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Evaluation of Functional Therapy Vs Intermaxillary Fixation in Condylar Fracture Treatment

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ABSTRACT

Purpose: To compare the outcomes after rigid intermaxillary fixation (IMF) versus functional therapy (FT) in patients with mandibular condylar fractures (CFs). **Patients and Methods:** A prospective comparative study with 3 follow-ups (FU) at 1, 3 and 6 months was undertaken in 2 groups, which exclusively privileged either surgical or conservative treatment due to different therapeutic agendas. Patients from Group1 (GI) received IMF for 10 days, followed by physiotherapy, whereas those in Group2 (GII) had undergone FT for 21 days via guiding elastics. In both groups, all concomitant fractures (if present) were treated by open reduction and internal fixation (ORIF). Patients with unilateral CFs, with or without concomitant mandibular fractures showing one or more of the following conditions were included: adult patients (>18 years of age) indicated for closed treatment, and sufficient dentition for arch bars application. Previous history of tempromandibular joint (TMJ) dysfunction, severe pre-traumatic skeletal dysgnathia, and mid face fractures was excluded. **Results:** 12 patients (6 in GI and 6 in GII) were included. The clinical TMJ Dysfunction Index of Helkimo (CTDI-H) was equal in both groups at 1 month FU, it became worse in GI than in the GII at 3 month FU, corresponding to better function on the short-term. At the 6 month FU, there were better values in the GII. The Magnetic Resonance Imaging (MRI) scans revealed that the trauma caused disc displacement for 33.3% of GI and 66.7 % of GII. At 6 months FU, 33.3% of GI had improvement in the degree of the disc displacement, but they still had internal derangement with reduction. In GII, 2 out of 4 retained the normal position of the disc and the others had improvement in the disc displacement degree only. **Conclusion:** Both treatment options may yield acceptable results, however, FT seems to be the appropriate treatment for rapid recovery of range of mandibular motion (ROMM), relief of pain during palpation of masticatory muscles, and recovery of disc position during FU. Its success depends on the passive maneuver of physiotherapy if there is no restricted maximum interincisal opening (MIO) and it should be in a forcible manner in case of restricted MIO.

KEYWORDS

Condylar fractures, Functional therapy, Intermaxillary fixation, Clinical TMJ dysfunction index of Helkimo, Magnetic resonance imaging, Physiotherapy.

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INTRODUCTION

Mandibular CFs account for 17.5% to 52% of all mandibular fractures and occur as either unilateral or bilateral, that can be combined with mandibular injuries. Although ORIF is widely provided for mandibular fractures, the treatment of CFs is still controversial in the literature.[1,2] The closed treatment as IMF offers many advantages. These cannot hide its demerits as altered dietary regimen and oral hygiene, wire trauma to soft tissues, and the fear of choking.[3] Also on TMJ functions, as TMJ stiffness, limited MIO, loss of bite strength, decrease in ROMM, deviation toward the CF side, and ankylosis.[4]

The FT gently pulls the dentition into a premorbid relationship and permits mandibular functions as early as possible to overcome the disadvantages of the rigid IMF.[5] There are many classifications in the literature, making it difficult to compare the treatment results. Several meta-analyses were attempted without evaluation the effect of function or soft tissue injury after trauma on affected and unaffected sides.[6] It was concluded that there is a need for better standardization of data collection as well as consequent randomization of patients treated in future studies to accurately compare different closed treatment modalities. Today, there is consensus that regaining optimal pain free function after CFs is an essential element.[7] As, this is difficult to achieve with rigid IMF, FT has been developed in recent decades.[4] It involves the principles of closed treatment but with immediate function followed by at least 3 months of rehabilitation, including guiding elastics and mobilization regimens.[8] The application of elastics allows some degree of remodeling and articulation in new position. Compared with rigid IMF, early mobilization reduces the development of soft tissue scarring, and the risk of altered dietary regimens or air way obstruction seems to be absent.[9] However, intensive physiotherapy program is needed after both treatments. Closed treatment is indicated in non-displaced or incomplete fractures, isolated intracapsular fractures, CFs in children, reproducible occlusion, and inability to receive extended general anesthesia.[10]

The aim of this study was to evaluate the clinical results and to examine prospectively if there is an improved functional outcome in patients treated with FT versus IMF. To receive comparable results, fracture patterns and inclusion criteria were precisely defined.

PATIENTS AND METHODS

Eligibility Criteria

The study design involved adult patients (>18 years of age) with unilateral CFs, with or without concomitant mandibular fractures indicated for closed treatment; with no concomitant mid face fractures; and they had sufficient dentition for arch bars application. All fractures were analyzed with orthopantomograms (OPGs) and computed tomography (CT) scans.

Patients were not admitted into the study if any of the following exclusion criteria were present: Previous history of TMJ dysfunction or internal derangement, bilateral CFs, severe pre-traumatic skeletal dysgnathia of the jaws, history of drug abuse, general or local conditions adversely affecting bone physiology, pregnant or medically compromised, unlikely to attend all the scheduled visits, physical or mental incapacity that prevented obtaining informed consent, and legal incompetence.

Settings, Interventions, Follow up

The patients were selected irrespective of sex, religion, and socio-economic status, from the Outpatient Clinic of the Departments of Oral and Maxillofacial Surgery at Al Zahraa hospital, Faculty of Dental Medicine, Al-Azhar University (Girls' branch), and Maadi Military Hospital, Cairo, Egypt, during the period from December 2013 to October

2016. They were divided randomly and equally into GI and GII by using coin toss to allocate them to I (heads) or II (tails), then they were categorized by even versus odd number. As a result, those with an even number were assigned to GI and those with an odd number were assigned to GII. To restore preinjury occlusion GI was treated by rigid IMF for 10 days, followed by physiotherapy, while GII had undergone FT for 21 days via guiding elastics in a class II vector on the CF side, which allows early performance of physiotherapy (Figure 1).

Patients were advised to chew on the side contralateral to CFs as a part of behavioral therapy. They were encouraged to eat soft food and to maintain chewing function as normally as possible. If, at the FU examination, mandibular deviation toward the affected CF existed, patients were instructed how to exercise. It was demonstrated how, during mouth opening, to manually press the chin to the side opposite to the CF, to perform symmetrical mouth opening. The goal of the recommended physiotherapy was to achieve proper neuromuscular control during mandibular movements. Altogether, 12 patients participated in this study, of which 6 were assigned to GI and 6 to GII, and were actively under FU 1, 3 and 6 months after initial treatment. The subjective assessment of complaints was documented by means of a questionnaire which included personal history, medical and dental history, occlusal status, and clinical investigation of functional parameters of the Research Diagnostic Criteria for Temporomandibular Dysfunction. [11] An informed consent was obtained before commencement of the treatment after explaining the study design and procedures. The local ethics review committee of the Faculty of Dental Medicine for Girls at Al-Azhar University approved the study.

Study Variables

Predictable variables: The primary predictable variable was the patients' demographic data (age, sex, trauma etiology, CF site, isolated CFs, concomitant fractures, fracture type, time before intervention, and occlusive support score). The secondary predictable variables were the preoperative CTDI-H and preoperative MRI findings.

Outcome Measures: The primary outcome measure was the physiotherapy period at which patients returned their normal MIO; the secondary outcome measures were the CTDI-H at 1, 3, and 6 months FU and MRI findings at 6 months FU.

The CTDI-H is used to evaluate and measure the functional outcomes after mandibular CFs and TMJ disorders. The index reported that, the mandibular dysfunctions should be considered if any of these 5 different symptoms is present: 1) Impaired range of movement, 2) Impaired function of the TMJ, 3) Presence of pain in the masticatory muscles, 4) Presence of pain in the TMJ, and 5) Presence of pain on movement of the mandible, where each symptom is judged, then categorized as a variable according to 3 grade scale scores as follow:1) Score 0 denotes "no symptoms"; 2) Score 1 denotes "mild symptoms"; 3) Score 5 denotes "severe symptoms".[12]

It comprises 5 indices A, B, C, D, and E which are summed up to calculate the final index. The 1_{st} index is the ROMM [A] which is the sum of other 4 scores: 1) The MIO; 2) The right maximum lateral excursion movement (RMLEM); 3) The left maximum lateral excursion movement (LMLEM); and 4) The protrusion movement (PM), the measure of each movement in millimeters was given a score from a correspondent range, then the sum of all movement scores was calculated, and the result was categorized. The 2^{nd} index is the TMJ function impairment [B] as the deviation from midline on opening or closing, accompanied with or without palpable TMJ sounds that may reach to severe symptoms as luxation and/or locking of TMJ when lateral movements are performed. The 3^{rd} index is pain during muscle palpation [C], the 4^{th} index is pain during TMJ palpation [D], and the 5^{th} index is pain during mandibular movement [E], all of them

are noted according to specific criteria. The above-mentioned scores are finally added together, and the patient obtains a total dysfunction score ranging from 0 to 25 points. The patients were classified into 4 categories [D0 (0 points) clinically symptom free, DI (1-4 points) mild symptoms, DII (5-9 points) moderate symptoms, and DIII (10-25 points) severe symptoms]. According to the index criteria, the worst mandibular function has the highest the score.

The MRI scans were performed after clinical and radiographic examinations confirmed the presence of CFs. The TMJ disc position was evaluated on the affected and the unaffected sides, in the closed and open mouth positions, to assess the position and reducibility of the articular disc. The degree of disc displacement was measured from a 12 o'clock (relative to the condyle). The degree of disc displacement was classified as none (normal, 0° to 10°), slight (11° to 30°), mild (31° to 50°), moderate (51° to 80°), or severe (80°).[13]

Statistical Analysis

Data were tabulated and the statistical measurements were obtained using statistical software IBM SPSS 22.0 for Windows software.

RESULTS

Demographic Data: There were no clinically differences between the 2 groups. The mean patient age was 31.33 ±15.10 years in GI and 42.83 ±20.33 years in GII (P=0.394). The male to female ratio was 2:1(P=1).

Injury related data: There was not a significant difference regarding the cause of CFs, the predominant cause was RTA (*P*= 0.023). The left CF was predominant (*P*=0.164). Isolated CFs were in only 33.3% of GII (*P*=0.455). Fracture typeI was predominant in both groups (*P*=0.788). At preoperative, significantly fewer GI patients (16.7%) had score1 of TMJ pain during palpation (P=0.000). For the remaining baseline injury parameters, in regard to ROMM, most patients in both groups suffered from severe impaired mobility (*P*=1), the TMJ function impairement score was 0 for 33.3% of GII while all the others showed score1, the muscle pain score1 showed 100% in GII and 50% GI, pain upon movements of the mandible score1 showed 100% in GI and 83.3% in GII.

Surgical Treatment: The mean of time before intervention, for GI, was 8.5±5.6 days, compared with 4.67 ±2.4 days for the latter. Nevertheless, this difference was not significant (P = 0.240).

Physiotherapy Protocol: Physiotherapy was started after 10 days in GI and immediately in GII. If the patient had a normal ROMM, the program included 4 passive voluntary exercises: MIO, right and left MLEM, and PM. The patients were instructed to repeat each exercise 10 turns for 5 times daily in front of a mirror for at least 2 weeks, to encourage mobilization. Visual feedback with a mirror is critical. In the case of a restricted MIO, the mouth gags were used to gradually increase the range of MIO until the patient was able to put the 3 middle fingers up to the first distal interphalangeal folds. At that point, a suitable size mouth prop is used to keep the jaw dilated for 1 hour. This forcible opening was repeated 5 times daily for 6 weeks, beside the voluntary mouth exercises.[14] GI needed longer period of physiotherapy to return their normal ROMM with mean of 2.33 ±0.516 months, but in GII, it was 1.67 ±0.516 months. However, there was no statistical difference (*P* = 0.132).

Outcomes

Clinical Dysfunction Index of Helkimo: In both groups, the final summing of A, B, C, D, and E values showed that there was no significant difference in outcome between the patients assigned to the 2 treatment groups at the 1month FU, as the patients in both groups had moderate symptoms

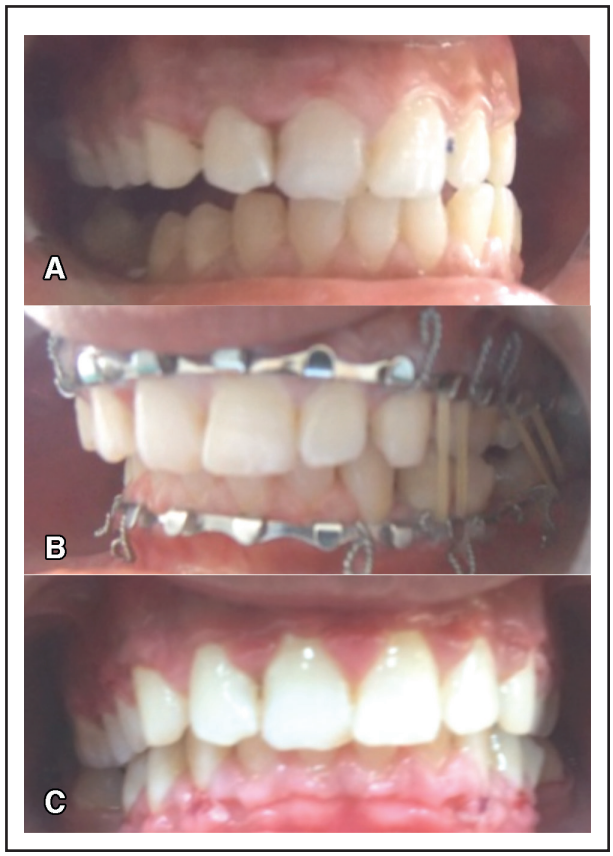

Fig. (1) Photographs representing A) Preoperative occlusion, B) Guiding elastics in class II vector on the CF side, C) Postoperative occlusion.

(DII; GI and GII, 100%), GII patients had lower DII values (better function) than GI patients (*P*=1). At the 3 months FU, the proportion of symptom free (D0) was 16.7% patients in GII only, also 66.7% attained DI, while 16.7 % remained as DII. 83.3% of GI patients DI, while 16.7% had DII (*P* =0.969). At the end of the FU period, only 16.7% of GI had D0 and the rest had DI scores. While, in Group II, D0 and DI had equal distribution among the patients (50% for each) without any statistical significance. A detailed group comparison can be found in Table (1). The overall comparison of scores between the 1_{st}, 2_{nd}, and 3_{rd} FU showed that the condition in GI improved in 16.7% and remained unchanged in 83.3%. For GII, 50% of the patients improved and 50% remained unchanged.

Table (1): *Assessment of clinical dysfunction index of Helkimo.*

CTDI-H	GI	GII	P value
Preoperative			0.982
D0	--	--	
DI	--	--	
DII	5(83.3)	6(100)	
DIII	1(16.7)	--	
1 month			1.000
D0	--	--	
DI	--	--	
DII	6(100)	6(100)	
DIII	--	--	
3 months			0.969
D0	--	1(16.7)	
DI	5(83.3)	4(66.7)	
DII	1(16.7)	1(16.7)	
DIII	--	--	
6 months			0.445
D0	1(16.7)	3(50)	
DI	5(83.3)	3(50)	
DII	--	--	
DIII	--	--	

MRI Findings: At 6 months FU, 33.3% of GI had improvement in the degree of the disc displacement to 12.50º ±5.50º degrees, but they still had internal derangement with reduction, while in GII, 2 cases out of 4 retained the normal position of the disc, and the other 2 had only improved 16.50º ±0.50º degrees. The open MRI images showed that all the cases had normal anterior translation of the condyle/disc assembly, except 1 case in GI Table (2).

Table (2): *Mean of disc displacement degree along 6 months FU in GI and GII.*

Variable	GI Mean ±SD	GII Mean ±SD	P value
Preoperative degree of disc displacement	19.50 ±5.50	19.50 ±6.40	1
degree of disc displacement 6 months FU	12.50 ±5.50	16.5 ±0.50	0.615

DISCUSSION

The management of mandibular CFs has generated a wide debate regarding the choice of treatment. The patient's age, duration of fracture, site of CFs, degree of displacement, time of presentation, and funds are also relevant considerations for the choice of treatment modalities.[15] Closed treatment provides acceptable functional results and it is a procedure with low cost, so it is indicated in cases, where there are no fund resources.[16] On the other hand, this did not agree with other studies, which revealed that, the closed treatment has the following drawbacks: patients' discomforts, facial asymmetry, chewing and speech problems, and the possible subsequent revision surgeries.[17] Additionally, there is a high risk of TMJ ankylosis due to prolonged IMF which leads to organization and ossification of the hematoma that developed inside the joint due to trauma.[18] Therefore, the use of FT was advocated for treatment of CFs. [5] The results of this study supported this suggestion, where all the patients in GII reported that the FT enabled them to function immediately and they needed shorter period of physiotherapy (1.67 ±0.516 months). However, the patients in GI needed a longer period of physiotherapy (2.33 ±0.516 months). Additionally, their speech, diet, and oral hygiene were also facilitated. [19] The CTDI-H is a clinically based index proposed for TMJ function assessment and makes comparison between-study possible.[20] This study revealed that it allowed the standardized classification of the severity of the TMJ disorder and the categorization of signs and symptoms, to properly establish the diagnosis.[21] On the contrary other study reported that, it is liable to bias. [22]

Early physiotherapy with gradual reduction of the muscle bound fragment creates favorable conditions. GII was similar to GI in the TMJ function impairment, while superior evaluation was seen regarding the relief of pain during palpation of masticatory muscles and TMJ. This may be due to the early beginning of physiotherapy in GII, which helped in resolution of inflammation inside or around the joints and relief of muscle spasm which occurred as sequelae of the trauma. So, physiotherapy has impact on reducing pain, significant impact on increasing range of motion, but lacks an impact for functional improvement. [23] This was insignificant for all variables all over the FU period, except for pain on palpation of TMJ at 1 month FU ($P = 0.000$).

Displacement of the articular disc disrupts the quality and interaction of the parts of the TMJ. The MRI results revealed that the trauma caused anterior disc displacement in 50% of the patients, limited anterior translation of the disc/condyle assembly in 83.3% of the patients mirror these functional disruptions,[13] but was not ascertained in other study.[24] The anterior disc displacement may occurred due to the tear of the retrodiscal tissues. [25] The MRI results at 6 months FU revealed that GII was superior to GI in regaining the normal relationship. This may be explained by the gradual traction done via guiding elastics during FT, had helped in the reduction of the displaced condylar segment with subsequent disc retraction and it was sufficient to reduce the disc in 2 cases,[26] but in GI, the reduction was abruptly performed, so prevented the disc chance for re-catching the condyle, in agree with many studies. [24, 27]

The key findings of this study are that closed treatment of CFs is a reliable method with high successful rate and low cost. Also, FT provided a shortened period of distress, when compared to rigid IMF. The clinical importance is that FT omits the risk of TMJ ankylosis.

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