A Comparison of Hard and Soft Occlusal Splints for the Treatment of Nocturnal Bruxism in Children Using the BiteSTRIP®

Kevser Kolcakoglu*/ Salih Dogan**/ Firdevs Tulga Oz ***/ Mustafa Aydınbelge****

Objective: *Bruxism is defined as a parafunctional activity. It could be in diurnal or nocturnal form, based on the time it occurs. The purpose of the study compares the effectiveness of occlusal splint treatments in children with nocturnal bruxism using the BiteStrip®.* ***Study Design:*** *The muscle activity of children was measured using the BiteStrip®. The groups used occlusal splints during nighttime sleep for three months, at the end of which their muscle activity were measured again through the use of the BiteStrip®.* ***Results:*** *Muscle pain in palpation and pain in the dynamic position of TMJ pain was significantly reduced in patients using soft occlusal splint (p=0.01). There was no significant change in the BiteStrip® score in both group I (p=0.11) and group II (p=0.61).* ***Conclusion:*** *Soft occlusal splints could reduce pain caused by nocturnal bruxism on muscle and TMJ. The relationship between treatment results and BiteStrip® scores of patients using soft occlusal splint or hard occlusal splint are not significantly.*

Keywords: *Bruxism, Teeth Grinding, Occlusal Splint, BiteStrip®, Children*

INTRODUCTION

Nocturnal bruxism, an oral-motor activity, is defined as a sleep and movement disorder in the International Classification of Sleep Disorders (ICSD-3), which is considered to be the gold standard and published by the American Sleep Disorder Association (ASDA) [1, 2]. It is reported that dental, systemic, and psychological factors play a part in the etiology of nocturnal bruxism, and it is widely accepted that it particularly occurs as a reaction to anxiety and stress[3].

Methods such as questionnaires, clinical observations, use of intra-oral aligners, electromyographic analysis of muscles of mastication, and polysomnography are used to determine the presence of nocturnal bruxism[4]. The major disadvantages posed by electromyographic devices are challenging to apply them in clinics, and their cables negatively affect the sleep comfort of the patient[5]. Over the past few years, BiteStrip®, a wireless device that can be used at home, was developed to overcome these challenges. The ease of use provided by this device shortens the duration of diagnosis for both the patient and the dentist. A few studies have demonstrated that successful and reliable results have been achieved with the BiteStrip®[5-7].

Maximum bite force can be exceeded by an even greater force during nocturnal bruxism, which has a multifactorial etiology, and can damage anatomic structures[8]. This factor must be eliminated in order to choose the effective treatment for nocturnal bruxism. Therefore, dental, psycho-behavioral, and pharmacological treatment approaches are employed. These treatments aim to reduce teeth grinding, relieve the pain in the facial and temporal areas, and increase the quality of sleep[7]. The present study aimed to reveal the appropriate dental treatment option for the treatment of nocturnal bruxism using BiteStrip®.

*Kevser Kolcakoglu, DDS, PhD, Erciyes University Faculty of Dentistry, Department of Pediatric Dentistry, Kayseri, Turkey.
**Salih Dogan, DDS, PhD, Associate Professor, Erciyes University Faculty of Dentistry, Department of Pediatric Dentistry, Kayseri, Turkey.
***Firdevs Tulga Oz, DDS, PhD, Professor, Ankara University Faculty of Dentistry, Department of Pediatric Dentistry, Ankara, Turkey.
****Mustafa Aydınbelge, DDS, PhD, Associate Professor, Erciyes University Faculty of Dentistry, Department of Pediatric Dentistry, Kayseri, Turkey.

Corresponding author:
Kevser Kolcakoglu
Department of Pedodontics, Erciyes University Faculty of Dentistry,
38039 Melikgazi, Kayseri, Turkey.
E-mail: kevser.kolcakoglu@gmail.com

MATERIALS AND METHOD

The study received ethics approval from the Clinical Research Committee of University's Erciyes Faculty of Medicine (No. 516.2014). The parents of the patients were asked to sign informed consent forms following the Helsinki principles.

Patient selection criteria

240 patients who complained of bruxism were referred to the Erciyes University, Department of Pediatric Dentistry.

In the first examination, 70 patients without nocturnal bruxism and 58 patients in their permanent dentitions were excluded from the study.

In the second clinical examination, 112 children (58 girls and 64 boys between the ages of 6-11) in their late mixed dentitions were selected.

To form a study group;

Stage 1:

- Patients complained about noises caused by teeth clenching and grinding at least six months. (These complaints should be more than three hours a night and also confirmed by family members).
- Patients who had discomfort, fatigue, or stiffness in the temporal muscle region when they woke up in the morning.
- Patients with no temporomandibular joint (TMJ) discomfort.
- Patients with masseter muscle hypertrophy during masticatory contraction [9].

According to these criteria, 69 patients were selected out of 112 patients.

Stage 2:

69 patients were evaluated according to the following criteria. 29 patients were excluded out of 69 patients in this *stage 2*.

- Patients whopresented intestinal parasites were detected as a result of consultation with Erciyes University, Children's Hospital, Department of Gastroenterology[8,10].
- Patients with Angle class II and Angle class III occlusion[11], also having limitation in the maximum mouth opening.
- Patients did not have canine-protective occlusion in lateral movements of the mandible [9,12,13.] .
- Patients wearing space maintainers.
- Patients detected with premature dental contacts.
- Patients using occlusal splint in their dental history.
- Patients who have a neurological disorder or drug use''.

Stage 3

- Finally, 40 patients (22 females, 18 males) with nocturnal bruxism were selected.

Bitestrip procedure and treatment groups

The dental and periodontal treatments of the patients were completed prior to the study. The study group was formed, selecting a total of 40 children, with an average age of 8.6 years who were diagnosed with nocturnal bruxism that indicated splint procedures.

All patients were introduced to the BiteStrip® (up2dent, Pulheim-Stommeln, Germany), a portable EMG device (Figure 1), in accordance with the manufacturer's instruction manual. Subsequently, the area where the BiteStrip® was to be placed was marked on the child's face. Without soft/hard occlusal splint in the patient's oral, the instruction manual was provided to the patient's parents and asked to use it at night under the supervision of their parents at their own home (Figure 2). The BiteStrip® was used to measure the masseter muscle activity, and the BiteStrip® scores obtained were recorded. Table 1 shows the BiteStrip® scores of the manufacturer and comparative values of these with the sleep laboratory. In line with the instructions given, the patients returned the device to the clinic. Patients whose scores could not be read by the devices due to misuse were shown the application again, provided with a new device, and asked to use it one more time.

Figure 1: Bitestrip®

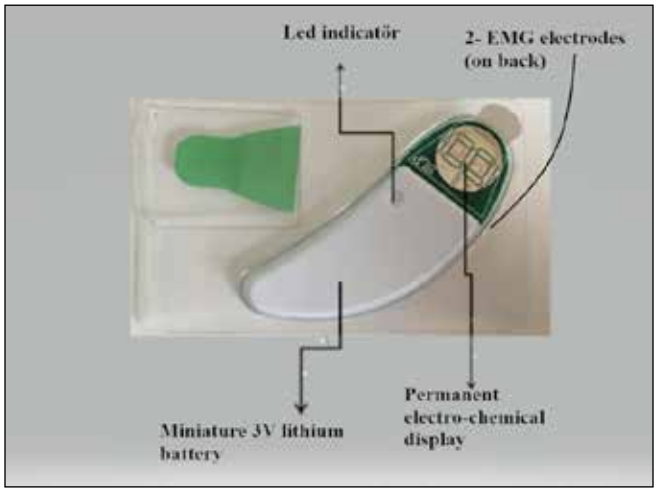


Figure 2: Instruction manual for the BiteStrip®

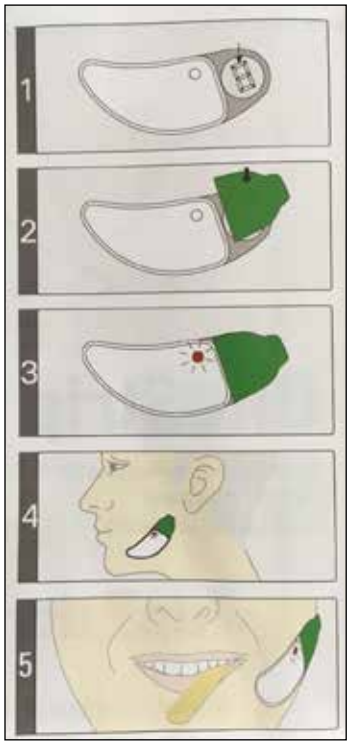


Table 1. BiteStrip®

L	No bruxism or present at very low level
1	Mild
2	Moderate
3	Severe
E	Error
-	No massester muscle activity or unsuitable dermal structure

The study group of 40 patients was randomly divided into two groups of 20 individuals each. Patients with different BiteStrip® scores were attentively distributed to each group while creating the groups. Group I was used for soft occlusal splints, whereas group II was used for hard occlusal splints. Subsequent to the occlusal splint procedure, after three months, the BiteStrip® scores of the patients were measured once again to determine the changes in muscle activity.

Considerations in groups

Hypertrophy of the muscles of mastication and/or muscle pain felt during chewing or palpation of neck muscles are among the symptoms observed in patients with the habit of nocturnal bruxism. The head-neck region soft tissue asymmetry and muscular hypertrophy were evaluated by palpation. Patients who felt tenderness were noted.

Additionally, parafunctional dental abrasion was determined as dental abrasion occurring on the bright, flat, and wide surfaces in the contact areas of the teeth. As parafunctional dental abrasion is a symptom that shows the presence and severity of the habit of bruxism, it was recorded for the patients included in this study, and the severity of abrasion was evaluated based on intra-oral images.

Preparation of Occlusal Splınts

Using hydrocolloid impression materials, (Cavex, Tulip Colorswitch Alginate, Holland), the maxillary teeth sizes were measured in all patients. Subsequent to the impression procedure, both hard and soft occlusal splints were applied in a way that would cover the incisal and occlusal surfaces of all teeth in the U form, using auto-polymerized transparent acrylic (Orthocryl EQ, Dentaurum. Germany) (Figure 3).

Occlusal splint was adjusted with articulating paper to the mouth to have an equal and simultaneous contact in all anterior and posterior teeth (Figure 4).

Duration of use for Occlusal Splınts

All bruxism patients were asked to use the splint for at least eight hours a night for a total period of three months. If patients' teeth are erupting, space was created in the splint to allow normal eruption during 3 months. Moreover, the patients were warned not to take any muscle relaxants, analgesics, or inflammatory drugs during the course of the treatment.

Statistical analysis

Statistical analysis was performed using SPSS software (IBM Statistical Package for Social Sciences, version 20.0; SPSS Inc., Chicago, Illinois, USA). The mean, standard deviation, frequency, and ratio values were used for the descriptive statistics of age and gender. The Shapiro Wilk's test was performed to determine the distribution of the data. The Mann-Whitney U test was used to analyze the independent quantitative data. Wilcoxon and Mc Nemar tests were used to analyze the dependent data. The analysis of the independent qualitative data was carried out using the Chi-square test. Significance was predetermined at *P* value of less than 0.05.

Figure 3: Occlusal Splint (U form)

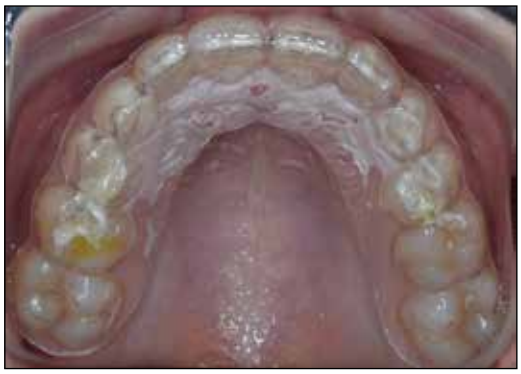
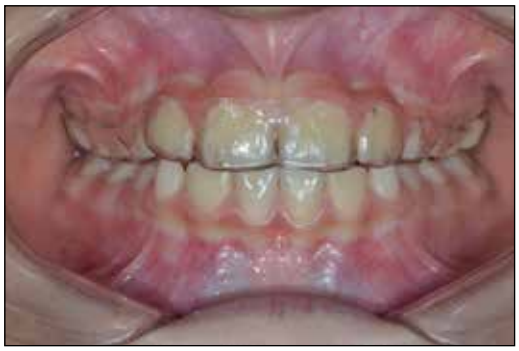


Figure 4: Occlusal Splint



RESULTS

Results of registration forms

The patients were distributed based on gender, age, the volume of teeth grinding, the severity of parafunctional abrasion, and BiteStrip® scores (Table 2). While the mean age of the patients in group I was 8.40 ± 1.23; group II was 8.70 ± 1.17. The study determined that the mean age of the patients was not different in group I and group II (p=0.43). It was determined that the sound of teeth grinding were similar in group I and group II (p=0.83). Whereas Bitestrip® score of group I before the treatment was 1.90 ± 0.64; group II was 2.25 ± 0.64. There is no difference between parafunctional wear levels in group I and group II (p=0.83)

Bitestrip® results

The pre-treatment and post-treatment BiteStrip® scores of the study group patients were evaluated in 40 children with nocturnal bruxism (Table 3). There was no significant difference between the pre-and post-treatment Bitestrip® scores of group I (p = 0.11) and group II (p = 0.61)

Examination findings of TMJ and Mastication Muscles

The presence of pain in the TMJ region, muscles of mastication, and neck muscles before and after the occlusal splint treatment was evaluated in 40 children diagnosed with nocturnal bruxism (Tables 4-5). The presence of pain in group I changed by p=0.01, and group II changed by p=0.09 in the dynamic position of TMJ the post-treatment period compared to the pre-treatment period. Muscle pain in palpation, group I changed by p=0.01 and group II changed by p=0.08 in the post-treatment period compared to the pre-treatment period.

Table 2. Distribution of the registration form results of the study group patients

N		Group I (Soft occlusal splint)			Group II (Hard occlusal splint)			p
		Percent	Mean ± S.D	N	Percent	Mean ± S.D		
Age		20	100.0%	8.40 ± 1.23	20	100.0%	8,70 ± 1,17	0.43
Gender	Female	8	40.0%		8	40.0%		0.99
	Male	12	60.0%		12	60.0%		
Sound of Teeth Grinding	Mild	2	10.0%		3	15.0%		0.83
	Moderate	13	65.0%		12	60.0%		
	Severe	5	25.0%		5	25.0%		
Severity of Parafunctional Abrasion of Teeth	Mild	4	20.0%		3	15.0%		0.83
	Moderate	11	55.0%		12	60.0%		
	Severe	5	25.0%		5	25.0%		
Pre-treatment Bitestrip® score	1	3	15.0%	1.90±0.64	3	15.0%	2.25±0.64	0.09
	2	12	60.0%		11	55.0%		
	3	5	25.0%		6	30.0%		
Muscle pain in Palpation (Pre-Treatment)	Absent	11	55.0%		12	60.0%		0.23
	Present	9	45.0%		8	40.0%		

N: Number, S.D: Standard Deviation, *p*<0,05 is significant difference

Table 3. Comparison of the presence of pain in dynamic position of TMJ in the study group patients

Pain in dynamic position of TMJ N		Group I (Soft occlusal splint)		Group II (Hard occlusal splint)		*Group I p*	*Group II p*
		Percent	N	Percent			
Pre- Treatment	Present	9	45.0%	8	40.0%	0.01*	0.09
Post- Treatment	Present	5	25.0%	7	35.0%		

N: Number, *p*<0,05 is significant difference

Table 4. Comparison of Muscle Pain in Palpation in the study group

Muscle Pain in Palpation N		Group I (soft occlusal splint)		Group II (Hard occlusal splint)		*Group I p*	*Group II p*
		Percent	N	Percent			
Pre- Treatment	Present	9	45.0%	8	40,0%	0.01*	0.08
Post- Treatment	Present	5	25,0%	9	45,0%		

N: Number, *p*<0,05 is significant difference

Table 5. Comparison of the Bitestrip® score scores in study group

	Bitestrip® score	Mean ± S.D.	p
Group I (Soft Occlusal Splint)	Pre- Treatment	1.90 ± 0.64	0.11
	Post- Treatment	2.05 ± 0.69	
Group II (Hard Occlusal Splint)	Pre- Treatment	2.25 ± 0.64	0.61
	Post- Treatment	2.15 ± 0.67	

N: Number, S.D: Standard Deviation, *p*<0,05 is significant difference

DISCUSSION

Some publications suggest that the prevalence of bruxism in children varies between 8 and 38% [14], and it can be seen that questionnaires, clinical findings, intra-oral aligners, electromyographic recording devices, and polysomnographic records taken in sleep laboratories have been used for the diagnosis[4]. Furthermore, parafunctional dental abrasion, masseter muscle hypertrophy[15], and thickening in linea alba are found in the intra-oral examination of nocturnal bruxism [16]. No consensus has been reached with regard to which method is advantageous over others for the treatment of nocturnal bruxism in children [17]. The present study aimed to analyze the hard and soft occlusal splints to treat nocturnal bruxism in children by using BiteStrip®.

Clinical studies of bruxism, which is diagnosed mostly through questionnaires and clinical examination[18], have reported that sound especially facilitates the diagnosis of bruxism [19]. Lavigne *et al* studied the accuracy of the criteria used for diagnostic purposes. They reported that they achieved accurate diagnosis by 83.3% in patients with bruxism by conducting polysomnographic evaluations in individuals with the teeth-grinding sound, dental abrasion, pain in muscles of mastication, and masseter muscle hypertrophy for at least five nights for a period of six months [20,21]. In light of these studies, the authors used a questionnaire form prepared for parents, which included information on medical history and provided the ease and quickness of use in daily practice to select the study group children in the present study. Deemed to be the most reliable method so far, electrophysiological recording systems are another method used in the diagnosis of nocturnal bruxism [20]. Nevertheless, the major disadvantage these systems pose is that they affect the natural sleep habit and are expensive and impractical [22]. Thus, battery-operated portable recording systems, which record EMG and enable patients to sleep at home, were developed with ease of use for patients [23,24]. In their study, Minakuchi and Clark compared the specificity and sensitivity of the BiteStrip® to a polysomnogram recording the EMG of the masseter muscle and determined a generally good level of specificity in all individuals. They reported that individuals with moderate and high levels of bruxism had a better specificity and stated that low cost was also a major advantage[25]. In their study, Shochat *et al* compared the masseter EMG and BiteStrip® records of six nocturnal bruxism patients, four obstructive sleep apnea patients, and eight patients with no indications, and they agreed on its statistical sensitivity and specificity [5]. The most important advantage of using the BiteStrip® is that it records the signals that stem from the forces exceeding the personal maximum bite force [6]. In the present study, it was observed that the BiteStrip® scores, which were obtained following the use of the BiteStrip® by children with bruxism, supported the clinical observations and results of examinations conducted prior to the use of the BiteStrip® in children. Therefore, the reliability of the inter-group comparison was ensured by conducting the standardization based on an objective criterion (p=0.09).

TMJ disorders in children and adolescents can lead to bruxism, and bruxism can bring about TMJ disorders [26]. In order to detect TMJ problems, mandible movements should be examined, and TMJ examination should be performed. Temporomandibular Irregularities/Diagnostic Criteria were used in the detection of TMJ disorders [27]. According to these criteria, TMJ static and dynamic palpation were performed to evaluate the presence of pain in TMJ [27,28]. Intra-articular pathology or incorrect occlusal relationship, or bruxism may cause pain in the dynamic position of TMJ [9,13,29]. Noguchi et al. stated that stabilization splints are effective in TMJ pain caused by bruxism[30]. Pettengill *et al* compared soft and hard occlusal splints and reported that they were effective in reducing muscle pain and that there were no significant differences between both splints[31]. Wright, however, reported that occlusal changes occurred in the occlusal splint users, the use of adapted soft occlusal splint did not lead to any occlusal changes, and non-adapted splints led to an increase in the symptoms of the patients. Moreover, he reported that soft occlusal splints would trigger parafunctional activity [32]. Kashiwagi *et al* stated that soft occlusal splints are effective in reducing pain in patients with masticatory muscle pain[33]. In the current study, both pain in the dynamic position of TMJ caused by bruxism and muscle pain in palpation were significantly reduced in group I (p=0.01).

Holmgren *et al* reported that the splints failed to stop the bruxism activity but diminished the symptoms [34]. Clark *et al* observed that the EMG activity decreased in half of the patients evaluated as a result of the occlusal splint treatment, one-fourth had no changes at all, and the remaining one-fourth had increased EMG muscle activity. Due to these different results, the effectiveness of splints on muscle activity has been reported to be unpredictable[35]. It is possible to use soft and/or hard occlusal splints on children with active bruxism [36]. In a study conducted by Hachman *et al* on children three to five years old with bruxism, it was reported that those using occlusal splints had less dental abrasion than those who did not use them. Nonetheless, as the splints to be used in children could affect growth and development, it was recommended to have frequent follow-ups and use them for a period of two to three months [37]. As a result of the study they carried out by taking the records of repetitive bite activity obtained from six healthy individuals using hard occlusal splints, soft occlusal splints, and natural teeth, Narita et al. reported that soft occlusal splints caused increased muscle fatigue and reduced muscle activity in repetitive bites. The repetitive bites in the hard occlusal splints did not cause any changes in the sensation of muscle fatigue or muscle activity[38]. Although hard occlusal splints used for bruxism distinctly reduce the activity in the muscles of mastication and specifically in the masseter muscles [39]. In this study, the authors used occlusal splint for 3 months in patient with nocturnal bruxism. However, there was no significant change in BiteStrip® score, providing information about muscle activity, in both groups.

There are no absolute data regarding which one is more beneficial among hard or soft occlusal splints. In the present study, however, it was found that p=0.11 upon the comparison of the pre-treatment and post-treatment results of the children who used hard and soft occlusal splints, as there was an insignificant increase in the children using soft occlusal splints, whereas a reduction was observed in the BiteStrip® score of the children who used hard occlusal splints, which was statistically p=0.61. There could be no significant change in BiteStrip® scores due to the adjust of the occlusal splint with articulation paper instead of T-SCAN or the limitations of the BiteStrip® on the craniofacial structure [40]. These conditions are limitations of the study.

CONCLUSION

- The presence of nocturnal bruxism in children could be diagnosed with Bitestrip®
- The presence of pain when TMJ is in the dynamic position and the muscle pain in palpation could be reduced by the soft occlusal splint absorbing the incoming occlusal forces.
- Complaints of pain on palpation could tend to increase due to the hard occlusal splint's failure to distribute the incoming parafunctional force both to the muscles and TMJ in a balanced manner.
- The relationship between treatment results and BiteStrip® scores of patients using soft occlusal splint or hard occlusal splint is not significant.

In conclusion, it is determined that there is a need for studies to analyze the etiology of bruxism in children and evaluate the effectiveness of the occlusal splint treatment on bruxism in a large population. İn addition to the correlation of the use of BiteStrip® with the craniofacial structure in the diagnosis of bruxism, the use of the splint procedure may not be sufficient in itself for the prevention of bruxism in children.

Conflict of interest

The authors declare no conflicts of interest

Funding

There was funding BAPSİS of Erciyes University for this study

REFERENCES

1. Sateia MJ. International Classification of Sleep Disorders-Third Edition. Chest. 2014;146(5):1387-94.
2. Thorpy MJ. Classification of sleep Disorders. Neurotherapeutics. 2012;9(4):687-701.
3. Dawson PE. Evaluation, diagnosis, treatment of occlusal problems. St. Louis: CV Mosby; 1989.
4. Lobbezoo F, Jacobs R, De Laat A, Aarab G, Wetselaar P, Manfredini D. [Chewing on bruxism. Diagnosis, imaging, epidemiology and aetiology]. Nederlands tijdschrift voor tandheelkunde. 2017;124(6):309-16.
5. Shochat T, et al. Validation of the Bitestrip screener for sleep bruxism. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;104(3):32-9.
6. Ahlberg K, et al. Bruxism and sleep efficiency measured at home with wireless devices. J Oral Rehabil. 2008;35(8):567-71.
7. Bader G, and Gilles Lavigne. Sleep bruxism; an overview of an oromandibular sleep movement disorder. Sleep Med Rev. 2000;4(1):27-43.
8. Manfredini D, and Frank Lobbezoo. Relationship between bruxism and temporomandibular disorders: a systematic review of literature from 1998 to 2008. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;109(6):26-50.
9. Bumann A, and Ulrich Lotzmann. TMJ disorders and orofacial pain: the role of dentistry in a multidisciplinary diagnostic approach. In: Rateitschak Klaus H WHF, editor. Color atlas of dental medicine. Thieme: Newyork; 2002. p. 201-46.
10. Tehrani MH, Pestechian N, Yousefi H, Sekhavati H, Attarzadeh H. The Correlation between Intestinal Parasitic Infections and Bruxism among 3-6 Year-Old Children in Isfahan. Dental research journal 2010;7:51-55.
11. Demir A, et al. The relationship between bruxism and occlusal factors among seven to 19 yeard old Turkısh children. Angle Orthod. 2004;74(5):672-6.
12. Okeson J. Management of temporomandibular disorders and occlusion-E-book. 8th ed: Elsevier Health Sciences; 2019.
13. Okeson JP. Management of temporomandibular disorders and occlusion-E-book. 8th ed: Elsevier Health Sciences; 2019.
14. Cheifetz AT, et al. Prevelance of bruxism and associated correlates in children as reported by parents. J Dent Child (Chic). 2005;72(2):67-73.
15. Ramfjord SP. Bruxism, a clinical and electromyographic study. J Am Dent Assoc. 1961;62:21-44.
16. Menapace SE, et al. The dentofacial morphology of bruxers versus non-bruxes. Angle Orthod. 1994;64(1):43-52.
17. Ierardo G, et al. Treatments of sleep bruxism in children: A systematic review and meta-analysis. Cranio. 2021;39(1).
18. Mizumori T, et al. Prediction of sleep bruxism events by increased heart rate. Int J Prosthodont. 2013;26(3):239-43.
19. Serra-Negra JM, et al. Environmental factors, sleep duration and sleep bruxism in Brazilian schoolchildren: a case-control study. Sleep Med. 2014;15(2):236-9.
20. Lavigne GJ, et al. Bruxism physiology and pathology: an overview for clinicians. J Oral Rehabil. 2008;35(7):476-94.
21. Rompré PH, et al. Identification of a sleep bruxism subgroup with a higher risk of pain. J Dent Res. 2007;86(9):837-42.
22. Lavigne GJ, and FR CDC. Current knowledge on awake and sleep bruxism: overview. Alpha Omegan. 2003;96(2):24-32.
23. Rugh JD. Electromyographic studies of bruxist behavior before and during treatment. J Calif Dent Assoc. 1975;3(9):56-9.
24. Harada T, et al. The effect of oral splint devices on sleep bruxism: a 6-week observation with an ambulatory electromyographic recording device. J Oral Rehabil. 2006;33(7):482-8.
25. Minakuchi H, et al. Sensitivity and specificity of a miniature bruxism detection device. Oral Surg Oral Med Oral Pathol Oral Radiol. 2005;99(4):440-1.
26. Magnusson T HM. Temporomandibular Disorders. Pediatric Dentistry: A Clinical Approach. John Wiley& Sons: West Sussex; 2016. p. 309-15.
27. Schiffman E, Ohrbach R, Truelove E, Look J, Anderson G, Goulet JP, et al. 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†. Journal of oral & facial pain and headache. 2014;28(1):6-27.
28. Conti PCR, Silva RDS, Rossetti LMN, Da Silva RDOF, Do Valle AL, Gelmini M. Palpation of the lateral pterygoid area in the myofascial pain diagnosis. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology. 2008;105(3):e61-e6.
29. Wieckiewicz M, Smardz J, Martynowicz H, Wojakowska A, Mazur G, Winocur E. Distribution of temporomandibular disorders among sleep bruxers and non-bruxers-A polysomnographic study. J Oral Rehabil. 2020;47(7):820-6.
30. Noguchi T, Kashiwagi K, Fukuda K. The effectiveness of stabilization appliance therapy among patients with myalgia. Clinical and experimental dental research. 2020;6(2):244-53.
31. Pettengill CA, et al. A pilot study comparing the efficacy of hard and soft stabilizing appliances in treating patients with temporomandibular disorders. J Prosthet Dent. 1998;79(2):165-8.
32. Wright EF, and Gary D. Klasser. Manual of Temporomandibular Disorders. 4th ed: Wiley Publishing Company; 2019.
33. Kashiwagi K, Noguchi T, Fukuda K. Effects of soft occlusal appliance therapy for patients with masticatory muscle pain. J Dent Anesth Pain Med. 2021;21(1):71-80.
34. Holmgren K, A. Sheikholeslam, and C. Riise. Effect of a full-arch maxillary occlusal splint on parafunctional activity during sleep in patients with nocturnal bruxism and sign and symptoms of craniomandibular disorder. J Prosthet Dent. 1993;69(3):293-7.
35. Clark GT, et al. Nocturnal electromyographic evaluation of myofascial pain dysfunction in patients undergoing occlusal splint therapy. J Am Dent Assoc. 1979;99(4):607-11.
36. Oral K. [Bruksizm; Tanı ve Tedavi] Bruxism: Diagnosis and Treatment. İstanbul: Quintessence; 2012.
37. Hachmann A, et al. Efficacy of the nocturnal bite plate in the control of bruxism for 3 to 5 year old children. J Clin Pediatr Dent. 1999;24(1):9-15.
38. Narita N, et al. Effects of jaw clenching while wearing an occlusal splint on awareness of tiredness, bite force, and EEG power spectrum. J Prosthodont Res. 2009;53(3):120-5.
39. Humsi ANK, et al. The immediate effects of a stabilization splint on the muscular symmetry in the masseter and anterior temporal muscles of patients with a craniomandibular disorder. J Prosthet Dent. 1989;62(3):339-43.
40. Sarinnaphakorn L, Qadeer S, Kerstein R. Force Distribution on Occlusal Splints Using T-Scan Occlusal Analysis. Advanced Dental Technologies & Techniques. 2020:11730.