

# Correlation between Clinical Features and 3 T Mri Findings of Disc Position Status in Patients with Internal Derangement of Temporomandibular Joint

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## ABSTRACT

**Background:** Internal derangement is defined as an abnormality in the articular disc position and sometimes its' morphology that may interfere with normal function. The aims of study was to correlate between the clinical signs and symptoms and 3 Tesla magnetic resonance imaging findings of the articular disc position in patients with internal derangement of temporomandibular joint.

**Materials and methods:** A total forty six (30 study and 16 control) participants aged between 18 and 49 years, were examined according to Helkimo clinical dysfunction index scoring criteria which include clinical examinations of the range of mandibular mobility, impaired TMJ function, muscle pain ,TMJ pain and pain during mandibular movement.

**Results:** There is statistically high significant difference between Helkimo clinical dysfunction index in the cases group (with temporomandibular joint disorders) and controls group with MRI findings of disc position, that as the severity of index increased, there were progression of disc displacement and shows positive association expressed by significant probability (p) value.

**Conclusion:** There is a significant correlation between Helkimos' clinical dysfunction index and MRI findings in patients with internal derangement of temporomandibular joint.

## KEY WORDS

TMJ, Helkimo index ,3 T MRI.

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## العلاقة بين المظاهر السريرية ونتائج التصوير بالرنين المغناطيسي (Tesla 3) لموقع القرص للمرضى الذين يعانون من الاضطراب الداخلي للمفصل الفكي الصدغي.

### المستخلص

**الخلفية:** يعرف الاضطراب الداخلي كشدوذ في موقع القرص المفصلي، وأحياناً في شكل القرص المفصلي التي قد تتداخل مع وظيفته الطبيعية. وكانت أهداف الدراسة الربط بين العلامات والأعراض السريرية ونتائج التصوير بالرنين المغناطيسي (Tesla 3) لموقع القرص المفصلي في المرضى الذين يعانون من الاضطراب الداخلي للمفصل الفكي الصدغي.

**المواد وطريقة العمل:** ستة وأربعين مشارك (ثلاثون مريض يعانون من اضطراب المفصل الفكي الصدغي وستة عشر متطوع سليمي المفصل لغرض المقارنة) تتراوح اعمارهم بين ثمانية عشر وتسعة واربعون عاماً، تم اختيارهم لهذه الدراسة. تم فحص المشاركين سريرياً وفقاً لمؤشر هلكيمو للخلل الوظيفي السريري والتي تشمل الفحوصات السريرية للمجموعة معدل حركة الفك السفلي، اختلال وظائف المفصل الفكي الصدغي، ألم العضلات، وآلام المفصل الفكي الصدغي والألم أثناء حركة الفك.

**النتائج:** هناك فرقا إحصائياً كبيراً بين ارتفاع مؤشر هلكيمو للخلل الوظيفي السريري بين مجموعة الذين يعانون من اضطرابات المفصل الصدغي الفكي ومجموعة سليمي المفاصل عندما تقارن مع نتائج التصوير بالرنين المغناطيسي (موقع القرص) فكلما شدة المؤشر زادت، كانت هناك تطور نزوح القرص وتمثل العلاقة الإيجابية باستخدام عامل التحسس الملموس (P value).

**الاستنتاج:** توضح هذه الدراسة أن هناك ارتباط كبير بين مؤشر هلكيمو للخلل الوظيفي السريري و نتائج تصوير الرنين المغناطيسي (Tesla 3) للمرضى الذين يعانون من الاضطراب الداخلي للمفصل الصدغي.

## INTRODUCTION

The definition of internal derangement is a mechanical fault of the joint which interferes with smooth joint function that is attributed to abnormal interaction like condyle and articular eminence of the articular disc, the clinical features that is included with internal derangement is articular pain and articular noises as discussed by Rudisch *et al.*<sup>(1)</sup>. The disc displacement is categorized based on the relation of the disc displacement with mandibular condyle. The displacement can be anterior, anterolateral, anteromedial, lateral, medial and posterior<sup>(2)</sup>. Magnetic

resonance imaging (MRI) of the temporomandibular joint has resulted in better understanding of the TMJ and better comprehension of its disorders. MRI can provide positional information about the disc location, information about the status of the quality of retrodiscal tissue; lateral pterygoid muscle and condition of the bone marrow<sup>(3)</sup>.

## MATERIALS AND METHODS

A prospective study was conducted on 46 patients attending Oral and Maxillofacial Surgery Department in AL- Yarmouk Teaching Hospital that were referred to clinic of Radiology for MRI from over the period

of 5 months (September 2014 - February,2015). The patients were selected and divided into two groups:

1. Case group thirty patients (18-49) years old (22 females and 8 males) were clinically diagnosed as having internal derangements of temporomandibular joint. All patients were complained from pain in preauricular area and muscles of mastication, clicking or crepitation of TMJ, a limitation or deviation in mandibular range of motion, they were again grouped according to severity.
2. Control group sixteen participants (18-46) years old (10 females and six males) with normal TMJs.

The patients examined according to Helkimo clinical dysfunction index scoring criteria of temporomandibular disorders which consists of standardized series of diagnostic tests based on clinical signs and symptoms as the following:

1. Determination of the mouth opening without pain and the mouth opening with pain (un-assisted mouth opening). This accomplished by measuring the inter-incisal distance plus the overbite when the patient opens his mouth as wide as he could. A general guide for minimum normal mouth opening is 45mm including the overbite.
2. Palpation the TMJ during opening and closing three times at least to detect the joint sound, clicking, crepitation, luxation or deviation of TMJ.
3. Determination of masticatory muscles and TMJ pain during excursive movement of mandible. Determination of the tender points of muscles by palpating muscles bilaterally the Temporalis Muscle, Masseter Muscle, Medial pterygoid muscle, Lateral pterygoid muscle, Posterior digastric muscle and Sternocleidomastoid muscle.
4. Examination of TMJ pain and tenderness was done by digital palpating of the joint performed from both lateral and posterior aspect, the finger tips were placed over the lateral aspect of both joints simultaneously while the posterior aspect was reached via the external auditory meatus by small finger forced anteriorly. The patient was instructed to do movement of opening, closing, laterotrusion to the right and left and protrusion, and then asked if he experienced pain in one movement or more.

MRI was carried out with MRI 3.0 Tesla, Achieva Philips Medical System Nederland B.V. with standard head coil, the patient in a supine position. Bite block were used during open mouth position. The data were collected on 256 × 256 matrix giving a pixel size of 0.60 × 0.57 mm. Proton Density (PD) pblique Sagittal (closed and opened mouth). (TR) =528 miliseconds, (TE) =13 ms, (FOV)=150 mm, flip angle =90° ,

number of slices =22 slice and slice thickness=2.0 mm.

## RESULTS

Significant differences in correlation between mobility index total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types. (P<0.001) means a very high significant differences in correlation between mobility index total score and the normal TMJ disc, the highest value 84.2 % at a negative (zero score), while lowest value 5.3% the at a high grade (score 5). In anterior disc displacement with reduction, the highest value 74.2% at a low grade (score 1), while the lowest value 0.0% at negative (zero score). Anterior disc displacement without reduction the highest value 59.1% at a high grade (score 5), while the lowest value 0.0% at a negative (zero score) (Table 1). Significant differences in correlation between impaired TMJ function total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types. (P<0.001) means a very high significant differences in correlation between impaired TMJ function total score and normal (Not displaced), the highest value 97.4 % at a negative (score zero), while the lowest value 0.0% the at a high grade (score 5). Anterior disc displacement with reduction, the highest value 96.8 % at a low grade (score 1), while the lowest value 0.0% at a high grade (score 5). Anterior disc displacement without reduction, the highest value 54.5 % at a high grade (score 5), the lowest value 0.0% at a negative (score zero) (Table 2).

Significant differences in correlation between muscle tenderness total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types. (P<0.001) means a very high significant differences in correlation between muscle tenderness total score and normal (Not displaced), the highest value 86.8 % at a negative (score zero), while the lowest value 2.6% at a high grade (score 5). Anterior disc displacement with reduction, the highest value 61.3 % at a low grade (score 1), while the lowest value 0.0% at a negative (score zero). Anterior disc displacement without reduction, the highest value 59.1 % at a high grade (score 5), while the lowest value 4.5% at a negative (score zero) (Table 3). Significant differences in correlation between TMJ tenderness total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types. (P<0.001) means a very high significant differences in correlation between TMJ tenderness total score and normal (Not displaced), the

highest value 100 % at a negative (score zero) while the lowest value 0.0% at a low grade (score 1), at a high grade (score 5). Anterior disc displacement with reduction, the highest value 51.6 % at a low grade (score 1), while the lowest value 19.4% at a high grade (score 5). Anterior disc displacement without reduction, the highest value 63.6 % at a high grade (score 5), the lowest value 4.5% at a negative (score zero) (Table 4). Significant differences in correlation between pain on mandibular movement total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types. (P<0.001) means

a very high significant differences in correlation between pain on mandibular movement total score and normal (Not displaced), the highest value 97.4 % at a negative (score zero), while the lowest value 0.0.% at a high grade (score 5). Anterior disc displacement with reduction, the highest value 80.6 % at a low grade (score 1), while the lowest value 9.7% at a negative (score zero), a high grade (score 5). Anterior disc displacement without reduction, the highest value 63.6 % at a high grade (score 5), while the lowest value 4.5% at a negative (score zero) (Table 5).

**Table 1: Correlation between mobility index total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types.**

Type of disc displacement	Mobility index total score								Median	Mean rank	P
	Negative (score zero)		Low grade (score 1)		High grade (score 5)		Total				
	N	%	N	%	N	%	N	%			
Normal	32	84.2	4	10.5	2	5.3	38	100.0	Negative (score zero)	23.4	<0.001
Anterior disc displacement with reduction	0	0.0	23	74.2	8	25.8	31	100.0	Low grade (score 1)	58.1	
Anterior disc displacement without reduction	0	0.0	9	40.9	13	59.1	22	100.0	High grade (score 5)	67.9	

**Table (2): Correlation between impaired TMJ function total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types.**

Type of disc displacement	Impaired TMJ function total score								Median	Mean rank	P
	Negative (score zero)		Low grade (score 1)		High grade (score 5)		Total				
	N	%	N	%	N	%	N	%			
Normal	37	97.4	1	2.6	0	0.0	38	100.0	Negative (score zero)	20.5	<0.001
Anterior disc displacement with reduction	1	3.2	30	96.8	0	0.0	31	100.0	Low grade (score 1)	57.7	
Anterior disc displacement without reduction	0	0.0	10	45.5	12	54.5	22	100.0	High grade (score 5)	73.5	

**Table (3): Correlation between muscle tenderness total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types.**

Type of disc displacement	Muscle tenderness total score								Median	Mean rank	P
	Negative (score zero)		Low grade (score 1)		High grade (score 5)		Total				
	N	%	N	%	N	%	N	%			
Normal	33	86.8	4	10.5	1	2.6	38	100.0	Negative (score zero)	22.5	<0.001
Anterior disc displacement with reduction	0	0.0	19	61.3	12	38.7	31	100.0	Low grade (score 1)	61	

Type of disc displacement	Muscle tenderness total score								Median	Mean rank	P
	Negative (score zero)		Low grade (score 1)		High grade (score 5)		Total				
	N	%	N	%	N	%	N	%			
Anterior disc displacement without reduction	1	4.5	8	36.4	13	59.1	22	100.0	High grade (score 5)	65.4	

Table (4): Correlation between TMJ tenderness total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types.

Type of disc displacement	TMJ tenderness total score								Median	Mean rank	P
	Negative (score zero)		Low grade (score 1)		High grade (score 5)		Total				
	N	%	N	%	N	%	N	%			
Normal	38	100.0	0	0.0	0	0.0	38	100.0	Negative (score zero)	24.5	<0.001
Anterior disc displacement with reduction	9	29.0	16	51.6	6	19.4	31	100.0	Low grade (score 1)	53.9	
Anterior disc displacement without reduction	1	4.5	7	31.8	14	63.6	22	100.0	High grade (score 5)	72.1	

Table (5): Correlation between pain on mandibular movement total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types.

Type of disc displacement	Pain on mandibular movement total score								Median	Mean rank	P
	Negative (score zero)		Low grade (score 1)		High grade (score 5)		Total				
	N	%	N	%	N	%	N	%			
Normal	37	97.4	1	2.6	0	0.0	38	100.0	Negative (score zero)	22	<0.001
Anterior disc displacement with reduction	3	9.7	25	80.6	3	9.7	31	100.0	Low grade (score 1)	56.8	
Anterior disc displacement without reduction	1	4.5	7	31.8	14	63.6	22	100.0	High grade (score 5)	72.2	

**DISCUSSION**

In present study the correlation analysis between mobility index total score of Helkimo clinical dysfunction index and MRI findings of TMJ disc displacement types, these findings were in agreement with that reported by Saeed (4); Aidar *et al* (5); Hasan and Abdelrahman (6). Limitation of condylar translation in open mouth was observed in this series only in joints with anterior disc displacement and significantly more frequent in cases of complete anterior disc displacement without reduction followed by complete anterior disc displacement with reduction, which could be explained as the anteriorly positioned disc may act as a mechanical interference to the anterior translation of the condyle to its normal position at the apex of the articular eminence in open mouth.

A previous study assessed the degree of mandibular mobility in patients with a clinical diagnosis of temporomandibular disorder and healthy individuals and found a significant difference in the groups of patients with muscle disorders and anterior disc displacement with reduction regarding mandibular mobility when compared with the control group (6). Range of movement is the most evident expression of joint function (7), and its limitation may be caused by disc displacement (8). In our study, 13 patients already had disc displacement at T<sub>1</sub>, and only patient 13 had limited movements (lower than 7 mm). Patient 1, who had a well-positioned joint disc at T<sub>1</sub>, T<sub>3</sub> and T<sub>4</sub> had disc displacement according to both MRIs, a likely sign of dysfunction (5). A very high significant differences in correlation between impaired TMJ

function total score and anterior disc displacement with reduction, these findings were in agreement with that reported by Güler *et al.*<sup>(9)</sup>; Bisi *et al.*<sup>(10)</sup>. These findings were in disagreement with that reported by Westesson *et al.*<sup>(11)</sup>; Saeed<sup>(4)</sup> because of a disc displacement does not necessarily cause functional abnormalities such as limited mouth opening or clicking. Disc displacements are defined as abnormal positions of the articular disc against the condyle and the TMJ articular eminence. The disorder has been linked to pain, articular sounds and limited mouth opening<sup>(12)</sup>. A very high significant differences in correlation between muscle tenderness total score and anterior disc displacement with reduction, these findings were in agreement with that reported by Taskaya-Yilmaz, and Ogutcen-Toller<sup>(13)</sup>; Saeed<sup>(4)</sup>; Aidar *et al.*<sup>(5)</sup>; Kassab *et al.*<sup>(14)</sup>. Continuous muscle activity could be provoked by displacement of the TMJ disc and ceased when the disc was returned to a normal position on opening mouth only to recur every time the disc became displaced on closure of mouth. Anterior disc displacement without reduction (closed lock) could cause spastic activity in the temporalis muscle on the affected side. Spastic activity of the masseter and temporalis muscles on the same side as a joint with anterior disc displacement hinders the condylar movement necessary to achieve reduction<sup>(15)</sup>. A very high significant differences in correlation between TMJ tenderness total score and anterior disc displacement without reduction. In a recent study by Emshoff *et al.*<sup>(16)</sup>, the MR findings most associated with TMJ pain were anterior disc displacement without reduction and the presence of bone marrow edema. Lamot *et al.*<sup>(17)</sup> revealed that “The effect of disc displacement on the presence of symptoms in our patients was most evident in the group with anterior disc displacement without reduction. On the basis of a high probability of developing pain in this group (OR of 26 for right TMJ, 31.92 for left TMJ), we conclude that anterior disc displacement without reduction can be considered to be an important cause of pain. On the other hand, we found only a marginal correlation between anterior disc displacement with reduction and symptoms. Symptoms in these patients were probably a result of changes in synovial, bone and ligamentous structures of the TMJ”.

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