Journal of Oral Medicine and Dental Research

Genesis-JOMDR-5(4)-70
Volume 5 | Issue 4
Open Access
ISSN: 2583-4061

Impact of Oral Post-Surgical Pain, Tooth Extraction, on Sleep Quality-Clinical Study

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Citation: Oliveira AS, Ramos SF and Januzzi E. (2024) Impact of Oral Post-Surgical Pain, Tooth Extraction, on Sleep Quality - Clinical Study. J Oral Med and Dent Res. 5(4):1-18.

Received: August 17, 2024 | **Published:** September 10, 2024

Abstract

Objective: To evaluate the relationship between postoperative pain and quality of sleep and its impact on the quality of life of patients who attended the oral surgery consultation at the University Clinic, Faculty of Dental Medicine, Universidade Católica Portuguesa in Viseu.

Materials and Methods: This cross-sectional observational study included 32 patients who attended the oral surgery consultation at the University Clinic, Faculty of Dental Medicine of the Universidade Católica Portuguesa in Viseu. Data were collected between 1 March and 20 May 2024, using validated subjective questionnaires. The study aimed to assess sleep quality, sleep schedule and hygiene, and oral pain. The following questionnaires were used Epworth Sleepiness Scale, Pittsburgh Sleep Quality Index, sleep diary and visual analogue scale. Data were entered into the Microsoft Office Excel® platform and processed using SPSS version 27 software.

Results: This study demonstrated that postoperative odontogenic pain negatively affects sleep quality, daytime sleepiness, sleep fragmentation, sleep latency, and subjective insomnia symptoms in the week following tooth extraction.

Conclusion: Sleep quality suffers a significantly high negative impact in the week following tooth extraction in all individuals in the sample, particularly in vulnerable patients. Further studies are needed to elucidate this complex and dynamic relationship between sleep and pain. Dentists need to be aware of changes in sleep quality following surgery.

Keywords

Sleep; Pain; Sleep disturbance; Oral surgery; Postoperative pain; Tooth extraction

Brief Summary

Current Knowledge/Study Rationale: Lack of sleep can increase pain sensitivity. Several recent studies suggest that a good night's sleep has a positive effect on pain control. On the contrary, several nights of poor sleep have a worsening effect on pain intensity. Pain can also cause significant changes in sleep. There is a bidirectional relationship.

Study Impact: The impact of non-restorative sleep has a negative impact on the quality of life of patients. The relationship between dentistry and sleep disorders, and the important role of the dentist in screening and identifying the population at risk, must become a reality.

Abbreviations

SD: Sleep disorders
SWS: Slow waves sleep
NSAIDs: Non-steroidal anti-inflammatory drugs
ESS: Epworth Sleepiness Scale
PSQ: Pittsburgh Sleep Quality Index
VAS: Sleep Visual Analog Scale
W1: week of tooth extraction
W2: week of suture removal

Introduction

Sleep is perhaps our greatest physiological impulse. Although this innate mechanism plays a vital role in maintaining and improving physical and mental health, many people neglect it, resulting in fewer hours of sleep than recommended and many others beginning to suffer from sleep disorders SD [1]. Patients who have undergone tooth extraction report the worst sleep quality and subjective symptoms of insomnia [2].

Healthcare professionals can and should encourage patients to improve their sleep quality and hygiene in the long term. Some of the advice that can be given includes developing the habit of sleeping 7 to 9 hours a night, having a regular bedtime (including weekends), maintaining a regular

sleep-wake cycle, being physically active and not overeating at night [1]. There are also substances that can affect sleep quality and should be used in moderation or avoided. Examples include caffeine, alcohol and tobacco [3].

Orofacial Pain

The central nervous system plays a crucial role in the regulation of facial tissues and is directly involved in the modulation of pain in this region [4]. The trigeminal nerve is responsible for most of the sensory nerve fibers, known as primary afferents, that innervate tissues in the orofacial region. It is a mixed nerve, containing both sensory and motor fibers. While the sensory fibers affect the sensitivity of the face, oral mucosa and teeth, the motor fibers are responsible for supporting the chewing muscles, particularly the masseter and temporal muscles [5].

Larger diameter afferent neurons are sensitive to tactile and proprioceptive stimuli. Most of the smaller nerve terminals terminate in free endings that function as nociceptors and are activated by tissue damaging stimuli. Some of these smaller terminals, such as A-delta fibers and C-fibers, are receptors that are sensitive to heat and cold stimuli. After prolonged exposure to a painful stimulus, such as injury and inflammation in orofacial tissues, nociceptive nerve endings begin to develop peripheral sensitivity that contributes to hyperalgesia and/or allodynia. The increased sensitivity of an inflamed tooth and pain in the temporomandibular joint in dentistry are also considered hyperalgesic pain [4].

Processes Underlying Pain and Sleep

The relationship between sleep and pain is important in the diagnosis and effective treatment of a wide range of health conditions and problems. The interaction occurs at several levels, both physiological and pathological [5].

What is happening in this interdisciplinary field is a change in the balance of neurotransmitters. GABA is one of the neurotransmitters linking sleep and pain. The activity of GABAergic cells in the area adjacent to the ventrolateral preoptic nucleus promotes REM sleep by inhibiting noradrenergic neurons. Large amounts of thermal stimulation (flushing) are more likely to cause awakening in N3 and REM sleep than in N2 sleep. N3 and REM sleep have the same pain tolerance as wakefulness. Heat pain stimulation, which is significantly associated with redness of a tooth socket after tooth extraction, was able to induce more arousals from sleep than other stimuli, and these arousals were more pronounced in light sleep stages (48.3%) than in deep sleep stages (27.9%) [6]. Periods of sleep restriction are associated with small increases in spontaneous pain and transient decreases in the thermal pain threshold [7].

However, most sensory stimulation does not reach consciousness during sleep [8]. It is thought to be caused by a partial 'loss' of sensory stimulation in the central nervous system. This mechanism allows a reduced response to external stimuli during NREM sleep to maintain sustained sleep development. Microarousals are associated with a decrease in the ability to "escape" painful stimuli [9].

Sleep-Pain-Sleep Interactions

A comprehensive understanding and analysis of pain characteristics is important to optimize treatment effectiveness and promote the best patient prognosis. However, the assessment of patients with pain should not be limited to this. From a biopsychosocial perspective, there are a variety of biological, psychological and social factors that can influence the occurrence of pain [10].

Sleep deprivation causes people to experience more pain and to feel that the pain is getting worse. In turn, pain causes more sleep disturbances, creating a vicious negative cycle of worsening pain and sleep. In addition, sleep deprivation appears to impair pain perception and emotional-cognitive reactivity [7].

The effect of acute pain on sleep is usually transient. This appears to follow a "linear pattern", with pain preceding complaints of poor sleep and sleep returning to normal after the acute pain has resolved [4].

Inflammation

Studies have shown that sleep deprivation can lead to an increased inflammatory response. Short sleep duration has been associated with an increase in pro-inflammatory cytokines such as interleukin-6, tumor necrosis factor alpha and C-reactive protein [9]. In general, blood pressure and blood vessels relax during sleep. However, it has been proposed that sleep restriction and hypertension may have a controversial effect on blood vessels, leading to increased inflammation [11].

Sleep-disordered breathing can also trigger a biochemical cascade that begins with hypoxia and sleep fragmentation. These events stimulate the sympathetic nervous system, leading to the release of catecholamines, cortisol and pro-inflammatory cytokines, which increase the inflammatory response [8].

The large release of cortisol during surgery can also disrupt sleep. Surgical trauma appears to be an important factor in sleep disturbance, with possible mechanisms of response to endocrine and inflammatory stress: pro-inflammatory cytokines released after surgery disrupt sleep with an increase in the duration of slow-wave sleep (SWS) and a decrease in REM sleep [9].

Therefore, the healing process also depends on sleep. Recovery from skin lesions depends on the inflammatory mediators mentioned above: the formation of granulation tissue occurs when macrophages release these mediators. We can therefore see that the efficiency of the healing process is directly dependent on the integrity of the immune system, the release of pro-inflammatory cytokines and the body's management of oxidative stress [12].

Sleep and Pharmacotherapy in Oral Surgery

Although much progress has been made in understanding the mechanisms of pain in dentistry

and in the innovative development of analgesics, anti-inflammatories and anesthetics, the control of acute post-operative pain remains a challenge [9]. In most cases, toothache is caused by acute inflammation, which is often the cause of sleep disturbance [5,6].

NSAIDs and corticosteroids

One way of controlling pain is with drugs that reduce pain, oedema and inflammation. Anti-inflammatory drugs include non-steroidal anti-inflammatory drugs (NSAIDs) and corticosteroids.

The most used NSAIDs in dentistry are ibuprofen and acetylsalicylic acid (aspirin). These are responsible for the secretion of prostaglandins: prostaglandin D2 induces sleep and prostaglandin E2 promotes wakefulness [13].

Corticosteroids are used in CO to prevent hyperalgesia and control inflammatory oedema. They are used in a variety of surgical situations, such as the extraction of impacted teeth (mainly third molars), periodontal surgery and the placement of implants [14]. These can cause side effects such as SD, insomnia, daytime hyperactivity and a significant reduction in REM sleep [15].

Analgesics

When NSAIDs are not sufficient to control postoperative pain, it is necessary to resort to analgesics. Among the most used in dentistry, paracetamol stands out. It is very effective in treating mild to moderate pain and has an excellent safety record in both adults and children. If needed, it is also one of the safest painkillers to use during pregnancy and breastfeeding [16]. A study of medical students found that self-medication with paracetamol had a negative impact on sleep [17].

Anesthetics

The ability to administer safe and effective local anesthesia is the cornerstone of oral surgery clinical practice. Among the most used anesthetics in oral surgery, lidocaine stands out as the gold standard [18].

Postoperative anesthesia, whether infiltrative or local, has been shown to induce similar patterns of sleep disturbance, including sleep fragmentation, reduction in total sleep time, and SWS and REM sleep deprivation. In the absence of surgical stress, hospitalization and postoperative pain, anesthesia alone does not appear to cause sleep disturbance [9].

Materials and Methods

Characterization of the study

This study is classified as a cross-sectional observational study and includes a total of 32 people who attended the Dental Clinic of the Faculty of Dentistry of the Portuguese Catholic University in Viseu. Data collection took place between 1 March and 20 May 2024.

Characterization of the sample

Participants were randomly selected from individuals undergoing treatment at the Oral Surgery Clinic of the University Dental School. The inclusion and exclusion criteria were as follows:

Inclusion criteria: Individuals of both sexes and of any ethnicity who attended the University Dental Clinic during the established data collection period, aged 18 years or older, and who voluntarily agreed to participate in the study; extraction treatment of any tooth element using a technique called closed surgery (without making an incision and without creating a flap); individuals with or without associated comorbidities (within safe parameters for extraction); and ability to understand and communicate; diagnosed or not with SD.

Exclusion criteria: All individuals who did not complete the informed consent and/or voluntarily expressed their desire not to participate in the study were excluded; were under 18 years of age; had physical and intellectual incapacity to respond to the proposed questionnaires; presented acute conditions that could alter the perception of pain; were diagnosed with DROS; syndromic patients and patients with metabolic risk or cardiovascular disease for less than 6 months; and/or any situation clinically uncontrolled.

In this study, patients were not given any standards for sleep hygiene. They were prescribed ibuprofen 600mg and paracetamol 1000mg to control postoperative pain.

Data Collection

Data were collected using validated subjective questionnaires designed to assess sleep quality, sleep schedule, sleep hygiene and oral pain. The questionnaires used were the Epworth Sleepiness Scale (ESS), the Pittsburgh Sleep Quality Index (PSQ), the Sleep Diary (to assess sleep habits and hygiene one week after oral surgery), and the Sleep Visual Analogue Scale (VAS) for pain assessment and perception. The purpose of using these questionnaires was to check whether the individual's sleep quality had changed after tooth extraction. The questionnaires are validated in Portuguese and were administered twice, once on the day of tooth extraction (before the procedure) and again on the day of suture removal, to allow for a before and after assessment. The sleep diary was given to each person in the sample on the day of the first consultation so that they could complete it at home for a period of 7 days, after which they would return to the University Dental Clinic and bring it with them.

The questionnaires were administered at the beginning of the consultation and then entered the Microsoft Office Excel® platform. Data collected later were also entered. Data processing was carried out using SPSS version 27 platforms.

Ethical Principles

Individuals attending the University Dental Clinic for dental treatment and meeting the established criteria were invited to participate and sign the informed consent form and were given all the necessary explanations before doing so.

The data collected will be used in accordance with the Declaration of Helsinki and will be used only for the purposes of this study, and confidentiality will be guaranteed. The anonymity of the participants is guaranteed and therefore the identification of the participants will never be published. They were

informed that they could withdraw if they wished.

Data collection was only allowed after approval by the Health Ethics Committee of the Universidade Católica Portuguesa (Appendices).

Epworth Sleepiness Scale (ESS)

The ESS is designed to measure the degree of excessive daytime sleepiness in adult patients. This questionnaire assesses the likelihood of falling asleep in eight different everyday situations.

Pittsburgh Sleep Quality Index (PSQ)

The PSQ is used to assess subjective sleep quality. It consists of 19 questions for the person and 5 questions for their spouse or partner (if they have one).

Visual Analogue Scale (VAS)

The VAS consists of a 10 cm grid with 10 levels of pain intensity, at the extremes of which are the phrases <no pain= and <worst possible pain=, and 6 smiles corresponding to the pain felt by the person at that moment.

Despite the advantages already mentioned, older people and children find it difficult to use because of the abstraction required for their understanding. In view of these difficulties described in the literature, we decided to use a scale with smiles for better understanding.

Sleep Diary

The sleep diary consists of a table in which the individual must describe how they slept over a period of 14 days. An adjustment was made to 7 days to allow data collection. This tool allows you to understand your sleep habits and hygiene.

Results

Demographic characterization of the sample

The presentation and analysis of the data obtained in a descriptive approach. They are divided into questionnaires and presented in the form of graphs, preceded by their description and analysis. The interpretation is reserved for the discussion chapter. The sample consists of 16 male and 16 female respondents. The distribution of the sample, considering the sexes, was occasionally balanced.

In terms of age, we found that they ranged from 18 to 80 years old. The data was collected from an adult population with an average age of 50.31 years. The median age was 51 years, the standard deviation was 19.25 years and the mode consisted of 3 ages: 20, 50 and 80 years.

Epworth Sleepiness Scale

The ESS assesses the degree of excessive daytime sleepiness in adults. Comparing the two weeks, week 1 (W1, week of tooth extraction) and week 2 (W2, week of suture removal), we found that the degree of

general daytime sleepiness of the individuals in the sample increased (Figure 1), as the probability of falling asleep "none" decreased in the first week compared to the second, and the probability parameters of falling asleep "moderate" and "strong" increased in the second week. The 'strong' parameter remained constant over the two weeks.

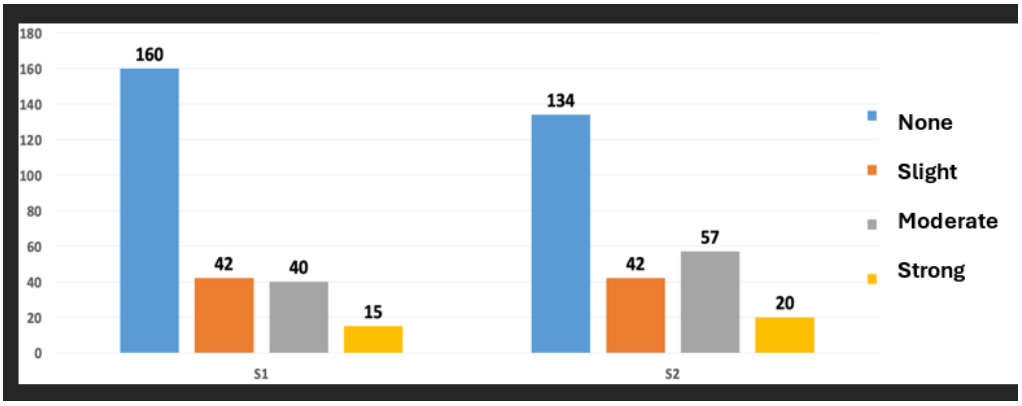

Figure 1: Variation in degree of daytime sleepiness between week 1 and week 2.

When evaluating the degree of daytime destruction in women, we found that the number of responses of probability of falling asleep "None" increased 18 times and "Slight" 4. The criteria "Moderate" and "Strong" increased 9 and 1 responses respectively.

On the other hand, looking at the degree of destruction of the male gender, we found a significant decrease in the probability of falling asleep "None" (18) and an increase in the number of "Slight" (4), "Moderate" (8) and "Strong" (4) responses.

When the statistics were clarified, the increase in the 'strong' probability was more pronounced for men. The increase in the "moderate" probability was similar for men (8) and women (9) and the "weak" probability was controversial for both: it increased for men (4) and decreased for women (4). We also noticed an equal and significant decrease in the probability of falling asleep, "none". In short, it is not possible to draw any conclusions as to which sex is more likely to accept changes in the degree of daytime sleepiness.

To compare whether pain affected the level of daytime sleepiness, we present two graphs (Figures 2 and 3). On the one hand, looking at the graph in Figure 2, the x-axis represents the individuals who experienced pain prior to tooth extraction, a total of 16 subjects. On the other hand, the graph in Figure 3 represents the change in ESS between week 1 and 2, and the X-axis only shows individuals who experienced pain in the week of tooth extraction (W1).

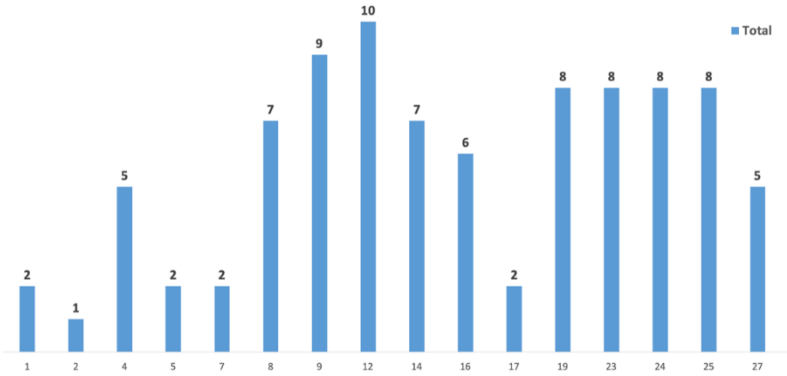

Figure 2: Pain Scale of the population that manifested painful symptoms (>0) in week 1.

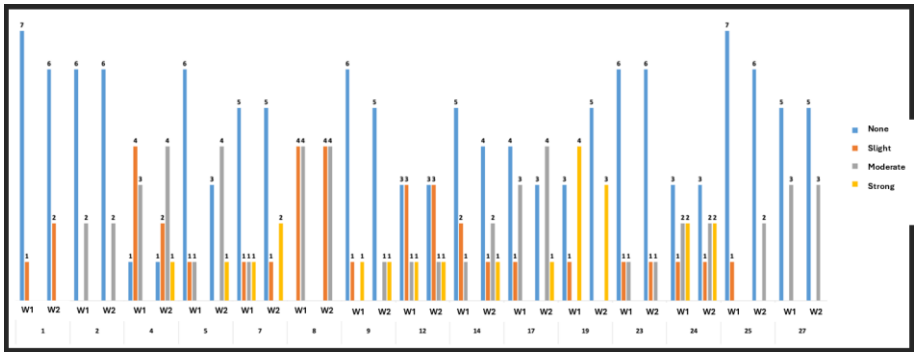

Figure 3: Epworth Sleepiness Scale of the population that manifested painful symptoms (>0) in week 1 and week 2.

Crossing the two graphs, we can see that the degree of sleepiness increased in individuals 1, 4, 5, 7, 9, 14, 17, 19 and 25 and remained constant in individuals 2, 8, 12, 23, 24 and 27. In summary, an increase in sleepiness and pain was observed in nine subjects.

The sample showed a significant relationship between the degree of sleepiness and pain according to Fisher's test for a value of $p<0.001$ (Figure 4).

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Probability * Pain Scale	64	12.5%	448	87.5%	512	100.0%

Probability * Pain Scale Crosstabulation

			Pain Scale											
			0	1	2	3	4	5	6	7	8	9	10	Total
Probability	Moderate	Count	12	1	3	0	0	0	0	0	2	0	0	18
		% within Probability	66.7%	5.6%	16.7%	0.0%	0.0%	0.0%	0.0%	0.0%	11.1%	0.0%	0.0%	100.0%
	None	Count	14	3	3	1	0	2	3	2	2	1	1	32
		% within Probability	43.8%	9.4%	9.4%	3.1%	0.0%	6.3%	9.4%	6.3%	6.3%	3.1%	3.1%	100.0%
	Slight	Count	10	0	2	0	0	1	0	0	0	0	0	13
		% within Probability	76.9%	0.0%	15.4%	0.0%	0.0%	7.7%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
	Strong	Count	0	0	0	0	1	0	0	0	0	0	0	1
		% within Probability	0.0%	0.0%	0.0%	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100.0%
Total		Count	36	4	8	1	1	3	3	2	4	1	1	64
		% within Probability	56.3%	6.3%	12.5%	1.6%	1.6%	4.7%	4.7%	3.1%	6.3%	1.6%	1.6%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	78.750[a]	30	<.001
Likelihood Ratio	30.180	30	.456
N of Valid Cases	64		

a. 41 cells (93.2%) have expected count less than 5. The minimum expected count is .02.

Figure 4: Significance relationship between the degree of drowsiness and pain according to the fisher test.

Visual Analog Scale

Only 17 of the 32 subjects experienced pain. As expected, pain decreased from the week of tooth extraction (W1) to the day of suture removal (W2) for most subjects who experienced painful symptoms (15 subjects). Only two subjects reported an increase in pain compared to the first week (Figure 5).

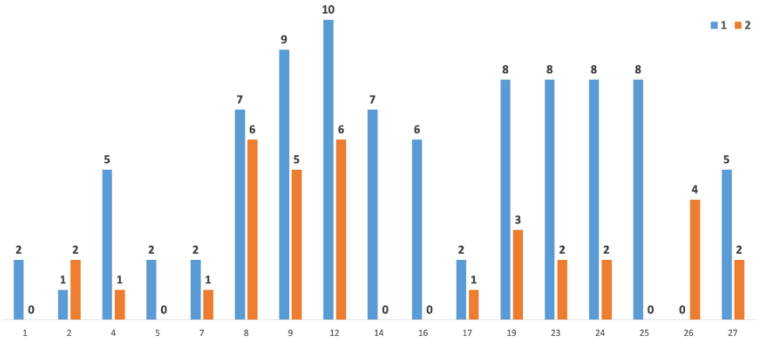

Figure 5: Visual Analog Scale of the population that manifested painful symptoms (>0) in week 1 and week 2.

Sleep Diary

Regarding the Sleep Diary, we validated that the average “Time to go to bed”, “Time to wake up”, “Time to fall asleep” and “Number of nighttime awakenings” of the population over 7 days were, respectively, 23h00m, 08:17, 0:10 and 1.14 nighttime awakenings per night.

It is important to have a pharmacological prescription protocol for the pre- and post-operative period that impacts sleep as little as possible and is effective in controlling pain. It must be considered that the dentist during the anamnesis must identify sleep disorders prior to the procedure.

Regarding the sleep diary, we validated that the average "time to go to bed", "time to wake up", "time to fall asleep" and "number of nighttime awakenings" of the population over 7 days were 23:00, 08:17, 0:10 and 1.14 nighttime awakenings per night, respectively.

It is important to have a pre- and post-operative pharmacological prescription protocol that minimizes sleep disturbance and effectively controls pain. It must be remembered that the dentist must identify sleep disorders during the preoperative history.

Regarding the "sleep disturbance" parameter, most of the population reported "no disturbance" during the week following tooth extraction (139 responses). The most common response was "toothache" (42 responses), followed by "shortness of breath" (39 responses), "getting up to go to the toilet" (7 responses), "nightmares" (4 responses) and "headaches" (1 response), as described in Figure 6.

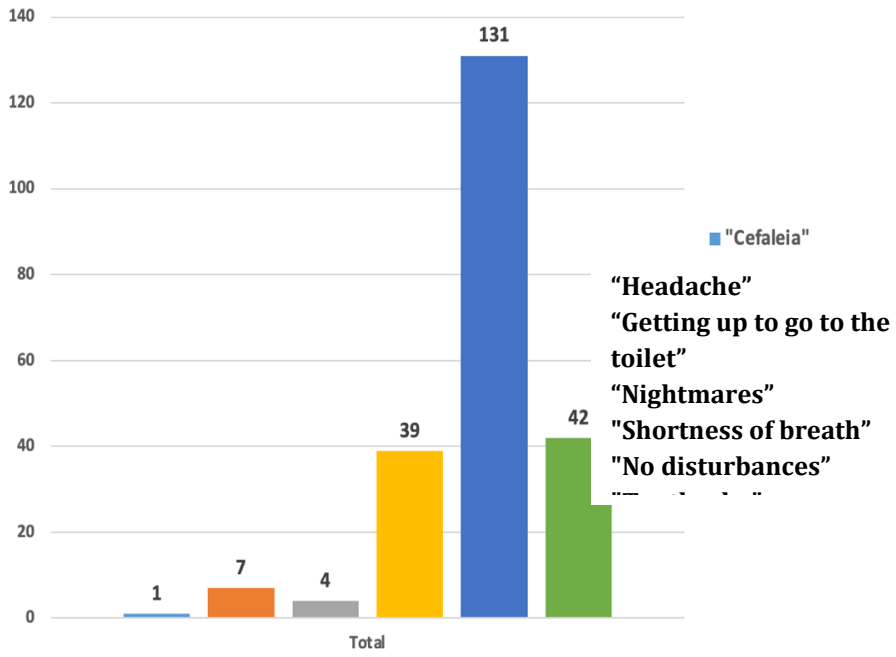

Figure 6: Quantitative distribution of sleep disturbances.

All subjects who reported 'toothache' and 'sleep disturbance' were taking medication: ibuprofen 600mg or paracetamol 1000mg, a total of 15 subjects. Of these people, 4 reported that their "time of waking up" was brought forward and 11 reported no change in this criterion. On the other hand, regarding "time to go to bed", 3 subjects reported going to bed later and 12 had no changes. Regarding "time to fall asleep", we found that 1 subject had more time to fall asleep than on other days, and 4 subjects reported an increase in the number of times they woke up during the night.

When assessing the medication administered to control post-operative pain 7 days a week, we found 30 responses where individuals resorted to taking 600 mg of ibuprofen and 18 responses supporting the use of 1000 mg of paracetamol for pain control.

Focusing on the parameter "morning disposition", 178 responses were from a restful sleep "rested", 39 from a less effective sleep "somewhat tired" and 7 from a non-refreshing sleep "very tired".

The results obtained show us that the activities most frequently carried out by the individuals in the sample before going to bed on the 7 days of the week are, in descending order: "watching TV" (127), "eating dinner" (35), "using a mobile phone" (18), "reading" (15), "working" (13), "listening to music" (8), "living with friends" (5) and "studying" (3).

Pittsburgh Quality Index

Sleep latency increased by 3 minutes per week after the tooth injury. It increased from 21 minutes (first week) to 24 minutes (second week).

When analyzing the criterion 'Takes more than 30 minutes to fall asleep', which may be an indicator of insomnia, we found that 21% of the sample may develop insomnia (Figure 7).

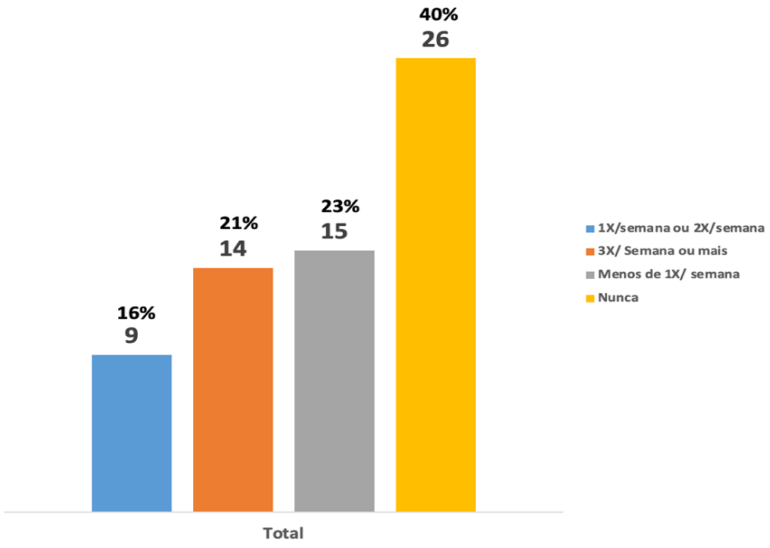

Figure 7: Latency time assessment “Taking more than 30 minutes to fall asleep”.

During the preoperative sleep history, the dentist must assess whether the patient has risk factors for developing sleep disorders and refer him or her to a specialist.

This assessment changes the way the patient is approached and managed if any change in sleep is identified that is compatible with a "probable" or "possible" sleep disorder: pre- and post-operative medications, indications for the patient due to the increased risk of exacerbated pain response, which can affect your quality of life and general health.

In the field "Other reasons for sleep disturbance", the most common answers were "work", "discomfort" and "anxiety". In terms of quality classification, most of the population said their sleep was of 'good'

quality (44 responses), followed by 'poor' quality (14 responses), 'very good' quality (3 responses) and finally 'very poor' quality (3 responses).

As described in Figure 8, the population's sleep quality worsened from week W1 to week W2, the number of 'good' and 'very good' responses decreased, and the number of 'poor' and 'very poor' responses increased in week 1 compared to week 2.

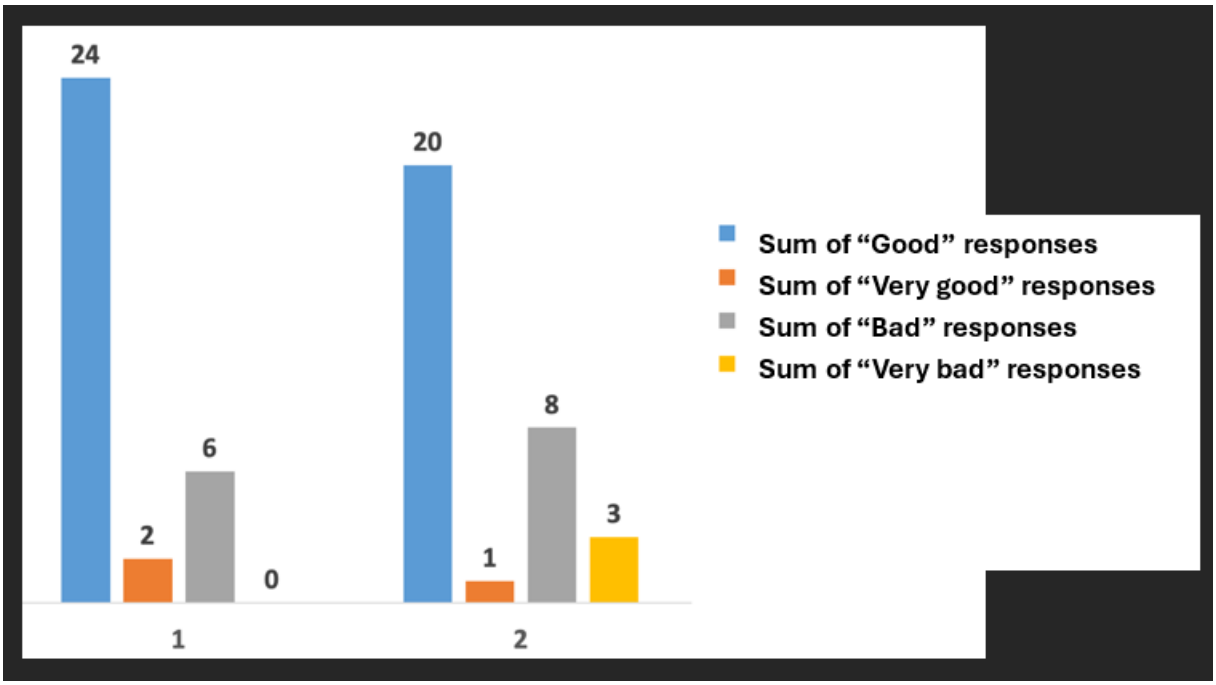

Figure 8: Variation in sleep quality classification in week 1 and week 2.

Discussion

A critical reflection will be carried out in a systematic and comparative way with the results of another research already carried out.

Sleep disorders are associated with increased pain perception [19]. They are common throughout life and affect a person's general wellbeing. One of the most common symptoms is insomnia. Insomnia is defined as taking more than 20 to 30 minutes to fall asleep, three times a week for three months. It is estimated that around 30% of the population suffers from this symptom [20]. In this study, 21% of the sample (14 people) were found to be at high risk of developing insomnia, as they reported taking an extra 30 minutes to fall asleep, three or more times a week.

In terms of hours slept, it is estimated that around 35% of the US population sleeps less than the ideal amount [21] and data from the Portuguese Sleep Association states that "Portuguese people sleep less than six hours a day on average" [22]. In comparison with the present study, we confirm that the average number of hours slept by the population of individuals in the Portuguese sample was 7h21m.

Various studies by [7, 8, 23, 24] have pointed out that pain worsens the quality of sleep. This is also confirmed in the present study by the PSQ, as the population's sleep quality worsened in the week after tooth extraction. The present study also showed that tooth extractions can pose a risk to sleep quality, even for a short period of time. These findings may be due to pain, changes in sleep patterns due to awakenings, and the use of medication to control postoperative pain.

In dentistry, most pain is of acute inflammatory origin. This type of pain is part of an individual's hypervigilance system warning of injury or potential tissue damage, where pro-inflammatory cytokines associated with DS are released [25].

The effect of acute pain on sleep is usually short-lived. It appears to follow a 'linear model', with pain preceding complaints of poor sleep and sleep returning to normal once the acute pain has subsided.4 Once dissolved, it tends to disappear [5,6]. In our study, we verified by VAS that pain decreased one week after extraction.

According to the results, the drugs most used by the sample to control postoperative pain were ibuprofen (30 responses) and paracetamol (18 responses). Both may have been responsible for triggering poor sleep quality, as both NSAIDs and paracetamol affect sleep architecture [13,17]. Further studies are needed to find a pharmacological therapy that is effective for pain and less disruptive to sleep.

A study showed that adult patients with pain had longer sleep onset latencies and more recurrent awakenings [24]. In comparison with our study, we also found an increase in sleep latency, as the population average increased from 21 minutes in the first week (W1) to 24 minutes in the second week (W2). In addition, it was found that one week after tooth extraction, out of a total of 64 responses, 48 were positive for "waking up in the middle of the night or very early", confirming the studies by that cortical micro-awakening (when the patient wakes up) increase in pain situations, inducing sleep fragmentation.

Anxiety is the most common mental disorder in the world (global prevalence of about 25%) [26]. People with anxiety or anxiety-related disorders often experience poor sleep quality and SD, particularly the symptom of insomnia [27]. In our study, 'work worries' and 'anxiety' were recorded as sleep disturbances. These disturbances disrupt sleep and may reduce the effectiveness of the dentist's postoperative recovery. In this sense, the dentist should recommend good sleep hygiene practices and, in more serious cases, prescribe a benzodiazepine such as midazolam, which has been shown to be effective in treating people with insomnia [12].

According to [28], daytime sleepiness did not make a significant difference one week after the extraction of lower third molars When discussing the present study, which used the same questionnaire (ESS) to assess the degree of daytime sleepiness, we clarify that the degree of sleepiness increased in the sample studied, with no significant differences observed between the sexes.

In a study, it was found that around 30% of people had difficulty initiating sleep, interruptions during sleep and drowsiness after falling asleep. Similarly, used the same questionnaire and reported a higher

percentage, around 45%. However, none of the studies used validated scales specifically designed to assess sleep disorders [28].

Exposure to blue light, mainly from digital devices such as smartphones and televisions, at the end of the day can lead to fragmented sleep [29]. In our study, we found that most of the population watches television before going to bed (127 responses) and many others use their mobile phones (18 responses). Once again, the dentist's active role should be to promote good sleep hygiene, free from electronic devices.

It is estimated that about 50 to 70 million people in the United States (about one third of the population) have SD and are unaware of it [21]. Confirming our study, 'shortness of breath' is the second most disruptive sleep symptom (39 responses), followed by 'toothache' with 42 responses. In addition, 17% of the sample reported 'breathing pauses' and 34% reported 'leg movements during sleep', two symptoms associated with SD. Once again, we found that patients attending dental clinics were presenting with symptoms associated with sleep disorders and the vast majority were not being screened. There is a need to encourage the implementation of sleep related issues so that dentists can be another line of support for the diagnosis/referral of sleep disorders.

Study Limitations

The present study had several limitations, namely the lack of a control group and the fact that it was a study based on subjective questionnaires. Therefore, the results should be interpreted with caution.

The degree of daytime sleepiness, sleep latency, nighttime awakenings and insomnia symptoms are subjectively assessed by individuals using questionnaires and not by objective methods such as the multiple sleep latency test, the multiple wakefulness test or polysomnography.

In addition, the sample size is relatively small, so the results cannot be extrapolated to the general population. The sample size was small because not all patients complied, some were illiterate, and others did not understand the questions asked. In addition, many refused to answer the questionnaire in the second week and many others forgot to send in their sleep diaries. Data collection was also difficult because the oral surgery curriculum unit is integrated with other disciplines in general practice.

It must be considered that other factors may have influenced the postoperative sleep of the included patients, such as their pre-existing mental state and the duration and recovery from surgery.

Conclusion

Clinical, experimental and epidemiological data support the idea that sleep disturbance contributes to the exacerbation of pain perception. Surgical procedures have postoperative pain and inflammatory responses as "side effects" that contribute to the deterioration of sleep quality. On the other hand, these 'side effects' are also exacerbated by sleep disturbance. It is therefore clear that sleep and pain have a bidirectional relationship.

Sleep is significantly altered after tooth extraction, especially in vulnerable patients, according to genetic and psychological factors. Pain, analgesics and anti-inflammatory drugs appear to contribute to DS in a bidirectional process of worsening sleep and pain. The dentist must advise the patient to get a good night's sleep the night before and after surgery, to avoid digital devices with blue light that disturb sleep, and if the patient expresses a lot of anxiety the night before surgery, to take an anxiolytic to help them fall asleep.

The present study showed that postoperative pain affects sleep quality, daytime sleepiness, sleep fragmentation, sleep latency and subjective symptoms of insomnia in the first week after tooth extraction. It is estimated that some individuals in the sample will suffer more from SD than those diagnosed.

Dentists should be aware of the decrease in sleep quality in the week after tooth extraction and understand the burden of SD; therefore, they should include some sleep-related questions in their history and provide sleep hygiene guidelines along with postoperative instructions to their patients.

The impact of SD on pain control has been underestimated in studies of postoperative pain and should be reconsidered when managing patients with this condition.

Further studies are needed to elucidate this complex and dynamic relationship between sleep and pain.

Acknowledgements

The authors have no conflict of interest to declare.

Funding Statement

None.

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