Using the Digital Occlusal Analysis (T-Scan NOVUS) in Diagnosis the MFDS in Iraqi Patients During Lateral Excursion Movements

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Abstract

The aim of the study is to evaluate the effectiveness of digital occlusal analysis (T- scan) in diagnosis the patients with MFDS during lateral excursion movements. Method and materials: participants with full dentition and angle class I relation. Patients diagnosed based on DC/TMD criteria, digital occlusal analysis including (disclusion time, occlusion time) registered by T-Scan NOVUS device during the excursion movements in both (Right and Left) sides. Results: Non-significant differences between the age groups, a significant differences between the gender groups and the females were more prevalent than the males, all the means values of occlusal parameters (disclusion time, occlusion time) were higher in MPDS patients group than healthy control group, Highly significant difference according (disclusion time, occlusion time) are documented between MPDS patients and the healthy control in lateral excursion movements (R & L). Conclusion: This study concluded, that the digital occlusal analysis measured by T scan Novus devise is a more accurate and objective method in diagnosis the patients with MPDS during lateral excursion movements.

Keywords: *Occlusion time, disclusion time, occlusal force, MFDS, T-scan, OT, DT, lateral excursion.*

Introduction

Myofascial pain is one of the most common types of chronic muloskeletal pain in clinical medicine[1,2]. A hyperirritable spot in a palpable taut band of skeletal muscle fibers, and having MTrPs is necessary to confirm the diagnosis of myofascial pain[3]. Several possible mechanisms can lead to the development of myofascial trigger points, including low-level muscle contractions, contractures, direct trauma, muscle overload, postural stress[4,5,6]. Dynamic stability in relation to the TMJ is the characteristic of the joint to achieve normal function[7].

T-Scan is a digital occlusion analysis system that records and measures tooth contact, force, and timing in real-time (8, 9 and 10). The Disclusion Time is defined as the duration of time that working and non-working molars and premolars are in contact during a mandibular excursive movement[11]. The more time taken for excursive movement (>0.4sec) leads to longer compression of the periodontal ligament, thereby leading to muscle hyperactivity[12]. The time reported from the first occlusal contact until reaching the maximum intercuspation is known as Occlusion Time (OT)[13]. According to the manufacturer, OT is recommended as less than 0.2 seconds[14, 15]. OT has been considered as a capable description of occlusion[16].

Method and Materials

This study was designed and conducted in the department of oral medicine in the teaching hospital of College of Dentistry/University of Baghdad in period from April 2019 to February 2020. The participants were selected according to the Diagnostic Criteria for Temporomandibular Disorders[17] after obtaining ethical approval from the institutional ethical committee and written informed consent. The participants completed

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a self-reported questionnaire, containing information about personal, medical, and dental histories.

Digital occlusal analysis including Disclusion time (DT) and Occlusion time (OT) registered using the T-Scan NOVUS system (T-Scan, Tekscan, Inc., S. Boston, MA, USA) system, shown in figure (1). Subjects with full dentition, Angle class I relation and no history of any systemic diseases related to both groups (patients and controls) which included in this study, while any patient has ongoing treatments or recently treated from TMJ disorders excluded from this study.

Analysis of data was carried out using the available statistical package of SPSS-25. The significance of difference of different means (quantitative data) were tested using Paired-t-test for difference of paired observations (or two dependent means. The significance of difference of different percentages (qualitative data) were tested using Pearson Chi-square test (c^2-test) with application of Yate's correction or Fisher Exact test whenever applicable. Statistical significance was considered whenever the P value was equal or less than 0.05.

Figure 1: T-Scan (Novus) device

Results

One hundred and ten (110) participant were included in this study with age range (18-43) years old and divided into two main groups: diseased group (show signs and symptoms of myofacial pain syndrom) with [85] patients and (25) healthy controlled free from signs and symptoms of MPDS. The male: female ratio of the DG was (17:68) and within the control group was (10:15). Table (1) showed the demographic characteristic of the study groups. There were no significant differences P>0.05 according to the age between the two study groups while according to gender this study reported a significant difference P≤0.05 and the females were more predominant than males.

Table (1) Demographic characteristic of the study groups.

		Diseased group		Control group		P value
		No	%	No	%	
Age (Years)	<20y	11	11.9	1	4.0	0.356 NS
	20---29	28	33.3	10	40.0	
	30---39	31	36.9	12	48.0	
	=>40y	15	17.9	2	8.0	
	Mean±SD (Range)	30.5±8.3		30.5±6.3		
Gender	Male	17	20.0	10	40.0	0.012 S
	Female	68	80.0	15	60.0	

*Significant difference between proportions using Pearson Chi-square test at 0.05 level,
NS: Non–Significant, SD: Standard Deviation, No: Number, % Percentage

Table (2) represented the descriptive Statistics of [Disclusion time test] parameter in the studied groups during lateral excursion movement (Right and left). The results showed the mean values in diseased group were higher than control group also a highly significant difference $P< 0.01$ has been documented between the diseased and control groups.

Table (2) Descriptive Statistics of [Discclusion time test] parameter in the studied groups distributed for different locations

Locations	Groups	No.	Mean	SD	P-vale [*]
Right Lateral	Diseased	85	0.54	0.45	0.020 S
	Control	25	0.15	0.14	
Left Lateral	Diseased	85	0.69	0.46	0.056 S
	Control	25	0.24	10.69	

NO: Number; S: significant P≤0.05

As shown in table (3) the occlusion time test parameter showed a significant difference $P≤0.05$ between the diseased group and control group during the excursion movements (R & L) and with average mean values higher in diseased group than control group.

Table (3) Descriptive Statistics of [Occlusion time test] parameter in the studied groups during lateral excursion movements (R & L)

Locations	Groups	No.	Mean	SD	P-vale [*]
Right Lateral	Diseased	85	0.57	0.39	0.053 S
	Control	25	0.10	0.28	
Left Lateral	Diseased	85	0.45	0.34	0.036 S
	Control	25	0.12	0.16	

S: Sig. at P<0.05, SD slandered deviation, NO: number

Discussion

This study illustrated that no differences P>0.05 in age groups while according to the gender a significant difference P≤0.05 was reported among studied groups. Also, the study showed MFDS is more common in females than males, with several studies registered a high prevalence of TMDs in females patients[18,19,20] which agree with current study. Pain intensity in women with TMD during the menstrual cycle was the highest and was associated with high concentrations of estrogen[21], this result was in agreement with other recent study reported by [22] that demonstrated the presence of estrogen receptors in women's TMJs changes metabolic functions, increasing ligament laxity. Other potential reasons include neurophysiologic and psychosocial reasons that result in more severe and more frequent pain in females than in males [23]. The finding of gender difference s associating with TMD pain symptoms supports the previous studies [24, 25]. The previous findings stated that TMD is most common among 20- to 40-year-olds [26, 27, 28], and these with agree the present study that showed a significant differences in TMD pain symptoms between age groups, but this study was in contrast with [29]. In certain cases of TMD or OFP, the etiology is at least partially related to occlusion in the form of excessive forces on individual teeth (high spots) or interferences to function [30]. These conditions can be readily detected by the T-Scan but not by just analyzing marks on the teeth [31]. The T-Scan measures both the relative force on each tooth and timing of the contacts, the practitioner can pinpoint any occlusal problem without guessing [32]. Prolonged excursive frictional contacts increase the total time PDL mechanoreceptors are compressed in excursive movements, where the PDL compression time is equal to the DT duration of that same excursion [33]. The more time the excursive interferences contact, the longer time the PDL are compressed, resulting in prolonged durations of masticatory muscle contractions [34]. The fact that mentioned above displayed in current study which all means of the diseased group were higher than the control group this agree with previous study documented by [35]. Ciavarella *et al.,* [36] illustrated that the prolonged disoclusion time, frequency of premature contacts and asymmetry in the occlusal force, intracapsular joint disorder lead to various temporomandibular joint related problems and this with agree with current study. Significantly longer disclusion time, higher posterior frictional contacts, and more TMD symptoms were observed in the post-orthodontic group, suggesting that orthodontic treatment increases posterior tooth friction. Computerized occlusal analysis is an objective diagnostic tool determining the quality of excursive movements following orthodontic treatment[37].

Specifically, Disclusion Time Reduction (DTR) of all molars and premolars to < 0.5 seconds per lateral excursion has been shown to reduce muscle hyperactivity levels and their related myogenous symptoms pre to post treatment. Different authors using this technique have reported statistically significant differences in Disclusion Time durations, muscle contraction levels, Time-to-Muscle Shutdown durations, and rapid muscular TMD symptom resolutions [38]. This study has considered occlusion time (OT) and has shown that the differences between healthy patients and those suffering from MPS were statistically highly significant and the average values of occlusion time were longer in comparison to the control group, The results of this study are similar to the results of studies carried out by Baldini, Nota and Cozza in Italy [39]: occlusion time longer by 0.18 s was recorded among investigative groups whereas the results were statistically significant,also is agree with Wang and Yin who reported average value of occlusion time was 1.36 ± 0.03 s longer than in the control group, whereas the average in patients with TMDs was as high as 2.05 ± 0.06 [40]. When compared between current study and Agne Dzingute *et al.,* [41] previous study was in contrary statically but is agree about the TMD group has the average value 0.045 s longer in comparison to the control group related to OT. The T scan results showed both occlusion time and disclusion time in the patients with TMD disorders are significantly extended than the normal subjects [42].

Conclusion

This study concluded, MPDS is more prevalent in the females than males, Occlusal parameters included (DT and OT) recorded by digital occlusal analysis (T-scan) showed with more average values in MFDS patients than the control group and a high significant difference P≤0.01 recorded between them. So the digital occlusal occlusal analysis measured by T scan Novus devise is a more accurate and objective method in diagnosis the patients with MPDS during lateral excursion movements.

Conflict of Interest: None

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Ethical Clearance: Not required

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