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Original Article

Assessment of temporomandibular joint dysfunction in condylar fracture of the mandible using the Helkimo index

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ABSTRACT

Introduction: Condylar fractures of the mandible are functionally important fractures as the condyle of the mandible being a part of the temporomandibular joint (TMJ) and can lead to TMJ dysfunction if not properly treated. **Materials and Methods:** This was a cross-sectional study of a total of 33 treated patients with fracture of the mandibular condyle who underwent examination as per the Helkimo index. Their dysfunction was quantified and clinicoepidemiological characteristics were assessed. It was found that majority of our patients were young males involved in a two-wheeler accident. All patients underwent intermaxillary fixation as the minimum treatment and 30% underwent open reduction and internal fixation in addition. **Results:** There was no statistically significant association between the degree of clinical dysfunction and factors such as age, mechanism of injury, type of condyle fracture, presence of other mandible fractures, and surgical procedure. However, dislocation of the mandibular condyle was found to be a negative prognostic factor and all these patients had some degree of dysfunction. **Conclusion:** The overall prevalence of TMJ dysfunction according to the Helkimo index was 90%. About 61% of patients had mild dysfunction (Di1) and 30% had moderate dysfunction (Di2). None of the patients had severe dysfunction. To conclude, the Helkimo index is a simple, effective, inexpensive, reliable screening index to assess TMJ dysfunction in condylar fractures of mandible.

KEY WORDS

Helkimo index; mandible condyle fractures; temporomandibular joint dysfunction

INTRODUCTION

Faciomaxillary injuries form an integral part of surgical trauma. Facial fractures can have long-term consequences, both functionally and esthetically. Condylar fractures assume more significance due to the high risk of developing temporomandibular joint (TMJ) dysfunction.[1]

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There have been few long-term surveys of functional outcome after condylar fractures of mandible, making an assessment of TMJ dysfunction quite challenging.

TMJ dysfunction is a generic term for a number of clinical signs and symptoms involving the masticatory muscles, the TMJs and associated structures. Functional

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disturbances of the masticatory system in children and adolescents are common and seem to increase with age into adulthood. Furthermore, a high frequency of clinical signs of dysfunction (e.g., clicking and tenderness of masticatory muscles on palpation) as well as subjective symptoms has been reported in patients with TMJ dysfunction. Although the cause of TMJ dysfunction is obviously multifactorial, malocclusion secondary to mandibular condyle fracture is considered to be one of the main causes.[2]

There is no standard systematic tool in place to study the functional status of treated condylar fractures; it is only based on a few symptoms and signs. The goal of this study was to assess the results of management of patients treated for condylar fracture of the mandible using the Helkimo index and determine its status as a systematic tool for its routine use to assess functional status in patients with treated condylar fracture. The Helkimo index consists of two parts – the anamnestic index, which is a structured questionnaire, and clinical dysfunction index which is based on clinical examination. This index has withstood the test of time since it is simple, practical, quantifies the dysfunction present and allows for correlation between the patient's symptoms and clinical finding, as compared to other clinical indices.[3]

MATERIALS AND METHODS

The present study was a cross-sectional descriptive study over a period of 8 years from August 2007 to July 2015. All patients presenting to the department of plastic and reconstructive surgery with condylar fracture of the mandible with or without associated condylar dislocation (subluxation and dislocation) between August 2007 and July 2015 were included in the study. The excluded patients were patients below 5 years of age, patients having psychiatric or debilitating neurological diseases, incomplete case records for eliciting demographic data and patients whose contact details were unavailable. Patients underwent treatment as per the standard institutional protocol, that is all patients with condylar fracture should undergo intermaxillary fixation (IMF) as the minimum treatment. Open reduction and internal fixation (ORIF), in addition, is done in bilateral dislocated fractures, displaced subcondylar fractures and grossly displaced high fractures.

After 8 weeks of surgery, the patients were explained about the study, informed consent was obtained and an interview by a structured pre-validated questionnaire, as per the Helkimo index, as summarised in Table 1, was carried out. Then, the patient underwent a detailed clinical examination by the investigator as per the Helkimo's clinical dysfunction index, as summarised in Tables 2 and 3. The Institutional Ethical Committee approval was obtained prior to the study.

Statistical analysis

Data were entered in Microsoft Excel Sheet, software of Microsoft Corporation, Redmond, Washington. USA and analysed using Statistical Package for Social Sciences (SPSS) 17.0 for Windows, a statistical software of IBM (New York, USA). The data were presented as percentages for continuous variables (such as age and Helkimo clinical dysfunction index, mechanism of injury, associated soft-tissue injuries and management of condylar fractures) as well as dichotomous variables (such

Table 1: Helkimo's anamnestic dysfunction index

Do you hear a sound in TMJ area? - yes/no
Do you have jaw rigidity on awakening or slow movement of the mandible? - yes/no
Do you feel fatigue in the jaw area? - yes/no
Do you have difficulty when opening the mouth? - yes/no
Do you have locked mandible during opening of mouth? - yes/no
Do you have pain in the TMJ or in the area of masticatory muscles? - yes/no
Do you have pain during the movement of the mandible? - yes/no
Do you have luxation of the mandible? - yes/no

Ai0: Those free of the above-mentioned symptoms, Ai1: Those having one or more of the first three symptoms and none of the Ai2 symptoms, Ai2: Those having one or more of the subsequent five symptoms

Table 2: Helkimo's clinical dysfunction index

Symptoms	*Clinical dysfunction index*		
	Absence of symptoms (0 point)	*Mild symptoms (1 point)*	*Acute symptoms (5 points)*
Mandibular mobility (Score Calculated from Table 3)*			
Restricted TMJ function (murmur, crackle and traction in joint)			
Painful mandibular movement			
Muscle pain (masseter profundus, masseter superficialis, temporalis, medial pterygoid and lateral pterygoid)			
Painful TMJ			
Total points			

Di0: Helkimo dysfunction index 0=0 points - No clinical symptoms, DiI: Helkimo dysfunction index 1=1-4 points - Mild dysfunction, DiII: Helkimo dysfunction index 2=5-9 points - Moderate dysfunction, DiIII: Helkimo dysfunction index 3=10-25 points - Acute/serious dysfunction

Table 3: *Mandibular mobility index

Sl No	*Sign*	*Score*
A	Maximal opening of mouth	
	>40 mm	0
	30-39 mm	1
	<30 mm	5
B	Maximal lateral movement to the right	
	>7 mm	0
	4-6 mm	1
	0-3 mm	5
C	Maximal lateral movement to the left	
	>7 mm	0
	4-6 mm	1
	0-3 mm	5
D	Maximal protrusion	
	>7 mm	0
	4-6 mm	1
	0-3 mm	5
Total points		

0 points: Mobility index 0 - Normal mandibular mobility, 1-4 points: Mobility index 1 - Slightly impaired mobility, 5-20 points: Mobility index 5 - Severely impaired mobility (Mobility Index Score of 0,1 or 5 to be used to score Mandibular Mobility in Table 2)

as associated comorbidities, associated bony injuries and condylar dislocation). The degree of TMJ dysfunction for varying follow-up periods was assessed using the Kaplan–Meier analysis. The test of significance used was Fisher's test, a non-parametric test.

RESULTS

A total of 33 condylar fracture treated patients were included in the study. Nearly 61% were in the age group of 18–30 years and 31–50 years accounted for another 30% of the patients. The male:female ratio was 9:1. Road traffic accidents accounted for 88% and falls accounted for 6% of the cases. Of the road accidents, 72% involved two-wheelers, 10% four-wheelers and 10% were pedestrians. Almost 95% of two-wheeler riders did not wear helmet at the time of injury. Nearly 33% of the patients had consumed alcohol prior to injury. Head injury was the most commonly associated injury in 21% of cases. About 36% of cases had associated extramandibular fracture and 58% had associated other mandibular fractures. Nearly 70% had high condylar and 30% had low condylar fractures. Around 78% had unilateral condylar fractures. Condylar dislocation was observed in 21% of patients, as depicted in Figure 1, and majority (57%) were unilateral. All patients underwent IMF as the minimum treatment and 27% underwent ORIF in addition, as shown in Figure 2. As per the Helkimo's anamnestic index, 45% had no symptoms, 30% had mild symptoms and 24% had severe symptoms, as shown in Figure 3. In the Helkimo

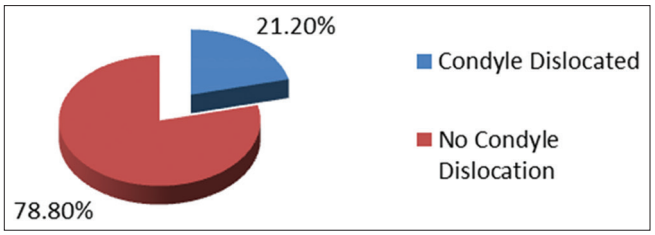

Figure 1: Associated condylar dislocation

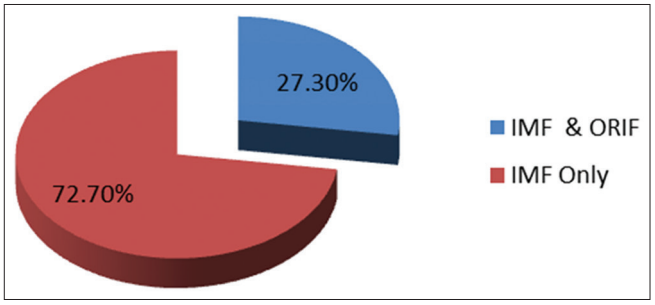

Figure 2: Surgical procedure

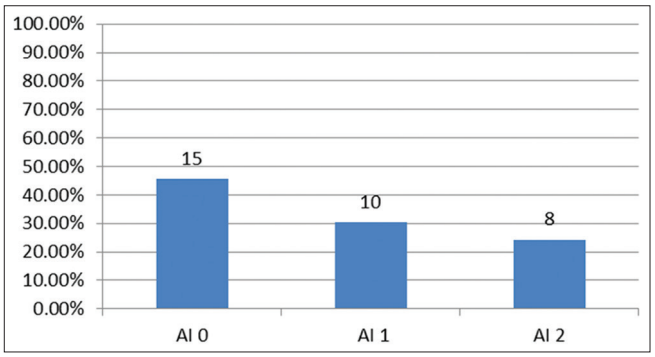

Figure 3: Helkimo's anamnestic dysfunction index

clinical dysfunction index, there was no dysfunction in 9%, mild dysfunction in 60% and moderate dysfunction in 30% of cases. None had severe dysfunction, as represented in Figure 4. It was found that condylar dislocation had a statistically significant association ($P = 0.036$) and was a negative prognostic factor.

DISCUSSION

In our study, the epidemiological data such as age distribution, sex distribution, mechanism of injury and contributing factors were comparable to other Indian and Asian data, possibly suggesting similar injury circumstances in the Indian subcontinent as compared to different areas in the Western world.

Associated injuries seen in our study were comparable to other studies. In our series, a majority of the patients had high condylar fractures, which shows variation across

different studies. However, most studies, including ours, show a majority of the condylar fractures to be unilateral.

Condylar dislocation is considered to be one of the indicators of the severity of injury, and our incidence of 22% was similar to that of other international studies. All our patients underwent IMF. Around 27% of the patients in our series needed to undergo ORIF in addition.

IMF is the basic, standard treatment followed worldwide, also supported with a study by Zachariades *et al*., who reported that conservative treatment with or without IMF, is the treatment of choice in majority of the patients.[4]

The Helkimo anamnestic index is based on the patients' symptoms; a majority of our patients were asymptomatic. A study by Köhler *et al*.[5] showed similar results, but Leuin *et al*.[6] reported a majority in their series having moderate symptoms. The most important indicator of TMJ dysfunction is the clinical dysfunction index and most comparisons are based on this categorisation. In this, a majority had mild dysfunction in our study, which was similar to a study by Härtel *et al*.[7] and Borgiel-Marek *et al*.[8]

We found that those patients with condylar dislocation in addition to condylar fracture had significantly more dysfunction, as depicted in Figure 5, than those with only a condylar fracture as seen in the series of Zhou *et al*.[9] and Zachariades *et al*.[4] The presence of dislocation in our study, as well as the above-mentioned studies, warranted an ORIF in addition to IMF, as is the case in Figure 7.

There was no statistically significant difference between those who underwent IMF and ORIF as compared with those who underwent IMF only, as represented in Figure 6. Kyzas *et al*. in 2012 published one of the largest meta-analyses of comparison between conservative (IMF) and conservative-surgical treatments (IMF and ORIF) of condylar fractures of mandible. It included four randomised trials and 16 non-randomised trials. They concluded that ORIF is as good as conservative treatment in most cases of condylar fracture of mandible, provided open reduction was done for specific indications only.[10]

In our study, the decision to do an ORIF is based on specific indications as a protocol. Those patients with bilateral dislocated fractures displaced low condylar fractures, and grossly displaced high fractures were considered for

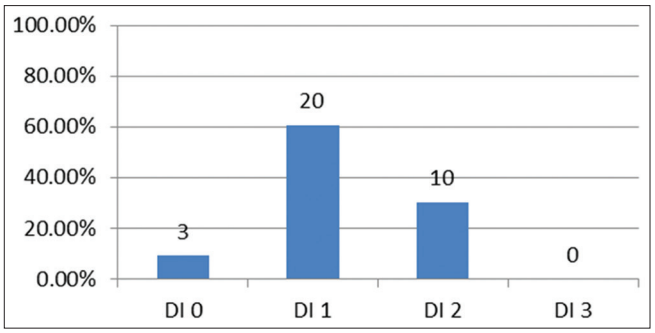

Figure 4: Helkimo's clinical dysfunction index

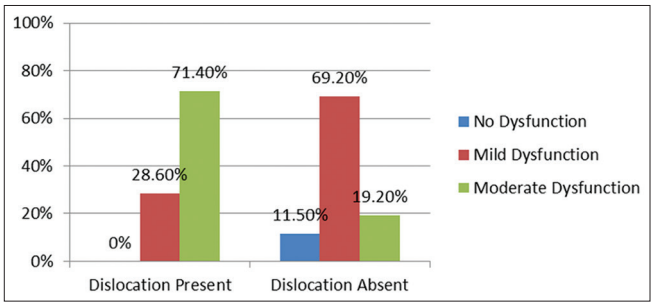

Figure 5: Association of clinical dysfunction with condylar dislocation

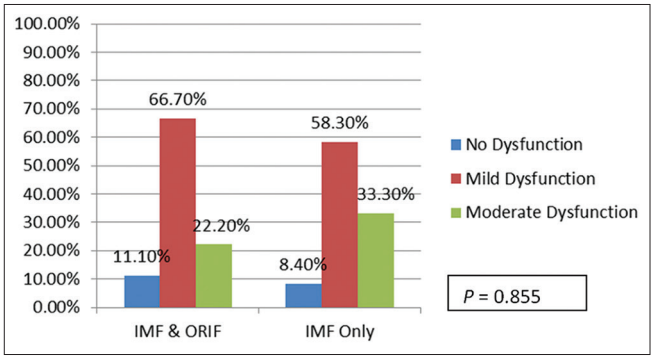

Figure 6: Association of clinical dysfunction with surgical procedure

surgery. Although ORIF is done, IMF screws are applied in these patients due to the following reasons:

- It reduces immediate post-operative pain
- In case immobilisation is deemed necessary –as in the case of pain, etc., loops or elastics can easily be applied in outpatient setting
- Guiding elastics can be applied during rehabilitation
- In case occlusion is deranged in post-operative setting (muscle spasm or redislocation), loops/elastics can be applied.

Based on these specific criteria and indications, we found that conservative treatment (IMF), as seen in Figure 8, was as good as conservative-surgical treatment (IMF and ORIF) with regard to the clinical TMJ dysfunction, a finding in the above-mentioned studies too.

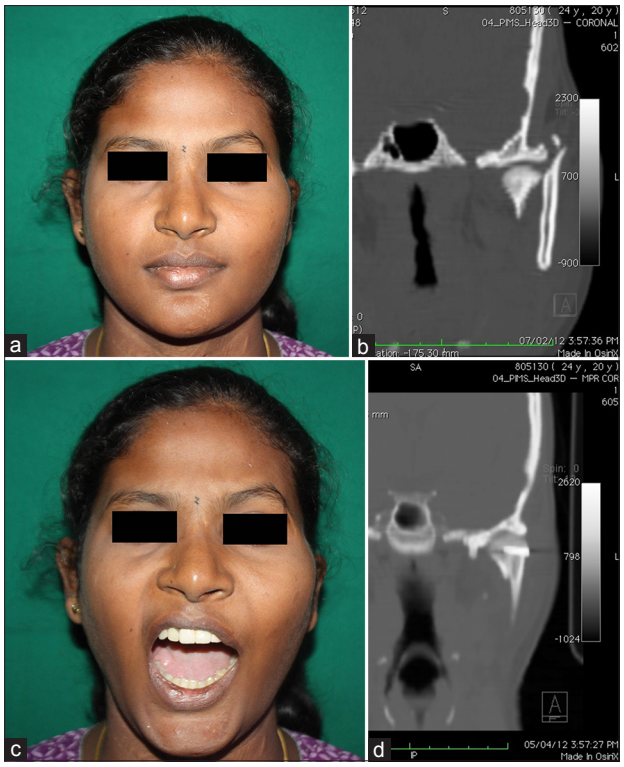

Figure 7: (a) High left condylar fracture with displacement (b) pre-operative computed tomography facial bone showing left high condylar fracture with displacement (c) post-operative intermaxillary fixation (arch bars) and open reduction and internal fixation of fracture with a screw through pre-auricular approach showing adequate mouth opening (d) post-operative computed tomography facial bone showing good reduction of fracture with screw *in situ* (Patient Consent has been obtained for Photo usage with identity concealed)

Our study showed no significant correlation between anamnestic index and clinical dysfunction index. It can be inferred that, although the patient may sometimes give no history of any symptoms, there might be subclinical dysfunction, which can only be diagnosed using the clinical dysfunction index. Thus, although the patient may not report any symptom, it becomes imperative to examine the patient using the clinical dysfunction index to diagnose this subclinical dysfunction and to quantify it.

Another observation is that, if a patient complains of significant symptoms, it may not always be severe on examination. Reassurance and mouth opening exercises are all that may be required to tackle the problem.

Following a fracture of the mandibular condyle, most patients will experience or develop some degree of dysfunction although far fewer complain of it. However, in this study, all the patients having an associated condylar dislocation reported having a moderate dysfunction of the TMJ at 8 weeks or later.

CONCLUSION

The Helkimo index is a simple, effective, inexpensive, reliable screening index to assess TMJ dysfunction

Figure 8: (a) Patient with left high condylar fracture with associated left zygoma and left orbital floor fracture (b) left oblique view (c) left lateral view (d) post-operative closed reduction of minimally displaced fracture and arch bar application for left condylar fracture (conservative-surgical treatment) (e) post-operative: Left oblique view (f) post-operative: Left lateral view (Patient Consent has been obtained for Photo usage with identity concealed)

in condylar fractures of mandible. Due consideration regarding routine clinical use can be given in view of the lack of gold standard clinical criteria to diagnose and prognosticate TMJ dysfunction in patients with condylar fractures of the mandible.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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