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The Effect of Temporomandibular Joint Disc Displacement Type on Jaw Function Limitation

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ABSTRACT

Aim: Temporomandibular joint disorder (TMD) present symptoms such as pain, swelling, clicking or crepitating sounds, limitations or blockages in jaw movements, and may even affect simple functions such as eating and speaking. This study aims to evaluate the impact of disc displacement type on jaw function in patients with TMD who suffer from disc displacement.

Material and Methods: This cohort study was conducted on patients with temporomandibular joint (TMJ) disc displacement. The independent variable was the type of disc displacement. The outcome variable was the scores on the Jaw Functional Limitation Scale-20 (JFLS-20). The covariates included the patient's age and pain score. Data collection methods were carried out using the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) guidelines and the JFLS-20 questionnaire, with pain levels also assessed using a visual analog scale. Data analysis was performed using ANOVA and Pearson Correlation tests, with a significance level set at 0.05.

Results: The study groups were formed by including 72 patients with disc displacement, while the control group was formed by including 28 healthy volunteers. The control group had lower JFLS-20 scores than the disc displacement groups($p<0.05$). Although there was no statistically significant difference in JLFS-20 scores between the disc displacement groups, disc displacement with reduction group had significantly lower pain scores than both disc displacement without reduction groups($p<0.05$).

Conclusion: It was observed that individuals with disc displacement experience restricted jaw functions, and this limitation is not affected differently by the various subtypes of disc displacement.

Temporomandibular Eklem Disk Deplasman Türünün Çene Fonksiyon Kısıtlılığı Üzerine Etkisi

Makale Bilgisi

Makale Geçmişi

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Çene Bozuklukları,
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ÖZET

Amaç: Temporomandibular eklem bozukluğu (TMB), ağrı, şişlik, klik veya krepitasyon sesleri, çene hareketlerinde kısıtlılık veya blokaj gibi semptomlar gösterir ve hatta yemek yeme ve konuşma gibi basit işlevleri etkileyebilir. Bu çalışma, disk deplasmanı olan TMB hastalarında disk deplasman tipinin çene işlevi üzerindeki etkisini değerlendirmeyi amaçlamaktadır.

Gereç ve Yöntem: Bu kohort çalışması, temporomandibular eklemde (TME) disk deplasmanı olan hastalar üzerinden yapıldı. Bağımsız değişken, disk deplasmanının tipiydi. Sonuç değişkeni, Çene Fonksiyonel Kısıtlama Ölçeği-20 (JFLS-20) puanlarıydı. Ortak değişkenler hastanın yaşı ve ağrı skoruydu. Veri toplama yöntemleri, Temporomandibular Disfonksiyon/ Tanı Kriterleri (TMD/TK) talimatları ve JFLS-20 anketi kullanılarak gerçekleştirilmiş, ayrıca ağrı seviyeleri görsel analog ölçeği ile değerlendirilmiştir. Veri analizi, ANOVA testi ve Pearson Korelasyon testi kullanılarak gerçekleştirilmiş ve anlamlılık düzeyi 0.05 olarak kabul edilmiştir.

Bulgular: Disk deplasmanı olan 72 hasta ile çalışma grupları, 28 sağlıklı gönüllü ile kontrol grubu oluşturuldu. Kontrol grubu, disk deplasman gruplarına göre daha düşük JFLS-20 puanlarına sahipti ($p<0,05$). Disk deplasmanlı gruplar arasında JLFS-20 skorları açısından istatistiksel olarak anlamlı bir fark bulunmamakla birlikte, redüksiyonlu disk deplasmanlı grup, redüksiyonsuz disk deplasmanlı gruplara göre anlamlı derecede daha düşük ağrı skorlarına sahipti ($p<0,05$).

Sonuç: Disk deplasmanı olan bireylerin çene fonksiyonlarında kısıtlılık yaşadıkları ve bu kısıtlılığın disk deplasmanının çeşitli alt tiplerinden farklı şekilde etkilenmediği görülmüştür.

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INTRODUCTION

Temporomandibular joint disorder (TMD) is characterized by abnormal functioning or disease of the two joints that control the movements of the jaw and face, as well as the muscles, tendons, and other tissues surrounding these joints.[1,2] These disorders present symptoms such as pain, swelling, clicking or crepitating sounds, limitations or blockages in jaw movements, and may even affect simple functions such as eating and speaking.[3–5]

For the clinical classification of TMDs, numerous disciplines, particularly surgeons, dentists, orthodontists, prosthodontists, radiologists, and physiotherapists have conducted studies. While Peck et al. [6] classification is one of the most important outcomes of these efforts, Schiffman et al. [7] Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) is the most current clinical diagnostic criteria. Both publications evaluate the displacements of the temporomandibular joint (TMJ) disc under four main headings: disc displacement with reduction (DDwR), DDwR with intermittent locking, disc displacement without reduction (DDwoR) with limited opening, and DDwoR without limited opening. Although the literature has generally examined the effects of TMJ disc displacement on the amount of maximal mouth opening, there is limited information on the degree to which different types of disc displacement affect jaw functions.

This study aims to evaluate the impact of disc displacement type on jaw function in patients with TMD who suffer from disc displacement. The first hypothesis of the study posits that individuals with disc displacement will have more limited jaw functions compared to those without TMD. The second hypothesis suggests that the various types of disc displacement will have differing degrees of impact on jaw functions.

MATERIAL AND METHODS

Study sample and design

This study was approved by local ethics committee on 02.03.2023 with the number 23-KAEK-037 and was conducted in accordance with the Declaration of Helsinki. After obtaining written and verbal consent from all participants who agreed to participate in the study, they were included in the study. It is a retrospective cohort study that involves clinical examination protocols administered to patients seeking treatment for TMJ pain at the Tokat Gaziosmanpaşa University Faculty of Dentistry Oral and Maxillofacial Surgery Clinic, as well as to volunteers without TMD. This cohort study was conducted and reported in accordance with the CONSORT guidelines.The inclusion criteria for this study were as follows: (I) between the ages of 18 and 65, (II) for the study group, having the same type of disc displacement on both sides, and (III) for the control group, patients without TMD or any pain in the head and neck region. The exclusion criteria were: (I) patients with asymmetrically affected TMJs, (such as right TMJ DDwR and left TMJ DDwoR with limited opening), (II) patients with Degenerative Joint Disease, (III) patients with subluxation, and (IV) patients with muscle pain only.

Study variables

The independent variable was the type of disc displacement. The type of disc displacement was determined by applying the DC/TMD criteria. DC/TMD was published in 2014 by Schiffman et al. [7] This assessment tool consists of internal parts, namely Axis-I and Axis-II. Axis-I usually includes physical examination tools to determine the type of TMD, while Axis-II includes pain scales, health questionnaires, and psychosocial questionnaires. The study group, consisting of patients with TMD, underwent DC/TMD instructions and were subsequently divided into 4 groups: DDwoR with limited opening,

DDwoR without limited opening, DDwR, and DDwR with intermittent locking. Additionally, the DC/TMD instructions were administered to healthy volunteers who did not report any TMD complaints. After confirming that they did not have TMD, a control group was formed.

The outcome variable was the Jaw Functional Limitation Scale-20 (JFLS-20) scores. The validation studies for the JFLS-20 were completed and published by Ohrbach et al.[8] in 2008. The JFLS-20 is a TMJ-specific tool that assesses limitations in chewing, jaw mobility, and verbal and emotional expression. It consists of three constructs and uses a 0 (No Restriction) to 10 (Serious Restriction) VAS with a total of 20 questions. This tool was used to evaluate the jaw function of patients with TMD in this study. Scoring is based on the average score of the first 6 questions for *mastication*, the average score of 7-10 questions for *mobility*, the average score of 13-20 questions for *communication*, and the average score of all questions for *global*. Additionally, a visual analog scale (VAS) scale from 0 to 10 was used to determine the patient's pain level. The covariates were the patient's age and pain score.

Data collection methods

DC/TMD instructions were applied twice to both the study and control groups by a researcher who was an oral and maxillofacial surgeon, and the type of disc displacement was determined. The JFLS-20 questionnaire and VAS for pain were completed by the patient.

Power analysis

A pilot study was conducted with 5 patients in each group to calculate the sample size. In the analysis using the G-Power program based on the average scores of the Global JFLS-20 for the groups, with a significance level (α) of 0.05 and power (1-β) of 0.95, an effect size of 0.7483315 was observed, and the minimum required sample size was calculated to be 20 per group, totaling 40. Considering potential data losses, the sample size was kept larger than the calculated value.

Data analysis

The n (%) format was used to represent categorical variables, and the ± standard deviation format for continuous variables. The ANOVA test was used to compare multiple groups because the data were normally distributed and homogenous. Post hoc analyses were performed using the Bonferroni test. To assess the correlation between two continuous variables, a Pearson Correlation test was utilized, and significance was defined as a p-value lower than 0,05.

RESULTS

Following the application of the inclusion and exclusion criteria, 72 out of 128 patients with TMD were included in the study as the study group. Furthermore, after applying the DC/TMD to 30 volunteers, it was observed that 2 individuals had unilateral DDwR, and they were subsequently removed, resulting in the formation of a control group consisting of 28 individuals. The Table 1 shows the disc displacement types, JFLS-20 scores, and pain scores.

Table 2 shows that there was no statistically significant difference between the groups in terms of age ($p=0,492$). However, there was a significant difference between the groups in terms of JFLS-20 scores and VAS scores ($p<0,05$).

Post hoc analyzes as shown in Table 3 were used to identify the differentiated group. The control group had lower scores than the disc displacement groups ($p<0,05$). Although there was no statistically significant difference in JLFS-20 scores between the disc displacement groups, DDwR group had significantly lower pain scores than both DDwoR groups (with and without limited mouth opening) ($p<0,05$).

Table 1. Distribution of disc displacement status, Jaw Functional Limitation Scale -20 scores and VAS pain scores

		Age		JFLS-20 Mastication		JFLS-20 Mobility		JFLS-20 Communication		JFLS-20 Global		Pain VAS Score	
	n (%)	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Normal	28 (21.9)	28.79	9.02	0.55	0.31	0.69	0.41	0.28	0.10	0.51	0.27	0.39	0.49
DDwR	49 (38.3)	27.94	10.33	3.24	2.06	3.96	2.51	2.15	2.01	3.08	1.81	3.26	2.08
DDwR with intermittent locking	11 (8.6)	24.18	6.11	2.50	2.34	4.11	3.19	2.86	2.79	3.12	2.41	4.09	3.53
DDwoR with limited opening	28 (21.9)	26.61	7.52	3.93	2.08	5.37	2.41	2.78	2.03	3.74	1.72	5.82	2.51
DDwoR without limited opening	12 (9.4)	30.42	10.94	3.24	1.80	3.54	2.84	1.26	1.43	2.48	1.63	5.33	2.70
Total	100 (100.0)	27.74	9.23	2.74	2.18	3.52	2.79	1.86	2.02	2.61	1.98	3.46	2.88

Table 2. Results of Anova analysis

	Sum of Squares	df	Mean Square	F	Sig.
Age	293.730	4	73.432	0.857	0.492
JFLS-20 Mastication	190.291	4	47.573	14.087	0.000
JFLS-20 Mobility	332.898	4	83.224	15.583	0.000
JFLS-20 Communication	112.795	4	28.199	8.488	0.000
JFLS-20 Global	173.489	4	43.372	16.222	0.000
Pain VAS Score	467.892	4	116.973	24.307	0.000

Table 3. Results of Bonferroni post hoc analysis applied to examine the difference between groups

	(I) Type of Disk Disorder	(J) Type of Disk Disorder	Mean Difference (I-J)	Std, Error	Sig,	95% Confidence Interval	
						Lower Bound	Upper Bound
JFLS-20 Mastication	Normal	DDwR	-2.69133*	0.43536	**0.000**	-3.9358	-1.4468
		DDwR with intermittent locking	-1.95110*	0.65393	**0.034**	-3.8204	-0.0818
		DDwoR with limited opening	-3.38607*	0.49115	**0.000**	-4.7900	-1.9821
		DDwoR without limited opening	-2.69012*	0.63407	**0.000**	-4.5026	-0.8776
	DDwR	DDwR with intermittent locking	0.74022	0.61314	1.000	-1.0125	2.4929
		DDwoR with limited opening	-0.69474	0.43536	1.000	-1.9392	0.5497
		DDwoR without limited opening	0.00121	0.59191	1.000	-1.6908	1.6932
	DDwR with intermittent locking	DDwoR with limited opening	-1.43497	0.65393	0.301	-3.3043	0.4343
		DDwoR without limited opening	-0.73902	0.76710	1.000	-2.9318	1.4538
	DDwoR with limited opening	DDwoR without limited opening	0.69595	0.63407	1.000	-1.1166	2.5085
JFLS-20 Mobility	Normal	DDwR	-3.26439*	0.54748	**0.000**	-4.8294	-1.6994
		DDwR with intermittent locking	-3.41721*	0.82236	**0.001**	-5.7680	-1.0665
		DDwoR with limited opening	-4.67786*	0.61764	**0.000**	-6.4434	-2.9123
		DDwoR without limited opening	-2.84524*	0.79738	**0.005**	-5.1246	-0.5659
	DDwR	DDwR with intermittent locking	-0.15282	0.77105	1.000	-2.3569	2.0513
		DDwoR with limited opening	-1.41347	0.54748	0.110	-2.9785	0.1515
		DDwoR without limited opening	0.41915	0.74435	1.000	-1.7086	2.5469
	DDwR with intermittent locking	DDwoR with limited opening	-1.26065	0.82236	1.000	-3.6114	1.0901
		DDwoR without limited opening	0.57197	0.96467	1.000	-2.1856	3.3295
	DDwoR with limited opening	DDwoR without limited opening	1.83262	0.79738	0.232	-.4467	4.1120
JFLS-20 Communication	Normal	DDwR	-1.87388*	0.43180	**0.000**	-3.1082	-0.6396
		DDwR with intermittent locking	-2.57429*	0.64859	**0.001**	-4.4283	-0.7203
		DDwoR with limited opening	-2.49536*	0.48714	**0.000**	-3.8879	-1.1029
		DDwoR without limited opening	-0.97929	0.62889	1.000	-2.7770	0.8184
	DDwR	DDwR with intermittent locking	-0.70041	0.60813	1.000	-2.4388	1.0380

		DDwoR with limited opening	-0.62148	0.43180	1.000	-1.8558	0.6128
		DDwoR without limited opening	0.89459	0.58707	1.000	-0.7836	2.5728
	DDwR with intermittent locking	DDwoR with limited opening	0.07893	0.64859	1.000	-1.7751	1.9330
		DDwoR without limited opening	1.59500	0.76084	0.381	-0.5799	3.7699
	DDwoR with limited opening	DDwoR without limited opening	1.51607	0.62889	0.174	-0.2816	3.3138
JFLS-20 Global	Normal	DDwR	-2.56981*	0.38737	**0.000**	-3.6771	-1.4625
		DDwR with intermittent locking	-2.61070*	0.58185	**0.000**	-4.2739	-0.9475
		DDwoR with limited opening	-3.23583*	0.43701	**0.000**	-4.4850	-1.9866
		DDwoR without limited opening	-1.97048*	0.56417	**0.007**	-3.5832	-0.3578
	DDwR	DDwR with intermittent locking	-0.04089	0.54555	1.000	-1.6004	1.5186
		DDwoR with limited opening	-0.66602	0.38737	0.881	-1.7733	0.4413
		DDwoR without limited opening	0.59934	0.52666	1.000	-0.9061	2.1048
	DDwR with intermittent locking	DDwoR with limited opening	-0.62513	0.58185	1.000	-2.2884	1.0381
		DDwoR without limited opening	0.64023	0.68254	1.000	-1.3109	2.5913
	DDwoR with limited opening	DDwoR without limited opening	1.26536	0.56417	0.267	-0.3474	2.8781
Pain VAS Score	Normal	DDwR	-2.87245*	0.51969	**0.000**	-4.3580	-1.3869
		DDwR with intermittent locking	-3.69805*	0.78061	**0.000**	-5.9295	-1.4666
		DDwoR with limited opening	-5.42857*	0.58629	**0.000**	-7.1045	-3.7526
		DDwoR without limited opening	-4.94048*	0.75690	**0.000**	-7.1041	-2.7768
	DDwR	DDwR with intermittent locking	-0.82560	0.73191	1.000	-2.9178	1.2666
		DDwoR with limited opening	-2.55612*	0.51969	**0.000**	-4.0417	-1.0706
		DDwoR without limited opening	-2.06803*	0.70657	**0.041**	-4.0878	-0.0483
	DDwR with intermittent locking	DDwoR with limited opening	-1.73052	0.78061	0.285	-3.9619	0.5009
		DDwoR without limited opening	-1.24242	0.91570	1.000	-3.8600	1.3752
	DDwo with limited opening	DDwoR without limited opening	0.48810	0.75690	1.000	-1.6755	2.6517

The relationship between the parameters was evaluated with the Pearson Correlation test. A statistically significant positive correlation was observed between all parameters including JFLS-20 scores and pain scores (Table 4) (p<0,0001).

Table 4. Evaluation of the relationship between parameters with Pearson Correlation test

		JFLS-20 Mastication	JFLS-20 Mobility	JFLS-20 Communication	JFLS-20 Global	Pain VAS Score
JFLS-20 Mastication	r	1	0.658*	0.653*	0.843*	0.451*
	p		0.000	0.000	0.000	0.000
JFLS-20 Mobility	r	0.658*	1	0.553*	0.828*	0.530*
	p	0.000		0.000	0.000	0.000
JFLS-20 Communication	r	0.653*	0.553*	1	0.861*	0.466*
	p	0.000	0.000		0.000	0.000
JFLS-20 Global	r	0.843*	0.828*	0.861*	1	0.551*
	p	0.000	0.000	0.000		0.000
Pain VAS Score	r	0.451*	0.530*	0.466*	0.551*	1
	p	0.000	0.000	0.000	0.000	

*. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

Disc displacement, which is a common type of TMD, can lead to many jaw dysfunctions, such as joint sounds, pain, and limited movement.[7,9,10] This study aimed to investigate the impact of different types of disc displacement on jaw functions in patients suffering from TMD. The study had two hypotheses, the first of which stated that individuals with disc displacement would have more limited jaw functions than those without TMD, while the second hypothesis predicted that different types of disc displacement would affect jaw functions to

varying degrees. Although the results supported the first hypothesis, the second hypothesis was rejected.

Regarding limitations in jaw function (JFLS-20), there were statistically significant differences between the control group and the disc displacement groups. Participants in the control group had lower scores throughout the questionnaire, indicating no functional limitations in their jaw movements. Conversely, the disc displacement groups had scores over 4 times higher than the healthy control group, indicating a functional limitation, although they did not completely lose their vertical jaw movements. Analysis of the JFLS-20 chewing scores showed that chewing hard foods was challenging for these patients, while they reported less difficulty chewing soft foods. There was no significant difference in functional limitation between the disc displacement groups, regardless of the type of disc displacement, with or without reduction.

Regarding pain scores, which are one of the most important clinical findings in patients with TMD [11,12], patients with DDwR had significantly less pain than patients with DDwoR. However, pain in the 'DDwR with intermittent locking' group, which is a transitional phase from DDwR to DDwoR[6,7], did not differ from the other groups. It is important to investigate the intermittent locking status in patients with DDwR during clinical examination and, if present, evaluate the necessary treatment protocols to prevent the problem from progressing further.

In the literature, most studies on TMDs or disc displacements have typically assessed jaw function using quantitative parameters such as pain, maximal mouth opening, and lateral range of motion.[13–16] However, it is important to consider that jaw function involves more than just these quantitative parameters. Eating, drinking, laughing, and talking are all integral parts of social life that involve jaw movements. Therefore, it was considered important to evaluate the social aspect of jaw function using the questions in the JFLS-20 questionnaire in this study, as it is a suitable tool for this purpose. The questionnaire allowed us to evaluate the limitations in jaw function experienced by patients with TMDs in a more comprehensive manner.

Ohrbach et al. [8] and Lövgren et al. [17] reported higher JFLS-20 results and pain scores in the group with chronic TMD, similar to our study, in their study comparing the clinical findings of patients with chronic TMD with the control group. Kim and Kim [18] evaluated patients with TMD in three groups as patients with muscle, joint, and muscle-joint combined disorders and reported that there was no significant difference between the JFLS-20 scores of these patients. In other studies using the JFLS-20 scoring, it has been reported that patients with TMD have higher scores than healthy individuals.[19–21] In these studies, TMD was generally evaluated as a single disorder, and the analyses were not detailed by examining the subtypes of disc displacement. In their meta-analysis study, Dinsdale et al. [22] evaluated jaw range of motion, muscle function, and proprioception impairment in patients with permanent TMD and reported that these factors may be related to TMD, but there is uncertainty in subgroups of TMD and new studies are needed in this area.

This study has several limitations. The first limitation, the type of disc displacement, was determined using the DC/TMD instrument only. Magnetic resonance imaging could be used for definitive diagnosis, but no additional radiological diagnosis was made, as previous studies [1,3,7] have confirmed that DC/TMD is a rapid and reliable tool for the clinical diagnosis of disc displacements.[7] The second limitation was the limitation of jaw functions, which was determined by the patients' self-scores. This may have caused the patient to give more restraint or pain scores than their current condition. In order to

minimize this effect, the questionnaires were explained to the patient in detail and a long time frame was given for scoring without any time limit.

CONCLUSION

As a result, it was observed that individuals with disc displacement experience restricted jaw functions, and this limitation is not affected differently by the various subtypes of disc displacement. Furthermore, the pain status may vary depending on the type of disc displacement. To determine the level at which subtypes of temporomandibular disorders affect jaw functions and to identify potential differences between them, it is recommended to conduct large-scale studies that include all subtypes of temporomandibular disorders.

Ethical Approval

This study was approved by Tokat Gaziosmanpaşa University Clinical Research Ethics Committee on 02.03.2023 with ethics committee number 23-KAEK-037.

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Conflict of Interest

The authors declare that they have no competing interests.

Author Contributions

Design: YB, Data collection or data entry: YB, Analysis and interpretation: YB, Literature review: YB, Writing: YB.

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