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Measurements of Bennett Angle by using Cadiax Compact II in Patients with TMJ Clicking Before and after Different Treatments Modalities

Hayder Mahdi Idan[1], Fawaz D. Al-Aswad[2]

[1]B.D.S Msc. Oral medicine

[2]B.D.S Msc. PhD. Oral Medicine, MFDS, RCPS Glasgow

Abstract: ***Background: Temporomandibular joints connect mandible to the cranial temporal bone and control the motions of mandible.It is considered as a complex joint, delicate and more useful in the human body.In normal physiologic temporomandibular joint, disc is placed between the mandibular condylar head inferiorly and the articular eminence superiorly and anteriorly when the jaw is closed, while through opening of the jaw, the disc slides and placed into location between the head of condyle and temporal articular eminence. Clicks can be defined as brief sounds created by mandibularmotion related with disc displacement with reduction, however click similar sounds can also be created by temporomandibular joint remodeling or hypermobility.Bennett angle can be defined as an angle made between average pathway of progressing temporomandibular joint condyle as per seen in horizontal plane and sagittal plane throughout lateral movements of lower dental arch. Aim of the study: Measurement of Bennett angle in patients with clicking using Cadiax CompactII before and after the treatment. Subjects, materials and methods: 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: Regarding Bennett angle, a significant difference between group 4 and control in the right side. Different modalities of treatment do not affect the Bennett angle, with the exception of group2(disk displacement with reduction with intermittent locking). Conclusions: Bennett angle is different in a specific group (disc displacement without reduction) as compared to control.***

Keywords: Bennett angle, Cadiax compact II, clicking, splint, laser

1. Introduction

Temporomandibular joints (TMJs) are defined as the articulation between the lower jaw and the cranium bone components. It involves head of mandible (condyle), glenoid fossa and articular eminence. These joints act as one anatomically control for both the occlusion and mandibular movement, the articulating surface of the condylar head is the upper and anterior surfaces which are lined by dense, non-vascular fibrous connective tissue. [1]

Bennett movement can be defined as lateral shift movement, it is a complex movement of lower jaw deriving from the movement of the mandibular condyle along lateral inclination of the TMJ fossa during lateral condylar movement. It involves two movements as following:

a) Immediate Bennett side shift: happens at the start of translation movements
b) Progressive Bennett side shift. [2]

In immediate type, the revolving condyle moves primarily straight medially by way of it leaves centric relationship at the beginning of lateral mandibular movement, while progressive type generates an angle which is named as Bennett angle created by the sagittal plane and the path of the advancing condylar head through lateral lower jaw movements, this could be observed in horizontal plane. [2]

Different interaction of structural and morphological components affected mandibular movements, these factors consist of neuromuscular system, anterior guidance (tooth guidance) andposterior guidance (condylar guidance), [3]and these movements are guided by many factors such as shape of bones, muscles, ligaments, and the occlusion of teeth all of these play in guide the mandibular movements. On the TMJ subjected to hinge and gliding movements. [4]

Occlusal splints or appliances can be defined as removable appliances creating harmony of neuromuscular in masticatory system. It can be prepared for covering occlusal faces of upper or lower teeth and can be made from various materials, it might be hard or soft or an intermediate texture. [5]

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. [6]

2. Subjects, materials and methods

The study sample consisted of seventy eight patients with intraarticular joint disorders (Current TMJ noises,click(s) during jaw movement) age and sex matched through thirty subjects as control withage range from 21-45 years old. Patients with intraarticular joint disorders were divided into four groups according to theDiagnostic Criteria for Temporomandibular Disorders. [7]

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.

Measurements of Bennett angle in control and patients with clicking using Cadiax compact IIbefore 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 closingof 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 hand piece is provided by disposable non-sterile protective shieldused for only one patient, which was disinfected before and after any patient treatment.

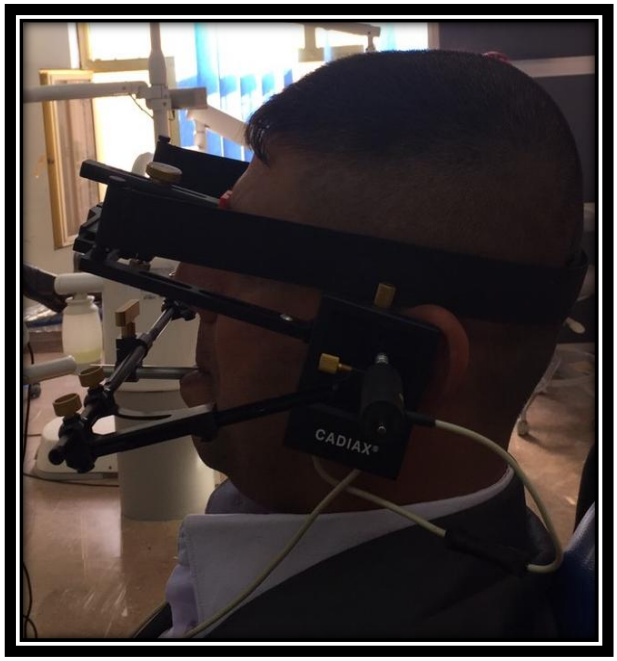

Figure 1: Mounting of Cadiax Compact II.

Figure 2: Application of laser therapy to patient with temporomandibular joint clicking

3. Results

1) Before treatment

The summary statistics of transverse condylar angleat 5 mm parameter in the studied and control groups 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 (disc displacement without reduction without limited opening) recorded the lowest mean value, followed by group 2 (disc displacement with reduction with intermittent locking), then group 1 (disc displacement with reduction). While a higher mean value in control group; (Table 1).

Table 1: Transverse condylar angle at 5 mm parameter in the studied and control groups distributed in right and left side

Side	Groups	No.	Mean	Std. D.	Std. E.	95% C.I. for Mean	
						L.b.	U.b.
Right	Group1	33	7.79º	2.93	0.51	6.75	8.83
	Group2	15	7.67º	2.19	0.57	6.45	8.88
	Group4	15	6.87º	2.64	0.68	5.4	8.33
	Control	31	8.45	1.95	0.35	7.74	9.17
Left	Group1	33	7.52º	2.88	0.5	6.49	8.54
	Group2	15	7.53º	2.1	0.54	6.37	8.7
	Group4	15	6.80º	3.03	0.78	5.12	8.48
	Control	31	8.32º	2.06	0.37	7.57	9.08

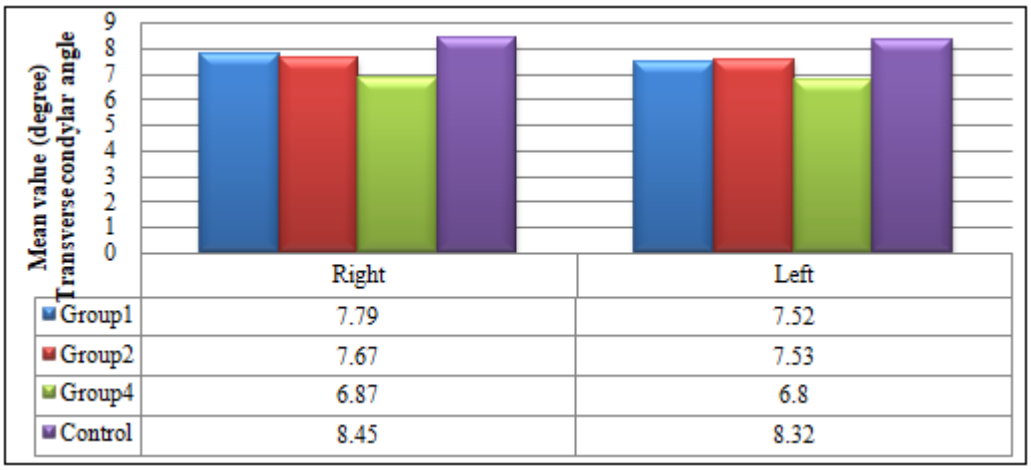

Figure 3: Charts transverse condylar angle at 5 mm parameter in the studied and control groups distributed in right and left sides

Results concerning right and left sides showed no significant differences (P>0.05)between all probable pairs in both sides, except a significant difference (P<0.05) between group 4 and control in the right side; (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	-0.660	0.288	NS
	Group2	Control	-0.780	0.317	NS
	Group4	Control	-1.580	0.045	S
Left	Group1	Control	-0.810	0.569	NS
	Group2	Control	-0.790	0.630	NS
	Group4	Control	-1.520	0.320	NS

(*) **S: Sig. at P<0.05: NS: Non Sig. at P>0.05**.

2. After treatment

The summary of statistics, as well as matched paired t-test for testing the mean values of transverse condylar angle at 5 mmbefore and after the treatment in different disordered groups using splint and laser compared to control; (Table 3).

The results showed no significant differences (P>0.05) for the studied disordered groups using splint and laser; except of transverse condylar angle at 5 mm of the right side using splint in group 2, showed significant difference(P<0.05).

Table (3): Matched paired t-test for testing differences in transverse condylar angle at 5 mm regarding splint and laser therapy

Groups	Parameters	Period	No.	Mean	SD	SE	MP (t-test)	Df	Sig. (*) (2-tailed)
Group1	TCA at 5mm right (Splint)	before	10	8.30º	3.090	0.980	-2.250	9	0.051 NS
		after	10	8.90º	3.000	0.950			
	TCA at 5mm left (Splint)	before	10	7.10º	2.470	0.780	-1.406	9	0.193 NS
		after	10	7.40º	2.370	0.750			
	TCA at 5mm right (Laser)	before	5	8.00º	2.120	0.950	-2.449	4	0.070 NS
		after	5	8.60º	1.670	0.750			
	TCA at 5mm left (Laser)	before	5	7.20º	2.170	0.970	-0.492	4	0.648 NS
		after	5	7.60º	0.890	0.400			
Group2	TCA at 5mm right (Splint)	before	10	6.90º	2.020	0.640	-2.449	9	0.037 S
		after	10	7.30º	1.770	0.560			
	TCA at 5mm left (Splint)	before	10	6.80º	1.620	0.510	-1.809	9	0.104 NS
		after	10	7.20º	1.870	0.590			
	TCA at 5mm right (Laser)	before	5	9.20º	1.790	0.800	0.408	4	0.704 NS
		after	5	9.00º	1.000	0.450			
	TCA at 5mm left (Laser)	before	5	9.00º	2.350	1.050	-2.449	4	0.070 NS
		after	5	9.60º	1.820	0.810			

Group4	TCA at 5mm right (Splint)	before	10	7.10º	2.510	0.800	-2.090	9	0.066 NS
		after	10	7.80º	2.530	0.800			
	TCA at 5mm left (Splint)	before	10	6.60º	2.370	0.750	-1.627	9	0.138 NS
		after	10	7.10º	2.180	0.690			
	TCA at 5mm right (Laser)	before	5	6.40º	3.130	1.400	-2.449	4	0.070 NS
		after	5	7.60º	2.610	1.170			
	TCA at 5mm left (Laser)	before	5	7.20º	4.380	1.960	-1.826	4	0.142 NS
		after	5	8.20º	3.900	1.740			

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

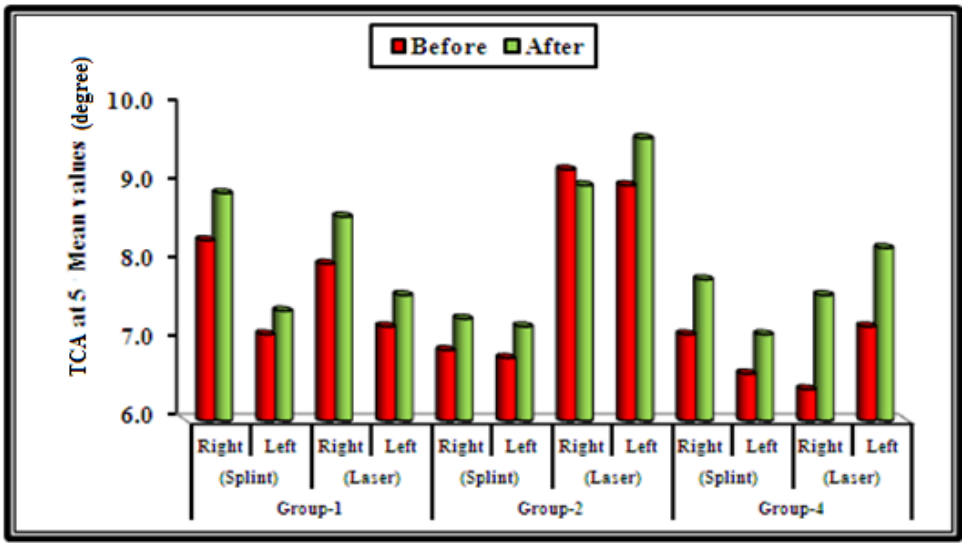

Figure 4: Chart of transverse condylar angle at 5mm mean values before and after treatment (splint and laser) in the disordered groups

4. Discussion

Bennett angle can be defined as an angle made between average pathway of progressing TMJ condyle as per seen in horizontal plane and sagittal plane throughout lateral movements of lower dental arch. [8]

The most common techniques for estimating Bennett angle and immediate mandibular lateral translation are interocclusal records using of different kinds of mandible recorded apparatus. [9,10,11]

Bernhardt *et al.*, (2003)[12] stated that measurements by Cadiax device offers more reliable in assessment of Bennett angle. More recently, Alkuhla and Al-Aswad (2017)[13] used Cadiax Compact II System in the measurement of Bennett angle.

In the present study the right Bennett angle in the control subjects was 8.45° and the left was 8.32°, this agrees with the results of many previous studies[8,13,14,15]and almost near to the result of Theusner *et al.*, (1993).[16]

This study showed that Bennett angle in symptomatic group is less than the control subject, however, non-significant difference, except for group 4 in the right side compared to control group. This agrees with the study done by Theusner *et al.*, (1993).[16] They demonstrated a higher Bennett angle in symptomatic-free group related to patients with TMDs by axiograph tracings device, this may be explained that the amount of tension applied on the articular joint disc, related ligaments and neuromuscular as well as degenerative osseous changes, all above mentioned might affect Bennett angle.

Up to our knowledge, there is no study performed on the measurement of Bennett angle before and after the treatment for patients with TMDs. However, the present study may be the first study to compare the Bennett angle before and after the uses of occlusal splints and laser therapy.

The present study demonstrated that the mean value of Bennett angle after the use of splint were higher than mean value before treatment in both right and left sided, except the left side in group 2 with a statistically non-significant differences. This may be explained that communal aim effect of occlusal splints is guarding on the articular disc of TMJ from stress that might cause disc displacement, in addition to reduce pain by producing constant balanced occlusion. Therefore, the relevant application process from the occlusal splints is often assist in permitting articular disc to get into anterior superior location above the condyle.

The present study demonstrated that the mean value of transverse condylar angle after laser therapy was higher than that before treatment in both right and left sided, except right side in group 2 with a statistically non-significant differences. This may be explained that laser therapy may be used in the treatment TMJ pain, . [17,18,19,20]laser may be used as a treatment option for patients with an interest in noninvasive, complementary therapy, however still conflicting idea, and much of this due to lack of dosage consensus used in treatment of the TMJ.

5. Conclusions

1) Bennett angle is different in disordered groups compared to control.
2) No significant differences between disordered groups either for using splint, or laser on Bennett angle.

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