Research Article

Comparison of Occlusion in Closed Versus Open Reduction with Internal Fixation in Mandibular Subcondyle Fracture

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Abstract |

Background: Treatment of mandibular subcondylar fractures has been controversial over years. The treatment modalities devised for such fractures are open reduction with internal fixation and closed reduction. Both have successfully been used over decades, yet the superiority of one over the other is yet to be assessed.

Objective: The objective of this study was to compare, open reduction with internal fixation of mandibular sub-condylar fracture with closed reduction in terms of fine occlusion.

Material & Methods: This was a randomized clinical trial conducted at Oral and Maxillofacial Surgery Department, King Edward Medical University & Allied Hospitals, Lahore. 70 patients who presented with unilateral sub-condylar fractures were included in the study. Patients were randomly divided into 2 groups. Group-A patients were treated with closed reduction and immobilization and discharged the same day whereas; Group-B patients were treated by open reduction with internal fixation, and retained in ward for 1 day. Both were recalled for periodic examinations and observation recorded. The objective was to compare both treatment methods in achieving balanced occlusion. Data was analyzed by using Statistical Package for the Social Sciences (SPSS) 20.0. Chi-square was used as test of significance taking p-value <0.05 as significant.

Results: At 1st month post-operative, 25(71.43%) Group A & 28(80%) Group B patients achieved fine occlusion and after 3 months fine occlusion was seen in 29(83%) & 33(94%) Group A & B respectively (p-value=0.133). Similar results were seen after 6 months.

Conclusion: The difference in results of both treatment modalities in terms of occlusion was statistically insignificant. Hence, either treatment is equally good.

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Introduction

Mandibular subcondyle fracture (MCF) is the next most common fracture of mandible bone after parasymphysis.[1] The varieties of fractures vary with the mode of injury, vector of force and site of impact, e.g. athletes and road traffic accidents; the severity of injury diverges. Impact on subcondyle leading to bone disruption causes inability to open mouth optimally, inhibits various joint movements

and bad occlusal balance.[1]

According to a 2013 study, MCFs account for 25-35% of mandibular fractures.[2] Lack of safety measures is resulting in rising number of variable fracture patterns. If fractured fragments are mal-treated or undiagnosed, severe functional disabilities follow including inability to open mouth, impaired occlusion of teeth and compromised lateral excursion of condyle.[3] Hence treatment needs to be standardized for effective management in terms of occlusion and patient satisfaction. There are two modes of managing these fractures; conservative treatment or surgical exploration.[3] Abdel-Galil recommended that subcondylar fractures should be classified to help the surgeon in choosing among the available of treatment options.[4]

Several authors have devised the classifications of MCF; the most commonly followed being Lindhal and Spiessel & Schroll classifications. Lindhal's system reflects certain anatomical features of MCFs including fracture levels, disruptions at the place of fracture and association of condyle's head to its articulation fossae but does not address fracture complexity.[4] High and low level sub-types of condylar fracture, with or without displacement or dislocation is suggested by Spiessel and Schroll, but does not give true insight of fracture. This creates controversy in management decisions (surgical or conservative) as both modalities have their own pros and cons.[3,5,6]

Numerous studies have been done but it is still controversial to adopt one procedure as a hallmark when it comes to treating MCFs. Hypocrites, Robert, Marker, Santler, Vilareal, and Andreson in their studies suggested that closed reduction is the better option with less morbidity.[7,8,9,10,11] Kotrashetti, Abdul Rasheed, Buck and Kinlock, Ellis, Smith, Tu, Essam al Moraissi, Singh, Yang & Alexander favored open reduction as superior mode of treatment.[2,6,12,13,14,15,16,17,18,19] Alexander found that surgical reduction is associated with less morbidity, minimal wound infection, optimal occlusion, no damage to nerve and at the same time jaw deviation on opening mouth can be corrected.[19] Ellis has extensively worked to find the optimal treatment of MCF and suggested that Open Reduction and Internal Fixation (ORIF) is superior to Maxillomandibular Fixation (MMF).[13] Leiser, Widmark ,Takenoshita, Assael and Haug, Hyde, Muhammad Shiju & Danda AK, they supported both modes of treatment as effective.[3,20,21,22,23,24,25]

To resolve this conflict several consensus meetings were held but to no avail and the treatment of MCFs remains controversial.[26]

This study was aimed to compare outcome of indirect fixation and immobilization versus open reduction with internal fixation of MCFs, so as to provide best possible treatment for patients with minimum morbidity, and also to restore fine occlusion.

Methods

This randomized clinical trial was conducted in the Oral and Maxillofacial Surgery Department, King Edward Medical University, Lahore from March 2014 to February 2015 after approval from institutional review board. After taking written informed consent, 70 male and female patients with ages ranging from 16-50 years, with displaced MCFs irrespective of multiple mandibular fractures were included in study. Fractures below condylar neck and above the angle of mandible with the fracture line extending from sigmoid notch till posterior border of ramus were labeled as MCFs. Patients having bilateral MCFs with mid-facial fractures, insufficient bilateral dentition, medically unfit for surgery; old healed mandibular fractures and history of previous mandibular surgery for the same indication were excluded from the study.

The patients were explained the purpose of the study and confidentiality was ensured. Detailed history and examination was done and confounders were controlled by strictly following the exclusion criteria. Initial evaluation included occlusal assessment which was categorized as fine or deranged. X-ray face PA view and Orthopantomograph (OPG) were done to assess the fracture. Biochemical, hematological investigations and X-ray chest were carried out as part of anesthetic workup.

The patients were randomly divided into two groups (35 in each group) by lottery method. Group A patients were treated by closed reduction and MMF while Group B patients were treated surgically by ORIF.

For closed reduction and MMF, group A patients underwent anatomical reduction which was achieved using teeth facets as guide. Once maximum intercuspation, i.e., centric occlusion, was achieved arch bar was secured with wires on upper and lower arch. Occlusion was rechecked and class 2 elastics were provided in direction which would proximate and immobilize fracture segments, while engaging elastics on upper arch bar hook, passing through lower arch bar peg and then upper arch bar hook again from opposite side towards fractured side, the teeth being in centric occlusion. Any sharp projection of wire or arch bar was checked and patient instructed about oral hygiene and liquid diet. Patients were recalled after four weeks to disengage the hardware and first assessment was recorded. Instructions were given for active physiotherapy after the removal of arch bar and elastics and patients were intimated of next visits, as per plan.

Group B patients, the ORIF group, were treated surgically by exposing fracture sites under general anesthesia. After mouth disinfection, incisions were given in accordance with fracture line and choice of surgeon. For SCFs the approach was extra-oral (retro-mandibular incision, preauricular incision or sub-mandibular incision) and for other mandibular fractures intra-oral vestibular incisions were given. Once all fractured segments were exposed they were reduced keeping centric occlusion and bone alignment in vision, fixation of fractured fragments was done in proximate position, with plates and screws; at least two screws were applied on either side of fracture line and incision lines were sutured. The skin sutures were removed on third day and steri-strips were applied for another week to avoid suture scars. The intra-oral sutures were removed on 5th day and strict oral hygiene and soft diet plan was given to patient for 6 weeks. After surgery, ORIF patients were observed in ward for 24 hours before being discharged.

In both groups, 3 follow-up visits were planned at 1st, 3rd & 6th months. At each visit, occlusion (fine /deranged) was recorded. Patients having maximum intercuspation and reporting satisfaction in mouth closing and chewing were categorized as fine occlusion while patients not having either of the two were labeled as having deranged occlusion.

The data were entered in Statistical Package for the Social Sciences (SPSS) version 20.0 for analysis. The quantitative variable (age) was expressed as mean ±Standard Deviation (SD) while the qualitative variables (gender and fine occlusion) was presented as percentages. The two groups were compared using t-test for quantitative data and chi-square for qualitative data. p-value <0.05 was considered significant in all the analyses conducted.

Results

A total of 70 patients with MCFs were included in the study and were randomized to receive treatment by either closed reduction with MMF (group A) or ORIF (group B). The group ratio was 1:1 with 35 patients in each group. The mean age of patients in Group-A, and in Group-B was 28.88±11.86 and 28.22±10.80 years (p-value 0.809). The minimum age of patients in both groups was 16 years while maximum age of patients in Group-A, and in Group-B was 48 and 55 years respectively. Both groups had a similar gender distribution i.e., 28(80%) male and 7(20%) female patients in each group. (Table 1)

At 1st month post-treatment, fine occlusion was achieved in 25(71.43%) group A and 28(80%) group B patients with p-value=0.403. After 3 months, again the difference in achieving fine occlusion was not statistically significant across the treatment groups i.e., occlusion in Group-A: 29(83%) vs. Group-B: 33(94%), p-value=0.133. After 6 months, no further improvement (from 3rd month) was appreciable and the same results were seen in patients i.e., Group-A: 29(83%) vs. Group-B: 33(94%), p-value=0.133. (Table 2)

Table 1: *Bseline Characteristics of 70 Patients*

No.	Parameter	Group A	Group B	P-Value
1	Age	28.89±11.87	28.33±10.8	0.809
2	Gender M	28(80%)	28(80%)	0.759
	F	7(20%)	7(80%)	
3	Pre- operative occlusion	0%	0%	-

Group A= closed reduction and immobilization
Group B= open reduction and internal fixation

Table 2: *Comparison of Post Treatment Fine Occlusion in 70 Patients in Follow-up*

No.	Follow up Time	Group A n (%)	Group B n (%)	P-Value
1.	Pre-operative	0 (0%)	0 (0%)	-
2.	1st month	25(71.43%)	28(80%)	0.403
3.	3rd months	29(83%)	33(94%)	0.133
4.	6th months	29(83%)	33(94%)	0.133

Group-A= Closed reduction and immobilization
Group-B = Open reduction and internal fixation

The response for occlusion in both treatment groups from baseline (pre-operative) till post-operative follow up time period at 1st, 3rd and at 6th month follow up time period is illustrated in Figure 1.

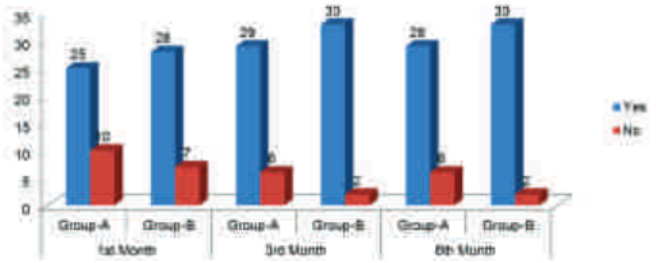

Figure 1: *Occlusion In Treatment Groups Pre Operative & Follow Up Time Intervals*

Group-A= Closed reduction and immobilization
Group-B = Open reduction and internal fixation

Discussion

The global trend of urbanization has led to an increased incidence of trauma and a synchronized rise in MCFs. Illicit substance use and interpersonal violence in young males have been strongly associated with MCFs.[27,28] Despite this trend, no consensus has been developed about the optimal treatment.[26] This study was designed to compare the widely used two treatment modalities (MMF & ORIF) for MCFs in terms of occlusion at different follow up intervals.

In this study, the ages of patients with MCFs ranged from 16 to 55 years with mean ages of group-A and group-B being 28.88±11.86 and 28.22±10.80 years respectively. Ogundare et al conducted 10 year review of mandibular injuries in an urban population and reported 37% of patients in 25-34-year age group.[27] Similarly, Afrooz et al reviewed 13,142 cases from the US National Trauma Data Bank and reported highest frequency of mandibular fractures in patients from 18 to 54 years.[28]

In the present study, 80% patients were male while 20% were female. This matches the previous epidemiological studies in which male prevalence has been reported. In the 2015 review of US National Trauma Data Bank, 80% of patients were male.[28] In 2003, 86% of the patients with mandibular fractures who presented to Washington DC trauma center were male.[27] The prevalence of MCFs in young males is partly explained by the usual mechanisms of mandibular fractures i.e., interpersonal violence, assault, illicit drug use, followed by road traffic accidents, falls and sports injuries all of which are more common in young males.[29]

In this study, patients were assessed at baseline and then followed up at 1st, 3rd and 6th month post treatment for fine or deranged occlusion. At base line all patients had deranged occlusion. At 1st month, 71.43% MMF patients and 80% ORIF patients achieved fine occlusion but the difference was not significant. At 3rd month, after active physiotherapy and maintenance of oral hygiene, fine occlusion was seen in 83% & 94% group A & B patients respectively; the difference still remained statistically insignificant. At the last follow up at 6th month post-treatment, no further improvement was observed in occlusion despite continuing physiotherapy. At all follow up visits, both treatment modalities were equally effective in terms of occlusion. Previous authors have found similar results for occlusion. The meta-analysis by Shiju et al documented uniform outcome of both treatments for MCFs.[24] In the study by Danda et al, the results are also consistent.[25] Singh et al and Yang et al also expressed satisfaction with both treatment options for attaining occlusion of MCFs.[17,18] In the review by Y. Leiser, satisfactory occlusion was seen in in low MCFs treated by either method.[3]

There are some contrasting results as well. Ellis-III that showed there was a greater percentage of malocclusion in patients treated by closed reduction and MMF as compared to ORIF.[13] Ellis et al utilized standardized occlusal photographs which were examined and scored by a surgeon and an orthodontist to document occlusion while in the present study patient satisfaction was the major outcome

criterion.[30] Rashid et al also reported surgical treatment to be superior but they included patient who had pre-traumatic malocclusion and excluded patients with normal pre-traumatic occlusion thereby studying a different population subset from the present study.[1] Kotrashetti showed in his study that at 6 month follow up, fine occlusion was achieved in 100% & 91.7% patients in the surgically-treated and closed reduction groups respectively and the difference was statis-tically significant (p-value 0.003).[2] There are two major differences between the 2013 study by Kotrashetti and the present study. Firstly, there was a small sample size (21 total patients) and secondly a different method was employed for closed reduction. The results varied in different studies due to different inclusion criteria, closed reduction method, number of plates provided and treatment duration.

In this study, 6 (17%) patients in MMF group and 3 (6%) patients in ORIF group did not achieve fine occlusion. In MMF group, mal-union, non-union, hematoma formation and infection are the major reasons. The cause of no-union /mal-union in closed reduction was use of non-rigid fixative wires which allowed excessive movements resulting in delayed healing and mal-union. In surgical group the failure was noticed due to hardware failure and infection. Patient compliance was another factor that had impact on results. Still there was no significant difference in fine occlusion in both groups

There were some limitations of the study. Firstly, the pre-traumatic record was not available and final outcome was based on surgeon's observation and self-reporting by patients. Secondly, the surgical approach in ORIF patients was not standardized for the purpose of the study. Rather, it was left to surgeon's choice in view of his expertise and skill. Thirdly, patient compliance in terms of physio-therapy, diet restriction and oral hygiene could not be ensured although there was no loss to follow up.

With either treatment, the risk of failure cannot be ruled out which is then treated surgically. Albeit small but patients who undergo ORIF are at the risk of second surgery and anesthesia. Variety of factors determine the success of treatment including patient's preference, dentition of patient, fracture site and number of fractures on mandible, occlusion status, age and gender of patient, level of fracture and displacement, any other facial fracture and position of fracture on one side or both sides. Expertise and facilities also count for success of treatment. There are potential complications of ORIF including damage to the facial nerve and visible scars and failed surgery. This study only represents a small part of population and does not represent the entire community, hence more work needs to be done on a larger scale in multicentres.

Conclusion

Outcome of both treatment modalities, in terms of occlusion did not show any significant difference statistically and both treatments are equally efficient regarding achievement of fine occlusion. Arguments for conservative treatment include reduced overall morbidity, in most cases acceptable occlusal results, avoidance of typical surgical complications, a simpler procedure, no nerve damage or a vascular necrosis.

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