



Comparison of Temporomandibular Joint Dysfunction of Team and Individual Athletes

Takım ve Bireysel Spor Yapan Sporcuların Temporomandibular Eklem Disfonksiyonunun Karşılaştırılması

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Makale Bilgisi/Article Information

Makale Türü/Article Types: Arařtırma Makalesi/Research Article

Geliř Tarihi/Received: 1 Nisan/April 2023

Kabul Tarihi/Accepted: 22 Temmuz/July 2023

Yıl/Year: 2023 | **Cilt – Volume:** 14 | **Sayı – Issue:** 2 | **Sayfa/Pages:** 197-208

Atıf/Cite as: Ünver, Ş., Yıldız, S. "Comparison of Temporomandibular Joint Dysfunction of Team and Individual Athletes"
Ondokuz Mayıs University Journal of Sports and Performance Researches, 14(2), Ağustos 2023: 197-208.

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Etik Kurul Beyanı/Ethics Committee Approval: "This study was approved by Ondokuz Mayıs University Social and Human Sciences Research and Publication Ethics Committee with the number 2023-21 dated 24.02.2023."

COMPARISON OF TEMPOROMANDIBULAR JOINT DYSFUNCTION OF TEAM AND INDIVIDUAL ATHLETES

ABSTRACT

Temporomandibular disorders (TMDs) are a group of disorders characterized by pain and dysfunction in the masticatory muscles and temporomandibular joints (TMJs). Although there are limited studies on this subject, available data show that TMD complaints are common in competitive athletes. In this study, it was aimed to compare the presence of TMD in team and individual sportsmen. In this study, a cross-sectional study was conducted. A total of 338 people, 97 women, and 241 men from different sports branches, who are between the ages of 18 and 25, participated in the study. The presence of TMD in participants was assessed using the Fonseca Anamnestic Index (FAI), which contains ten questions. According to the score obtained from the questionnaire, individuals were classified as having no TMD, mild, moderate, or severe TMD. The data was analyzed statistically. 28.69% of the study group was female and 71.31% was male. There were no severe TMD cases in individual sports. While moderate and severe cases were 13.4% in females, they were 7.8% in males. There was no difference in TMD scores between team sports and individual sports ($p>0.05$). There was a significant difference between females and males in terms of TMD scores. The TMD scores in females were higher than in males ($p=0.023$). TMD scores were found to be higher in those who were stressed and had clenching or jaw pain ($p=0.001$, $p=0.001$ respectively). There was no difference between income status, tooth brushing frequency, and TMD. As far as we know, this is the first study to evaluate the relationship between sports branches and TMD. Our results showed that there was no difference in TMD scores between individual and team athletes. These results highlight the need for additional research to identify other risk factors.

Keywords: Temporomandibular Disorders; Athlete; Branch; Fonseca Anamnestic Index.



TAKIM VE BİREYSEL SPOR YAPAN SPORCULARIN TEMPOROMANDİBULAR EKLEM DİSFONKSİYONUNUN KARŞILAŞTIRILMASI

ÖZ

Temporomandibular bozukluklar (TMB), çiğneme kasları ve temporomandibular eklemlerde ağrı ve işlev bozukluğu ile karakterize edilen bir grup bozukluktur. Bu konuda sınırlı sayıda çalışma olmasına rağmen, eldeki veriler takım sporcularında TMB şikayetlerinin yaygın olduğunu göstermektedir. Bu çalışmada, takım ve bireysel spor yapan sporcuların TMD varlığının karşılaştırılması amaçlanmıştır. Bu çalışmada, kesitsel bir anket çalışması yapılmıştır. Araştırmaya farklı spor branşlarından 18-25 yaş arası 97 kadın, 241 erkek olmak üzere toplam 338 kişi katılmıştır. Katılımcılarda TMB varlığı, on soru içeren Fonseca Anamnestik İndeksi (FAI) kullanılarak değerlendirildi. Anketten alınan puana göre bireyler TMB'si olmayan, hafif, orta ve ağır TMB'si olan kişiler olarak sınıflandırıldı. Veriler istatistiksel olarak analiz edildi. Çalışma grubunun %28,69'u kadın, %71,31'i erkekti. Bireysel sporlarda ciddi TMB vakası görülmedi. Orta ve ağır vakalar kadınlarda %13,4 iken erkeklerde %7,8 idi. Takım sporları ile bireysel sporlar arasında TMB skorları açısından farklılık yoktu ($p>0,05$). Kadınlar ve erkekler arasında TMB puanları açısından anlamlı bir farklılık vardı. Kadınlarda TMB puanları erkeklere göre daha yüksekti ($p=0,023$). Stresli ve diş sıkma ya da çene ağrısı olanların TMB puanları daha yüksek bulundu ($p=0,001$). Gelir durumu ve diş fırçalama sıklığı ile TMB arasında farklılık yoktu. Bildiğimiz kadarıyla bu çalışma, spor branşları ile TMD ilişkisini değerlendiren ilk çalışmadır. Sonuçlarımız, bireysel ve takım sporcuları arasında TMD puanlarında fark olmadığını gösterdi. Bu sonuçlar, diğer risk faktörlerini belirlemek için ek araştırma ihtiyacını vurgulamaktadır.

Anahtar Sözcükler: Temporomandibular Bozukluklar, Sporcu, Branş, Fonseca Anamnestik İndeksi.



INTRODUCTION

Temporomandibular disorders (TMDs) are a group of disorders characterized by pain and dysfunction in the masticatory muscles and temporomandibular joints (TMJs) (Gauer and Semidey, 2015). TMDs are common in the community. It affects 10-15% of people aged 20-40 in the adult population. more common in women than men (Gauer and Semidey, 2015). The most common symptoms of TMD are limited jaw movements, regional pain, and sound from the TMJ during movement (LeResche, 1997). In addition, morphological and functional chang-

es in masticatory muscles, mandibular disarticulation, and orofacial pain can be seen (Emodi-Perlman et al., 2020). Bruxism is a repetitive jaw muscle activity characterized by clenching or grinding of the teeth and/or supporting or pushing the mandible (Lobbezoo et al., 2013). Bruxism, a risk factor for TMD, may lead to the progression of TMD (Ohlmann et al., 2020). In addition, stress, depression, anxiety, and pain are conditions that can negatively affect them. TMD itself can also negatively affect physical and psychosocial status and reduce the quality of life (Liu et al., 2013).

It has been reported that the frequency of TMD in athletes varies according to the quality of the sport, and the frequency and intensity of the training (Sailors et al., 1996). It has been shown that changes in TMJ position can alter the synchronization of the head and jaw muscles with muscles in other parts of the body, triggering postural changes in body balance and physical performance (Moon and Lee, 2011). Although there are limited studies on this subject, available data show that TMD complaints are common in competitive athletes (Freiwald et al., 2021). In competitive sports, techniques are constantly being developed to improve performance. It has also been reported that the risk of developing TMJ changes is greater during extreme sports (Gallagher et al., 2018; Duplat and Achilles, 2018). It is suggested that the probability of developing TMD is higher in boxing, which is a sport related to its branch, physically and psychologically, due to the large number of traumas to the face area (Spinas et al., 2014). Another study showed that the posture of softball athletes may have a higher incidence of TMD due to the increase in the electrical activity of the masseter, the main muscle involved in the mandibular ascent process (Santos et al., 2009). However, the German Association for Craniomandibular Function and Disorders has recommended that TMD patients be directed to sports, especially endurance sports, as a complementary form of self-treatment (Lange et al., 2020).

In this study, it was aimed to compare the presence of TMD in athletes active in team or individual branches.

MATERIAL AND METHODS

Study Population

In this study, a cross-sectional questionnaire study was conducted. This study was carried out with the participation of 97 female and 241 male athletes between the ages of 18-25, who are actively involved in sports in team or individual branches. Participants were selected from those who were actively involved in different sports branches (Badminton, Basketball, Football, Handball, Judo, Martial Arts (Taekwondo/Boxing/Kickboxing/Karate), Swimming, Skiing/Snowboarding, Vol-

leyball, Wrestling). Individual or team sports athletes who voluntarily agreed to participate in the study were included in the study. Those who had a recent toothache and those who had a history of trauma to the head and neck region were not included in the study. Characteristics such as age, gender, sports branches, stress status, income status, and tooth brushing frequency were questioned. This study was approved by Ondokuz Mayıs University Social and Human Sciences Research and Publication Ethics Committee (2023-21).

Fonseca Anamnestic Index

The Fonseca Anamnestic Index (FAI) was created in Brazilian Portuguese to evaluate the extent of TMD based on the indications and symptoms of the patient. FAI consists of 10 questions: ‘Yes’ (10 points), ‘No’ (0 points), and ‘Sometimes’ (5 points), to which the participant is asked to respond. The total score received by the person on the scale is evaluated as “0-15 points = no TMD”, “20-40 points = mild TMD”, “45-65 points = moderate TMD”, and “70-100 points = severe TMD”. Its Turkish version, developed by Kaynak et al. was used to determine the presence and level of TMD in participants (Kaynak et al., 2023).

Statistical Analysis

The SPSS 21.0 program was used for statistical analysis of the data. The normal distribution of data was determined by the Kolmogorov-Smirnov test. Mann-Whitney U test was used to compare two groups, and a Kruskal-Wallis test was used to compare three or more groups. p value was considered significant below 0.05.

RESULTS

Table 1. The distribution of TMD severity according to sport branches and gender

	n	No (%)	Mild (%)	Moderate (%)	Severe (%)
Branches					
Individual Sports	157	89 (56.7)	55 (35)	13 (8.3)	-
Team Sports	181	103 (56.9)	59 (32.6)	13 (7.2)	6 (3.3)
Gender					
Female	97	44 (45.4)	40 (41.2)	10 (10.3)	3 (3.1)
Male	241	103 (61.4)	74 (30.7)	16 (6.6)	3 (1.2)

A total of 338 volunteers participated in the study. There were 97 women (28.69%) and 241 men (71.31%). First, the individual or team player information of the participants was obtained. We grouped the participants as no, mild, mode-

rate, and severe according to TMD scores. There were no severe cases in individual sports. While moderate and severe cases were 13.4% in females, they were 7.8% in males. The results are shown in Table I.

Table 2. Distribution of FAI scores by individual and team athletes

Questions	Branches	Yes (10 points)	No (0 point)	Sometimes (5 points)
		n (%)	n (%)	n (%)
Do you have difficulty opening your mouth wide?	Individual	3 (1.9)	149 (94,9)	5 (3.2)
	Team	6 (3.3)	161 (89,0)	14 (7,7)
Do you have difficulty moving your jaw to the right and left?	Individual	0	152 (96,8)	5 (3,2)
	Team	5 (2,8)	171 (94,5)	5 (2,8)
Do you feel tired or muscle pain while chewing?	Individual	12 (7,6)	119 (75,8)	26 (16,6)
	Team	18 (9,9)	137 (75,7)	26(14,4)
Do you have frequent headaches?	Individual	25(15,9)	86 (54,8)	46 (29,3)
	Team	22 (12,2)	103 (56,9)	56 (30,9)
Do you have pain or tension in your neck area?	Individual	26 (16,6)	96 (61,1)	35 (22,3)
	Team	30 (16,6)	108 (59,7)	43 (23,8)
Do you have pain in your ear or jaw joint?	Individual	6 (3,8)	133 (84,7)	18 (11,5)
	Team	10 (5,5)	163 (90,1)	8 (4,4)
Do you hear any noise from the jaw joint while chewing or opening your mouth?	Individual	14 (8,9)	123 (78,3)	20 (12,7)
	Team	29 (16,0)	133 (73,5)	19 (10,5)
Do you have habits such as clenching or grinding your teeth?	Individual	10 (6,4)	128 (81,5)	19 (12,1)
	Team	24 (13,3)	145 (80,1)	12 (6,6)
Do you feel that your teeth are not closing properly?	Individual	22 (14,0)	119 (75,8)	16 (10,2)
	Team	32 (17,7)	129 (71,3)	20 (11,0)
Would you describe yourself as a nervous person?	Individual	38 (24,2)	73 (46,5)	46 (29,3)
	Team	45 (24,9)	66 (36,5)	70 (38,7)
TMD total	Individual (n:157)	109 (69,4)	29 (18,5)	19 (12,1)
	Team (n:181)	126 (75,1)	22 (12,2)	23 (12,7)

We evaluated the FAI scores by separating them according to individual and team sports. The distribution of FAI answers according to sports branches is shown in Table II.

Table 3. Comparison of TMD scores by gender, stress status, clenching or jaw pain, income status, and tooth brushing frequency

	Branches	n	Mean	SD	Mean Rank	P
TMD Scores	Individual sports	157	17.45	15.40	163.57	0.295
	Team sports	181	19.75	17.66	174.64	
Gender						
TMD Scores	Female	97	22.22	18.51	188.44	0.023
	Male	241	17.26	15.67	161.88	
Stress Status						
TMD Scores	Yes	164	24.67	17.79	205.96	<0.001
	No	174	13.05	13.29	135.14	
Clenching or Jaw Pain						
TMD Scores	Yes	38	43.29	19.04	286.42	<0.001
	No	300	15.57	13.46	154.69	
Income Status						
TMD Scores	Income > spending	68	16.32	15.13	156.47	0.448
	Income = spending	152	18.68	14.93	174.16	
	Income < spending	118	20.04	19.39	171.00	
Tooth Brushing Frequency						
TMD Scores	1 per day	111	17.97	15.77	166.67	0.891
	2 per day	154	17.99	15.89	166.94	
	3 per day	43	22.09	20,10	183,22	
	4 or more per day	8	16.88	11.93	171.38	
	Once every 2-3 days	22	21.14	20.47	174.25	

We then compared TMD scores by sports branches, gender, stress status, clenching or jaw pain, income status, and frequency of tooth brushing. No significant difference was found between sports branches and TMD scores ($p=0.295$). There was a significant difference between females and males in terms of TMD scores. The TMD score in women was higher than in men ($p=0.023$). When we examined the stress status, it was found that TMD was higher in those who were stressed ($p=0.000$). TMD was more common in those with clenching or jaw pain ($p=0.000$). There was no difference between

income status, tooth brushing frequency, and TMD ($p=0.448$, $p=0.891$, respectively). The comparison of the TMD scores of the participants according to their characteristics is shown in Table III.

DISCUSSION

TMD is a common disorder that affects quality of life. TMDs can negatively affect an individual's schoolwork, work performance, and social activities by affecting them psychologically. It can also contribute to the emergence of emotional and cognitive problems (Kaynak et al., 2023). TMD peaks between the ages of 20 and 40. Symptoms such as muscle pain, joint pain, TMJ degeneration, articular disc displacement, chewing difficulty, swallowing difficulty, reduced range of motion during TMJ function, and mandibular deviation may be seen in TMD (Resende et al., 2013). In TMD, the appearance of symptoms and the deterioration of functions related to related structures vary between individuals (Trize et al., 2018). Gender, genetics, hormones, and stress sensitivity are seen as risk factors in the multifactorial etiology of TMD.

Regular physical activity positively affects people's health, improves their overall muscle condition and body composition. It is also an accessible, safe, and low-cost activity (Cormie et al., 2017). In order for sports activities to be successful, physical and mental health should be good, as well as physical ability. Problems such as TMD, periodontal disease, mouth breathing, malocclusion, and tooth loss can negatively affect the athlete's nutrition, training, and rest. This imbalance can lead to a decrease in performance and even the athlete's withdrawal from training and competition (Reinhel el al., 2015). TMD symptoms can limit individuals' willingness to exercise. But it has also been reported that regular physical activity helps control pain and other symptoms and can reduce treatment costs for chronic conditions (Geneen et al., 2017). There are many studies conducted to determine the frequency of TMD in students.

The FAI used for the diagnosis of TMD was developed and approved in 1992 (Rodrigues-Bigaton et al., 2017). FAI, a test with proven reliability, is used by organizations such as the American Academy of Orofacial Pain Questionnaire for diagnostic and screening purposes (Pastore et al., 2018). FAI provides useful data in epidemiological studies by enabling low-cost data collection without the influence of the researcher. It can also help identify TMD symptoms that people are unaware of and prevent further worsening. Because of its simplicity and effectiveness, FAI is widely used in clinical and community-based TMD studies (Berni et al., 2015). There are many studies evaluating the frequency of TMD in university students using FAI. In these studies, the prevalence of TMD was found to be 60%, 60%, and 55%, respectively (Özdiñç et al., 2020; Kaynak et al., 2019; Bicaj et al., 2017).

It was also shown that TMD was more common in dentistry students compared to students who did not study dentistry (80% versus 6%) (Bahrani et al., 2012). Wahid et al. reported a prevalence of TMD of approximately 92% among medical students (Wahid et al., 2014). In a study of medical students, 38.9% had mild TMD, 17.5% had moderate, and 2.4% had severe TMD (Yakşı et al., 2023). In our study, the total of mild, moderate, and severe TMD in sports faculty students was 146/338 (43.19%). In our series, mild cases were 114/338 (33.72%), moderate cases were 26/338 (7.69%), and severe cases were 6/338 (1.77%). We think that the differences between studies are due to population sizes, differences in gender distribution of students, individual, psychosocial, and social differences, and education in different academic fields.

According to the American Dental Association data, 44-99% of TMD findings are due to trauma (American Academy of Pediatric Dentistry University of Texas Health Science Center., 1990). The risk of injury in contact sports is greater than in non-contact sports (Chapman, 1989). In a questionnaire study evaluating TMD symptoms in male basketball players and a non-athlete control group, no difference in TMD symptoms was found between the two groups (Weiler et al., 2010). Zamora-Olave et al. reported that the frequency of TMD in water polo players was found to be 70 in 347 subjects (20.2%) (Zamora-Olave et al., 2018). But the frequency of individual symptoms was not included in this study (Zamora-Olave et al., 2018). In our study, there were 46.44% individual athletes and 53.56% team athletes. Students who did individual sports did not have severe TMD. In this study, no significant difference was found between individual and team players in terms of TMD scores (Table III).

Studies have reported that TMD is more common in women than men (Özdiñç et al., 2020; Kaynak et al., 2019; Gas et al., 2021). This is in line with the study that found women are more prone to TMD than men (1.6 to 1) (Basafa and Shahabee, 2016). This has potentially been associated with female reproductive hormones affecting pain modulation and physical structures (Berger et al., 2015). In addition, factors such as women's roles in society and responsibilities at home and at work may also be risk factors for the development of TMD (Riffel et al., 2015). In addition, it has been stated that women have more TMD signs and symptoms than men. Few studies have found a relationship between gender and the severity of TMD (Bicaj et al., 2017; Dervis, 2019; Karthik et al., 2017). One study reported higher levels of pain and muscle tenderness in women with TMD compared to men (Schmid-Schwab et al., 2013). In our study, TMD was 53/97 (54.63%) in females and 93/241 (38.58%) in males. According to FAI scores, severe TMD findings were found in 3.1% of females and 1.2% of males. There was a significant difference between men and women in terms of TMD scores. Females had a significantly higher FAI value compared to males (Table III).

Psychosocial factors are closely related to TMD. In a study conducted with 303 students, TMD was found to be associated with emotional stress and anxiety (Paulino et al.,2015). The same result was found in dentistry students (Namvar et al.,2021;) Ahuja et al.,2018). The fact that dental students have to acquire extensive theoretical knowledge, rigorous clinical work, and interpersonal skills seems to be a factor. A study showed that fear of failure in both personal and team athletes was associated with psychological stress in athletes (Gustafsson et al., 2017). In our study, we found that the TMD score was higher in those under stress (Table III). Our results are consistent with other studies.

Clenching is one of the most harmful oral parafunctional activities. It is an important factor in the etiology of TMD (Ohrbach et al., 2011). It was reported that there was a significant association between oral habits and signs and symptoms of TMD (Winocur et al., 2006; Motta et al., 2013). In this study, we found that the clenching of the teeth or jaw pain were associated with the TMD score (Table III). We also evaluated the effect of income status and the number of daily toothbrushes on the FAI score. We found that these factors did not affect the TMD score.

CONCLUSION

As far as we know, this is the first study to evaluate the relationship between sports branches and TMD. Our results showed that there was no difference in TMD scores between individual and team athletes. These results highlight the need for additional research to identify other risk factors.

Author Contribution Rates

Design of the Research: ŞÜ(%70), SY(%30)

Data Acquisition: ŞÜ(% 60), SY(%40)

Statistical Analysis: ŞÜ(%70), SY(%30)

Preparation of the Article: ŞÜ(%40), SY(%60)

REFERENCES

- Ahuja, V., Ranjan, V., Passi, D., & Jaiswal, R. (2018). Study of stress-induced temporomandibular disorders among dental students: An institutional study. *Natl J Maxillofac Surg*, 9(2), 147-154. DOI: 10.4103/njms.NJMS_20_18
- Bahrani, F., Ghadiri, P., & Vojdani, M. (2012). Comparison of temporomandibular disorders in Iranian dental and nondental students. *J Contemp Dent Pract*, 13(2), 173-7. DOI: 10.5005/jp-journals-10024-1116
- Basafa, M., & Shahabee, M. (2006). Prevalence of TMJ disorders among students and its relation to malocclusion. *Iran J Otorhinolaryngol*, 18, 53-59. Doi: 10.22034/ijo.2006.251261.
- Berger, M., Szalewski, L., Bakalczuk, M., Bakalczuk, G., Bakalczuk, S., & Szkutnik, J. (2015). Association between estrogen levels and temporomandibular disorders: a systematic literature review. *Prz Menopauzalny*, 14(4), 260-270. DOI: 10.5114/pm.2015.56538
- Berni, K.C., Dibai-Filho, A.V., & Rodrigues-Bigaton, D. (2015). Accuracy of the Fonseca anamnestic index in the identification of myogenous temporomandibular disorder in female community cases. *J Bodyw Mov Ther*, 19, 404-409. DOI: 10.1016/j.jbmt.2014.08.001
- Bicaj, T., Shala, K., Krasniqi, T.P., Ahmedi, E., Dula, L., & Lila-Krasniqi, Z. (2017). Frequency of symptoms of temporomandibular disorders among prishtina dental students. *Open Access Maced J Med Sci*, 5(6), 781-784. doi: 10.3889/oamjms.2017.165.
- Chapman, P.J. (1989) Mouthguards and the role of sporting team dentists. *Aust Dent J*, 34(1), 36-43.
- Cormie, P., Zoepf, E.M., Zhang, X., & Schmitz, K.H. (2017). The impact of exercise on cancer mortality, recurrence, and treatment-related adverse effects. *Epidemiol Vern*, 39, 71-92. DOI: 10.1093/epirev/mxx007
- Dervis, N.E. (2019). Prevalence of temporomandibular disorder in Turkish university students: A questionnaire study. *Balkan J Dent Med*, 23(2), 80-87. DOI: 10.2478/bjdm-2019-0015
- Duplat, Y.S., & Achilles, M.N. (2018). Prevalência de sinais e sintomas para disfunção temporomandibular em lutadores de boxe. *Rev Pesqui Fisioter*, 8(2), 191-198. DOI:10.17267/2238-2704rpfv8i2.1882
- Emodi-Perlman, A., Eli, I., Smardz, J., Uziel, N., Wieckiewicz, G., Gilon, E., Grychowska, N., & Wieckiewicz, M. (2020). Temporomandibular disorders and bruxism outbreak as a possible factor of orofacial pain worsening during the covid-19 pandemic-concomitant research in two countries. *J Clin Med*, 2020; 9(10): 3250. DOI: 10.3390/jcm9103250
- Freiwald H.C., Schwarzbach, N.P., & Wolowski, A. (2021). Effects of competitive sports on temporomandibular dysfunction: a literature review. *Clin Oral Investig*, 25(1), 55-65. DOI: 10.1007/s00784-020-03742-2
- Gallagher, J., Ashley, P., Petrie, A., & Needleman, I. (2018). Oral health and performance impacts in elite and professional athletes. *Community Dent Oral Epidemiol*, 46(6), 563-568. DOI: 10.1111/cdoe.12392
- Gas, S., Ekşi-Özsoy, H., & Cesur-Aydın, K. (2021). The association between sleep quality, depression, anxiety and stress levels, and temporomandibular joint disorders among Turkish dental students during the COVID-19 pandemic. *Cranio*, 1-6. DOI: 10.1080/08869634.2021.1883364
- Gauer, R.L., & Semidey, M.J. (2015). Diagnosis and treatment of temporomandibular disorders. *Am. Fam. Physician*, 91, 378-386.
- Geneen, L.J., Moore, R.A., Clarke, C., Martin, D., Colvin, L.A., & Smith B.H. (2017). Physical activity and exercise for chronic pain in adults: an overview of cochrane reviews. *Cochrane Database Syst Rev*, 1, CD011279. DOI: 10.1002/14651858.CD011279.pub3
- Gustafsson, H., Sagar, S.S., & Stenling, A. (2017). Fear of failure, psychological stress, and burnout among adolescent athletes competing in high level sport. *Scand J Med Sci Sports*, 27(12), 2091-2102. DOI: 10.1111/sms.12797
- Karthik, R., Hafila, M.I.F., Saravanan, C., Vivek, N., Priyadarsini, P., Ashwath, B. (2017). Assessing prevalence of temporomandibular disorders among university students: A Questionnaire Study. *J Int Soc Prev Community Dent*, 7(1), 24-29. DOI: 10.4103/jispcd.JISPCD_146_17
- Kaynak, B.A., Taş, S., & Salkın, Y. (2023). The accuracy and reliability of the Turkish version of the Fonseca anamnestic index in temporomandibular disorders. *Cranio*, 41(1), 78-83. DOI: 10.1080/08869634.2020.1812808
- Kaynak, B.A., Tas, S., Unluer, N.O., Yasar, U., Erdoganoglu, Y. (2019). Üniversite öğrencilerinde temporomandibular eklem disfonksiyonu prevalansının araştırılması. *H.Ü. Sağlık Bilimleri Fakültesi Dergisi*, 6(3), 287-98. doi: 10.21020/husbfd.594937.
- Lange, M., Ahlers, M.O., Ottl, P., Deutsche Gesellschaft für Funktionsdiagnostik und-therapie. https://www.dgfdt.de/de_DE/was-kann-ich-selbst-tun-1 (Accessed 01 April 2020).
- LeResche, L. (1997). Epidemiology of temporomandibular disorders: Implications for the investigation of etiologic factors. *Crit. Rev. Oral Biol. Med*, 8, 291-305. doi: 10.1177/10454411970080030401.
- Liu, F., & Steinkeler, A. (2013). Epidemiology, diagnosis, and treatment of temporomandibular disorders. *Dent. Clin. N. Am.*, 57, 465-479. doi: 10.1016/j.cden.2013.04.006.
- Lobbzoo, F., Ahlberg, J., Glaros, A.G., Kato, T., Koyano, K., Lavigne, G.J., de Leeuw, R., Manfredini, D., Svensson, P., & Winocur, E. (2013). Bruxism defined and graded: An international consensus. *J. Oral Rehabil*, 40, 2-4. doi: 10.1111/joor.12011.

- Moon, H.J., Lee, Y.K., (2011). The relationship between dental occlusion/temporomandibular joint status and general body health: part I. Dental occlusion and TMJ status exert an influence on general body health. *J Altern Complement Med.* 17(11), 995-1000. doi: 10.1089/acm.2010.0739.
- Motta, L.J., Guedes, C.C., De Santis, T.O., Fernandes, K.P., Mesquita-Ferrari, R.A., & Bussadori, S.K. (2013). Association between parafunctional habits and signs and symptoms of temporomandibular dysfunction among adolescents. *Oral Health Prev Dent.* 11(1), 3-7. doi: 10.3290/j.ohpd.a29369.
- Namvar, M.A., Afkari, B.F., Moslemkhani, C., Mansoori, K., & Dadashi, M. (2021). The Relationship between Depression and Anxiety with Temporomandibular Disorder Symptoms in Dental Students. *Maedica (Bucur).* 16(4), 590-594. DOI: 10.26574/maedica.2021.16.4.590
- Ohlmann, B., Waldecker, M., Leckel, M., Bomicke, W., Behnisch, R., Rammelsberg, P., & Schmitter, M. (2020). Correlations between Sleep Bruxism and Temporomandibular Disorders. *J Clin. Med.* 9, 611. DOI: 10.3390/jcm9020611.
- Ohrbach, R., Fillingim, R.B., Mulkey, F., Gonzalez, Y., Gordon, S., Gremillion, H., Lim, P.F., Ribeiro-Dasilva, M., Greenspan, J.D., Knott, C., Maixner, W., & Slade, G. (2011). Clinical findings and pain symptoms as potential risk factors for chronic TMD: descriptive data and empirically identified domains from the OPPERA case-control study. *J Pain.* 12(11), 27-45. doi: 10.1016/j.jpain.2011.09.001
- Özding, S., Ata, H., Selçuk, H., Can, H.B., Sermenli, N., & Turan, F.N. (2020). Temporomandibular joint disorder determined by Fonseca anamnestic index and associated factors in 18 to 27 year old university students. *Cranio.* 38(5), 327-332. DOI: 10.1080/08869634.2018.1513442
- Pastore, G.P., Goulart, D.R., Pastore, P.R., Prati, A.J., & de Moraes, M. (2018). Comparison of instruments used to select and classify patients with temporomandibular disorder. *Acta Odontol Latinoam.* 31, 16-22. PMID: 30056462
- Paulino, M.R., Moreira, V.G., Lemos, G.A., da Silva, P.L., Bonon, P.R.F., & Batista, A.U.D. (2015). Prevalence of signs and symptoms of temporomandibular disorders in college preparatory students: associations with emotional factors, parafunctional habits, and impact on quality of life. *Ciênc. saúde colet.* 23(1), 173-186. doi: 10.1590/1413-81232018231
- Reinhel, A.F., Scherma, A.P., Peralta, F.S., & Palma, I.C.R. (2015). Saúde bucal e performance física de atletas. *ClipeOdonto.* 7(1), 45-56.
- Resende, C.M., Alves, A.C., Coelho, L.T., Alchieri, J.C., Roncalli, A.G., & Barbosa, G.A. (2013). Quality of life and general health in patients with temporomandibular disorders. *Braz Oral Res.* 27, 116-21. doi: 10.1590/s1806-83242013005000006.
- Riffel, C.T.D., Flores, M.E., Scorsatto, J.T., Ceccon, L.V., De Conto, F., & Rovani, G. (2015). Association of temporomandibular dysfunction and stress in university students. *Int. J. Odontostomat.* 9(2), 191-197. DOI:10.4067/S0718-381X2015000200003.
- Rodrigues-Bigaton, D., de Castro, E.M., & Pires, P.F. (2017). Factor and Rasch analysis of the Fonseca anamnestic index for the diagnosis of myogenous temporomandibular disorder. *Braz J Phys Ther.* 21(2), 120-126. doi: 10.1016/j.bjpt.2017.03.007.
- Sailors, M.E. (1996). Evaluation of sports-related temporomandibular dysfunctions. *J Athl Train.* 1996; 31(4): 346-50. PMID: 16558422. PMCID: PMC1318920
- Santos, R.C.O., Padovan, Neto, J.B., Pinto, S.S., & Cyrillo, F.N. (2009). Comparison of the electromyographic activity of the right and left masseter muscles in softball athletes during sports hitting gesture. *Revista Brasileira de Ciência e Movimento,* 17(2).
- Schmid-Schwap, M., Bristela, M., Kundi, M., Piehslinger, E. (2013). Sex-specific differences in patients with temporomandibular disorders. *J Orofac Pain.* 27(1), 42-50. doi: 10.11607/jop.970.
- Spinas, E., Aresu, M., & Giannetti, L. (2014). Use of mouth guard in basketball: observational study of a group of teenagers with and without motivational reinforcement. *Eur J Paediatr Dent.* 15(4), 392-396. PMID: 25517587.
- Trize, D.M., Calabria, M.P., Franzolin, S., Cunha, C.O., & Marta, S.N. (2018). Is quality of life affected by temporomandibular disorders? *Einstein* 16, eAO4339. doi: 10.31744/einstein_journal/2018AO4339
- Wahid, A., Mian, F.I., Razzaq, A., et al. (2014). Prevalence and severity of temporomandibular disorders (Tmd) in undergraduate medical students using Fonseca's Questionnaire. *Pakistan Oral & Dental Journal,* 34(1), 38-41.
- Weiler, R.M., Vitalle, M.S., Mori, M., Kulik, M.A., Ide, L., Pardini, S.R., & Santos, F.M. (2010). Prevalence of signs and symptoms of temporomandibular dysfunction in male adolescent athletes and non-athletes. *nt J Pediatr Otorhinolaryngol.* 74(8), 896-900. doi: 10.1016/j.ijporl.2010.05.007
- Winocur, E., Littner, D., Adams, I., & Gavish, A. (2006). Oral habits and their association with signs and symptoms of temporomandibular disorders in adolescents: A gender comparison. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006 ;102(4):482-87. doi: 10.1016/j.tripleo.2005.11.007
- Yakşi, E., Demirel, A., Yaşar, M.F., Kılınc, S., & Balci, M. (2023). The prevalence of temporomandibular disorders among medical students. *Northwestern Med J.* 3(1), 38-44. doi: 10.54307/NWMJ.2023.66376
- Zamora-Olave, C., Willaert, E., Montero-Blesa, A., Riera-Punet, N., Martinez-Gomis, J. (2018). Risk of orofacial injuries and mouthguard use in water polo players. *Dent Traumatol.* 34(6), 406-412. doi: 10.1111/edt.12434.