

Occlusal Interferences Removal Influenced the Condylar Angular Inclination in Patients with TMJ Internal Derangement

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Abstract

The aim of the Study: is to discuss the role of occlusal interferences on angular condylar inclination in patients with TMJ internal derangement. And to demonstrated that the digital guiding of the selective digital occlusal adjustment (enameloplasty) are more accurate and time saving.

Materials and Methods: Eighty-four patients with full dentition and angle class I diagnosed with DC/TMD criteria, teeth contact registered digitally by using T-Scan NOVUS device, Cadiax Compact II axiographic device was used to control the Sagittal Condylar Inclination (SCI) and Bennett angle (BA) before and after occlusal interventions (occlusal adjustment and occlusal splint).

Results: Eighty-four patients (76.2% females: 23.8% male) were participated in this study with age range (19-45 years old), highly prevalence of occlusal interferences was reported. No significant differences in (SCI) before and after occlusal interventions, Bennett angle demonstrated a significant difference before and after occlusal interventions.

Conclusion: The Transverse Condyle Inclination (Bennett angle) highly influenced by the occluding teeth. Enameloplasty that had been done in this study showed significant effects on Bennett angle. Therefore, any full mouth rehabilitation should be carefully evaluated to avoid abnormal condylar inclination and result in abnormal joint structures relationship.

Key words: Cadiax, T-Scan, Occlusal interferences, condyle inclination, Bennett angle.

Introduction

Occlusion is the first and probably the most controversial etiologic factor of TMD. The presence of Working side interferences is considered by some authors to be a predisposing factor for disk displacement^{1,2}. Non-Working Side Interference are associated with an increased risk of bone loss, mobility and TMJ dysfunction³. Condylar

position may also play a significant role in the etiopathogenesis of TMJ disorders⁴.

Temporomandibular joints may be harmed especially in atypical protrusive interferences or by moving the mandible into a physiologically unsound position leading to muscle pain (myalgia)⁵. The premature or interfering contacts points are lead to destructive forces through the masticatory system

and result in parafunction effects such as clenching^{6,7}.

Quantitative occlusal analysis techniques have been developed to overcome the limitations of qualitative assessment, such as subjective interpretation. The T-Scan system accuracy for recording the results was confirmed by multiple accuracy studies^{8,9}. In addition, many researchers emphasise the importance of electronic axiography in differential diagnostics of mastication organ dysfunctions, through accuracy and precision of the measurement data obtained^{10,11,12}.

Materials and Methods

The participants were recruited from the attendants to the teaching clinic of oral medicine in the teaching hospital of College of Dentistry/ University of Baghdad the period from April 2019 to January 2020. The study protocol was approved by the ethical committee of the College of Dentistry/ University of Baghdad. An informed consent was obtained from the patients. According to the inclusion criteria and DC/TMD of Schiffman¹³ *et al.*, at 2014, eighty-four patients with TMJ internal derangement (disc displacement) of both genders were selected to participate in the present study.

Digital evaluation of occlusal interferences of all the included subjects was performed using the T-Scan occlusal imaging and analysis system (T-Scan NOVUS, Tekscan, Inc., S. Boston, MA, USA). TMJ axiographic evaluation was measured with Cadiax Compact II by (GAMMA Medizinisch-wissenschaftliche Fortbildungen) for

TMJ registration. These clinical examinations were done by one examiner supervised by special expert. The inclusion criteria were: subjects should have full dentition with Angle class I relation, with no signs and symptoms any systemic diseases.

Occlusal interventions included: Occlusal adjustment OA (enameloplasty) guided by T-scan¹⁴, and combination of occlusal splint (OS) and occlusal adjustment (OA). Occlusal splint also adjusted digitally by T-scan. The right and left sagittal condylar inclination (SCI) and Bennett angle (BA) were registered before occlusal interventions and after one month.

Statistical analysis: data analysis approaches were demonstrated by the application of the statistical package (SPSS) ver. (22.0). Descriptive data analysis presented in Mean value and Standard Deviation. Matched Paired-Samples T Test procedure compares the means of two variables for a single group. Likelihood Ratio test: Is assesses the goodness of fit of two competing statistical models. Significant at $P < 0.05$.

Results

Eighty-four subjects (76.2% females: 23.8% male) were participated in this study with age range (19-45 years old) had full dentition and angle class I. Table (1) is showing the distribution of the Occlusal Interferences in the TMJ ID group for different studied locations with comparison's significant through a contingency table, with comparison's significant using Likelihood Ratio test.

Table (1): Distribution of [Occlusal Interference test] in the studied groups among different studied locations with comparison’s significant

Group	Resp.	Centric Relation		Right Lateral				Left Lateral				Protrusion	
				W		N		W		N			
		No	%	No	%	No	%	No	%	No	%	No	%
TMD Group	No	3	4	74	88	28	33	75	89	28	33	23	27
	Yes	81	96	10	12	56	67	9	11	56	67	61	73
	Total	84	100	84	100	84	100	84	100	84	100	84	100
C.S. P-value		P=0.000 HS		P=0.000 HS		P=0.003 HS		P=0.000 HS		P=0.003 HS		P=0.000 HS	

(*) HS: High Significant at P<0.01; S: Significant at P< 0.05; NS: Non Significant at P> 0.05; [Testing based on Binomial test, and LRT: Likelihood Ratio test]. W: working side interference; N: non-working side occlusal interference

Occlusal interferences in all locations registered a highly significant difference at P<0.01. Table (2) is showing the summary statistics and comparisons significant concerning studied angular measurements of “RSCI, and LSCI” parameters in relative to different treatments, “OA and OA+OS”, before and after treatments.

Table (2): Summary statistics concerning studied angular “RSCG, and LSCG” in relative to effectiveness of studied treatments.

Parameters	Treatments	Period	Mean	SD	SE	MD	MP t-test	P-v. (*)
RSCI	OA	Before	49.15	7.83	1.75	-2.60	-1.43	0.168 NS
		After	51.75	6.06	1.36			
	OA+OS	Before	46.25	11.43	2.56	2.20	0.55	0.588 NS
		After	44.05	10.08	2.25			
LSCI	OA	Before	46.05	7.36	1.65	-0.35	-0.22	0.832 NS
		After	46.40	7.21	1.61			
	OA+OS	Before	43.25	8.48	1.90	-1.60	-0.74	0.471 NS
		After	44.85	7.93	1.77			

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

Test Statistics: Matched Paired t-test.

Results showed that there were no significant differences ($P>0.05$) for testing mean differences in relative to effectiveness of studied treatments, either in RSCG, or in LSCG angular. Table (3) shows summary statistics and comparisons significant concerning studied angular measurements of the “R BA, and LBA” in relative to different treatments, “OA and OA+OS”, before and after

treatments. Results shows that no significant differences were accounted at $P>0.05$ for testing mean differences in relative to effectiveness of combination treatment, either in RBA, or in LBA angular measurements, except highest level of change was associated with the application of “OA” treatment in relative to both RBA which registered a highly significant difference at $P<0.01$ and LBA which also registered a significant difference at $p<0.05$.

Table (3): Summary statistics concerning studied angular “RBA, and LBA” in relative to effectiveness of studied treatments

Parameters	Treatments	Period	Mean	SD	SE	MD	MP t-test	P-value
RBA	OA	Before	9.00	4.51	1.01	1.55	3.007	0.007 HS
		After	7.45	2.52	0.56			
	OA+OS	Before	7.60	3.87	0.87	1.40	1.986	0.062 NS
		After	6.20	1.96	0.44			
LBA	OA	Before	7.70	3.60	0.80	1.40	2.237	0.037 S
		After	6.30	2.39	0.53			
	OA+OS	Before	7.70	3.13	0.70	0.65	1.092	0.288 NS
		After	7.05	2.68	0.60			

(*) HS: Highly Sig. at $P<0.01$; NS: Non Sig. at $P>0.05$; Test Statistics: Matched Paired t-test; RBA: Right Bennett Angle; LBA: Left Bennett Angle.

Results showed that no significant differences were accounted at $P>0.05$ for testing mean differences in relative to effectiveness of combination treatment, either in RBA, or in LBA angular measurements, except highest level of

change was associated with the application of “OA” treatment in relative to both RBA which registered a highly significant difference at $P<0.01$ and LBA which also registered a significant difference at $p<0.05$.

Discussion

Some studies, however, have indicated that the role of occlusion in TMD is more important than generally accepted, especially in internal derangements of the temporomandibular joint (TMJ)^{15,16}. Few papers published which performed digital guided adjustment for both occlusal interventions modalities (enameloplasty and occlusal splints)^{17,14}. The use of the dynamic recording T-Scan device in the present study avoided many of the problems apparent when using static recording methods to observe occlusal contacts at different lateral mandibular positions. This study also in agreement with Jussila et al., (2018)¹⁸ study which documented that one of the common occlusal disturbances were interferences in working side mandibular movements. Non-working side interferences are highly destructive for joint and dental structure due to the amount and direction of force generated (Haralur, 2013)¹⁹. Huang et al., (2006)^{20,21} published two articles and documented that the presence of the occlusal interferences leads to changes of the condylar position during lateral movements of the lower jaw and lead the occurrence of a laterodeviating forces on the mandible.

Bennett movement is very critical because there is a continuous contact of the occlusal surfaces particularly during immediate side shift. Thus a laterosuperior movement of the rotating condyle will require shorter posterior cusps than will a straight lateral movement; likewise, lateroinferior movement will permit longer posterior cusp than will a straight lateral movement²².

Bennett angle that registered in the present study are similar to what reported in pervious study done by Schierz et al., in (2014)²³. The present study is one of the few papers to also assess Bennett angle. Although Payne in (1997), evaluated the components of BA, immediate side shift (in mm), and the angle of progressive side shift PPS. The mean PSS angles he found were about 6° with a range from 0.3- 12°. The mean of BA registered in the present study is consisted with Payne's PSS angles and others previous studies²⁴. Bennett angle registered a significant difference after the removal of occlusal interferences by the occlusal adjustment (enameloplasty) alone.

The statistical analyses of the present study were in agreement with study indicated that the range of SCI between (25 and 45°)^{29,30}. The present study demonstrated a higher mean of SCI in patients with TMJ internal derangement than that documented in previous study done by^{23,31} (Więckiewicz et al., 2014; Schierz et al., 2014). Correct understanding of dynamic occlusion is very critical in differentiating between the normal and pathological occlusal parameters. Sagittal condylar inclination showed a non-significant differences in the group patients whom received both occlusal interventions (OA+OS).

Conclusion

The horizontal condylar inclination highly influenced by the occluding teeth. Enameloplasty that had been done in this study showed a significant effect on Bennett angle in patients with TMJ internal derangement. Any full mouth rehabilitation, occlusal adjustment, should be carefully evaluated to avoid teeth contacts with occlusal interferences

that lead to abnormal condylar inclination and so result in abnormal joint structures relationship.

Ethical Clearance: The Research Ethical Committee at scientific research by ethical approval of both MOH and MOHSER in Iraq

Conflict of Interest: None

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