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# Measurements of Horizontal condylar inclination by using Cadiax compactII in patients with TMJ clicking before and after different treatments modalities

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## Abstract

**Background:** Temporomandibular joint can be defined as a small and complex joint in the body. The bony portions of the joint consist of glenoid fossa, mandibular condyle and articular eminence which is a part of the temporal bone. Between the two bony structures, the articular disc is found. Disc displacement characterized by alteration in the articular disc position (abnormal position) locating between the mandibular fossa and the head of the condyle. Clicking can be defined as a brief sounds that are created from the movements of mandible, associated with displacement of the disc with reduction. Remodeling of the joint or joint hypermobility can produce clicking like sounds. Horizontal condylar angle can be defined as an angle formed in the horizontal plane between the Frankfurt horizontal plane and a line connecting a point on the head of the condyle, in centric and protrusive position.

**Aim of the Study:** Measurement of horizontal condylar inclination in patients with clicking using Cadiax CompactII before and after the treatment.

**Subjects, materials and Method:** The study sample consisted of seventy eight patients with disk displacement and thirty one as control subjects. Patients with intra articular joint disorders were divided into four groups according to the Diagnostic Criteria for Temporomandibular Disorders (Group1-disk displacement with reduction. Group2-disk displacement with reduction with intermittent locking. Group3-disk displacement without reduction with limited opening. Group 4-disk displacement without reduction without limited opening).

**Results:** Horizontal condylar inclination, results concerning right and left sides shows highly significant differences between control and group 4, while no significant differences were seen in the studied disorder groups either for using splint or laser

**Conclusions:** The differences of Horizontal condylar inclination recorded by non-invasive Cadiax CompactII device may be used in the diagnosis of disc displacement without reduction without limited opening. The different modalities of treatment used do not influence the horizontal condylar inclination.

***Keywords:*** *horizontal condylar inclination, Cadiax compact II, clicking, splint, laser.*

## Introduction

Temporomandibular joint (TMJ) is arthrodial ginglymus joint, which is formed from glenoid fossa, articular tubercle, articular disc, condyle, retro discal tissue, joints capsule and synovial membrane,[1] consider the most commonly joint used in the human body with a bilateral concurrent capacity to move the lower jaw. [2] Clicking is predominantly created as mandibular condyle travels above displaced disc with morphologic alterations. [3] Controversy quit remains as to whether or not anterior disc displacement in the lack of other signs and symptoms for example pain and/or mouth opening restriction should be treated.[4] Some investigators proposed that clicking may considered as usual variation, resultant from practical adaptation of TMJ

and/or aging. Other investigators involved degenerative TMJ disease as a part of relevant application process of TMJ. [5] Computed axiography allows non-invasive three-dimensional imaging of the condylar path on the basis of recorded hinge-axis movements. Axiographic recordings of the mandibular joint motion permit the diagnosis of muscular dyscoordination, hyper and hypomobility, dynamic asymmetries of movement and joint pathologies, [6] all are often assist in the identification of the causes. The present study consist of two modalities of treatment, occlusal splint and laser therapy, the most common purposes of intra oral appliance therapy are to provide joint stabilization, protect the teeth, redistribute forces, relax elevator muscles, and decrease or control the effects of bruxism. Stabilizing oral appliance that fully covers one arch and does not reposition the mandible or alter the occlusion is considered a standard part of therapy of temporomandibular joint disorders (TMDs). [7] Low level laser therapy (LLLT) is a type of therapy for musculoskeletal illness, with an anti-inflammatory, analgesic, regenerative actions, as well as limited time of treatment, easy applied with less contraindications. [8]

**Subjects, materials and methods**

The study sample consisted of seventy eight patients with intra articular joint disorders (Current TMJ noises, click(s) during jaw movement) and thirty one as control subjects with age range from 21-45 years old. Patients with intra articular joint disorders were divided into four groups according to the Diagnostic Criteria for Temporomandibular Disorders. [9]

1-Group1(thirty three patients with disk displacement with reduction).

2-Group2 (fifteen patients with disk displacement with reduction, with intermittent locking).

3-Group3 (fifteen patients with disk displacement without reduction, with limited opening), this group excluded from the measurements by Cadiax compact II due to limited mouth opening.

4-Group4 (fifteen patients with disk displacement without reduction, without limited opening.

The control group attending to the dental center for different diagnostic purposes which have not (TMDs) by clinical examination and patients were clinically diagnosed to have intra articular joint disorder.

Measurements of horizontal condylar inclination in control and patients with clicking using Cadiax compact II before and after the treatment; (Figure 1).

Hard occlusal splint of 2mm thickness was prepared to cover the maxillary teeth. The surface of splint was smooth and removing the posterior interferences to deliver centric relation occlusion, it was used for two months at night (eight hours) by patients and then repeated the measurements of horizontal condylar inclination by Cadiax Compact II to determine any change that occur.

Diode class IV laser of wave length 940 nm ±10 with the power of 4 watt using deep tissue handpiece (30mm diameter = 7.1cm² area), energy is 1200 J and energy density is 169 J/cm² for 300 second in each side.

Patients and dentist wear protective eye glasses during the session of treatment, patients were treated in four sessions (four weekly treatments). The deep tissue handpiece of laser probe was placed over the TMJ area which was identified throughout the clinical examination anterior to the ear, at the opening and closing of the mouth; (Figure 2).

Adequate level of beneficial energy in a short period of time was applied to the affected TMJs to provide active therapeutic effects. According to manufacturing recommendation, some patients may need more than one laser application or a series of treatments before significant improvement is stated.

Deep tissue handpiece is provided by disposable non-sterile protective shield used for only one patient, which was disinfected before and after any patient treatment.


**Figure (1): Mounting of Cadiax Compact II.**

**Figure (2): Application of laser therapy to patient with temporomandibular joint clicking.**

## Results

### Before treatment

The summary statistics regarding of the horizontal condylar inclination at 5 mm parameter in the studied groups before the treatment distributed in right and left sides, such that, mean values, standard deviation, standard error, 95% confidence interval for the population mean; (Table 1).

Group 4 recorded the lowest mean value, followed by group 2, group 1. Control group recorded a higher mean value; (Table 1).

**Table (1): The summary of statistics of horizontal condylar inclination at 5 mm parameter in the studied groups before treatment distributed in right and left sides.**

| Side | Groups | No. | Mean | Std. D. | Std. E. | 95% C.I. for Mean | |
|---|---|---|---|---|---|---|---|
| | | | | | | L.b. | U.b. |
| Right | Group1 | 33 | 49.27 | 7.76 | 1.35 | 46.52 | 52.02 |
| | Group2 | 15 | 48.20 | 4.92 | 1.27 | 45.48 | 50.92 |
| | Group4 | 15 | 42.67 | 9.55 | 2.47 | 37.38 | 47.96 |
| | Control | 31 | 51.16 | 7.39 | 1.33 | 48.45 | 53.87 |
| Left | Group1 | 33 | 48.15 | 9.3 | 1.62 | 44.85 | 51.45 |
| | Group2 | 15 | 47.27 | 5.57 | 1.44 | 44.18 | 50.35 |
| | Group4 | 15 | 41.87 | 9.27 | 2.39 | 36.73 | 47 |
| | Control | 31 | 50.16 | 8.23 | 1.48 | 47.14 | 53.18 |

Results concerning right and left side, showed a highly significant difference (P<0.01) between control and group 4. While no significant difference (P>0.05) between control and other groups; (Table 2).

**Table (2): Significant levels for testing all pairs of comparisons by (LSD)**.

| Site | Groups (I) | Groups (J) | Mean Difference (I-J) | Sig. | C.S. (*) |
|---|---|---|---|---|---|
| Right | Group1 | Control | -1.890 | 0.322 | NS |
| | Group2 | Control | -2.960 | 0.218 | NS |
| | Group4 | Control | -8.490 | 0.001 | HS |
| Left | Group1 | Control | -2.010 | 0.345 | NS |
| | Group2 | Control | -2.890 | 0.280 | NS |
| | Group4 | Control | -8.290 | 0.002 | HS |

**(*) HS: Highly Sig. at P<0.01; S: Sig. at P<0.05 :NS: Non Sig. at P>0.05**

After treatment

The summary statistics, as well as matched paired t-test for testing the mean values of differences of horizontal condylar inclination at 5 mm before and after treatment in different disordered groups using splint and laser therapy; (Table 3).

Results showed no significant differences between studied disordered groups (P>0.05) either for using splint or laser; (Table 3).

**Table (3): Summary statistics and matched paired t-test for testing differences in horizontal condylar inclination at 5 mm regarding splint and laser therapy.**

| Groups | Parameters | Period | No. | Mean | SD | SE | MP (t-test) | df | Sig. (*) (2-tailed) |
|---|---|---|---|---|---|---|---|---|---|
| Group1 | HCI at 5mm right (Splint) | Before | 10 | 48.40 | 8.550 | 2.700 | -0.739 | 9 | 0.479 NS |
| | | After | 10 | 48.80 | 7.890 | 2.490 | | | |
| | HCI at 5mm left (Splint) | Before | 10 | 45.80 | 9.330 | 2.950 | -1.253 | 9 | 0.242 NS |
| | | After | 10 | 46.50 | 9.100 | 2.880 | | | |
| | HCI at 5mm right (Laser) | Before | 5 | 44.00 | 9.140 | 4.090 | -2.236 | 4 | 0.089 NS |
| | | After | 5 | 45.00 | 9.350 | 4.180 | | | |
| | HCI at 5mm left (Laser) | Before | 5 | 47.80 | 9.340 | 4.180 | -1.372 | 4 | 0.242 NS |
| | | After | 5 | 48.60 | 8.620 | 3.850 | | | |
| Group2 | HCI at 5mm right (Splint) | Before | 10 | 49.20 | 5.550 | 1.760 | -0.287 | 9 | 0.780 NS |
| | | After | 10 | 49.50 | 4.480 | 1.420 | | | |
| | HCI at 5mm left (Splint) | Before | 10 | 47.80 | 6.140 | 1.940 | 0.439 | 9 | 0.671 NS |
| | | After | 10 | 47.50 | 5.280 | 1.670 | | | |
| | HCI at 5mm right (Laser) | Before | 5 | 46.20 | 2.770 | 1.240 | -1.500 | 4 | 0.208 NS |
| | | After | 5 | 46.80 | 3.110 | 1.390 | | | |
| | HCI at 5mm left (Laser) | Before | 5 | 46.20 | 4.660 | 2.080 | -0.250 | 4 | 0.815 NS |
| | | After | 5 | 46.40 | 5.900 | 2.640 | | | |
| Group4 | HCI at 5mm right (Splint) | Before | 10 | 43.40 | 9.910 | 3.130 | -0.732 | 9 | 0.483 NS |
| | | After | 10 | 44.00 | 8.590 | 2.720 | | | |
| | HCI at 5mm left (Splint) | Before | 10 | 42.70 | 9.040 | 2.860 | -0.557 | 9 | 0.591 NS |
| | | After | 10 | 43.00 | 9.450 | 2.990 | | | |
| | HCI at 5mm right (Laser) | Before | 5 | 41.20 | 9.710 | 4.340 | -1.633 | 4 | 0.178 NS |
| | | After | 5 | 42.00 | 8.770 | 3.920 | | | |
| | HCI at 5mm left (Laser) | Before | 5 | 40.20 | 10.57 | 4.730 | -1.510 | 4 | 0.206 NS |
| | | After | 5 | 41.60 | 10.14 | 4.530 | | | |

(*) NS: Non Sig. at P>0.05; Testing based on MP (t-test)

## Discussion

Horizontal condylar angle can be defined as an angle made in a horizontal plane between line joining point on TMJ condyle in protrusive and centric location and Frankfurt-horizontal plane. [10]

Horizontal condylar inclination can be recorded by

several ways:

A-Interocclusal records. [11]

B-Pantographic tracings. [12]

C-Electronic jaw tracing devices. [13]

D-Radiographical methods. [14]

Many examiners evaluate the importance of electronic axiography in diagnosis of TMDs, due to precision and accuracy of their results. [15,16] Also, Obrez and Gallo, (2006) [17] identified the development of three-dimensional recorded systems provide more accurate data and information in the assessment of the movements of TMJ condylar head.

The findings of Cruzoe'-Rebello *et al.,* (2003) [18] through their clear expression of horizontal condylar inclination showed no existing difference statistically between average horizontal condylar inclination values of normal TMJs and TMJs with internal derangement. Similarly the results of this study showed no difference between average horizontal condylar inclination values of control group and patients with disc displacement with reduction (group1 and group 2).

The present study demonstrated that mean value of horizontal condylar inclination at five mm in (both right and left) in control group, in the summary achievement of this researches this agrees with the study done by Alsawaf and Garlapo (1992), [19] they stated that the values of horizontal condylar inclination is between 44° and 55° which is near to the results done by Alfredo *et al.,* (2010), [20] they determine the mean horizontal condylar path inclination in occlusally healthy dentate subjects. Eccentric movements of five mm from reference positions were recorded using a Denar Cadiax Compact System.

In the study done by Čimić *et al.,* in 2015, [21] the mean value of sagittal condyle inclination 41.0° ±10.5 for right joint and 40.7° ±9.8 for the left joint. The different values in these studies may be explained by different samples in each study, considering the influence of the lower jaw function on eminence development, different patterns of chewing movements, variations in the condylar shape and condylar pathway, [22] condylar position in the glenoid fossa,[23] and chewing habits (chewing side preference). [24]

In a summary of all research accomplishments, current work have a specific issues that the pathway followed by condylar head in the glenoid fossa is curved, condyle moves along posterior incline of articular eminence from its superior-anterior location within glenoid fossa. The angle formed by the movement of condylar head away from horizontal reference plane mentioned as condyle guidance angle. As a result later slope of articular eminence and articular condyle surfaces effect horizontal condylar inclination. [25] Regarding horizontal condylar inclination right and left side, results were recorded lower mean value in group 4 than control group with a highly significant differences.

## Conclusions

Horizontal condylar inclination is different in disordered groups compared to control. The differences of Horizontal condylar inclination recorded by non-invasive Cadiax CompactII device may be used in the diagnosis of disc displacement without reduction without limited opening. The different modalities of treatment used do not influence the horizontal condylar inclination.

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**Conflict of Interest:** None to declare.

**Ethical Clearance:** All experimental protocols were approved under the College of Dentistry, University of Baghdad, Iraq and all experiments were carried out in accordance with approved guidelines.

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