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MANDIBULAR BORDER MOVEMENTS AND HORIZONTAL CONDYLAR INCLINATION VALUES OF PATIENTS WITH DEGENERATIVE JOINT DISEASE AND CONTROL GROUP: A COMPARATIVE STUDY

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ABSTRACT
Temporomandibular joint (TMJ) disorders include myofascial pain disorder, articular disc disorders and degenerative bone changes or the osteoarthritis (OA). Osteoarthritis comprises a low-inflammatory condition with multifactorial etiology and numerous radiological pictures, which was similar to osteoarthritic disorders in other synovial joints in the body. The angle at which the condyle transfers away from the horizontal reference plane referred to as the condylar guidance. Twenty patients with degenerative joint disease examined according to "Research Diagnostic Criteria for Temporomandibular Disorders" and twenty-control group. Cadiax compact II used to evaluate horizontal condylar inclination. The result showed lower mean value of mandibular boarder movements and "horizontal condylar inclination" for degenerative joint disease group compared with control with significant difference between two groups. The assessment of the masticatory system movement using jaw-tracking device and mandibular boarder movement might aid in diagnosis of different disorder of jaw locomotor system.

KEYWORD: degenerative joint disease, Horizontal condylar inclination, Cadiax compact II.

INTRODUCTION

The temporomandibular articulation involves bilateral, diarthrodial joints, each joint designed by a mandibular condyle and its corresponding temporal cavity (the glenoid fossa and articular eminence). TMJ and its connected structures play an essential role in guiding mandibular motion and distributing stresses created by everyday tasks, such as chewing, swallowing, and speaking. TMJ disorders (TMD) were a class of degenerative musculoskeletal conditions, associated with the morphological and functional deformities (Zarb, G.A. and Carlsson, G.E., 1999). Remodeling of the load-bearing joints was an essential adaptation process needed for the suitable stress distribution and function. It has established that, the progressive and regressive, mechanically induced remodeling was a normal process. When the capability for the joint to remodel has exceeded, remodeling merges into degenerative joint disease (de Bont LG *et al*., 1986). The characteristic osteoarthritic changes detected in the mandibular joint include alterations in the size and shape of joint components, precisely, flattened fossa, the less pronounced articular eminence, reduced the condylar volume and thickened disc. Degenerative-remodeling present in pathologic TMJs may result from either reduced the adaptive capacity in the articulating structures or from extreme or sustained physical stress to the joint structures (Arnett *et al*., 1996 and Tanaka *et al*., 2008).

The angle at which the condyle travels away from the horizontal reference plane, referred to as the "condylar guidance". This angle varies from person to person and from one side to the other (Okeson, 1993). Since no reliable method currently exists that can unconditionally used by researchers and clinicians to diagnose and measure the presence and severity of degenerative joint disease (Simone Vieira CarraraI *et al*., 2010). One of the fundamental tests to assess mandibular jaw joint function is determination of the range of motion of the joints during maximum jaw opening and lateral and protrusive movements; restriction of these movements reflected a sign of dysfunction (Khalid H. Zawawi, *et al*., 2003). Several method used to capture horizontal condylar inclination (Smita A khalikar *et al*., 2017) claimed that protrusive records and OPG might use as a reliable guide for assessing condylar guidance angulation. A pantograph was a part of instrumental functional analysis. The tracings of the mandibular movements present additional vital information, which completes patient's medical history and clinical examination, its advantage lies in its noninvasive recordings of condylar inclination and with electronic device, all the data documented on the computer, which enables comparison and monitoring of the TMDs (Čimić *et al*., 2015). The aim of this study was to determine boarder movement measurements and values of horizontal condylar inclination for patients with degenerative joint disease and compare them with control group. The study excluded the edentulous patients, patients with class I and class II Kennedy classification patients with parathyroid gland disease, neoplastic disease, and patients with developmental disorders of the TMJ such as "condylar aplasia, hypoplasia, or hyperplasia".

MATERIALS & METHODS

The study sample consist of twenty patients with degenerative joint disease (8 male and 12 female)

diagnosed according to "Diagnostic Criteria for Temporomandibular Disorders Clinical Protocol and Assessment Instruments" 2013, and twenty-control group (10 male and 10 female). A scientific committee in Baghdad University/ college of dentistry as well as Ministry of Health in Iraq granted the ethical approval for this case control study. The study conducted in College of dentistry Baghdad University. Patients age range from 25-55 years old, and all patients informed about the study and informed consent obtained from the Patients. The patient was sitting "securely upright" in a chair, which could adjusted for height. The patient position, in the chair should adjusted for utmost comfort for both the patient and the examiner. The examiner was standing to the" patient's right" and fronting the patient. This position permits the examiner to execute the "full examination" using each hand as necessary, while the other hand used, to stabilize the patient's head or the mandible.

For opening movement maximum unassisted opening measured and maximum assisted opening also determined. Excursive movements complement open movements for full assessment of jaw mobility; these involve mediotrusion left and right and protrusion movement.

Lateral pole of TMJ (0.5 kg of palpation pressure) examined using one finger, Each TMJ examined independently by placing one fingertip on the skin overlying the right TMJ, and the other hand stabilizes the head. While palpating the joint, the patient asked to open and close, the right TMJ examined while the mandible moved to the right, to the left, and protrusively and left joint examined simultaneously for any noise during movement. Start up the Cadiax compact II Software on the computer. Next, the patient data had entered and device mounted on the patient, the patient brought into the reference position with unforced chin point guidance. The coordinates of this position recorded. Excursive movements made from this reference position. All movements carried out three times figure (1).

The patient asked to carry out the movement, which was protrusive movement, mediotrusion movement to the left and mediotrusion to the right side and opening and closing movement. The "Cadiax® system" supports different articulator brands to program the patient setting. The Denar® Mark II had been chosen.

Statistical analysis

All data interpreted in a computerized database structure. "Statistical Package for Social Sciences" (SPSS) version 20 was applied. Comparisons were done using; Two Independent Samples t-test, two independent Mann-Whitney test And Contingency Coefficient (CC), with P value considered statistically significant when < 0.05.

FIGURE 1: Cadiax compact II mounted on patient

RESULTS & DISCUSSION

Table 1 shows observed frequencies and their percentages distribution of studied "Demographical Characteristics" Variables (DCv.), age groups, and gender with comparisons significant.

TABLE 1: Distribution of the studied Osteoarthritis, and Controlled Groups according to (Age and Gender) with comparison's significant

DCv.	Age group	No. and %	Groups: Degenerative joint	Groups: Control	Total	C.S. P-value
Age Groups Yrs.	25 -	No.	1	12	13	CC=0.580
		%	5.0%	60.0%	32.5%	P=0.000
	35 -	No.	8	8	16	HS
		%	40%	40%	40%	
	45 - 55	No.	11	0	11	
		%	55.0%	0.0%	27.5%	
Mean ± SD			44.74± 6.32	34.05± 4.61	39.4 ± 7.69	
Gender	Male	No.	8	10	18	CC=0.100
		%	40%	50%	45%	P=0.525
	Female	No.	12	10	22	NS
		%	60%	50%	55%	

(*) HS: Highly Sig. at P<0.01; NS: No Sig. at P>0.05; Testing based on Contingency Coefficient (CC).

The results indicated that highly significant different at P<0.01 are accounted for (DCv.) concerning age groups among disordered (degenerative joint disease), and controlled groups, as well as mean, and standard deviation estimates are illustrated for the studied disordered group, and controlled which showed that Osteoarthritis group had registered elder age compared with controlled. In addition to that, gender distribution are reported no significant difference at P>0.05.

Figure 2: represented "Demographical Characteristics" variables distribution of age groups, and gender in the studied groups.

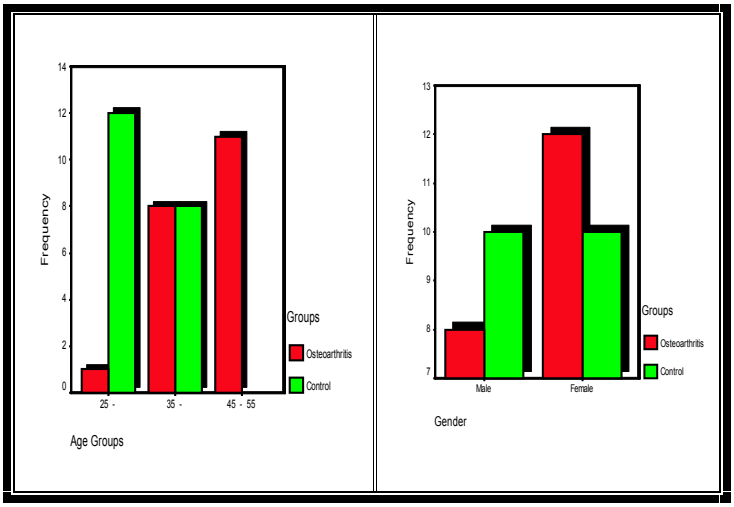

FIGURE 2: Distribution (Age and Gender) of the studied degenerative joint, and Controlled Groups

TABLE 2: Summary Statistics of mouth opening Parameter in studied degenerative joint and controlled groups

Parameter	Groups	No.	Mean	SD	CS P_{-value}
Maximum opening	Dege. joint	20	41.55	5.75	0.000
	Control	20	48.80	4.19	HS
Maximum assisted opening	Dege. joint	20	44.45	5.90	0.000
	Control	20	51.70	4.78	HS

(*) HS: Highly Sig. at P<0.01; based on two independent t-test.

The results indicated a significant different at P>0.05 are accounted for the Maximum opening and the Maximum assisted opening between the degenerative joint disease and the control group.

TABLE 3: Summary Statistics of the Mediotrusion parameter in studied degenerative joint and controlled groups

Parameter	Groups	No.	Mean	SD	CS P_{-value}
Mediotrusion Right	Dege. joint	20	7.20	1.15	0.000
	Control	20	9.50	1.00	HS
Mediotrusion Left	Dege. joint	20	7.40	1.35	0.000
	Control	20	9.25	1.02	HS

(*) HS: Highly Sig. at P<0.01; Testing based on two independent t-test.

The results indicated that a significant different at P>0.05 are accounted for the mediotrusion "left and right" parameter between the degenerative joint disease and the control group

TABLE 4: Summary Statistics of the Protrusion parameter in studied Degenerative joint and controlled groups

Parameter	Groups	No.	Mean	SD	CS P_{-value}
Protrusion	Dege.joint	20	5.30	1.30	0.000
	Control	20	6.85	0.75	HS

(*) HS: Highly Sig. at P<0.01; Testing based on two independent t-test.

The results indicated a significant different at P>0.05 are accounted for protrusion parameter between degenerative joint and control group.

TABLE 5: Summary Statistics of HCI 3mm and 5mm parameter in studied Degenerative joint and controlled groups

Parameters	Groups	No.	Mean	SD	CS P_{-value}
3mm- Right	Dege. joint	20	40.85	8.60	0.008 HS
	Control	20	49.25	10.44	
5mm- Right	Dege. joint	20	39.95	7.94	0.003 HS
	Control	20	48.65	9.64	
3mm- Left	Dege. joint	20	40.85	10.38	0.027 S
	Control	20	48.05	9.32	
5mm- Left	Dege. joint	20	40.75	11.45	0.059 NS
	Control	20	47.00	8.63	

(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05; NS: No Sig. at P>0.05; Testing based on two independent t-test, , and two independent Mann-Whitney test.

The results indicated a significant different at P>0.05 are accounted for horizontal condylar inclination at 3 and 5mm between degenerative joint and control group except for 5mm left. The results shwed that no significant different concerning gender distribution between disordered "degenerative joint disease" and controlled group table (1). Although female outnumbered male in degenerative joint group, with most patients being on older age group (Cyrus cooper *et al*., 2013), mentioned that the incidence of degenerative joint disease increases with age, and women have greater rates than men, especially beyond the age of 50 years

Mean age for disordered group was higher than control group Lawrence RC *et al*., point out that TMJ "degenerative joint disease" occurs with greater frequency as age increases. The result indicated a significant decreased in maximum mouth opening and assisted maximum mouth opening compared to control group table (2), (Abhijeet Deoghare and Shirish Degwekar, 2010), in their study point out that decreased mouth opening was found in (86.66%) of patients with "osteoarthritis" and was one of the most common findings along with crepitation and might related to the mechanical impediment of articular surface that limit the condylar translation. Lateral movements of less than 8 mm classified as restricted (some authors set the cut-off point to 7 mm); the mean values for the lateral movement of control group in this study table (3) were within range of normal (Jeffrey P. Okeson, 2013). The result showed a significant difference between control group and degenerative group regarding mediotrusion left and right, the studies by (Celic R, V Jerolimov *et al*., 2003 and Celic R, V Jerolimov and D Knezovic, 2004), clarified that the statistically significant differences in the range of lateral mandibular movements clearly separated asymptomatic subjects and patients with TMJ disorders.

For protrusion, result showed significant correlation between degenerative joint and control groups table (4), Protrusive movements of less than 7 mm considered restricted, although they were not always signs of pathology that urgently calls for treatment (Vassil Svechtarov, *et al*., 2015). The decreased values of border movement for degenerative joint group in general related to irregularities of articular surface that create mechanical interference limiting the boarder movement.

Clinical observations demonstrated that numerous factors might play a role in the progression of TMD to degenerative changes. Thus, each TMD case must treated uniquely. Such factors include the independent or interrelated roles of trauma, parafunction, unstable occlusion, functional overloading, and increased joint friction (Nitzan DW., 2001).The respective roles of each of these potential components are controversial, however, as direct cause and effect relationships have not been determined with consistency.

A study of completely dentate adult found "horizontal condylar angles" to be between 40 and 49 degrees (Orth B., 2004), yet another study reported values between 44 and 55 degrees (Alsawaf MM and Garlapo DA., 2004), which were within the range measurements of this control group table (5).

The result of this study shows a significant difference between degenerative joint disease and control group. As the condyle moves out of the most superior and anterior position from glenoid fossa, it slides along the posterior slope of the articular eminence. The angle at which the condyle moves away from the horizontal reference plane referred to as the condylar guidance angle. Hence, the articulating surface of the condyle as well as the slope of the articular eminence influences the "horizontal condylar angle" obtained) Takayama Y, *et al*., 2008).

The flattening of the condyle, local erosion, local bony outgrowth (osteophyte) and sclerosis, as well as the decrease in the posterior slope of the articular eminence results in decreased downward movement of the condyle in the glenoid fossa relative to the horizontal plane resulting in a decreased horizontal condylar angle (T. Sreelal *et al*., 2013). These reasons might explain the decrease in measurement of "horizontal condylar angle".

CONCLUSION

This study conclude that determination of mandibular boarder movement and the use of mandibular tracing device that determine horizontal condylar inclination values could be used as noninvasive method for diagnosis of degenerative joint disease disorder since there is significant difference compared to control group, further study required to compared different tempromandibular joint disordered like intraarticular disc disorder and

myofascial pain disorder with control group concerning the same parameter used for this study.

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