surgeons have attempted to achieve four main goals when repairing mandibular fractures: anatomic restitution, immobilization, prevention of infection and rehabilitation of function. Meeting these goals is essential for successful bone healing and correct post-operative function of the stomatognathic system.[3]

Two methods of treatment were used to achieve these goals: conservative closed reduction with simple jaw support or maxillo-mandibular fixation (MMF) and open reduction with fixation by intraosseous wiring and MMF.[3]

Critics of prolonged immobilization have noted patient complaints of panic, insomnia, social inconvenience, phonetic disturbances, loss of effective work time, physical discomfort, weight loss and difficulty in recovering a normal range of jaw movement.[4]

In recent years, new techniques using rigid internal fixation (plate osteosynthesis) for the treatment of mandibular fractures have been introduced.[5] The basic concept of rigid fixation is absolute stability and there are a variety of techniques advocated to achieve this goal. Michelet, et al (1973) and Champy, et al (1978) suggest that engaging a single cortex is sufficient for rigid osteosynthesis. In contrast, other authors believe that rigid osseous fixation is not obtained without bicortical engagement of the screws. A number of authors also report that compression has been principally achieved through a large compression system, less rigid mini-systems may suffice, however.[4]

The purpose of this study was to compare results seen with closed reduction versus open reduction and those seen with wire osteosynthesis versus rigid bone plating system in the management of mandibular fracture. The retrospective survey was carried out in patients with mandibular fractures in Dammam Central Hospital over the period 1993-1996 (1413H-1416H).

Materials and Methods

All records of seventy-nine patients with mandibular fractures independent of any other facial bone fracture, who were admitted to the Oral and Maxillo-facial Surgery Department in Dammam Central Hospital from 1993-1996 (1413H-1416H), were reviewed. Diagnosis was based on routine clinical and radiographic examination, and fracture sites were classified as parasymphyseal, body, angle and subcondylar fracture with the exclusion of dentoalveolar fractures. In terms of treatment, fractures were divided into four groups. Group I - fractures treated with closed reduction; Group II - fractures were treated with wire osteosynthesis; Group III - fractures were treated with rigid plate osteosynthesis; and Group IV - fractures were treated with combination of both wire and rigid plate osteosynthesis.

Antibiotic coverage (Amoxil, 500mg/8h and Flagyl, 500mg/8h) was commenced routinely on admission and continued for 5-7 days post-operatively. Follow-up was performed 6-10 weeks post-operatively. Post-operative complications such as infection, dehiscence, neurosensory disturbances and malocclusion were recorded.

Results

Seventy-nine patients (67 males and 12 females, age range: 3-83) with 101 mandibular fractures were included in this study. The causes of the fractures were motor vehicle (78%), assault (9%) and miscellaneous (sporting accidents, and industrial accidents 13%). Thirty-three fractures involved the parasymphyseal region (32.7%), thirty fractures in the angle region (29%), and twenty-four in the body (23.8%). There were fourteen fractures in the condylar area (13.8%) which were treated by closed

reduction.

Forty-five fractures (44.6%) were managed by bone plate osteosynthesis, and forty-one fractures (40.6%) were treated by closed reduction. On the other hand, ten fractures (9.9%) were treated with wire osteosynthesis while five fractures (4.9%) were treated by a combination of wire and bone plate osteosynthesis.

The distribution of fractures is shown in Table 1. Group I (closed reduction) angle 12, body 8, parasymphysis 7 and condyle 14; Group II (wire osteosynthesis) angle 6, body 2 and parasymphysis 2; Group III (rigid plate osteosynthesis) angle 11, body 11 and parasymphysis 23; and Group IV (combination of wire and plate osteosynthesis) angle 1, body 3, parasymphysis 1.

Infection developed in three patients who were treated with bone plates (Group III) but none from the other groups. The average time lapse between reduction and the evidence of an infection was seven days. Total of five fractures (11.11%) became infected with rigid plate osteosynthesis. Two patients had two infected fractures each: one had body and angle and the second had an angle and parasymphysis fracture. The remaining patient had a single edentulous body fracture that became infected. Of the plated fractures that developed infection, three were treated with the intraoral approach (body, angle and edentulous body) and two were treated with the extraoral approach (parasymphyseal and angle). The infection developed among the patients whose surgical repair was made after five days or more from the time of injury. The operating time and average hospital stay were approximately the same in all groups except in Group I which was slightly shorter than other groups.

Two patients with three infected fractures were treated with antibiotic cover for ten days. One patient with two infected fractures was treated by removing the bone plates and immobilizing by intermaxillary fixation for four weeks to achieve union. In both cases, healing was uneventful. Wound dehiscence, which developed in three patients with five infected fractures, was treated by secondary repair after five days of antibiotic cover.

Following secondary repair, healing was uneventful. There were no cases of non-union or fibrous union in any group of the study, even in those who had infection.

Forty-five fractures were associated with teeth in all groups. Teeth in the line of fracture were retained at the time of reduction and no infection was experienced for all forty- five fractures. None of the patients experienced malocclusion, only minor premature contact was noted in five patients; one patient each in Group I and Group II, three patients in Group III, and none in Group IV. Premature contacts were corrected subjectively by minor selective equilibration.

Table 1. Distribution of fractures among groups of the study.

No.	Location	Group 1	Group II	Group III	Group IV	Total	Percentage (%)
1	Angle	12	6	11	1	30	29.7%
2	Body	8	2	11	3	24	23.8%
3	Parasymphyseal	7	2	23	1	33	32.7%
4	Condyle	14	0	0	0	14	13.8%
5	Total	41	10	45	5	101	
6	Percentage (%)	40.6%	9.9%	44.6%	4.9%		100

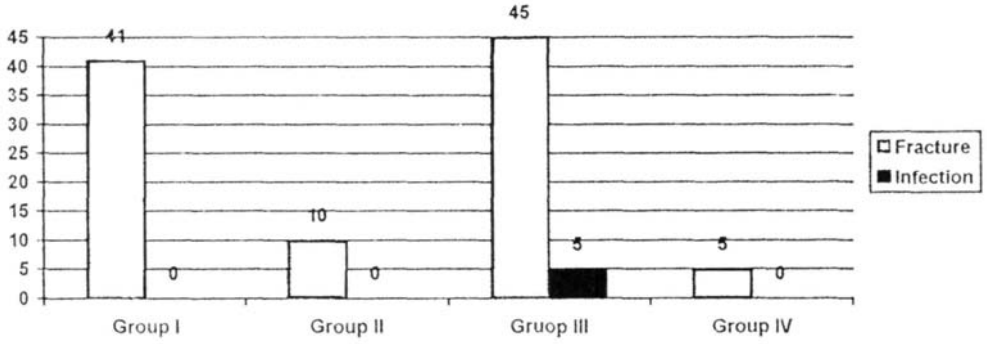

Figure 1. Infection related to groups in the study.

There was no neurosensory disturbance of the inferior alveolar nerve among any group in the study. Radiologically, no screws or wires appeared to involve the mandibular canal.

Discussion

Mandibular fractures are common facial injuries and are most frequently treated by oral and maxillofacial surgeons.[1,2] The patients' age and sex distribution of this study corresponds to the reports of other authors.[1,2,8] The leading causes of mandibular fractures were motor vehicle accidents and assaults, and correspond with the findings of Bochlogyros[1] and Allan and Daly.[2]

Rigid internal fixation offers many advantages. It provides maximum stabilization of the fragments and subsequently eliminates the need for MMF and thereby permits early jaw mobilization.[4,67] Moreover, it allows precise anatomical reduction, since it is done under direct vision.[7] The advantages of this technique are not without a cost. Rigid fixation technique is a major surgical procedure and may carry an increased risk of complications.[5] It requires adequate knowledge of the available fixation systems and the advantages and disadvantages of each system. In addition, these procedures are extremely technique sensitive, increasing the potential for morbidity or suboptimal results and stressing the need for skillful, well-trained surgeons.[5]

No single technique alone can be useful for treating all types of mandibular fracture.[1] All techniques can be useful for treating fracture cases depending on the skill and knowledge of the surgeon and the type of fracture. Currently, established methods for treating mandibular fractures include conservative closed reduction with or without maxillo-mandibular fixation and open reduction with rigid osseous fixation.[3] As such, undisplaced or minimally displaced mandibular fractures are normally indicated for uncomplicated closed reduction with maxillo-mandibular fixation.

In this study, 40.95% of fractures were managed by closed reduction with or without maxillo-mandibular fixation (including 13.8% of condylar fractures) with good results and without complications. Although interdental wiring techniques are the most simple form of management in dentate patients with well known advantage,[1] they suffer from serious disadvantages of prolonged maxillo-mandibular fixation.[1,9] Fourteen condylar fractures (13.8%) were treated conservatively without any complications in the study. Conservative treatment usually refers to immobilization of mandible in normal occlusion for a variable period of time followed by jaw opening exercises.[10] Although many authors report that most

condylar fractures of the mandible were treated conservatively, opinions differ as to the management of dislocated condylar fractures.

Forty-five fractures (44.6%) were managed by rigid plate osteosynthesis in this study. Complications developed only in Group III arid none from the other groups. The overall complication was infection. An infection developed in three patients in five fractures (11.11%) with rigid plate osteosynthesis. There are a number of reports of high complication rates in fractures treated with rigid plate Fixation,[45] although there are also reports of low complication rates.[9] The results of this study are in harmony with Theriot, et al,[4] Anderson and Alpert[5] who reported 16% infection rate whereby all infections were in fractures associated with teeth. Tuovinen, et al[9] reported 3.6% infection rate and Peled, et al[3] reported 9.2% infection rate.

Correct handling of the bone and soft tissue during surgery and preventing hematoma formation can minimize the infection rate with rigid Fixation.[3] Anderson, et al[5] reported a number of possible reasons for infection which included improper technique in the use of rigid Fixation, involvement of multiple surgeons and poor patient compliance.

Koury, et al[6] concluded that bony union can occur in the face of infection as long as immobilization of the fractured segments is maintained. When using rigid internal Fixation for mandibular fracture, absolute rigidity is essential. Moreover, Koury's results[6] encourage the treatment of initially infected mandibular fractures by rigid Fixation.

Three infected fractures were treated by antibiotic therapy while two infected fractures with loose Fixation were treated by the removal of bone plates. This is in agreement with the suggestions of other authors.[456] Of the Five infected fractures, two were angle, two body and one parasymphysis. Although statistically not significant, it appears that angle and body fractures may have high infection rates compared to fractures of the parasymphysis with rigid Fixation. This is probably due to technical difficulty in achieving compression at the angle. Further, the biomechanical forces exerted by the muscles of mastication have a greater influence at the angle than in other regions of the mandible. It is easy to preload the fracture at the parasymphysis. Preloading fractures and further compression exerted by the plates have proven to aid the fracture stability.[4] Improvement in the infection rate has also been found due to the surgeons' skill, experience and improved technique. This Fmding is in agreement with Peled, et al,[3] Theriot, et al[4] and Anderson, et al.[5] Wound dehiscence was noticed in three patients, in fractures treated by rigid fixation. Probable reasons may be infection and poor oral hygiene. No case of malocclusion was experienced in any group in the study. Peled, et al[3] reported 7.8% malocclusion in fractures treated with rigid fixation. Also, no case of non-union or fibrous union was noticed in any group of this study which is in agreement with Tuovinen, et al.[9] Post-operative neurosensory disturbance in inferior alveolar and mental nerve was not found in the study groups which is similar to the findings of Theriot, et al.[4] Overall complication rates was low and is in concurrence with those published by other authors.[3,46]

Conclusion

A number of techniques are at the disposal of the oral and maxillofacial surgeon for the management of fractured mandible. Each technique has its advantages and disadvantages. Conservative closed reduction and fixation still has a place for the treatment of mandibular fractures. New techniques like rigid internal fixation (plate osteosynthesis) offer many advantages to the patient and is superior to more conventional techniques inspite of minor infection rates. The infection can, however, be

reduced by careful selection of patients, use of antibiotics, skill and experience of the surgeon and meticulous performance of the technique.

Based on the study, the following conclusions have been arrived at:

- Rigid fixation gives better reduction and stabilization.
- The use of plate is quick and easy provided that surgeon is skillful.
- Tooth at fracture line can be left without any complication.
- Risk of infection following open reduction does not increase with rigid fixation.
- Bony union can occur in the presence of infection as long as immobilization is maintained.
- Resolution of infection can occur even when a plate is present.
- If resolution of an infection does not occur, plates are left 8-12 weeks to achieve bone union and then removed.
- Proper administration of antibiotics pre- and post-operatively decrease the rate of infection.
- Conventional closed fracture management with maxillo-mandibular fixation can also yield satisfactory results when strictly indicated.

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