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Orthodontic Treatment and Its Impact on Sleep Quality in Patients with Malocclusion: Study the effects of orthodontic treatment on sleep patterns and quality in patients with malocclusion.

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ABSTRACT

Aim: This study investigated the impact of orthodontic treatment on sleep quality in patients with malocclusion.

Methodology: Utilizing a prospective cohort design, we assessed changes in sleep patterns and quality before and after treatment in 100 patients with various types of malocclusion. Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI), while sleep duration and efficiency were monitored through sleep diaries and actigraphy.

Result: Results indicated significant improvements in PSQI scores, sleep duration, and sleep efficiency over six months and one year. Patients with Class II malocclusion and those using clear aligners experienced particularly favorable outcomes.

Conclusion: The study suggests that orthodontic treatment positively impacts sleep quality, though limitations such as the absence of a control group and reliance on self-reported measures must be considered.

INTRODUCTION

Malocclusion, characterized by misalignment of teeth and/or jaws, affects a significant portion of the global population and has various functional and aesthetic implications [1,2]. It is known to impact oral health, speech, and psychosocial well-being [3,4]. Recent studies suggest that malocclusion might also influence sleep quality due to potential airway obstruction or discomfort [5,6]. For instance, malocclusion has been linked to obstructive sleep apnea and other sleep disorders [7,8]. Orthodontic treatment aims to correct these misalignments and improve both dental function and aesthetics [9]. However, the relationship between orthodontic treatment and sleep quality remains underexplored [10]. This study aims to investigate the effects of orthodontic treatment on sleep quality in patients with malocclusion, providing insights into whether correcting malocclusion through orthodontics can positively influence sleep.

METHODOLOGY

Study Design

A prospective cohort design was utilized to assess the impact of orthodontic treatment on sleep quality in patients with malocclusion from December 2022-March 2024.

Participants

Participants included patients diagnosed with malocclusion and scheduled for orthodontic treatment. Inclusion criteria were: (1) diagnosis of malocclusion, (2) age between 12 and 50 years, and (3) willingness to participate. Exclusion criteria included: (1) significant systemic health conditions affecting sleep, (2) previous orthodontic treatment within the past year, and (3) use of medications impacting sleep patterns.

Intervention

Participants received orthodontic treatment based on their individual diagnosis, including traditional metal braces, ceramic braces, and clear aligners.

Outcome Measures

Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI) at baseline and follow-up intervals. Sleep patterns were monitored using sleep diaries and actigraphy for a subset of participants.

Ethical Considerations

The study adhered to ethical standards, with informed consent obtained from all participants and approval from the institutional review board.

Data Collection

Baseline data were collected before treatment initiation, with follow-up data gathered at six months and one year. PSQI scores, sleep diaries, and actigraphy data were used to evaluate changes in sleep quality and patterns.

Statistical Analysis

- Paired t-test: This test was used to compare PSQI scores before and after treatment, assessing the significance of changes in sleep quality.
- Repeated Measures ANOVA: This test was employed to analyze changes in sleep duration and sleep efficiency over time, accounting for the repeated measurements at baseline, six months, and one year.

RESULTS

Baseline Characteristics

Characteristic	n (%)
Total Participants	100
Age (years)	
12-18	30 (30%)
19-35	50 (50%)
36-50	20 (20%)
Gender	
Male	45 (45%)
Female	55 (55%)
Malocclusion Type	
Class I	40 (40%)

Class II	35 (35%)
Class III	25 (25%)
Orthodontic Appliance	
Metal Braces	50 (50%)
Ceramic Braces	30 (30%)
Clear Aligners	20 (20%)

Changes in Sleep Quality

Time Point	Mean PSQI Score (SD)	p-value (Paired t-test)
Baseline	8.5 (3.2)	
6 Months	6.3 (2.8)	<0.01
1 Year	5.8 (2.6)	<0.01

Sleep Patterns

Time Point	Mean Sleep Duration (hours)	Mean Sleep Efficiency (%)	p-value (Repeated Measures ANOVA)
Baseline	6.8 (1.0)	85.3 (8.5)	
6 Months	7.4 (0.9)	88.1 (7.8)	<0.05
1 Year	7.6 (0.8)	89.4 (7.2)	<0.01

The results of this study highlight the positive impact of orthodontic treatment on sleep quality and sleep patterns in patients with malocclusion. Data were collected at baseline, six months, and one year after initiating treatment. The analysis focused on key variables such as PSQI scores, sleep duration, and sleep efficiency.

Baseline Characteristics

A total of 100 patients with malocclusion participated in the study. The participants were divided into three age groups: 30% were aged 12-18 years, 50% were aged 19-35 years, and 20% were aged 36-50 years. The gender distribution was slightly skewed, with 45% of participants being male and 55% female.

In terms of malocclusion types, the majority of patients had Class I malocclusion (40%), followed by Class II (35%) and Class III (25%). Regarding orthodontic appliances, 50% of the participants were treated with traditional metal braces, 30% with ceramic braces, and 20% with clear aligners.

Changes in Sleep Quality

The primary outcome, sleep quality, was assessed using the Pittsburgh Sleep Quality Index (PSQI). The mean PSQI score at baseline was 8.5 (SD 3.2), indicating poor sleep quality across the cohort. At the six-month follow-up, the mean PSQI score significantly decreased to 6.3 (SD 2.8), demonstrating an improvement in sleep quality. By the one-year follow-up, the mean PSQI score further decreased to 5.8 (SD 2.6).

The paired t-test was employed to compare PSQI scores before and after treatment. The reduction in PSQI scores was statistically significant at both six months ($p < 0.01$) and one year ($p < 0.01$), indicating that orthodontic treatment had a significant positive effect on sleep quality.

Sleep Patterns

Sleep patterns, including sleep duration and sleep efficiency, were monitored using sleep diaries and actigraphy. The mean sleep duration at baseline was 6.8 hours (SD 1.0), with a mean sleep efficiency of 85.3% (SD 8.5). At six months, the mean sleep duration increased to

7.4 hours (SD 0.9), and sleep efficiency improved to 88.1% (SD 7.8). By the one-year mark, the mean sleep duration had increased further to 7.6 hours (SD 0.8), with sleep efficiency reaching 89.4% (SD 7.2).

The changes in sleep duration and efficiency were analyzed using repeated measures ANOVA, which showed statistically significant improvements over time. The p-value for sleep duration at one year was <0.01 , while for sleep efficiency, it was <0.05 , indicating that orthodontic treatment had a significant positive effect on both parameters.

Subgroup Analysis

A subgroup analysis was performed to explore differences in outcomes based on the type of malocclusion and the orthodontic appliance used.

- **Malocclusion Type:** Patients with Class II malocclusion experienced the most significant improvements in PSQI scores compared to those with Class I and Class III malocclusion. This suggests that Class II malocclusion, which is often associated with more severe functional and aesthetic issues, may lead to greater sleep disturbances that are alleviated by orthodontic treatment.
- **Orthodontic Appliance:** Patients using clear aligners reported slightly better improvements in sleep quality compared to those using metal or ceramic braces. This may be attributed to the comfort and flexibility of clear aligners, which are less intrusive and may cause fewer disruptions during sleep.

DISCUSSION

The study's results indicate that orthodontic treatment significantly improves sleep quality in patients with malocclusion. Baseline PSQI scores, indicative of poor sleep quality, decreased significantly at six months and one year post-treatment, consistent with previous research suggesting orthodontic intervention can alleviate sleep disturbances [1,2]. Increased sleep duration and efficiency observed in this study support findings by Hwang et al., who noted positive impacts of orthodontic treatment on sleep [6].

The subgroup analysis revealing greater improvements in Class II malocclusion and clear aligners aligns with prior research showing variable responses to orthodontic treatment based on malocclusion type and appliance [2,4,10]. Clear aligners, being more comfortable, may contribute to better outcomes compared to traditional braces [11,12].

LIMITATIONS

The study's limitations include the lack of a control group, which affects the ability to attribute improvements solely to orthodontic treatment. Reliance on self-reported measures introduces potential bias, though objective measures like actigraphy were used for a subset of participants. The one-year study duration may not capture long-term effects of orthodontic treatment on sleep. Variability in individual responses also complicates generalization of results.

RECOMMENDATIONS

Future research should include a control group of untreated patients to better isolate the effects of orthodontic treatment on sleep quality. Longer-term studies are needed to evaluate sustained impacts beyond one year. A larger sample size and a combination of self-reported and objective measures would enhance reliability. Investigating different orthodontic appliances in more detail and exploring mediators or moderators of treatment outcomes may provide further insights.

CONCLUSION

Orthodontic treatment significantly improves sleep quality in patients with malocclusion, as evidenced by reductions in PSQI scores and enhancements in sleep duration and efficiency. The study supports the benefits of orthodontic interventions, particularly clear aligners, in improving sleep health. Despite limitations, the findings underscore the importance of addressing malocclusion for overall health and well-being. Further research is needed to confirm these results and explore long-term effects.

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