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The effect of temporomandibular joint disorder on postural disorders

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Abstract
Aim: The aim of this study is to investigate the dysfunction of posture complaints in patients receiving temporomandibular joint disorders (TMJD) diagnosis.
Material and Methods: The study group consisted of 25 TMJD patients and 25 matched controls. Demographic data of all participants were recorded. Tender points were assessed by the digital thumb palpation method applied to specific muscle points, and the number of the tender points was recorded. The postural assessment was performed with The New York Posture Rating (NYPR).
Results: The number of tender points in the anterior and lateral regions was significantly higher in the TMJD group, in opposite, in posterior there was a significantly higher tender point in the control group ($p<0.05$). There was no significant difference between the groups in the total number of tender points ($p>0.05$). NYPR total score the head, shoulder, spine, hip, foot, neck, chest, shoulder lateral, upper back, upper body, abdomen, low back postures in TMJD group were more disordered than the control group. Also, the NYPR total score of the TMJD group was found to be significantly lower than the control group ($p<0.05$).
Discussion: According to our results, TMJD is related to head, neck, shoulder, chest, upper-lower back, trunk, abdomen, and ankle. Although the evidence presented in the literature shows that the relationship between TMJDs and posture is still controversial and unclear, we obtained similar results with the literature using other postural assessment methods. Thus, taking into account the advantages of the New York Posture Rating Scale, we conclude that this is a clinical method that can be used as a guide in the detection of TMJD and associated postural alterations.

Keywords
TMJD; Temporomandibular dysfunction; Posture

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Introduction

The posture of the human body has been extensively studied because of the effects of the position changes. Alterations in the human posture may also lead to misuse of the body, such as normal structure and functioning deviations. When these changes in normal posture are persistent, they can result in pain and disability.

Postural alterations can affect body systems, including the stomatognathic system. A close association between posture disorder and craniomandibular disorder has been described. For example, hyperactivity of the back neck and shoulder muscles is required to prevent falling of head in anterior position. This hyperactivation can cause fatigue, discomfort ,and activation of trigger points [1].

Temporomandibular joint (TMJ) disorders (TMJD) are musculoskeletal disorders that affect the masticatory muscles, jaw joints, and related structures and are common in the community [1, 2]. Common symptoms include pain in the oropharyngeal region, limitation in jaw movement, and sounds from the temporomandibular joint, as well as head and ear pain, tooth pain, and vertigo [1-3]. Factors that are effective in the etiology of temporomandibular joint disorders are psychological, neuromuscular, and anatomic causes [4]. Systemic factors have also affected temporomandibular joint disorders and generalized joint hypermobility is a systemic factor associated with temporomandibular joint disorders [5].

Body posture in temporomandibular joint disorders is often described as a neglected risk factor [6]. TMJD is not only related to the position of the jaw and skull; other structures (e.g. cervical spine, suprahyoid and infrahyoid structures, shoulders and thoracolumbar spine) are also associated with TMJD [7]. TMJ is directly related to the biomechanics of cervical and scapular structures due to the common neuromuscular system. Postural alterations in the vertebrae may cause disorders in the TMJ, as well as disorders in the TMJ, may cause postural alterations [6]. The aim of this study is to investigate the dysfunction of posture complaints in patients receiving TMJD diagnosis.

Material and Methods

The study was approved and conducted at Haliç University. All subjects voluntarily agreed to participate in the study and signed an informed consent form. The study group consisted of 25 TMJD patients and 25 matched controls.

The inclusion criteria were determined as follows: between 18 and 45 years of age, muscle sensitivity and pain, alterations in jaw movements and limitation, hearing of jaw joint sounds and disorder of chewing pattern. Patients with traumatic injuries after accidents and injuries other than the diagnosed disease, those who had radiotherapy treatment and who had a congenital disorder in the jaw joint were excluded from the study.

Demographic data of all participants were recorded. Tender points were assessed by the digital thumb palpation method applied to specific muscle points (approximately the amount of pressure required to blanch the examiner's nail), and the number of the tender points was recorded. The postural assessment was performed with 'The New York Posture Rating (NYPR)'. In this evaluation system, posture alterations that may occur in 13 different parts of the body were followed and scored. According to this, if the posture is normal, five (5) points are given, moderate disorder was given three (3) points, and severe disorder was given (1) point . The total score of the test result is a maximum of 65, a minimum of 13. The standard evaluation criteria developed for this test were "very good" if the total score was 45, "good" for 40-44, "medium" for 30-39, "weak" for 20-29 and "bad" for <=19 (12-13).

Statistical analysis

Statistical analyses were performed using the Windows-based SPSS 24.0 statistical package program. Mean ± standard deviation (X ± S) and the percentage (%) value were calculated. When comparing dichotomic categorical data, we used the non-parametric Chi-Squared and the Fisher's Exact tests. The level of significance was determined as $p<0.05$.

Results

The TMJD group consisted of 22 male and 3 female participants, control group consist of 16 male and 9 female participants. The mean age was found to be 32.24 ± 11.00 for the TMJD group and 30.04 ± 8.82 for the control group. There was no significant difference between TMJD and control group in terms of age ($p=0.676$).

The comparison of tender points was given in Table 1. The number of tender points in the anterior ($p=0.021$) and lateral ($p=0.032$) regions was significantly higher in the TMJD group while in posterior there was a significantly higher tender point in the control group ($p= 0.043$). There was no significant difference between the groups in the total number of tender points ($p=0.391$).

According to the NYPR total score, the head, shoulder, spine, hip, foot, neck, chest, shoulder lateral, upper back, upper body, abdomen, low back postures were more disordered than the control group. Also, the NYPR total score of the TMJD group was found to be significantly lower than the control group (Table 2).

Table 1. Tender points of groups

	TMJD group	Control group	p*
Anterior tender point number	2.76±1.23	1.96±0.93	0.210
Posterior tender point number	2.28±1.40	2.88±0.78	0.043
Lateral tender point number	2.72±1.79	1.68±0.90	0.032
Total tender point number	7.76±3.76	6.52±1.87	0.391

*Mann Whitney-U test
Values are given as mean ± standard deviation.

Discussion

The main purpose of our study was to evaluate the association between postural alterations and TMJD. There is ample research in the literature regarding posture alterations and TMJD; there are many differences such as sample groups, postural evaluation methods, and evaluated postural segments. Despite these studies, there is a debate on the relationship between posture alterations and TMJD. In the current study, we used the New York Posture Rating Scale for assessment of postural

Table 2. Group comparison of postural disorder

	TMJD group (n)	Control group (n)	p*
Head posture			
Advanced disordered	3 (%12)	0	
Mild disordered	12 (%48)	2(%8)	0.00
Normal	10 (%40)	23(%92)	
Shoulder posture			
Advanced disordered	3(%12)	0	
Mild disordered	13(%52)	4(%16)	0.02
Normal	9(%36)	21(%84)	
Spine posture			
Advanced disordered	2(%8)	0	
Mild disordered	13(%52)	2(%8)	0.001
Normal	10(%40)	23(%92)	
Hip posture			
Advanced disordered	0	0	
Mild disordered	14(%56)	2(%8)	0.001
Normal	11(%44)	23(%92)	
Foot posture			
Advanced disordered	3(%12)	8(%32)	
Mild disordered	12(%48)	2(%8)	0.005
Normal	10(%40)	15(%60)	
Foot arch			
Advanced disordered	1(%4)	2(%8)	
Mild disordered	2(%8)	3(%12)	0.73
Normal	22(%88)	20(%80)	
Neck posture			
Advanced disordered	14(%56)	1(%4)	
Mild disordered	10(%40)	23(%92)	0.00
Normal	1(%4)	1(%4)	
Chest posture			
Advanced disordered	14(%56)	1(%4)	
Mild disordered	8(%32)	22(%88)	0.00
Normal	3(%12)	2(%8)	
Shoulder lateral posture			
Advanced disordered	12(%48)	1(%4)	
Mild disordered	12(%48)	11(%44)	0.00
Normal	1(%4)	13(%52)	
Upper back posture			
Advanced disordered	11(%44)	1(%4)	
Mild disordered	10(%40)	1(%4)	0.00
Normal	4(%16)	23(%92)	
Trunk posture			
Advanced disordered	16(%64)	1(%4)	
Mild disordered	8(%32)	3(%12)	0.00
Normal	1(%4)	21(%84)	
Abdominal posture			
Advanced disordered	17(%68)	2(%8)	
Mild disordered	3(%12)	5(%20)	0.00
Normal	5(%20)	18(%72)	
Lumbar posture			
Advanced disordered	17(%68)	5(%20)	
Mild disordered	5(%20)	1(%4)	0.00
Normal	3(%12)	19(%76)	
	TMJD group	**Control group**	**p****
NYPR Total score	37.16±7.80854	55±6.35085	0.00

*Chi-squared test**Mann-Whitney-U test
SD: Standard Deviation; NYPR: New York Posture Rating; TMJD: Temporomandibular Joint Disorders

alterations in the subjects with TMJD and healthy matches. According to the statistical results of our study, TMJD is related to head, neck, shoulder, chest, upper-lower back, trunk, abdomen, and ankle. On the other hand, TMJD is not related to spine, hip, and foot arch. The relationship between cervical, head, and shoulders region postural alterations was expected due to the mechanism of biomechanical adaptation of temporomandibular muscles in this region [8]. In many studies, the relationship between TMJD and the postural alterations of the upper body quadrant has been demonstrated [9]. The muscles of the stomatognathic system and the cervical region muscles are closely related. If the musculoskeletal system is thought to consist of various integrated muscle chains, any discomfort in a body segment will lead to the reorganization of other parts. This excellent adjustment of posture control leads to alteration and realignment of the body. Deviations in the lower extremities may interfere with the postural organization and affect the head and neck posterior. However, there was no relationship between TMJD and spine, hip and foot arch in the current study. Similar to our study, Chaves et al. found no correlation between postural changes in spine, hip and lower limbs [7]. Also, Saito et al. suggested no relationship between TMJD and foot longitudinal arch [8].

Postural assessments in our study confirmed the findings of previous studies, which revealed TMJD related alterations in body posture, particularly in head, neck, shoulder and upper back. These deviations seem to confirm the relationship between the position of the TMJD and other body parts. Our results support the theory that a deviation in one joint subunit may lead to compensations in other joints. However, the key point of our study is the assessment method. The New York Posture Rating Scale is clinically practical, time-consuming, and inexpensive method of postural assessment. Many studies have been conducted on the relationship between TMJD and posture that required expensive equipment such as three-dimensional ultrasonography, photographic, and radiographic methods. In the study by Saddu et al., both photographic and radiographic methods were used to evaluate head and craniocervical posture among individuals with and without TMJD. According to the results of this study, head and cervical posture did not influence the occurrence of TMJD [9]. Uritani et al. suggested that TMJDs in young females are associated with the head position relative to the trunk as the result of ultrasound-based 3D motion analyzer assessment [10]. Other methods used in the literature to investigate the relationship between TMJD and head-neck posture were magnetic resonance imaging (MRI), teleradiographs and questionnaires [7, 11].

In conclusion, according to our results, TMJD is related to head, neck, shoulder, chest, upper-lower back, trunk, abdomen, and ankle. On the other hand, TMJD is not related to spine, hip, and foot arch. Although the evidence presented in the literature shows that the relationship between TMJDs and posture is still controversial and unclear, we obtained similar results with the literature using other postural assessment methods. Thus, taking into account the advantages of the New York Posture Rating Scale, we conclude that this is a clinical method that can be used as a guide in the detection of TMJD and associated postural alterations.

Scientific Responsibility Statement
The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement
All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest
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