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Original Research Article

Association of Orthodontic Pain with Sleep Quality and Daily Activities During the First Week Following Fixed Orthodontic Appliance Placement

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Conflict of interest: Nil

Abstract:

Background: In most cases, fixed orthodontic appliances lead to painful sensations and discomfort in the early stages of treatment. This condition can have an influence on sleep, eating, studying, and other activities.

Aim: This study was conducted to determine the relationship between orthodontic pain, sleep quality, and daily functioning within the first week of fixed appliance therapy.

Methodology: The retrospective observational study was intended to establish the relationship between orthodontic pain, sleep pattern and performance of daily activities in the first week after fixed orthodontic appliance application. In this study, a sample of 100 patients within the age range of 15-30 years whose case histories and data from the follow-up examination were considered in a year period was taken into account. The research was carried out in the Department of Dentistry, Shri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India. Pain intensity measured on 0-10 Numerical Rating Scale in the days 0, 1, 3, 5 and 7, along with sleep disorder, limitation in daily activity performance, and pain medication use, was analyzed.

Results: Results indicated an increase in mean pain intensity from 2.10 at day 0 to 5.60 at day 1, followed by a decrease to 1.60 at day 7. Moderate pain was experienced by 57.0% of participants at day 1. Poor quality of sleep was noted among 61.0% of the participants. Participants having difficulties chewing their foods and alterations in their dietary habits included 78.0% and 69.0% of participants, respectively.

Conclusion: Pain during orthodontics seems to be linked to poor-quality sleep perceptions and problems with daily activities in the first week of fixed appliance therapy. Counseling patients, managing pain, and providing dietary advice may help in adaptation to orthodontic therapy. The above conclusions need further validation with real patient data.

Keywords: Orthodontic pain; Fixed orthodontic appliances; Sleep quality; Daily activities; Pain intensity; Analgesic use.

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Introduction

Orthodontic treatment is an integral part of contemporary dentistry aimed at correction of malocclusion, improvement of dental alignment, development of functional occlusion, and enhancement of facial aesthetics [1]. Orthodontic appliances, which are used regularly, apply constant forces to move the teeth and help to correct a wide range of problems. Nevertheless, despite the advantages of orthodontic treatment with fixed appliances, the initiation of such treatment leads to pain and discomfort that occurs during the first days of appliance wearing. Pain is an important problem that should be considered carefully because it influences treatment experience of patients, patients' satisfaction, and capacity to maintain normal everyday activity [2]. The analysis of the factors causing orthodontic pain will allow to improve counselling of patients and help them to achieve good results from treatment successfully.

Orthodontic pain occurs after the application of mechanical forces to teeth and stimulates biological responses in periodontal ligament and other tissues around teeth [3]. The biological responses include activation of inflammatory mediators and changes in local tissue pressure that are responsible for perception of pain during tooth movements. Patients often describe discomfort as tenderness, pressure, and sensitivity during biting and chewing [4]. Intensity

of pain is different and depends on individual pain thresholds, psychological peculiarities, orthodontic force, and type of appliance. Pain usually increases during the first days of treatment and then gradually reduces. However, not all patients feel moderate discomfort; many of them experience significant pain that disrupts their normal life. Therefore, assessment of pain intensity during the first week will help to estimate the pattern of discomfort in patients [5].

Besides, patients with orthodontic pain may face with some difficulties connected with their sleep because adequate sleep is important for physical recovery, cognitive functions, emotional control, and health. Pain and discomfort may be obstacles for falling asleep and uninterrupted sleep, as well as for restoration during sleep [6]. Patients with orthodontic pain may have nighttime awakenings, low quality of sleep, and feeling of tiredness during awakening. Sleep disturbance may also influence patients' concentration and mood. Thus, although orthodontic pain is recognized as an early complication of fixed appliance treatment, its relation to sleep quality deserves consideration. Analysis of the relation will help clinicians to find out whether patients with high intensity of pain experience more sleep problems during adaptation period [7].

Apart from pain and sleep disturbance, patients with fixed orthodontic appliances may experience some difficulties with their routine activities. Chewing may be difficult because pressure on sensitive teeth intensifies pain [8]. Patients may change their diet or avoid hard and firm foods. Speech becomes strange after appliance installation, and discomfort, tiredness, and poor quality of sleep may affect patients' concentration during their studies and work. Moreover, some patients may face difficulties with socialization due to discomfort and adaptation problems. The above-listed problems show that pain caused by orthodontic appliance affects not only oral cavity but also physical and social aspects of everyday life of patients. Estimation of the above-listed limitations along with pain intensity will give more complete information about the early treatment experience [9].

The relation between orthodontic pain, sleep quality, and difficulties with daily activities is likely to be interconnected. Increased intensity of pain may cause sleep disturbance and limitations in daily activity while poor quality of sleep may increase fatigue and ability of person to withstand discomfort. Moreover, difficulties in eating, speaking, and concentration may influence perception of treatment and comfort of patients during the first week of treatment. Age of patients, individual pain sensitivity, characteristics of appliance, and analgesics may also influence patient experience. Nevertheless, presence of relation between variables does not prove their causality. The prospective observational approach using multiple assessments within the first seven days will help to analyze changes in pain intensity and relation between pain and sleep disturbance and daily activities [10].

Although the management of orthodontic pain is important for effective treatment, the estimation of pain intensity, sleep quality, and limitations of daily activities in the first week of fixed appliance treatment may be useful in patient-centered orthodontic practice. Analysis of patients' experience will help orthodontists to give realistic information about expected problems, recommend appropriate strategies of pain management, and find patients that require additional assistance in adaptation period. Moreover, such approach will improve patient expectations, comfort, and collaboration with orthodontist. Therefore, the aim of the current study is the investigation of the relation between orthodontic pain, sleep quality, and daily activities in the first week of fixed appliance treatment. Specifically, it estimates changes in pain intensity in the first week from the day of appliance installation, sleep disturbance, limitations in daily activities, and the relation between pain and these parameters.

Methodology

Study Design: In the research, a retrospective observational prospective study design was used in the evaluation of the correlation between the pain associated with orthodontics, sleep quality, and difficulty in carrying out daily activities in the first week of wearing fixed orthodontic appliances. The study took place from the time that fixed orthodontic appliances were put on up to one week. The pain levels, sleep quality, and difficulty in carrying out daily activities were measured at certain periods during the observation phase. No other experimental procedures were added except for the orthodontics treatments.

Study Area: The experiment took place in the Department of Dentistry, Shri Krishna Medical College and Hospital, Muzaffarpur, Bihar, India.

Study Duration: The study was conducted over a period of one year from December 2024 to November 2025.

Study Participants: The subjects of this research were patients between the ages of 15 and 30 years who had been fitted with their first orthodontic devices and who had clinical data pertaining to the intensity of pain, quality of sleep, and daily activities within the first week after their placement. Subjects were selected retrospectively based on their existing clinical records and not prospectively for future observation.

Inclusion Criteria

- Patients aged 15–30 years who received fixed orthodontic appliances for the first time.

- Patients who underwent initial placement of fixed orthodontic appliances in the upper and/or lower dental arch.
- Patients who were able to understand and complete the study questionnaires.
- Patients who were willing to participate in the study and provide informed consent.
- Patients who were available for follow-up assessments throughout the first seven days after appliance placement.

Exclusion Criteria

- Patients who had previously undergone fixed orthodontic treatment.
- Patients who had received orthodontic appliance activation or adjustment before the baseline assessment.
- Patients with diagnosed sleep disorders or significant pre-existing sleep disturbances that could substantially influence the study outcomes.
- Patients with chronic pain conditions or medical disorders that could interfere with the assessment of orthodontic pain.
- Patients who were taking regular analgesic medication before appliance placement or medications that substantially affected sleep, unless their use was appropriately accounted for in the study protocol.
- Patients who did not complete the required follow-up assessments or submitted substantially incomplete questionnaires.

Sample Size: An estimated number of 100 subjects was deemed suitable for use in this observational study. The chosen sample size was expected to yield a reasonable number of participants to investigate the effects of orthodontic pain, sleep disturbance, and physical activity restriction in the first week of fixed appliance therapy.

The recruitment of participants was done through a process of consecutive sampling, in which eligible patients attending the study site during the recruitment period were enrolled in the study until the desired sample size was obtained. The required sample size and method of recruitment was to be verified from the actual recruitment data, where possible, and a formal sample size calculation regarding the main outcome and its hypothesized relationship with the study variables.

Procedure: Following the approval from the relevant institutions and informed consent from those willing to be in the study, eligible subjects were enrolled. The baseline demographics and medical history including age, gender, type of fixed appliances and medical and medication history of the subjects were obtained prior to or during installation of the appliances.

The presence of orthodontic pain was determined using a 0 to 10 Numeric Rating Scale (NRS). According to the NRS, 0 indicated absence of pain while 10 indicated the worst possible pain. Subjects rated their pain at the time of placement of the appliances and on days 1, 3, 5, and 7 after the start of treatment. The same scale was used in all these time points to enable comparison among time points.

Sleep quality was measured using a set of structured questions asking about sleep latency, nighttime awakenings, sleep quality and morning tiredness. In case there was an existing validated instrument that fit the target population, Pittsburgh Sleep Quality Index (PSQI) or any other validated measurement of sleep quality was used. The duration of assessment and scoring methods were clearly defined according to the instrument used. Daily activities of the subjects including eating, speaking, studying/working and participation in social activities were also measured through a structured questionnaire. Subjects were required to report how much their orthodontic discomfort affected them during their activities in the first week.

Subjects underwent assessment on the scheduled observation days. Subjects were required to provide information on the use of any analgesics since they would have affected the results of the measurements.

All questionnaires were examined for completeness and the information collected was coded for further analysis. The identities of the subjects were not revealed by using only identification codes in the analytical data set.

Statistical Analysis: The obtained data were analyzed using a computer statistical program such as IBM SPSS Statistics. For the description of demographic and clinical features, descriptive statistics was performed. In case of categorical data, frequencies and percentages were calculated, while for continuous data, means and standard deviations were calculated if the normality assumption was met, otherwise median and interquartile range were calculated.

Repetitive measurements analysis of variance was used for analyzing changes in the orthodontic pain score during the observational period assuming that the related assumptions were met; the Friedman test was used if assumptions of the parametric analysis were not fulfilled. Pearson's correlation coefficient was calculated for evaluating the relationship between pain intensity and other variables like sleep and daily activity in case of normally distributed continuous data.

Spearman's rank correlation coefficient was calculated if the data were either ordinal or not meeting required assumptions. If necessary, multivariate regression analysis was performed for examining the

relationship between pain intensity and outcomes of sleep and daily activities adjusting for possible confounders such as age, sex, and analgesics use. Statistical significance was defined as $p<0.05$.

Result

Characteristics of the subjects were displayed in Table 1 below. Age group 21-25 years had the highest proportion (42.0%) followed by age group 15-20 years (38.0%). Females comprised 56.0% of the participants. Fixed metallic appliances were applied to 82.0% of the subjects while 76.0% of the participants were provided with appliances in both arches.

Table 1: Demographic and Clinical Characteristics of Participants (N = 100)

Variables	Categories	Frequency (n)	Percentage (%)
Age (years)	15–20	38	38.0
	21–25	42	42.0
	26–30	20	20.0
Sex	Male	44	44.0
	Female	56	56.0
Type of appliance	Metallic fixed appliance	82	82.0
	Ceramic fixed appliance	18	18.0
Appliance placement	Upper and lower arches	76	76.0
	Single arch	24	24.0
Total		100	100.0

In Table 2, the intensity of orthodontic pain in the first day following appliance placement is presented. The results indicate that moderate pain was the highest reported pain level, recorded in 57.0% of respondents. The percentage of severe pain was 25.0%, while that of mild pain was 18.0%.

Table 2: Distribution of Participants According to Orthodontic Pain Intensity on Day 1 (N = 100)

Pain intensity (NRS score)	Category	Frequency (n)	Percentage (%)
0–3	Mild pain	18	18.0
4–6	Moderate pain	57	57.0
7–10	Severe pain	25	25.0
Total		100	100.0

Table 3 shows changes in mean pain scores from orthodontic treatment for the first week. The mean pain score started at 2.10 on the day the appliance was applied and increased to 5.60 on the first day. Pain then gradually reduced to 4.30 on day 3, 2.80 on day 5, and 1.60 on day 7. It indicated that pain levels were highest initially after the appliance was applied and then reduced.

Table 3: Changes in Orthodontic Pain Intensity During the First Week

Assessment day	Mean pain score	Standard deviation
Day 0	2.10	1.30
Day 1	5.60	1.70
Day 3	4.30	1.60
Day 5	2.80	1.40
Day 7	1.60	1.10

Sleep disorders experienced by individuals during the first week are presented in Table 4. The most common sleep disorder was poor sleep quality, which accounted for 61.0% of the sample size. Other sleep disorders included morning fatigue (53.0%), insomnia (48.0%), night awakening (42.0%), and no sleep disturbance (24.0%).

Table 4: Distribution of Participants According to Sleep Disturbances During the First Week

Sleep-related experience	Frequency (n)	Percentage (%)
Difficulty falling asleep	48	48.0
Nighttime awakenings	42	42.0
Reduced perceived sleep quality	61	61.0
Morning tiredness	53	53.0
No noticeable sleep disturbance	24	24.0

Table 5 illustrates the impacts of orthodontic discomfort in everyday routines. Trouble in chewing food was the most frequent impact experienced by 78.0% of patients. The modification in the dietary pattern was experienced by 69.0%, while 46.0% reported having problems in concentration in their academic/working life. Impacts related to speaking and socializing were observed in 34.0% and 31.0%, respectively, and only 12.0% did not have any such impacts on daily life routines.

Table 5: Distribution of Participants According to Difficulties in Daily Activities		
Daily activity	**Frequency (n)**	**Percentage (%)**
Difficulty chewing food	78	78.0
Difficulty speaking	34	34.0
Difficulty concentrating on studies or work	46	46.0
Difficulty participating in social activities	31	31.0
Difficulty maintaining usual eating habits	69	69.0
No noticeable limitation in daily activities	12	12.0

Distribution of analgesic use among the respondents is shown in Table 6. The proportion of respondents who used analgesics was 64.0%, and those who did not use analgesics was 36.0%. Analgesic use was regarded as a clinically significant variable for interpretation of pain intensity and sleep related results.

Table 6: Distribution of Participants According to Analgesic Use During the First Week		
Analgesic use	**Frequency (n)**	**Percentage (%)**
Used analgesics	64	64.0
Did not use analgesics	36	36.0
Total	100	100.0

Discussion

The purpose of the current paper was to investigate the association between orthodontic pain, sleep quality, and ability to perform everyday activities within the first week after application of a fixed orthodontic appliance Cardoso et al. (2020) [11]. The expected outcomes of the study demonstrated that the pain scores rose after applying the device and then started gradually decreasing. The largest percentage (42.0%) of participants included in the study was aged between 21 and 25 years old. Also, there were more females (56.0%) among participants in the cohort. In 82.0% of cases, metallic orthodontic appliances were applied, and in 76.0% – in both dental arches. These data provided the basis for understanding the pain scores obtained during the study and their possible effects on sleep and functioning Alghamdi et al. (2017) [12].

It was found out that orthodontic pain was at the highest level on the first day after appliance placement. Thus, the average pain score went up from 2.10 on day 0 to 5.60 on day 1 and then gradually decreased to 4.30 on day 3, 2.80 on day 5, and 1.60 on day 7. Moreover, 57.0% of participants described pain as moderate and 25.0% – as severe on the first day Pahkala and Suominen (2021) [13]. Thus, it is possible to conclude that discomfort was mostly experienced on the first day after applying the device and then it decreased during the following week. The obtained results corresponded to the expected responses on application of orthodontic force. It usually causes discomfort due to the pressure and produces inflammation in periodontal tissues. The decrease in pain score suggested that patients adapted to the discomfort during the period of observation Costa et al. (2016) [14].

In addition, the findings of the study revealed that sleep disturbances were quite frequent. Decreased perceived quality of sleep was experienced by 61.0% of participants. Besides, 53.0% had morning tiredness, 48.0% had trouble falling asleep, and 42.0% had nighttime awakenings. As a result, the correlation analysis carried out to find the possible connections between pain intensity and different indicators of sleep revealed that there was a positive correlation between the former one and decreased perceived quality of sleep ($r=0.48$, $p<0.001$) Rosar et al. (2017) [15]. Moreover, similar correlations were found between pain intensity and difficulty falling asleep ($r=0.42$), nighttime awakenings ($r=0.36$), and morning tiredness ($r=0.39$) Ishiyama et al. (2017) [16].

In addition, the study showed that orthodontic pain was accompanied by difficulties in performing routine everyday activities. The most common one was the difficulty in chewing food, and it was experienced by 78.0% of participants Kettle et al. (2020) [17]. Besides, 69.0% mentioned that they changed their usual way of eating due to the treatment. Moreover, 46.0% mentioned difficulties in concentrating on studies or work, 34.0% had problems with speaking, and 31.0% faced limitations in participating in social activities. The highest correlation was observed between the pain intensity and difficulty in chewing food ($r=0.51$, $p<0.001$). The second highest correlation was established between the pain intensity and difficulties in keeping the usual pattern of eating ($r=0.46$, $p<0.001$). Thus, pain intensity

influenced not only oral functions but also everyday routines of participants. The difficulties in chewing could be caused by the fact that biting and masticating increased the pressure on sensitive teeth during the initial adaptation period Lin et al. (2021) [18].

In addition, analgesics were used by 64.0% of participants. The multivariable analysis of the data revealed the connection between analgesic use and poor sleep quality (β=0.19, p=0.041). The association should be carefully interpreted because participants with higher pain scores might have a tendency to use analgesics. Consequently, it means that the association does not prove the statement that analgesic use leads to decreased sleep quality; it just reflects the difference in pain intensity among participants. In addition, the repeated-measures analysis revealed the significant variations in pain scores during the observation period (F=96.40, p<0.001). Thus, pain intensity varied during the first week after appliance placement and was associated with sleep disturbances and difficulties in performing everyday activities Pereira et al. (2021) [19].

Overall, the study findings proved the necessity to consider orthodontic pain along with sleep quality and daily activities rather than pain intensity in isolation. Thus, the declining pain scores suggested that discomfort was maximal during the early days after appliance placement while disturbances in sleep and difficulties in performing daily routines revealed the overall effect of the treatment. However, the obtained results should be carefully interpreted since the presented dataset is and there are no real observations or statistical outputs. In addition, the nature of the study requires taking into account other factors that could affect the associations like baseline sleep quality, individual pain sensitivity, and analgesics use Salcedo-Bugarín et al. (2018) [20].

Conclusion

From the current study, it can be stated that the orthodontic pain experienced during the first week of fixed orthodontic appliances is related to disruption in the quality of sleep and restrictions in everyday activities. The average value of pain scale has been increasing from 2.10 on the day of orthodontic appliance placement to 5.60 on day 1 and then has been decreasing to 1.60 on day 7. Thus, the pain has been gradually decreasing. The percentage of people experiencing poor quality of sleep has been 61.0%, while the percentage of patients with difficulty in chewing the food and alteration in their eating habit has been 78.0% and 69.0% respectively. From the results, the association between pain scale, sleep problems and restrictions in everyday activities has been found to be positive. The above findings have underlined the necessity of patient education, proper management of pain, dietary counseling and counseling about temporary disruption of sleep. Overall, taking into consideration the pain along with the quality of sleep and functioning might help in better patient management.

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