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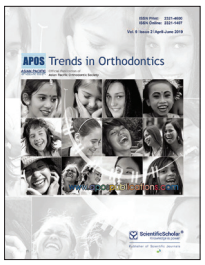

Original Article

The effect of orthodontic treatment with fixed appliances on sleep quality in adults and adolescents in Saudi Arabia using Pittsburgh sleep quality index

Omar Hamad Alkadhi[1], Ali A. Alomran[2], Nawaf S. Alrafee[3], Faisal A. Alaresh[3], Marzouq S. Alqahtani[3], Faisal N. Talic[3]

[1]Department of Preventive Dentistry, Division of Orthodontics, Riyadh Elm University, [2]Department of Dentistry, Alfarabi Colleges, [3]Department of Dentistry, Riyadh Elm University, Riyadh, Saudi Arabia.

***Corresponding author:**
Omar Hamad Alkadhi, Department of Preventive Dentistry, Division of Orthodontics, Riyadh Elm University, Riyadh, Saudi Arabia.

omar.alkadhi@riyadh.edu.sa

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ABSTRACT

Objectives: The aim of this study was to investigate the effect of pain caused by orthodontic fixed appliances on sleep quality of participants using the Pittsburgh Sleep Quality Index (PSQI).

Materials and Methods: A previously validated Arabic version of PSQI was electronically distributed through different social media platforms and in waiting areas of orthodontic offices. Eligibility criteria included healthy adults and adolescents with orthodontic fixed appliances and with no systemic conditions that may affect sleep. The cut-off point used to determine poor sleep quality was (>5).

Results: Three hundred and eighteen participants were included in the final analysis (28.9% males and 71.1% females). Both males and females with orthodontic fixed appliances had poor sleep quality with (Mean = 6.48, SD = 2.85, P = 0.000) for males, and (Mean = 7.18, SD = 2.87, P = 0.000) for females. Comparing males and females, we found that females scored higher than males in both subjective sleep quality and PSQI global score.

Conclusion: Individuals undergoing orthodontic treatment with fixed appliances have poor sleep quality. Females undergoing orthodontic treatment tend to have poorer sleep quality compared to males.

Keywords: Orthodontic fixed appliances, Sleep quality, Pittsburgh sleep quality index

INTRODUCTION

Pain is an unpleasant condition that can affect quality of life, including their sleep quality and patterns. There is evidence that the relationship between sleep and pain is bidirectional where pain affects sleep and vice versa.[1] Patients with chronic pain suffer from poor sleep quality.[2] Orofacial pain is also associated with poor quality of life and is known to affect sleep quality and cause sleep disturbance.[3-5] In orthodontics, activation of fixed appliances is usually associated with pain that increases in evenings and nights, especially, in the first 3 days following activation with the peak at 24 h post-activation.[6-9]

Sleep is an important function of the brain and it plays an essential role in metal health. Individuals with lower sleep quality may demonstrate mental health issues such as anxious, depressive, and anti-social problems.[10,11] It is also critical to individuals' health and well-being. Poor sleep quality has deleterious effects on the body. It increases the risk of preterm birth in pregnant women, declining cognitive performance, skin aging, and the risk of developing systemic conditions such as diabetes.[12-15]

Pittsburgh Sleep Quality Index (PSQI) is a tool that was developed in 1989.[16] It has seven components, each measures one aspect of sleep quality with a total score named the global score. It evaluates the sleep quality of participants during the past month.[16] Several studies have investigated the validity and reliability of PSQI. Carpenter and Andrykowski reported that PSQI has internal consistency, reliability, and validity with participants suffering from sleep problems having higher PSQI scores.[17] Fichtenberg *et al*. found that different PSQI components scores are valid against sleep diary data, Beck Depression Inventory, and Epworth Sleepiness Scale.[18]

Although it is well documented in the literature that activation of orthodontic appliances results in pain, it is not clear in the literature whether orthodontic therapy with fixed appliances has an effect on sleep quality. Hence, the aim of this study was to investigate the association between pain caused by orthodontic fixed appliances and sleep quality of participants using PSQI.

MATERIALS AND METHODS

The current study comprised a sample 318 participants. They gave consent by completing the questionnaire as it was mentioned in the first page of the questionnaire. This study was registered at the research center at Riyadh Elm University, with registration number: FRP/2019/84, and IRB approval number: RC/IRB/2019/78.

The inclusion criteria were:

- Healthy adults and adolescents.
- Undergoing orthodontic treatment with fixed appliances.

Exclusion criteria were:

- Individuals with chronic conditions that may alter sleep quality.

Sleep quality assessment

A previously validated Arabic version of PSQI was used distributed in electronic format via social media (WhatsApp, Twitter, and Instagram) in addition to distributing the electronic form to patients in the waiting area in Orthodontic offices.[19] The target population was adults and adolescents undergoing orthodontic treatment with fixed appliances. PSQI is scored using seven components. The sum of scores of the seven components was calculated to find the global score. The range of total score is (0–21). As the score grows higher, sleep quality decreases. The cut-off point we used to determine poor sleep quality was >5.[16]

Statistical analysis

Descriptive statistics were calculated and one-sample *t*-test was used to compare PSQI global score and the cut-off value of 5 as the value above which, participants are considered to be poor sleepers.[16] Comparison between males and females for PSQI is done using independent samples *t*-test. *P*-value of ($P < 0.05$) was used as a cut-off point. The statistical software that was used was IBM SPSS version 24 statistical package will be used (IBM SPSS Statistics for Mac, Version 24.0. Armonk, NY: IBM Corp.).

RESULTS

In October 2019, 799 participants responded to this self-reported questionnaire which included demographic and orthodontic treatment data and the Arabic version of PSQI. After applying eligibility criteria and excluding incomplete responses, we ended with 318 participants. The sample comprised 92 males (28.9%) and 226 females (71.1%). The age distribution of participants was 80 12–18-year-olds (25.2%) and 238 above the age of 18-years-old (74.8%).

One-sample *t*-test showed that there is a statistically significant difference between PSQI global score and the cut-off value of 5 (Mean = 6.97, SD = 2.87, $P = 0.000$) [Table 1]. We also found that there is a statistically significant difference in PSQI global score and in subjective sleep quality between males and females ($P = 0.049$, $P = 0.028$), respectively, where females had poorer sleep quality than males [Table 2].

DISCUSSION

The relationship between pain caused by different conditions and sleep quality has been thoroughly investigated in the literature. Chronic pain and pain severity were found to be a predictors of sleep quality.[20,21] In this study, we studied sleep quality of individuals undergoing orthodontic treatment with fixed appliances. Pain caused by the activation of orthodontic appliances can range from mild to severe pain.[22] It was important to note that this pain is not chronic and it is acute after activation. However, because of the nature of orthodontic treatment that dictates continuous activation every 4–6 weeks, this pain can be significantly troublesome.

Orthodontic treatment is known to cause pain, and pain is associated with sleep disturbance.[1,6] Pain caused by orthodontic treatment is an evident symptom. It is known to initiate at 2 h after activation of fixed appliances, peaks at 24 h, and starts decreasing after the 3rd day.[8] Moreover, elastic separators placement can lead to pain after 1 week.[23] Majority of patients undergoing orthodontic treatment with fixed appliances also reported pain during and after their orthodontic visits.[24] Different components of orthodontic appliances can cause different degrees of pain. Bands were found to cause pain at insertion while activation of fixed appliances peaked at 24 h.[25]

In this study, we compared the sleep quality of participants using PSQI with the cut-off point for poor sleep quality (>5). We found that participants undergoing orthodontic treatment have PSQI scores higher than 5. This indicates poor sleep

Table 1: Comparison between PSQI Global Score for all participants (*n*=318), males (*n*=92) and females (*n*=226), and the test value (5) using one-sample *t*-test.

Global score	Mean	SD	Mean Difference	Sig. (2-tailed)	SEM	95% Confidence interval of the difference	
						Lower	Upper
All participants	6.97	2.87	1.97***	0.000	0.16	1.66	2.29
Males	6.48	2.85	1.48***	0.000	0.30	0.89	2.07
Females	7.18	2.87	2.18***	0.000	0.19	1.80	2.55

***P<0.001. PQSI: Pittsburgh sleep quality index

Table 2: Comparison of each component of PSQI and the global score between males (*n*=92) and females (*n*=226) using independent samples *t*-test.

Component	Gender	Mean	SD	Mean difference	Sig. (2-tailed)	SEM	95% Confidence interval of the difference	
							Lower	Upper
Subjective sleep quality	Male	0.63	0.75	−0.22*	0.028	0.101	−0.423	−0.024
	Female	0.85	0.84					
Sleep latency	Male	1.52	0.87	−0.014	0.895	0.103	−0.216	0.189
	Female	1.54	0.82					
Sleep duration	Male	0.89	1.04	−0.228	0.095	0.136	−0.497	0.040
	Female	1.12	1.13					
Habitual sleep efficiency	Male	0.96	1.08	0.116	0.377	0.131	−0.142	0.373
	Female	0.84	1.05					
Step disturbances	Male	1.17	0.57	−0.056	0.404	0.067	−0.188	0.076
	Female	1.23	0.53					
Use of sleep medications	Male	0.24	0.60	−0.128	0.153	0.089	−0.304	0.048
	Female	0.37	0.77					
Daytime dysfunction	Male	1.07	0.75	−0.165	0.116	0.105	−0.370	0.041
	Female	1.23	0.88					
PSQI global score	Male	6.48	2.85	−0.70*	0.049	0.354	−1.395	−0.003
	Female	7.18	2.87					

*P<0.05. PQSI: Pittsburgh sleep quality index

quality. Comparing sleep quality of males to females, we found that females had poorer sleep quality in both the global PSQI score and in the subjective sleep quality component. This is consistent with the findings of several studies that investigated sleep quality among healthy and ill individuals.[26,27]

The limitations of this study include that there was no comparison group recruited to better understand the differences and that the questionnaire was electronically distributed which made it not possible to calculate the response rate. Further studies are recommended to evaluate sleep quality with different types of orthodontic appliances and to develop protocols that help patients sleep better after activation.

CONCLUSION

- Individuals undergoing orthodontic treatment with fixed appliance have poor sleep quality.
- Females undergoing orthodontic treatment tend to have poorer sleep quality compared to males.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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