Cumhuriyet Dental Journal, 25(Suppl): 29-33, 2022
DOI: https://doi.org/10.7126/cumudj.1030953

Cumhuriyet Dental Journal

| cdj.cumhuriyet.edu.tr | Founded: 1998 Available online, ISSN: 1302-5805 Publisher: Sivas Cumhuriyet Üniversitesi

# Temporomandibular Joint Disease and Vitamin D Level in Fibromyalgia#

**Samed Şatır[1,a,*], Özlem Şatır[2,3,b]**

[1]Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Alanya Alaaddin Keykubat University Antalya, Turkey
[2]Department of Physical Medicine and Rehabilitation, Antalya Kepez State Hospital, Antalya, Turkey
[3]Department of Physical Medicine and Rehabilitation, Alanya Education and Research Hospital, Alanya Alaaddin Keykubat University Alanya, Antalya, Turkey
*Corresponding author

**Research Article**

*Acknowledgment*
*#This study was presented as an oral presentation at the ''Sivas Cumhuriyet University 1st International Dentistry Congress'' held between 23-25 November 2021.*

*History*

*Received: 01/12/2021*
*Accepted: 31/01/2022*

**ABSTRACT**

***Objectives:*** The aim of our study is to show the prevalence of temporomandibular joint disease (TMD) in fibromyalgia (FM) patients in Turkish population and to evaluate the relationship between vitamin D levels of FM patients with TMD.

***Materials and Methods:*** Patients diagnosed FM in the last 4 months were examined in terms of TMD using DC/TMD criteria. By using biochemical data of the patients included in the study, the relationship between vitamin D levels and TMD was interpreted.

***Results:*** Among the 39 FM patients who underwent temporomandibular joint examination (mean age 39.8; age range 18-59), the number of patients with TMD (muscle pain, joint pain, mouth opening limitation, disc displacement, degenerative joint disease) was 30 (29 female, 1 male), while the number of patients without any TMD was found 9 (7 female, 2 male). No statistically significant difference was found between those with TMD and those without TMD in terms of vitamin D (Mann-Whitney U test, D vit).

***Conclusions:*** Dentists should be aware that patients with widespread pain in the temporomandibular joint area may be candidates for FM and should be careful in evaluating laboratory tests of these patients. The prevalence of TMJ in FM patients and its relationship with vitamin D should be examined with new studies with large patient participation.

***Keywords:*** Fibromyalgia, Temporomandibular Joint, Vitamin D

# Fibromyaljide Temporomandibular Eklem Hastalığı ve D Vitamini Seviyesi#

*Bilgi*
*#Bu çalışma 23-25 Kasım 2021 tarihleri arasında düzenlenen 'Sivas Cumhuriyet Üniversitesi 1. Uluslararası Diş Hekimliği Kongresi'nde sözlü bildiri olarak sunulmuştur.*
**Sorumlu yazar*

*Süreç*

*Geliş: 01/12/2021*
*Kabul: 31/01/2022*

**ÖZ**

***Amaç:*** Çalışmamızın amacı, Türk toplumunda fibromyalji (FM) hastalarındaki temporomandibular eklem hastalık (TMEH) prevalansını göstermek ve FM hastalarına ait D vitamini seviyelerinin TMEH ile ilişkisini değerlendirmektir.

***Gereç ve Yöntemler:*** Son 4 ay içerisinde FM teşhisi konmuş hastalar DC/TMD kriterleri kullanılarak TMEH açısından incelenmiştir. Yapılan muayene ile masseter ve temporal kasta ağrı, eklem ağrısı, redüksiyonlu/ redüksiyonsuz disk deplasmanı ve dejeneratif eklem hastalığı sorgulanmıştır. Çalışmaya dahil edilen hastaların biyokimya verileri kullanılarak D vitamini seviyelerinin TMEH ile ilişkisi yorumlanmıştır.

***Bulgular:*** Temporomandibular eklem muayenesi yapılan toplam 39 FM hastasından (yaş ortalaması 39,8; yaş aralığı 18-59) 36'sı kadın 3'ü ise erkektir. Tüm hastalar içerisinde TMEH tespit edilenlerin sayısı 30 (29 kadın, 1 erkek) iken, herhangi bir TMEH bulgusuna rastlanmayan hastaların sayısı 9 (7 kadın, 2 erkek)'dur. TMEH tespit edilen hastaların 26'sında kas ağrısı gözlenmiştir. Kas ağrısı görülmeksizin eklem ağrısı ve dejeneratif eklem hastalığı bulunan sırasıyla 2 ve 1 hasta tespit edilmiştir. TMEH varlığı olanların D vitamini değerleri TMEH varlığı olmayanlara göre düşük olmasına rağmen istatistiksel olarak anlamlı bir farklılık bulunamamıştır (Mann-Whitney U test).

***Sonuçlar:*** Diş hekimleri özellikle temporomandibular eklem bölgesinde yaygın ağrı şikâyeti olan hastaların FM hastası adayı olabileceğinin farkında olmalı ve bu hastaların laboratuvar testlerini değerlendirme konusunda dikkatli olmalıdır. Geniş hasta katılımı ile yapılacak yeni çalışmalar ile FM hastalarındaki TMEH prevalansının D vitamini ile olan ilişkisi incelenmelidir.

***Anahtar Kelimeler:*** Fibromyalji, Temporomandibular Eklem, D Vitamini.



[a] *samed.satir@alanya.edu.tr* *https://orcid.org/0000-0002-5863-5928* [b] *drozlemsatir@gmail.com* *https://orcid.org/0000-0001-5428-8722*

*How to Cite:* Şatır S, Şatır Ö. (2021) Temporomandibular Joint Disease and Vitamin D Level in Fibromyalgia, Cumhuriyet Dental Journal, 25(Suppl): 29-33.

## Introduction

Fibromyalgia (FM) is a chronic syndrome with symptoms such as widespread body pain, fatigue, cognitive dysfunction, decreased sleep quality-sleep disorder and anxiety.[1] The annual prevalence is between 2-4% and it is 6-9 times more common in women than in men.[2,3] Since there is no laboratory test or radiographic finding associated with the disease yet, FM is diagnosed by clinical evaluation. However, since symptoms such as anxiety, sleep disorder and dizziness can be encountered in many neurological and metabolic disorders, various radiological examinations and laboratory tests are used for differential diagnosis.[4]

Temporomandibular joint diseases (TMD) are the leading painful conditions affecting the masticatory muscles and maxillofacial region and may be associated with FM.[5] In some studies, it has been stated that the rate of TMD in FM is over 71%.[6,7] Sleep bruxism is the primary cause hyperactivity and hypertrophy of masticator muscles in individuals with TMD.[8]

Vitamin D provides calcium (Ca) balance and bone turnover in the body and can affect the entire metabolism due to its receptors in various organs. As a result of studies on vitamin D, it has been reported that its deficiency is associated with many cardiovascular, metabolic, infectious and autoimmune diseases.[9-18]

It has been reported that individuals with vitamin D deficiency have muscle pain, cramp, weakness, and fatigue.[19] In various studies evaluating vitamin D levels in FM patients, its effects on neurological symptoms such as pain were examined.[20,21]

The aim of our study is to show the prevalence of TMD in FM patients and to evaluate the relationship between vitamin D levels of FM and TMD.

## Materials and Methods

Ethics committee approval was obtained from Ethics Comitee of Antalya Education and Research Hospital for this study (26/12/2019, 27/11, 2019-393).

### *Patients*

Patients who applied to the Physical Medicine and Rehabilitation Clinic between January 2019 and January 2020 in Antalya Kepez State Hospital and met the criteria of FM according to the American Rheumatology Association 2016 revised diagnostic criteria were determined as candidates for the study. These patients were called back to the clinic for temporomandibular joint (TMJ) examinations for a maximum of 4 months from the date of the diagnosis of FM. Research diagnostic criteria for temporomandibular disorders (DC-TMD) were used to determine the status of TMD.[22] Based on DC-TMD, pain in the masseter and temporal muscle, joint pain, disc displacement with/without reduction, degenerative joint disease were questioned. Masseter and temporal muscle pains are classified as muscle pain, muscle-fascia pain, reflected muscle-fascia pain and local muscle pain according to DC-TMD. Pain caused by horizontal jaw movements and TMJ palpation is considered joint pain. Patients with an opening-closing click during the opening and closing of the jaw are accepted in the reduction disc displacement group and are divided into two classes as intermittent locking and non-intermittent locking. Locking during jaw opening and closing is defined as disc displacement without reduction. If the maximum mouth opening is less than 40mm, it is classified as non-reduction disc displacement with mouth opening limitation, and if there is a maximum mouth opening of 40mm or more, it is classified as non-reduction disc displacement without mouth opening limitation.[22,23] Patients have crepitation during jaw movements are included in degenerative joint disease. Individuals diagnosed with other systemic diseases (osteoarthritis, rheumatoid arthritis, systemic lupus erythematosus, osteoporosis) that may cause TMD, who have a history of trauma associated with the TMJ with any treatment, and orthognathic or TMJ surgery for various reasons (trauma, orthognathic therapy, etc.) were excluded from the study.

### *Vitamin D*

During the FM diagnosis, the vitamin D values obtained from the patients in Antalya Kepez State Hospital were recorded considering the reference ranges retrospectively. Premenopausal women were included in the study in order to prevent the effect of supportive and hormonal therapy taken during menopause in the results.

### *Statistical Analysis*

Mann-Whitney U test which is the non-parametric was used to compare the not normal distribution of vitamin D levels in FM patients with and without TMD ($p<0.05$).

## Results

Of the 39 FM patients (mean age 39.8; age range 18-59) who underwent TMJ examination, 36 were female (mean age 39.4; age range 18-44) and 3 were male (mean age 44.3; age range 36-59). While there were 30 (29 female, 1 male) patients with TMD among all patients, 9 (7 female, 2 male) patients without any TMD were detected. Muscle pain was observed in 26 of the patients with TMD. 2 and 1 patients with joint pain and degenerative joint disease were identified, respectively, without muscle pain (Table 1).

Although the vitamin D levels of those with TMD were lower than those without TMD, no statistically significant difference was found (Mann-Whitney U test, $p=0.257$) (Table 2).

## Discussion

The prevalence of TMD in FM ranged from 75% to 80%.[24] In this study, the rate of TMD in FM was found to be 76.9%, and this result is consistent with the

literature.[6,7] In addition, the prevalence of TMD in the Turkish population is thought to be around 30%.[25,26] The high rate of TMD we detected in FM patients suggests that this finding is independent of the prevalence of the general population. The presence of various systemic diseases that may cause the symptoms of TMD may affect the prevalence achieved.

Masseter and temporal muscles were identified as the most common muscle pain associated with TMJ pain in FM.[24] As there are studies in which masticator muscle pain is seen in 87% of FM patients[27], there are also researches in which it is seen in all FM patients included in the study.[28] In our study, the rate of patients with temporal and/or masseter muscle pain was 66% among all FM, while was 86% among patients with TMD. Although our results are compatible with the literature, the differences in the examination criteria used in the detection of TMD and the methods to question the presence of pain may cause variability in the results. The length of time between the patients are diagnosed with FM and the TMJ examination can affect the pain characteristics in the masticatory muscles. In addition, a decrease in the prevalence of TMD may have been observed in the patients included in our study due to the initiation of the FM treatment.

In a study that found the disc displacement rate as 22.5% in FM, it was emphasized that asymptomatic TMD were seen in the general population and patients without chronic pain related to the TMJ were considered healthy.[6] In our study, the rate of disc displacement in FM patients was 30%. Considering that the relationship between FM and TMD is more related to pain-parafunction in masticator and facial muscles, the difference between the findings may not be clinically significant.

Vitamin D level is measured by 25-OH vitamin D in serum. Values below 20 ng/mL are defined as vitamin D deficiency, while between 21-29 ng/mL are considered as vitamin D insufficiency.[29] In our study, the average vitamin D level of all FM patients was determined to be 19.89 ng/mL. In patients with TMD, the average vitamin D level was below 20 ng / mL. In patients without TMD, the mean value was determined as 28.83 ng/mL. Vitamin D level did not make a statistically significant difference between patients with and without TMD. However, the fact that patients in the TMD group have low values that meet the definition of vitamin D deficiency makes a clinically significant difference.

In a meta-analysis comparing the vitamin D levels of FM patients with healthy individuals, more studies were found showing that FM patients had significantly lower vitamin D levels.[30] 4 of studies showing that low levels of vitamin D in patients with FM have been made in Turkey and an average vitamin D level of FM patients in these studies 15.45 ng / ml. Results of our study are consistent with vitamin D levels in patients with FM in Turkey.

There is a general acceptance that menopause usually begins at the end of the 40s[31]. Although the mean age of the female patients we included in the study was below 40 and there was no evidence of a relationship between vitamin D and menopause, being in the premenopausal period was determined as the inclusion criterion. Metabolic and physiological changes in premenopausal women overlap with fibromyalgia findings. Therefore, it is difficult to distinguish the effects of both menopause and fibromyalgia on vitamin D levels in women.

The relationship between musculoskeletal pain and vitamin D is a current research topic.[32] In another study, it was stated that there is a correlation between the vitamin D level of FM patients and the presence of pain.[33] Karahan *et al*. stated in a multicenter retrospective study that the duration, localization and severity of pain and vitamin D insufficiency did not present a significant relationship but the topic should be examined with prospective studies.[34] It is reported that there is a significant relationship between chronic widespread pain and vitamin D especially in females.[35] The high prevalence of TMD in FM patients and the prevalence of masticator muscle pain suggest that the relationship between TMD and vitamin D deficiency is possible.

Table 1. Distribution of FM patients (n = 30) with TMD

| n (related muscle) | Muscle Pain | Muscle-Fascia Pain | Reflected Muscle-Fascia Pain | Local Muscle Pain | Muscle Pain (-) | Joint Pain (+) |
|---|---|---|---|---|---|---|
| **Joint Degeneration (-)** | 5 (1 t, 1 m, 3 tm) | 2 (1 t, 1 m) | 3 (1 t, 2 m) | 7 (3 t, 2 m, 2 tm) | | |
| **Disc Displacement with Reduction (Locking -)** | 2 (t) | 1 (t) | | | 1 | |
| **Disc Displacement with Reduction (Locking +)** | 1 (tm) | | 2 (1 t, 1 tm) | | | 1 |
| **Disc Displacement without Reduction (MOL +)** | 1 (m) | | 1 (tm) | | | 1 |
| **Disc Displacement without Reduction (MOL -)** | 1 (t) | | | | | |
| **Degenerative Joint Disease** | | | | | 1 | |

t: Temporal muscle, m: Masseter muscle, tm: Both temporal muscle and masseter muscle, MOL: Mouth opening limitation

Table 2. Vitamin D levels of FM patients with and without TMD

| Groups | Vitamin D (25-OH vitamin D) (ng/mL) | | | p |
|---|---|---|---|---|
| | Mean | Median | Max-Min | |
| TMD (+) (n=30) | 17.92 | 16.03 | 31.71 - 4.23 | 0.257 |
| TMD (-) (n=9) | 28.83 | 29.72 | 55.18 - 4.21 | |
| Mann-Whitney U test, p=0.05 | | | | |

In case of deficiency or insufficiency of vitamin D, which has an important place for a health

y bone structure and proper muscle function, the TMJ consisting of many different elements such as muscles, bones that make up the joint surfaces (mandible and os temporale) and joint disc may be affected.[29,36] In a study, the relationship between vitamin D receptor polymorphism and TMD was examined. Although a significant relationship between Taq1, Apa1 gene polymorphism and TMD could not be detected, it was emphasized that this issue should be studied in large cohort studies.[37] In another study, while vitamin D levels did not show a statistically significant difference between those with TMD and healthy individuals, parathyroid hormone was found to be significantly higher in TMD group. Researchers associated the increase in parathyroid hormone levels with low vitamin D levels and stated that the vitamin D levels of patients with TMD should be evaluated.[38]

The main limitation of our study is that it is based on retrospective data. TMJ examination of the patients included in the study was performed prospectively, but the diagnosis of FM and vitamin D levels are not. The reliability of the data was tried to be increased by shortening the time between FM diagnosis and TMJ examination to a maximum of 4 months. The number of patients included in the study decreased due to this time criteria. Another limitation is that since this study was designed as a cross-sectional study, it did not include comparisons with healthy individuals. Another case-control study may be planned to support the findings of this study.

## Conclusions

The rate of FM in individuals with TMD is reported to be between 10% and 20%.[39] Dentists should be aware that patients with widespread pain, especially in the TMJ area, may be candidates for FM and should be careful in evaluating the laboratory tests of these patients. The relationship between the prevalence of TMD and vitamin D in FM patients should be investigated with new studies with larger groups.

## Funding

No funding agent.

## Conflict of Interest

The authors declare that they have no conflict of interest.

## Ethics Approval

Ethics committee approval was obtained from Ethics Comitee of Antalya Education Training and Research Hospital for this study (26/12/2019, 27/11, 2019-393).

## References

1. Kia S, Choy E. Update on treatment guideline in fibromyalgia syndrome with focus on pharmacology. The Biomedicines 2017;5(20).
2. Gür A. Fibromiyaljide etiyopatogenez. Türk Fiz Tıp Rehab Derg. 2008;54(Özel Sayı 1):4-11.
3. Fitzcharles MA, Ste-Marie PA, Goldenberg DL, Pereira JX, Abbey S, Choinière M et al. National Fibromyalgia Guideline Advisory Panel. 2012 Canadian Guidelines for the diagnosis and management of fibromyalgia syndrome: executive summary. Pain Res Manag. 2013 May-Jun;18(3):119-126.
4. Heymann RE, Paiva ES, Martinez JE, Helfenstein M Jr, Rezende MC, Provenza JR et al. New guidelines for the diagnosis of fibromyalgia. Rev Bras Reumatol Engl Ed. 2017;57 Suppl 2:467-476.
5. Durham J, Newton-John TR, Zakrzewska JM. Temporomandibular disorders. BMJ. 2015 Mar 12;350:h1154.
6. Pimentel MJ, Gui MS, Martins de Aquino LM, Rizzatti-Barbosa CM. Features of temporomandibular disorders in fibromyalgia syndrome. Cranio. 2013 Jan;31(1):40-45.
7. Rhodus NL, Fricton J, Carlson P, Messner R. Oral symptoms associated with fibromyalgia syndrome. J Rheumatol. 2003 Aug;30(8):1841-1845.
8. Palinkas M, Bataglion C, de Luca Canto G, Machado Camolezi N, Theodoro GT, Siéssere S et al. Impact of sleep bruxism on masseter and temporalis muscles and bite force. Cranio. 2016 Sep;34(5):309-315.
9. Karahan AY, Kaya B, Kuran B, Altindag O, Yildirim P, Dogan SC, et al. Common Mistakes in the Dual-Energy X-ray Absorptiometry (DXA) in Turkey. A Retrospective Descriptive Multicenter Study. Acta medica (Hradec Kralove) 2016; 59:117-123.
10. Mavromati M, Philippe J. [Endocrinology, what's new in 2016]. Rev Med Suisse 2017; 13:45-48.
11. Yagiz AE, Ustun N, Paksoy H, Ustun I, Mansuroglu A, Guler H, et al. Association of Vitamin D with Disease Activity in Rheumatoid Arthritis and Ankylosing Spondylitis. J Clin Anal Med 2015; 6:486-489.
12. Brouwer-Brolsma EM, Vaes AMM, van der Zwaluw NL, van Wijngaarden JP, Swart KMA, Ham AC, et al. Relative importance of summer sun exposure, vitamin D intake, and genes to vitamin D status in Dutch older adults: The B-PROOF study. J Steroid Biochemy Mol Biol 2016; 164:168-176.

13. Colak S, Aydogan BI, Gokcay Canpolat A, Tulunay Kaya C, Sahin M, Corapcioglu D et al. Is primary hyperparathyroidism a cause of endothelial dysfunction? Clin Endocrinol (Oxf) 2017; 87:459-465.
14. Fidan F, Alkan BM, Tosun A. Çağın pandemisi: D vitamini eksikliği ve yetersizliği. Turk J Osteoporos 2014; 20:71-4.
15. Cerit Z. Vitamin D, body composition, and epicardial adipose tissue. Clin Nutr 2017; 36:1450.
16. Dogru A, Balkarli A, Cobankara V, Tunc SE, Sahin M. Effects of Vitamin D Therapy on Quality of Life in Patients with Fibromyalgia. Eurasian J Med 2017; 49:113-117.
17. Sugiyama T. Vitamin D and bone health: interpreting observational studies. J Intern Med 2017; 282:272-273.
18. Tonnesen R, Hovind PH, Jensen LT, Schwarz P. Determinants of vitamin D status in young adults: influence of lifestyle, sociodemographic and anthropometric factors. BMC Public Health 2016; 16:385.
19. Hightower JM, Dalessandri KM, Pope K, Hernandez GT. Low 25-Hydroxyvitamin D and Myofascial Pain: Association of Cancer, Colon Polyps, and Tendon Rupture. J Am Coll Nutr 2017; 36:455-461.
20. Batista ED, Andretta A, de Miranda RC, Nehring J, Dos Santos Paiva E, Schieferdecker ME. Food intake assessment and quality of life in women with fibromyalgia. Rev Bras Reumatol Engl Ed. 2016 Mar-Apr;56(2):105-110.
21. de Carvalho JF, Silva DN. Serum levels of vitamin B12 (cobalamin) in fibromyalgia. Rheumatol Int. 2016 May;36(5):741-742.
22. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP et al. International RDC/TMD Consortium Network, International association for Dental Research; Orofacial Pain Special Interest Group, International Association for the Study of Pain. Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) for Clinical and Research Applications: recommendations of the International RDC/TMD Consortium Network and Orofacial Pain Special Interest Group. J Oral Facial Pain Headache. 2014 Winter;28(1):6-27.
23. Li XY, Jia C, Zhang ZC. The normal range of maximum mouth opening and its correlation with height or weight in the young adult Chinese population. J Dent Sci. 2017 Mar;12(1):56-59.
24. Ayouni I, Chebbi R, Hela Z, Dhidah M. Comorbidity between fibromyalgia and temporomandibular disorders: a systematic review. Oral Surg Oral Med Oral Pathol Oral Radiol. 2019 Jul;128(1):33-42.
25. Kaynak BA, Taş S, Salkın Y. The accuracy and reliability of the Turkish version of the Fonseca anamnestic index in temporomandibular disorders. Cranio. 2020 Aug 25:1-6.
26. Nekora-Azak A, Evlioglu G, Ordulu M, Işsever H. Prevalence of symptoms associated with temporomandibular disorders in a Turkish population. J Oral Rehabil. 2006 Feb;33(2):81-84.
27. Gui MS, Pedroni CR, Aquino LM, Pimentel MJ, Alves MC, Rossini S et al. Facial pain associated with fibromyalgia can be marked by abnormal neuromuscular control: a cross-sectional study. Phys Ther. 2013 Aug;93(8):1092-1101.
28. Fujarra FJ, Kaziyama HH, Siqueira SR, Yeng LT, Camparis CM, Teixeira MJ et al. Temporomandibular disorders in fibromyalgia patients: are there different pain onset? Arq Neuropsiquiatr. 2016 Mar;74(3):195-200.
29. Holick MF, Binkley NC, Bischoff-Ferrari HA, Gordon CM, Hanley DA, Heaney RP et al. Evaluation, treatment, and prevention of vitamin D deficiency: an Endocrine Society clinical practice guideline. J Clin Endocrinol Metab. 2011 Jul;96(7):1911-1930.
30. Makrani AH, Afshari M, Ghajar M, Forooghi Z, Moosazadeh M. Vitamin D and fibromyalgia: a meta-analysis. Korean J Pain. 2017 Oct;30(4):250-257.
31. Stojanovska L, Apostolopoulos V, Polman R, Borkoles E. To exercise, or, not to exercise, during menopause and beyond. Maturitas. 2014 Apr;77(4):318-323.
32. McBeth J, Pye SR, O'Neill TW, Macfarlane GJ, Tajar A, Bartfai G, et al. Musculoskeletal pain is associated with very low levels of vitamin D in men: results from the European Male Ageing Study. Ann Rheum Dis 2010; 69:1448-1452.
33. Olama SM, Senna MK, Elarman MM, Elhawary G. Serum vitamin D level and bone mineral density in premenopausal Egyptian women with fibromyalgia. Rheumatol Int 2013; 33: 185-192.
34. Karahan AY, Hüner B, Kuran B, Sezer N, Çelik C, Salbaş E et al. Vitamin D Düzeyi ile Non-spesifik Kas İskelet Sistemi Ağrıları Arasındaki İlişkinin Değerlendirilmesi: Çok Merkezli Retrospektif Bir Çalışma (İnme Çalışma Grubu). Turk J Osteoporos 2017; 23:61-66.
35. Plotnikoff GA, Quigley JM. Prevalence of severe hypovitaminosis D in patients with persistent, nonspecific musculoskeletal pain. Mayo Clin Proc 2003; 78:1463-1470.
36. Nickel JC, Iwasaki LR, Gonzalez YM, Gallo LM, Yao H. Mechanobehavior and Ontogenesis of the Temporomandibular Joint. J Dent Res. 2018 Oct;97(11):1185-1192.
37. Yilmaz AD, Yazicioglu D, Tüzüner Öncül AM, Yilmaz E, Ereş G. Vitamin D receptor gene polymorphisms (Apa1 and Taq1) in temporomandibular joint internal derangement/osteoarthritis in a group of Turkish patients. Mol Biol Rep. 2018 Dec;45(6):1839-1848.
38. Demir CY, Ersoz ME. Biochemical changes associated with temporomandibular disorders. J Int Med Res. 2019 Feb;47(2):765-771.
39. Moreno-Fernández AM, Jiménez-Castellanos E, Iglesias-Linares A, Bueso-Madrid D, Fernández-Rodríguez A, de Miguel M. Fibromyalgia syndrome and temporomandibular disorders with muscular pain. A review. Mod Rheumatol. 2017 Mar;27(2):210-216.