



ARAŞTIRMA / RESEARCH

Temporomandibular joint disorders in children associated with early loss of first permanent molar

Çocuklarda erken daimi 1. molar diş çekimiyle ilişkili temporomandibular eklem hastalıkları

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Abstract

Purpose: The aim of this study was to evaluate the correlation between early loss of first permanent molar (FPM) and temporomandibular joint disorder (TMD) symptoms in the children.

Materials and Methods: 99 children (aged between 8 and 16) who had their FPM/s extracted at least two years ago were included in this study. The patients had clinical examination of oral status and temporomandibular joint (TMJ). Magnetic resonance imaging (MRI) findings were also evaluated with TMD symptoms. The correlation between the number of FPM loss and TMD symptoms was statistically analyzed.

Results: Only one FPM loss was recorded in 59 children, while 34 had two FPM loss and 7 had three or four FPM extracted. 10 of these children (10.1%) had at least one TMD symptoms. A positive correlation was found between the number of FPM loss and at least one TMD symptom.

Conclusion: The results of this study have shown the early loss of FPM has significant impact on TMD. The occlusion variations associated with eruption sequence and early FPM loss should be carefully followed to prevent TMD.

Keywords: Children, first molar extraction, temporomandibular joint disorder

Öz

Amaç: Bu çalışmanın amacı, çocuklarda daimi birinci azı dişin (FPM) erken kaybı ile temporomandibular eklem hastalıkları (TMD) semptomları arasındaki ilişkiyi değerlendirmektir.

Gereç ve Yöntem: En az iki yıl ve daha öncesinde FPM çekilmiş 99 çocuk (8 ile 16 yaş arası) çalışmaya dahil edildi. Hastaların oral muayenesi ve temporomandibular eklem (TMJ) klinik muayenesi yapıldı. TMD semptomları ile Manyetik rezonans görüntüleme (MRG) bulguları da değerlendirildi. Kayıp FPM sayısı ve TMD semptomları arasındaki korelasyon istatistiksel olarak analiz edildi.

Bulgular: 59 çocukta sadece bir FPM çekimi, 34'ünde iki FPM çekimi ve 7'sinde üç veya dört FPM çekimi yapıldığı kayıt edildi. Bu çocukların 10'unda (% 10.1) en az bir TMD semptomu görüldü. FPM çekim sayısı ile en az bir TMD semptomu arasında pozitif korelasyon bulundu

Sonuç: Bu çalışmanın sonuçları erken FPM kaybının TMD üzerinde önemli bir etkisi olduğunu göstermiştir. Erüpsiyon sekansı ile ilişkili oklüzyon varyasyonlar ve erken FPM kaybı TMD'yi önlemek için dikkatle takip edilmelidir.

Anahtar kelimeler: Çocuk, daimi 1. molar diş çekimi, temporomandibular eklem hastalığı

INTRODUCTION

Temporomandibular disorder (TMD) is a collective term including various clinical problems which

involve temporomandibular joints (TMJ) and/or associated structures (soft tissues, masticatory system)¹. The etiology of TMD is complex and multifactorial and predisposing factors of TMD include

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masseter muscles, occlusal interferences, parafunctional habits (bruxism), trauma, hypermobility, age and gender of the patient and systemic diseases. The American Academy of Pediatric Dentistry (AAPD) guidelines also reported that etiologic factors suggested as contributing to the development of TMD are anatomical factors (skeletal and occlusal), orthodontic treatment needs (skeletal anterior open bite, skeletal class II-III profile, posterior crossbite), psychosocial factors, pathologic, genetic and hormonal factors².

Previous studies proposed that the loss of molar teeth support and occlusal relationship are strongly associated with the presence and severity of osteoarthritis, and the loss of more teeth significantly increase the prevalence of crepitation^{3,4}. The restoration of decayed molar teeth is therefore suggested to decrease or eliminate pain associated with TMD. The success of the treatment depends on the stabilization of occlusion, the distribution of occlusal forces and the decrease in the amount of forces on TMJ. The loss of first permanent molar (FPM) teeth also causes secondary alterations such as the shift and tilting of remaining teeth in the alveolar arch. The remaining teeth can move mesial or distal as well as in vertical direction which subsequently causes a condition defined as 'tightly locked occlusion'. Wang et al.³ have shown that tightly locked occlusion is related to TMD especially in female patients while Kuwahara et al.⁵ has suggested that the loss of FPM in the early ages causes atrophy of the condyle and other components of TMJ.

Predisposing risk factors and precipitating factors contribute to the development of TMDs. The available data suggests a poor correlation between any single etiological factor and resulting signs and symptoms. Alterations in any one or a combination of teeth, periodontal ligament, the TMJ, or the muscles of mastication may lead to TMD. But the effects and the relation of occlusal factors on TMD are still controversial in dental literature. For this reason, the aim of this retrospective study was to investigate possible correlation between the occlusal discrepancies such as early loss of FPM/s and TMD symptoms.

MATERIALS AND METHOD

The present study was carried out for the evaluation of TMD symptoms in children from October 2018 through March 2019 in Department of Oral and

Maxillofacial Surgery, Faculty of Dentistry, Cukurova University. The subjects were selected randomly from patients who had their FPM/s extracted in their mixed dentition stage. The inclusion criteria for the selection of the participants were the following: children aged 8 to 16 years old, had their FPM/s extracted at least two years ago. The exclusion criteria were the presence of any developmental anomalies of TMJ, the presence of rheumatoid arthritis, psoriatic arthritis or muscle disease, patients receiving orthodontic therapy and cleft lip/palate patients. A total of 174 patients with extracted FPM/s were invited for clinical examination. Among the 174 participants, 99 participants admitted the invitation and the study population consisted of these patients. The study was undertaken on these participants. The parents/guardians of the participants also signed an informed consent for the clinical evaluation and for the use of data obtained by the questionnaires. Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Medicine, Cukurova University (Grant no: 57/2016-22). The present study was carried out in compliance with the norms that regulate research involving human beings in the Declaration of Helsinki.

Clinical examination

A clinical examination was performed for each participant. The clinical examination included both a brief intra-oral examination of dental and periodontal status, reporting presence or absence of caries and gingivitis, as well as an examination of the temporomandibular system. The specialist dentist who has also been calibrated to a gold-standard (DDS, PhD) examined the patients for the following signs and symptoms of TMD according to the The Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD)⁶:

1. The presence of TMJ sounds (clicking, crepitus, popping) during opening and closing the jaws was evaluated with a stethoscope (auscultation)
2. The presence of deviation equal to or more than 2 mm during mandibular movements (deviation, deflection) was noted.
3. The presence of TMJ sensitivity was evaluated by palpation of right and left condyles.
4. The maximum mouth opening was measured by the distance between the incisal edges of the maxillary and mandibular central incisors. The patients were instructed to try to open their

mouth 'as wide as' possible and the distance was measured by a passively located millimetric calipers. An opening between 35 mm and 50 mm was considered as 'normal'.

5. The sensitivity and/or pain of masseter muscle, temporal, internal and external pterygoid and sternocleidomastoid muscles were evaluated by palpation.
6. The presence of headaches more than once in a week was noted.

These signs and symptoms were noted as 'positive or negative' (present or absent) together with the number of missing FPM and time of FPM/s extraction. The children with apparent TMD symptoms were directed to magnetic resonance imaging (MRI) for further evaluation of TMJ. The amount and the location of the missing FPM were recorded.

Statistical analysis

Data analysis was performed using the Statistical Package for the Social Sciences version 23.0 (SPSS Inc., Chicago, IL., USA). The data were organised in tables and submitted to statistical tests. Descriptive statistic were used for the characterisation of the sample. The frequency and correlation analysis between TMD symptoms and missing FPM were evaluated by chi-square test. The probability level for statistical significance was determined as $p=0.05$.

RESULTS

The study population consisted of 99 children. The mean age was $10 \pm 2,1$ years (age range 8 to 16); 41.4% boy's (n=41) and 58.6% girl's (n=58). The gender distribution of the study population was not found significantly different. The FPM extraction was done two years ago in 53 children and more than two years in 46 children. 59 children had only one, 34 had two, and 7 had three or four of their FPM extracted.

Although there was no significant correlation between the TMD symptoms and the time period after molar extraction ($p>0.05$). 6 out of 10 children with TMD symptoms had their extractions more than two years ago. 10 children (10.1%) of our study population had at least one TMD symptom. Three children had TMJ sound (3.03%), 4 patients had limitation of mouth opening (4.04%) and 5 patient of them had muscle pain (5.05%). Two children (2.02%)

had multiple symptoms. The distribution and percentage of TMD symptoms in the study population was summarized in Table 1.

Table-1. The distribution and percentage of TMD symptoms in the study population

	n	%
TMJ sound	3	3.03
Deviation-deflection	0	0
Sensitivity on palpation of TMJ	0	0
Limitation of jaw opening	4	4.04
Myofascial pain	5	5.05
Headache	0	0
Presence of multiple symptoms	2	2.02
Total	14	14.14

TMJ :Temporomandibular joint

Among 99 children patients, it was found that 10 children (10.1 %) had at least one TMD symptom. None of the children from 59 patients with only one extracted FPM experienced any symptoms while 18.2 % (6 patients) of 34 patients with two extracted molars. 57.1 % (4 patients) of 7 children with three or four extracted molars had at least one TMD symptoms. These findings showed a significant correlation between TMD symptoms and the number of extracted FPM ($p<0.001$). The distribution of TMD symptoms and the number of teeth loss was shown in Table 2.

Table-2. The distribution of TMD symptoms and the number of teeth loos.

Number of teeth loss	Total number of patients	Number of patients with TMD symptom/s	%
1	59	0	0
2	34	6	18.2
3 or 4	7	4	57.1
Total	99	10	10.1
P-value	$p<0.001^*$		

*Chi square test, TMD (Temporomandibular disorder)

DISCUSSION

Although the prevalence of caries has significantly decreased especially in the west countries during the last three decades, there is still a considerable amount of teeth that needs to be extracted due to early childhood caries. The most frequently extracted teeth are the FPMs probably due to their eruption time and their prolonged exposure time to oral flora. There are many studies evaluating the TMD etiology in dental

literature, however research on the frequency and etiology of childhood TMD is still scarce.^{7,11,15}

The accuracy and reliability together with the standardization of clinical examination methods have always been problematic in epidemiological studies. Therefore, only one calibrated dentist (DDS, PhD) performed all clinical TMJ examinations using standardized methods (RDC/TMD) in the current study.

Although the anatomy of TMJ in children and adults is the same, the growth and development process in children may have special effects on the joint⁸. The children may tolerate the occlusal differences better than the adults, but still children and teenagers suffer a significant amount of TMD symptoms⁹. The prevalence of TMD tends to increase with age and is reported to range from 5% to 10% during mixed dentition and from 5% to 32% during puberty.¹⁰ Investigators reported the prevalence of clicking as 2.7% in the primary dentition, 10.1% in late mixed dentition, and 16.6% in permanent dentition¹¹. In this study, TMD prevalence was found 14.14% and this rate is compatible with the similar studies.

Farsi and Alamoudi¹² shown that TMJ sound is the most frequent TMD symptom in children with aged between 4 and 6 which is in accordance with other studies in the literature.^{13,14} A review of Da Silva et al.¹⁵ mentioned that joint sounds such as TMJ symptom are common in children between 6-12 years old and could represent a possible onset of early TMD. On the other hand, Bertoli et al.¹⁶ have found that myofascial pain is more common symptom in children. In the current study, it was also found that myofascial pain is the most frequent TMD symptom in our study population.

Histopathologic tissues taken from cadavers and rats studies have shown that the loss of posterior teeth is correlated with the histological changes of TMJ^{17,18,19}. It is therefore suggested that the increase the increased functional forces on TMJ may explain this casual relationship. The postmortem macroscopic and microscopic study of TMJ have shown that the increase of functional loading causes an adaptation process involving localized surface alterations²⁰. Kurita et al.²¹ have compared the histological findings of asymptomatic TMJ discs obtained during autopsies with symptomatic discs which were surgically obtained. The results showed that while normal discs are biconcave the surgically obtained discs were deformed and thicker together with

various other histological differences.

The studies on the etiology of TMD in children are usually focused on the loss of primary molars^{12,22}. These studies have also shown that the loss of primary molars are associated with the joint sounds due to the increase of loading on TMJ. Franks et al.²³ have shown that TMJ pain is more frequent on the sides of the jaws with tooth loss compared to the sides which still have dental support. Similarly, Martinez et al.²⁴ have proven that the TMJ sounds are more frequent on the sides with the loss of posterior teeth. Prithi et al.²⁵ have suggested that the TMD signs and symptoms are significantly correlated with the increasing number of tooth loss by the age of the patients. Accordingly Wang et al.²⁶ have explained that the only tightly locked occlusion is related to TMD and the symptom prevalence increases especially when the loss of posterior teeth are present in different quadrants. de Santis et al.²⁷ reported that the number of occlusal contact points is lower among children with TMD. The results of our study confirm these findings as when the loss of FPM and lack of occlusal interference occur in multiple and different quadrants, the frequency of TMD symptom also increase. Therefore, it may be suggested that the loss of posterior teeth may contribute to the etiology of TMD.

In conclusion, the results of this study show that the early loss of first permanent molars have effects on TMD and support the concept of abnormal occlusion on TMD etiology. Dental clinicians should evaluate that early loss of FPM/s may lead to TMD. Every comprehensive dental examination should include a TMJ history and assessment for dental practice. The findings also highlight the necessity of preventive treatments approaches at early ages of life.

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