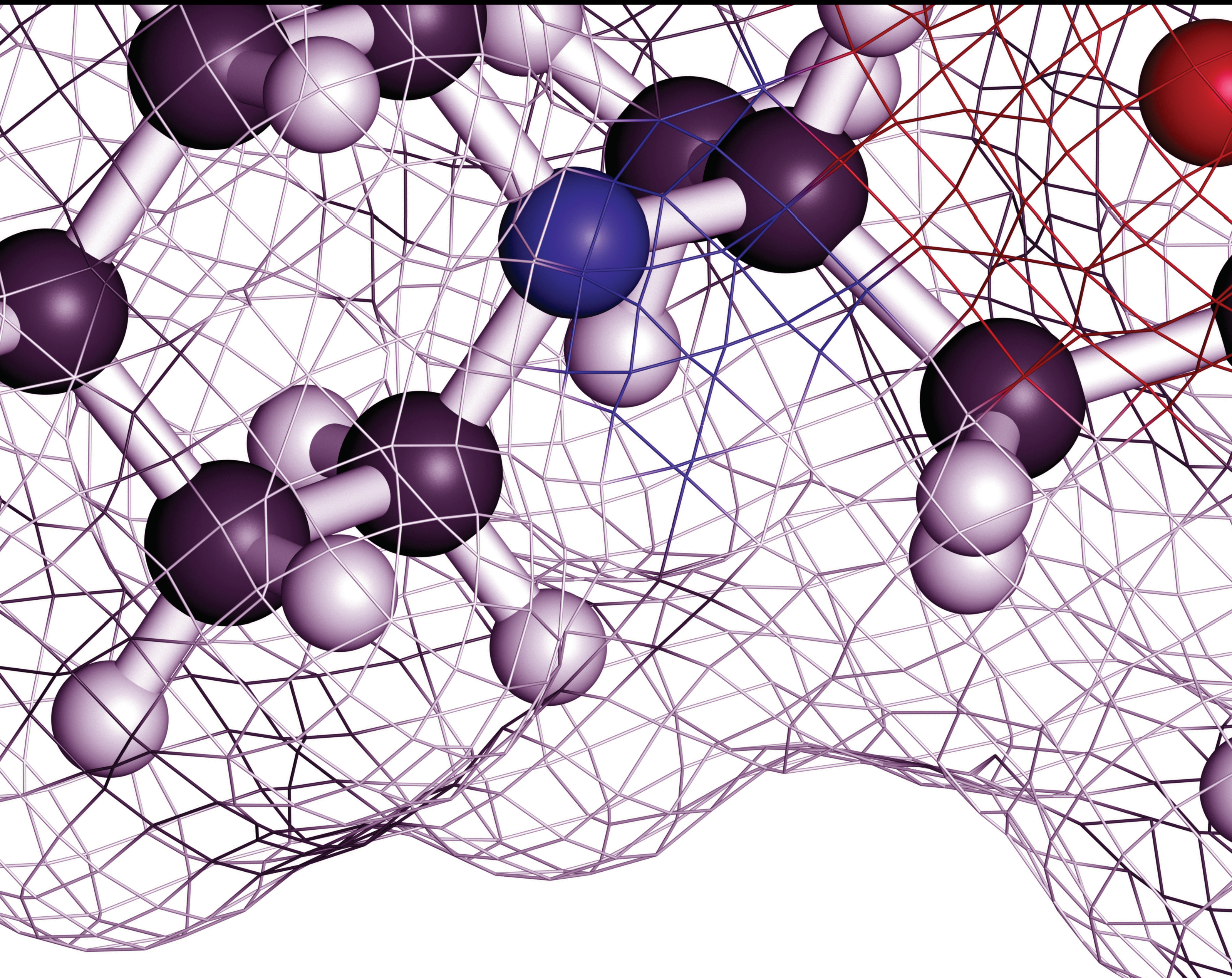
Pain Research and Management

Odontogenic and Non-Odontogenic Pain of the Orofacial Region

Lead Guest Editor: Mohammad Khan
Guest Editors: Sam'an Malik Masudi and Sheikh M. Alif



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Research Article

Perceived Pain during Rapid Maxillary Expansion (RME): Trends, Anatomical Distinctions, and Age and Gender Correlations

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Objectives. To investigate pain trends and characteristics of different facial districts in patients undergoing rapid maxillary expansion (RME) and its possible correlations with age and gender. *Materials and Methods*. 85 subjects (45 males and 40 females) undergoing RME were selected and analyzed during first two weeks of treatment. Patients rated daily two types of pain perception: the general perceived pain (GPP), i.e., the pain overall perceived in the face, and the local perceived pain (LPP), i.e., the pain perceived locally in the following anatomical areas: anterior palate (APA), posterior palate (PPA), nasal (NA), joint (JA), and zygomatic (ZA). Patients were provided the Numeric Rating Scale (NRS) and Wong–Baker Faces Pain Rating Scale (FPS) to correctly assess their GPP and LPP. Pearson correlation coefficient and analysis of variance (ANOVA) were, respectively, used to define the linear relationship between all the variables considered and to verify whether the response variables (gender and age) were significantly different ($\alpha < 0.05$). *Results*. Sample's mean age was 10.11 years. Average pain values of GPP and LPP progressively rise from day 1 to days 2-3 (pain peak) and tended to decrease until day 14, with a linear decrease for GPP and a not linear decrease for LPP. PPA and APA resulted the most painful areas, followed, respectively, by JA, ZA, and NA. Statistically significant differences resulted in average pain values according to patients' age and gender, both in GPP and LPP. *Conclusion*. RME causes perception of pain in several maxillofacial areas. Pain reported during RME resulted positively correlated with age and gender of patients.

1. Introduction

Fear of suffering is often a major deterrent against beginning an orthodontic treatment and is the primary cause of discontinuity and lack of compliance in patients undergoing long-term procedures [1]. Pain and discomfort occur during all types of orthodontic procedures, such as separator placement, archwire placement and activations, application of orthopedic forces, and debonding. Patients wearing fixed appliances reported higher values for intensities of pressure, tension, pain, and teeth sensitivity when compared with patients wearing removable appliances [2]. The greatest levels of discomfort and pain were reported by patients undergoing fixed orthodontic therapies and orthopedic therapies [1, 2]. The active phase of palatal expansion is variable in length, generally lasting 10–14 days, with patients reporting pain mainly during the first days of device activation [1, 2]. Despite the importance of this factor in clinical practice, orthodontic pain is rarely scientifically investigated, especially with regards to common fixed orthodontic therapies, such as rapid maxillary expansion (RME) [3, 4]. Variable amounts of orthopedic force are generated in RME of median palatal sutures. This force is absorbed and propagated in the three planes of the craniofacial complex through tissue displacement and remodeling mechanisms that exert pressure on the bones surrounding the maxilla via cranial and circummaxillary sutures [3, 4]. Analyzing stress and force distribution during RME on craniofacial structures, Jafari et al. have observed a high level of stress dissemination to all circummaxillary sutures and important bone displacements, not only in the anterior and posterior palate but also in nasal and zygomatic bones [5]. Moreover, with respect to growing age, it has been demonstrated that RME is capable of modifying the condyle-fossa relationship and of affecting the joint area [6].

Several clinical studies have investigated pain related to RME, mostly comparing the use of different activation protocols (2 turns/die vs. 1 turn/die) or of different types of appliances [7, 8]. However, there has been little study of the perception of pain in craniofacial districts other than those that are most heavily loaded, i.e., the palate and upper teeth. The single study (Önçağ et al.) that has examined RME-related pain perception in 5 craniofacial areas (palatal, dental, malar, frontal, and temporal) reported increased pain perception in the dental and palatal areas compared to the others and a significant statistical difference in average pain for all the anatomical districts considered [9].

The aim of this study is to analyze pain trends and characteristics and the possible correlations with age and gender variables, during the first 14 days of RME therapy, observing patient perceived pain not only in the palatal area but also in the nasal, joint, and zygomatic areas.

2. Materials and Methods

A consecutive series of patients under the age of 14 undergoing RME therapy in the Orthodontics Department of the Sapienza University Hospital of Rome were asked to participate in the study, from March 1st to December 27th 2019, a total of 96 patients. The contraction of the maxillary arch and the presence of a mono or bilateral cross-bite were criteria for inclusion. Intellectual disability, metabolic/chronic disease, current use of pain medication, previous orthodontic treatment, or failure to give informed consent by each patient's parents were criteria for exclusion. This study was approved by the Institutional Ethics Committee (N.53/18–0000711), and informed consent was obtained from each patient's parents.

All patients underwent expansion therapy of the upper jaw using a rapid palatal expander (RPE) that was attached to bands on the first maxillary molars with traditional hyrax screws (A0620 SS, manufactured by Leone S.p.A, Florence, Italy). The RPE appliance activation protocol, which lasted 14 days, required 2 activations per day: 1 in the morning and 1 in the evening.

The participants were asked to avoid analgesic medication throughout the activation period; those who took medication of this type during the period of therapy were later excluded from the study.

At the time of positioning of the palate expansion appliance, parents were instructed about the methods and activation times of the appliance. All patients received a pain assessment card and were instructed how to correctly fill out the form, which was then returned once completed. Participants were asked to indicate their pain perception at the end of each day, precisely 30–60 minutes after the second daily activation, for all 14 days of treatment. To minimize participant dropout, patient's parents were asked to set an alarm clock and check the proper compilation of the pain assessment card every day.

Both of the scientifically recognized scales for pain assessment [10, 11], the Numeric Rating Scale (NRS) and the Wong–Baker Faces Pain Rating Scale (FPS), were used; the former was used to evaluate the general pain perceived during the day and the latter to evaluate pain perceived in specific anatomical areas.

General perceived pain (GPP): overall perceived pain during the day. The pain self-assessment scale used was the Numeric Rating Scale (NRS) (Figure 1(a)).

Local perceived pain (LPP): pain perceived during the day related to a specific anatomical zone. The areas considered were the anterior palate area (APA), posterior palate area (PPA), joint area (JA), nasal area (NA), and zygomatic area (ZA) (Figure 1(b)).

The areas were also represented graphically on the card with numbers to facilitate the evaluation (Figure 1(c)). The pain self-assessment scale used was the Wong–Baker Faces Pain Rating Scale (FPS).

2.1. Statistical Analysis. All data obtained were examined using SAS software (version 9.4). Statistical analysis identified several different indicators (mean, median, standard deviation, max and min), which were used to construct a line plot graph to represent the distribution. The Shapiro–Wilk test was used to test the normality assumption of data. A Pearson correlation coefficient was used to define the linear relationship between all the variables considered. Analysis of variance (ANOVA) was used to verify whether the response variables (gender and age) were significantly different. The threshold for statistical significance was set at $\alpha < 0.05$.

3. Results

A total of 96 patients participated in the study. However, 7 subjects were excluded because of incomplete data, and 4 subjects were excluded because they took pain medication during treatment. Thus, the final number of study participants was 85 patients: 45 males and 40 females. The age range was 7–14 years, with a median age of 10.11 years (Table 1).

All patients (100%, $n = 85$) reported general pain (NRS) during the 14 days of the study and in all the anatomical areas examined (FPS). The mean pain range for GPP was from 2.58 (day 14) to 6.17 (day 2), using the NRS scale. The mean pain range for LPP was from 0.23 (ZA_day 11) to 4.82 (PPA_day 2), using the FPS scale.

3.1. General Perceived Pain (GPP). Figure 2 shows the trend and quality of perceived pain, according to the NRS scale. Males reported higher average pain values (5.02_NRS) than females (2.58_NRS) for each day of treatment (Figure 2(b)). On day 2, the highest pain values were reported by both male (6.89_NRS) and female (5.37_NRS) patients.

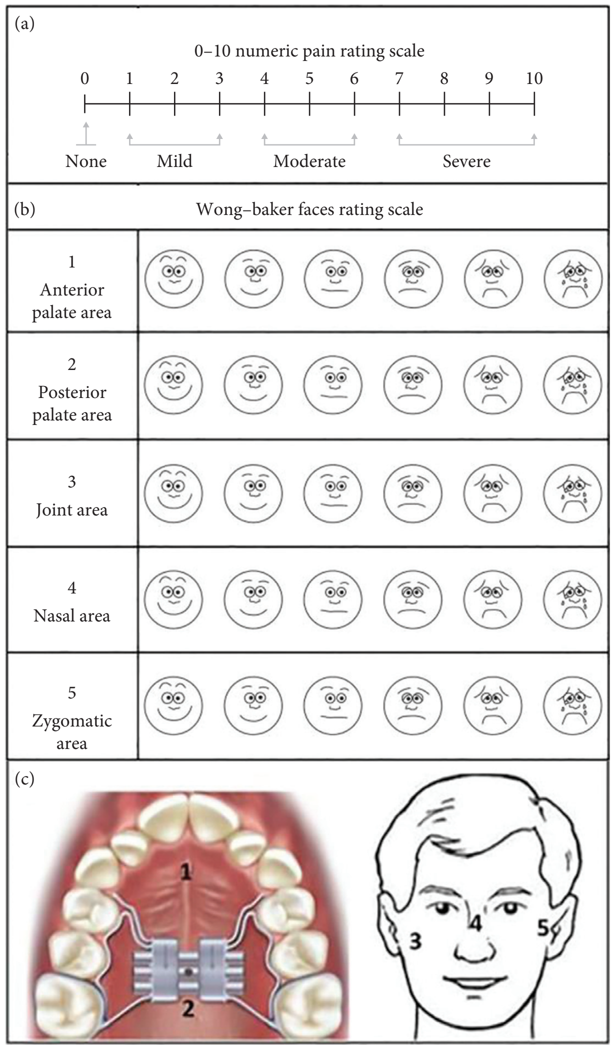

Figure 1: Pain scales used for daily evaluation. (a) NRS. (b) Wong–Baker FPS. (c) Picture used to facilitate patients' identification of anatomical areas.

Table 1: Basic characteristics of the participants and average pain values (FPS) in the different anatomical areas analyzed in the first 2 weeks of treatment.

Characteristics	Subjects		
	Male	Female	Total
Age, years, mean (SD)	10.89 (1.93)	9.25 (1.73)	10.11 (2.00)
Gender, number (%)	45 (53%)	40 (47%)	85 (100%)
Pain values (FPS), mean (SD)			
Anterior palate area (APA)	1.41 (0.27)	2.75 (1.39)	2.04 (0.73)
Posterior palate area (PPA)	1.70 (0.98)	3.43 (1.34)	2.51 (1.11)
Joint area (JA)	1.67 (1.22)	1.64 (0.54)	1.65 (0.82)
Nasal area (NA)	1.30 (0.32)	1.67 (0.66)	1.10 (0.37)
Zygomatic area (ZA)	0.94 (0.33)	1.29 (1.05)	1.19 (0.57)

An age-related analysis reveals differences in pain perception between all ages under investigation. Results for each age group are listed in the decreasing order of average pain values during the 14 days of study (NRS): "13 y" (average = 5.57; 5 Pt.), "12 y" (average = 5.28; 15 Pt.), "11 y" (average = 4.96; 10 Pt.), "14 y" (average = 4.57; 5 Pt.), "10 y" (average = 4.05; 15 Pt.), "9 y" (average = 3.31; 15 Pt.), "7 y" (average = 2.46; 10 Pt.), and "8 y" (average = 1.96; 10 Pt).

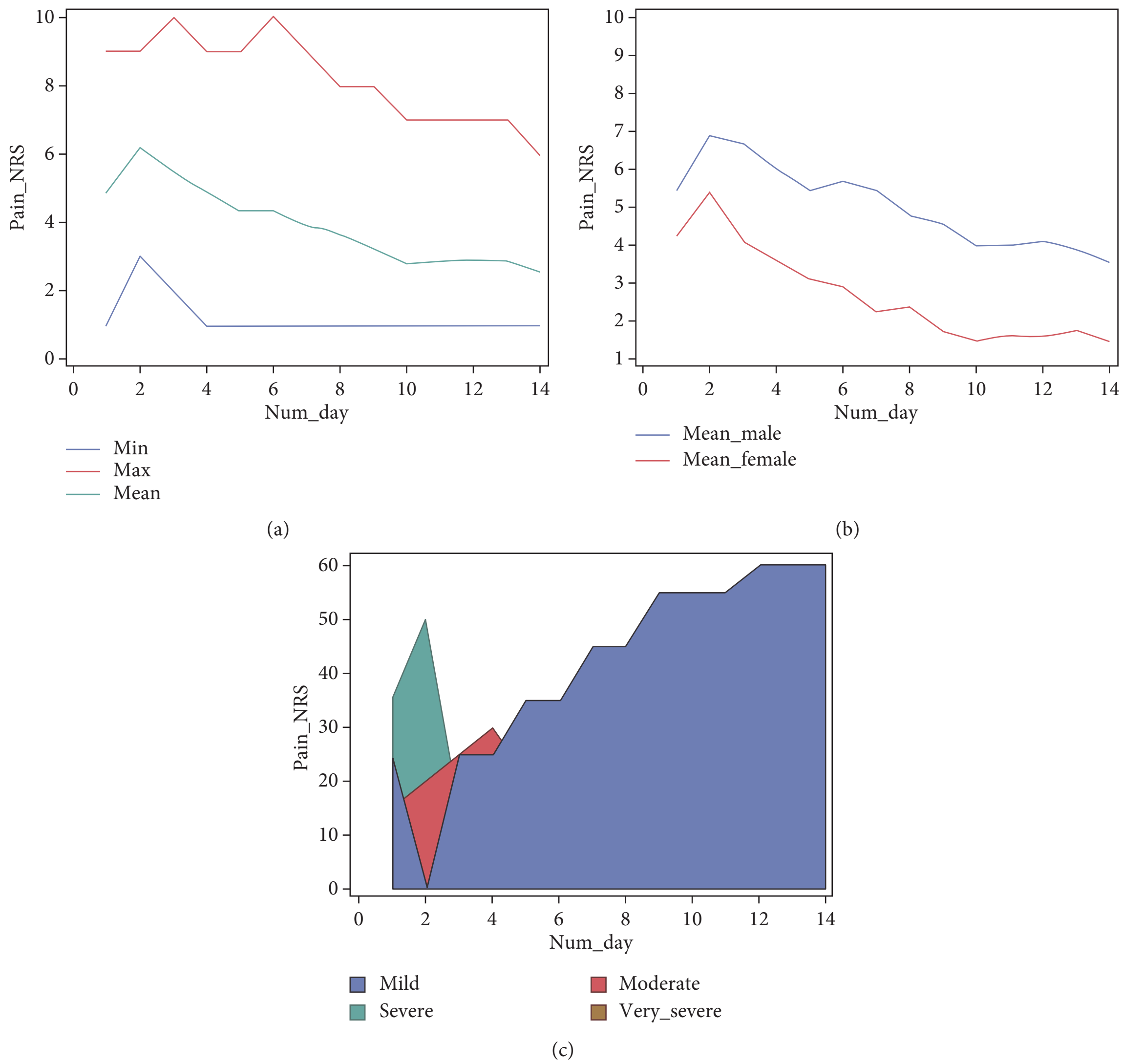

Figure 2: Pain related to RME in the first 2 weeks of treatment according to the NRS scale. (a) Pain values over time in all patients and (b) in male and female patients. (c) Qualitative perception over time in all patients.

The ANOVA *t*-test supports "gender" and "age" as statistically significant variables ($\alpha < 0.05$).

3.2. Local Perceived Pain (LPP). Figure 3 shows the pain trend in each analyzed area, according to the FPS scale. All the averages by the area are listed in Table 1. Females reported higher pain values than males for every considered area except for JA (Table 1, Figures 3(b) and 3(c)). On days 2 and 3, the highest pain values were reported by both male and female patients, differently according to the anatomical area analyzed. Day 2 resulted the pain peak day for the areas APA (F = 5.25_FPS/M = 1.55_FPS) and PPA (F = 6.25_FPS/M = 3.55_FPS). Day 3 resulted the pain peak day for the areas NA (F = 3.00_FPS/M = 1.33_FPS) and ZA (F = 3.00_FPS/M = 1.11_FPS). Concerning the area JA, day 3 resulted the pain peak day for females (3.00_FPS) and day 2 for males (4.44_FPS).

There were differences in the pain perception of patients of different ages in each of the areas analyzed. Results are listed in Table 2 in a decreasing order, from the age reporting the most pain to the one reporting the least pain during the 14 days of therapy.

The pain trend was not linear across the areas examined, so the "Pearson correlation coefficient" was applied to evaluate whether any linear correlation existed among the different variables. In terms of pain increase, positive linear correlations were found among peak days and several of the following days ($\rho > 0.7$). In particular, there was a strong relationship of dependence among peak days 2 and 3 and days 6 and 8, for all investigated anatomical districts ($0.72 < \rho < 0.94$) (Table 3). It, therefore, was decided to examine these four days more closely. The results of this analysis are listed in Table 4 under Supplementary Materials Section, organized according to gender and age.

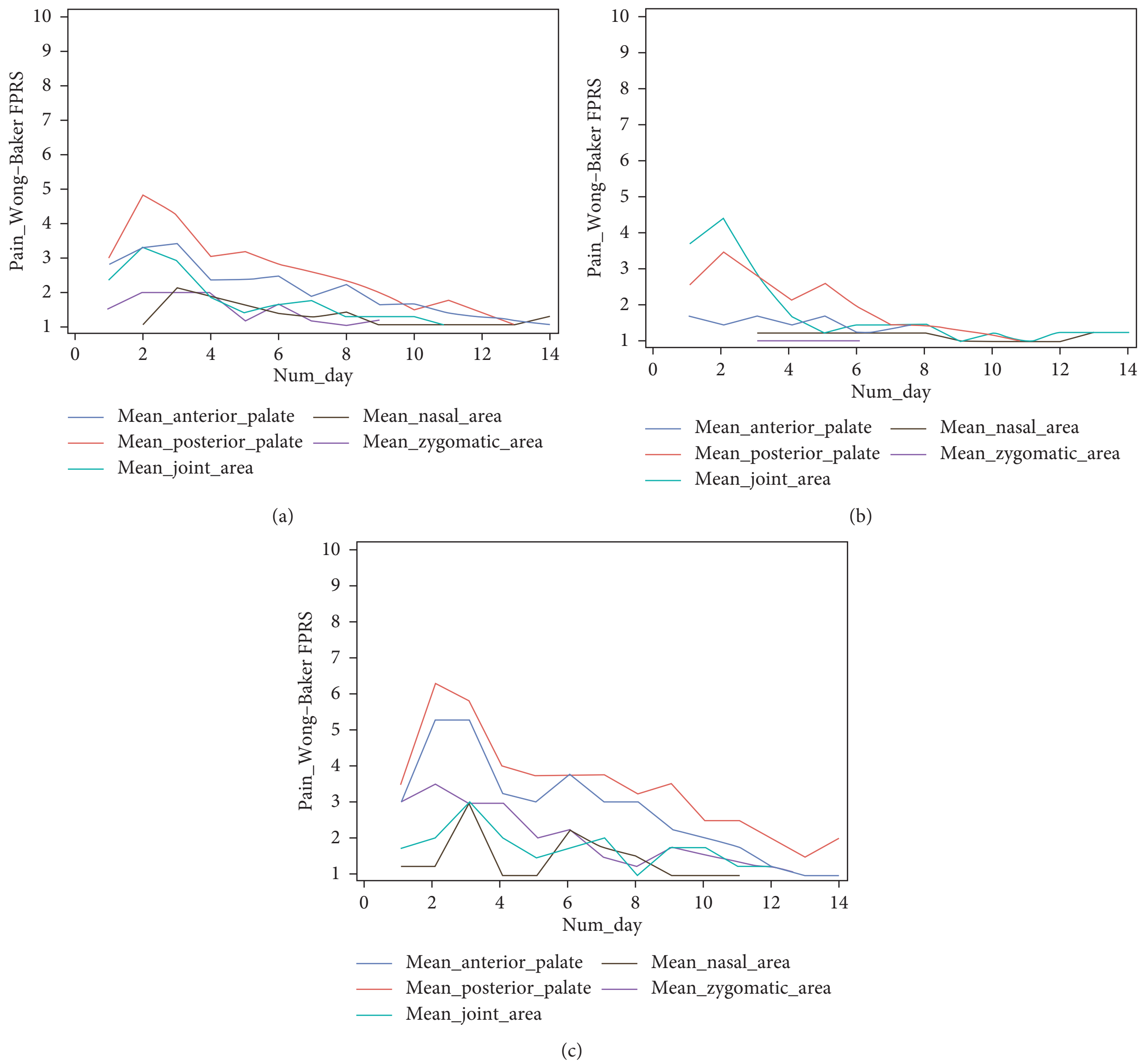

Figure 3: Pain related to RME in the first 2 weeks of treatment according to the Wong–Baker Scale in the different districts analyzed (a) and according to gender: male (b) and female (c).

The ANOVA t-test demonstrated significant differences between the "gender" and "age" variables ($\alpha < 0.05$), except for in JA, where gender was not significant.

Supplementary data related to the ANOVA test analysis of both GPP and LPP are listed in Table 5 under Supplementary Materials Section.

4. Discussion

Clinical studies have demonstrated pain related to RME as a frequent symptom, reported by 66, 12–99% of patients [12, 13]. These data are confirmed by the present study, in which 100% of subjects undergoing RME ($n = 85$) reported pain throughout the entire active phase of therapy (NRS) and in all the examined anatomical districts (FPS).

Analysis of general perceived pain (GPP) indicates pain was greatest during the first 6 days of activation, with a maximum peak at day 2 (NRS: 6, 18) and tended to decrease gradually in the following days; these findings concur with the current literature [7, 13, 14]. However, the quality of RME-related pain reported in our study is not consistent with those of previous studies. Indeed, though GPP pain levels were mostly described as mild throughout the treatment period, they were referred to as moderate or strong by the majority of our participants during the first days of activation. Needleman et al. [7] also reported high pain levels, especially after the first 6 screw turns; during this period, 69% of patients, moreover, had to take pain medication. Geçgelen Cesur and Aksoy [12] indicated moderate pain levels during the initial 7 days of therapy. Two other studies demonstrate pain presence throughout the entire therapy, but with very low reported values [14, 15].

However, our local perceived pain (LPP) analysis resulted in average pain levels inferior to the NRS, with FPS

Table 2: Average pain values (FPS) in the different anatomical areas analyzed in the first 2 weeks of treatment, according to patient age.

Anterior palate (APA)		Posterior palate (PPA)		Joint area (JA)		Nasal area (NA)		Zygomatic area (ZA)	
Average pain*	Patient age	Average pain*	Patient age	Average pain*	Patient age	Average pain*	Patient age	Average pain*	Patient age
3.14 ± 1.70	13	4.36 ± 2.06	8	4.57 ± 1.55	8	4.00 ± 2.22	14	3.68 ± 2.08	14
2.78 ± 1.76	8	3.57 ± 1.70	7	2.48 ± 1.42	9	1.48 ± 0.98	10	1.82 ± 1.31	9
2.64 ± 0.84	7	3.14 ± 1.87	13	1.78 ± 0.58	7	1.44 ± 1.01	11	1.48 ± 1.01	8
2.52 ± 1.69	10	2.48 ± 1.58	10	1.71 ± 1.25	12	1.09 ± 0.49	12	1.33 ± 0.83	10
2.14 ± 0.99	12	2.48 ± 1.53	12	1.14 ± 1.87	14	1.00 ± 1.27	9	1.18 ± 0.66	12
1.21 ± 0.89	11	1.78 ± 0.80	11	0.71 ± 1.81	11	0.43 ± 0.75	7	0.30 ± 0.75	11
1.14 ± 0.89	9	1.43 ± 2.11	9	0.095 ± 0.24	10	0.14 ± 0.53	8	0.01 ± 0.53	7
0.86 ± 1.87	14	1.00 ± 2.04	14	0.00 ± 0.00	13	0.00 ± 0.00	13	0.00 ± 0.00	13

*Mean ± standard deviation.

Table 3: Linear correlations among peak days 2 and 3 and days 6 and 8, for all investigated anatomical districts, according to Pearson correlation coefficient.

—	ρ^*	P value**
Anterior palate (APA)		
Day 2_day 6	0.73	<0.0001
Day 2_day 8	0.72	<0.0001
Day 3_day 6	0.83	<0.0001
Day 3_day 8	0.79	<0.0001
Posterior palate (PPA)		
Day 2_day 6	0.74	<0.0001
Day 2_day 8	0.85	<0.0001
Day 3_day 6	0.79	<0.0001
Day 3_day 8	0.72	<0.0001
Joint area (JA)		
Day 2_day 6	0.73	<0.0001
Day 2_day 8	0.77	<0.0001
Day 3_day 6	0.83	<0.0001
Day 3_day 8	0.78	<0.0001
Nasal area (NA)		
Day 2_day 6	0.72	<0.0001
Day 2_day 8	0.74	<0.0001
Day 3_day 6	0.94	<0.0001
Day 3_day 8	0.76	<0.0001
Zygomatic area (ZA)		
Day 2_day 6	0.85	<0.0001
Day 2_day 8	0.76	<0.0001
Day 3_day 6	0.83	<0.0001
Day 3_day 8	0.81	<0.0001

*ρ, Pearson correlation coefficient; positive linear correlation for $0.72 < \rho < 0.94$. **P value <0.0001.

ranging from 1.10 to 2.51. Even painful days (days 2, 3, 6, and 8) resulted in mild discomfort according to this analysis; furthermore, we saw great variability between the anatomical districts examined. These outcomes, together with the conflicting evidence in the existing literature, draw attention to the difficulties surrounding subjective pain evaluation even using validated scales as well as to the necessity of further investigating how other variables (gender, age, psychological factors, and hormonal factors) contribute to pain evaluation and extreme individual variability.

In this regard, interesting gender-related and age-related results were found by this study, including a statistically significant difference between male and female pain perception. While males reported higher pain values than females for GPP (NRS), this evidence was contradicted by their reporting of LPP (FPS). Females, in fact, reported higher LPP (FPS) pain values in all considered facial districts, except the joint area (JA), which is also the only area showing no statistical significance.

Though several clinical studies of RME-related pain have not identified significant gender differences [7, 8, 13], others similarly demonstrate females experiencing significantly more pain than males [14, 15]. Variability in pain perception based on sex and gender has been long debated. Genetic, molecular, physiological, and psychosocial factors contribute to differences in processing pain and pain perception in men and women. In particular, women's threshold for pain is greater, more varied, and more variable than for men.[16]. In a study including children and adolescents, Allen et al. [17] noticed important sex differences in the cortisol-pain relationship. Increase in cortisol was positively associated with greater pain tolerance in males and greater pain sensitivity in females. A literature review by Berkley et al. [16] highlighted the importance of gender in pain perception and inflammation, underlining the influence of hormonal modulation on nociception through factors such as estradiol, menstrual cycle, or the sex-related effects of NSAIDs and ASICs. These findings validate the existence of a gender-related difference in pain perception during RME, though increased sensitivity in females only occurred in LPP.

Our age-related analysis also pointed to significant variations in evaluations of both GPP and LPP. Though studies of pain and its correlation with age and aging show increased perception of discomfort with age, research on the prevalence of pain in children and adolescents displays inconsistent findings, and it is difficult to reach general conclusions concerning pain prevalence and characteristics in this particular population group [18]. Haraldstad et al. [19] reported that pain increases with age, with girls between 16 and 18 reporting the highest discomfort. A study by Blankenburg et al. [20], of perception of different nociceptive stimuli, including pressor and mechanical stimulation, found that children are more sensitive to most painful stimuli than adolescents and also noted that growth-related changes during puberty seem to influence pain perception. At the craniomaxillofacial level, these different pain perceptions may be explained by tissue and morphological differences in bones structures related to age changes. During craniofacial growth, sutures represent secondary growth centers that respond to mechanical stress with various structural effects: sutural interdigitation becomes more complex with increase in age. Median palatal sutures respond to RME with a greater expansion rate at the age of 8 than in patients who are 12, 13, or 14 years old [2]. In this study, GPP results support the evidence in the literature, with greater reported pain as age increases: patients aged 7-8 reported inferior pain values than older patients; the values reported by patients aged 12-13 were especially high. However, our LPP results show great variability among examined districts as well as highest pain values in patients aged 8 (mean = 2.66) and 14 (mean = 2.14). The lowest values were reported by patients aged 11 (mean = 1.09) and 13 (mean = 1.26).

The differences emerging from comparison of the two analyses may be due to the use of different scales, NRS and FPS, and reflect the findings of previous studies that have also used both [10, 11].

There were also interesting trends our LPP findings on pain location and timing. As expected, the posterior and anterior palate areas resulted in the highest pain values. It is interesting to note that the nasal area, the closest anatomical area and the one experiencing the greatest changes after RME, was the district in which the lowest average pain level was reported. However, some pain was reported for every examined district. Jafari et al. observed the deep anatomical effects of RME appliances, reporting the highest stress levels in the areas of the maxillary bone, zygomatic process, external walls of the orbit, frontozygomatic suture, and the frontal process of maxilla [5]. Interestingly, these areas of high-stress distribution coincide with some of the most painful anatomical districts of this study. These findings are suggestive of the role of circummaxillary sutures in modulating orthodontic pain perception, as a constraint on the transmission of the expansion forces to the other neighbouring anatomical districts.

As with the GPP findings, using the NRS scale, reported LPP pain was greater in the first day of the activation of the appliance, unlike the GPP findings; however, there is no clear linearity in the decrease of LPP pain over time. Various increases in pain values, different for each examined area, were noticed from day 3 to day 14. The pain values reported on days 6 and 8, in particular, were strongly correlated with the peak days, in all the areas considered ($\rho > 0.7$). Some studies on cranial sutures undergoing mechanical stress could explain this pain "reactivation" over time. Cleall et al. [21] reported the presence of highly vascularized connective tissue with moderate chronical inflammation response inside the sutural bone of monkeys undergoing RME after 14 days of treatment. Investigating histological changes in the mean palatine suture in patients undergoing RME, Caprioglio et al. [22] later reported the presence of a highly vascularized and coagulum-rich central osteoid matrix, especially on day 7 of activation. A recent murine study by Wu et al. [23] describes a particular arrangement and orientation of new bone formation in expanding sutures, with the largest volumetric increase on day 7 of expansion. Finally, an interesting investigation by Che et al. [24] on the role of the nonneural cholinergic system in bone remodeling after RME shows increasing values of ACh and an increasing RANK/OPG ratio after 1, 3, and 7 days of expansion. The presence of pronounced bone remodeling phenomena, such as ACh, seems to align with the results about pain development obtained in our study, which indicate days 6 and 8 as the most related to average pain peak days (days 2 and 3). These inflammation processes involve increased molecular expression that we know to be involved in pain modulation.

Despite the interesting results obtained, this study presents some limitations. The patient sample examined is too limited to represent reliable results regarding the characteristics of RME-related pain, especially in connection with patients' age and gender. Furthermore, the pain assessment was limited to patient self-assessment, but the importance of using multiple methods of pain assessment, given the complexity of changes that this symptom can undergo during experimental procedures, especially in a children's population, needs to be emphasized.

5. Conclusions

(i) RME therapy caused pain in the entire study population at the palate, joint, zygomatic, and nasal areas

(ii) Age and gender were positively correlated with overall pain perception and with pain perception in every single area analyzed except the joint area

(iii) In all examined facial areas, perceived pain trends do not decrease linearly; further studies are needed to deeply analyze if bone remodeling and inflammation processes during RME might modulate pain perception over time.

Data Availability

The data used to support the findings of this study are included within the article and the datasets are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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Supplementary Materials

Table 4: Pain levels in the different anatomical areas analyzed on days 2, 3, 6, and 8 (FPS). *Mean ± standard deviation. Table 5: ANOVA procedure supplementary data of NRS and FPS scales analysis, according to age and gender response variables. (*Supplementary Materials*)

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Research Article

The Prevalence of Dental Anxiety Associated with Pain among Chinese Adult Patients in Guangzhou

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Background. Anxious people appear to exaggerate the severity of aversive experiences such as anxiety and pain. Anxiety towards dental procedures is a common difficulty that may be experienced by dental patients all over the world. The goal of the study is to find out the prevalence of dental anxiety and its associated factors in Chinese adult patients. *Methods*. A cross-sectional study was conducted on 183 dental adult patients whose age ranged from 18 to 70 years. Demographic details, first and most recent dental visits with experience, the MDAS, and the Visual Analogue Scale for Anxiety (VAS-A) were obtained. Data were analyzed by frequency analysis, chi-square test, and Spearman correlation test. *Results*. Most of the respondents were female (68.9%) and 30–45 years age group. The mean total score for dental anxiety on the MDAS was 13.63 (3.1). 80.3% of participants suffered from moderate or high dental anxiety. Age must show a strong association with dental anxiety among the participants ($p = 0.011$). The first dental visit experience, the frequency of the dental visit, most recent dental experience, length of time since the most recent dental visit, and postponement of the dental visit are strongly associated with the MDAS score ($p = 0.001$). *Conclusions*. The MDAS score exhibits that Chinese adult patients have significant dental anxiety and phobia. Identifying patients with dental anxiety as soon as possible is essential to providing better dental care.

1. Introduction

Dental anxiety is a distress and unease situation that occurred in patients against the dental treatment procedure [1]. Despite modern and technical advancements in dentistry, existing research shows that dental anxiety remains a concern. Amid modern dental innovation and technical advancements, dental anxiety continues to be a major issue affecting both children and adults. Several studies have found a "dynamic vicious cycle" linking dental anxiety to poor oral health [2, 3]. Dental anxiety comprises a large proportion of people of all ages and social backgrounds, which often leads to poor oral health due to total avoidance of dental care, inconsistent dental attendance, or poor engagement [4]. Patients who suffer from dental anxiety are more likely to postpone or neglect dental treatment, resulting in the deterioration of their oral health. The progression of untreated oral infections, combined with feelings of remorse, humiliation, or worthlessness, contributes to an increase in dental anxiety, and the vicious cycle continues [3]. According to a recent study, 83.1 percent of Chinese adult patients had moderate to severe dental anxiety, and 16.2 percent met the requirements for specific dental phobia [5]. Patients suffering from dental anxiety are a significant source of stress that can jeopardize the dentist's clinical efficiency. As a result, patients with dental anxiety must be identified before treatment initiation. It will assist dental care professionals in breaking the cycle and providing successful treatment [6].

The Modified Dental Anxiety Scale (MDAS) is a reliable and factual tool used in clinical settings to assess dental anxiety [7]. MDAS is an extension of Corah's Dental Anxiety Scale (CDAS), a 4-item tool that asks patients to quantify their anxiety levels in four different dental circumstances. Humphris et al. suggested that MDAS improves on the original CDAS by including a question item about receiving local anesthetic injections and requesting the potential answers to each question on a Likert scale ranging from "not

Table 1: Characteristics of the study participants.

Variables		Frequency	Percentage (%)
Gender	Male	57	31.1
	Female	126	68.9
Age (years)	18–30	57	31.1
	30–45	66	36.1
	46–60	48	26.2
	60–70+	12	6.6
Educational level	Uneducated	36	19.7
	High school	67	36.6
	Degree/diploma	59	32.2
	Postgraduation	21	11.5
Employment	Employed (full time)	87	47.5
	Unemployed	24	13.1
	Student	42	23.0
	Retired	30	16.4
Self-perceived oral health	Good	32	17.5
	Average	101	55.2
	Poor	50	27.3
Dental experience	Yes	114	62.3
	No	69	37.7
First dental visit	<12 years old	43	23.5
	12–18 years old	82	44.8
	>18 years old	58	31.7
First dental experience	Good	56	30.6
	Not bad	77	42.1
	Bad	50	27.3
Frequency of dental visits	Every 6 months	72	39.3
	Every 12 months	49	26.8
	Less frequent/when needed	62	33.9
Most recent dental experience	Good	108	59.0
	Bad	75	41.0
The length of time since the most recent dental visit	Within 3 months	82	44.8
	3–12 months	54	29.5
	Longer than 12 months	47	25.7
Postponement of the dental visit	Yes	110	60.1
	No	73	39.9
MDAS score		13.63 (3.1)*	
MDAS score level	Less	36	19.7
	Moderate	128	69.9
	Severe	19	10.4

*Mean (SD), descriptive and frequency analyses.

anxious" to "extremely anxious." [7] The MDAS has the benefit of being a cost-effective tool for population-based research due to its simplicity [8]. Dental anxiety and fear have a detrimental effect on oral and dental health these days. It also causes complications and increases in costs. Based on the existing literature findings, we aimed to investigate the prevalence of dental anxiety and the factors that could induce dental anxiety in Chinese adult patients who visited our dental clinic at Guangzhou. We assume that the findings can also be used to minimize dental anxiety.

2. Methods

183 Chinese adult patients in First Affiliated Hospital, Sun Yat-Sen University, were included in this study according to inclusion criteria. Each participant received written informed consent and signed before participating to this study.

Each participant was given a set of questionnaires adopted from Dou et al. including three sections in this cross-sectional study [5]. In the first section, the question was regarding sociodemographics, oral health practice, and dental visits. Assessment of dental anxiety was done in the second section of the questionnaire. A Chinese version of the Modified Dental Anxiety Scale (MDAS) was adopted from Dou et al. [5] and divided into a 5-item measure to assess fear of dental procedures, including before going for treatment, waiting for treatment, drilling, cleaning, and local anesthetic injections. Ratings of 1–5 indicated "not anxious," "slightly anxious," "fairly anxious," "very anxious," and "extremely anxious" correspondingly. Dental fear can be described

Table 2: Participant responses for the MDAS.

Item name	Not anxious	Slightly anxious	Fairly anxious	Very anxious	Extremely anxious
Before going for treatment	73 (39.9%)	37 (20.2%)	55 (30.1%)	18 (9.8%)	0 (0%)
Waiting for treatment	90 (49.2%)	19 (10.4%)	74 (40.4%)	0 (0%)	0 (0%)
Drilling	19 (10.4%)	36 (19.7%)	18 (9.8%)	110 (60.1%)	0 (0%)
Cleaning	36 (19.7%)	72 (39.3%)	56 (30.6%)	0 (0%)	19 (10.4%)
Local anesthetic injections	37 (20.2%)	0 (0%)	18 (9.8%)	36 (19.7%)	92 (50.3%)

Frequency analysis.

Table 3: Association of the MDAS score and other risk factors.

Variables	X^2 (df)	p value
Gender	6.092 (6)	0.413
Age	34.626 (18)	0.011
Educational level	16.742 (18)	0.541
Employment	10.373 (18)	0.919
Self-perceived oral health	3.827 (12)	0.986
Dental experience	1.591 (6)	0.953
First dental visit	25.672 (12)	0.012
First dental experience	0.846 (120)	0.999
Frequency of dental visits	127.511 (12)	0.001
Most recent dental experience	61.196 (6)	0.001
The length of time since the most recent dental visit	110.845 (12)	0.001
Postponement of the dental visit	44.281 (6)	0.001

Chi-square (degree of freedom).

when the total MDAS score was 19 or above [4]. The researchers were trained and calibrated before this study, and the reliability of the intraexaminer was evaluated using the kappa test. A kappa value of 0.780 was achieved. Visual Analogue Scale (VAS) was used in the third section to assess the pain level for dental experiences.

All statistical analyses were performed by IBM SPSS v.26. The mean total MDAS score was calculated for all the categorized variables. Descriptive and frequency analyses were performed on all variables. A chi-square test was performed to compare the mean MDAS score between categories in the same variable. Tukey's post hoc test was performed to control for multiple comparisons. Spearman rank correlation was done to assess the strength of association between MDAS and variables.

3. Results

Table 1 shows the characteristics of the study participants. Among the 183 respondents, 31.1% were males and 68.9% were females. Most of the patients were 30–45 years age group (36.1%). The mean total score for dental anxiety on the MDAS was 13.63 (3.1). Based on the MDAS score, 19.7% of the subjects were identified to be less anxious (5–9 total score), 69.9% were moderately anxious (10–18 total score), and 10.4% were seriously anxious (≥19 total score). Most of the participants had an average level of self-perceived oral health (55.2%). Most of them went to the dentist for the first time when they were 12–18 years old (44.8%) with not bad (42.1%) to bad experiences (27.3%). Among the respondents, 75 had reported bad experiences in their most recent dental visit. More than half of the participants (60.1%) had reported that they postponed their dental visit.

Table 2 shows the participant responses for each MDAS item. Before going to treatment, 39.9% did not feel anxious, while 30.1% were anxious. Nearly half of the participants (49.2%) reported that they do not feel anxious during waiting for treatment following others who felt fairly anxious (40.4%). More than half of the participants reported that they feel very anxious during drilling (60.1%). Half of the respondents (50.3%) reported that they were extremely anxious about local anesthetic injections following very anxious (19.7%).

Table 3 shows the chi-square result of the MDAS score and other variable associations. Age must show a strong association with dental anxiety among the participants ($p = 0.011$). The first dental visit is also associated with developing dental anxiety ($p = 0.012$). Having a bad experience during the first dental visit was a contributing factor for anxiety. Frequency of the dental visit, most recent dental experience, length of time since the most recent dental visit, and postponement of the dental visit are strongly associated with the MDAS score ($p = 0.001$).

Table 4 shows the correlation between the MDAS score and other variables. No correlation was found between the MDAS and variables including age, gender, educational background, employment status, and self-perceived oral health status. Negative dental experience during treatment demonstrated a strong relation with dental anxiety. Participants who had experiences of the less frequent dental visit were more anxious compared to those with more frequent visits ($p = 0.001$). Pain at the most recent dental visit or

Table 4: The correlation between the MDAS score and other variables.

Variables	Spearman correlation	p value
Gender	−0.085	0.324
Age	−0.034	0.644
Educational level	−0.096	0.197
Employment	−0.009	0.909
Self-perceived oral health	0.061	0.415
Dental experience	−0.019	0.804
First dental visit	−0.080	0.282
First dental experience	0.010	0.892
Frequency of dental visits	−0.337	0.001
Most recent dental experience	−0.064	0.393
The length of time since the most recent dental visit	−0.062	0.43
Postponement of the dental visit	0.033	0.653

Chi-square (degree of freedom).

before the present dental visit was an important factor correlating with dental anxiety among participants.

4. Discussion

"Dental anxiety" and "dental phobia" create a major problem for both patients and dentists. These two words are often used synonymously; however, there are key differences between them. Dental anxiety is characterized as a specific patient response to dental procedure-related stress when the trigger is unclear, ambiguous, or not present at the time [9]. Dental phobia is described as intense and constant anxiety in a dental setting, which causes the person to avoid going to the dentist at all costs unless a physical issue becomes overwhelming [10]. It is recommended that dental practitioners evaluate dental anxiety and dental phobia during clinical assessments using a valid and reliable scale that can accurately measure the subjective experience of dental anxiety and phobia [10].

The results of the present study indicate an increase in dental anxiety among patients with pulpal pain as compared to previous studies [10, 11]. Our findings have shown that young patients were more likely to experience dental anxiety and phobia than older patients. Furthermore, past negative experiences in childhood and adolescence, periodontal problem perception, and feeling the gag reflex during dental care were risk factors for dental anxiety and dental phobia. In our study, 83.3% of the subjects reported moderate to extreme dental anxiety, which is higher than the results of previous studies. Another Chinese study by Duo et al. found that 83.1% of people had moderate to severe dental anxiety [5]. According to Esmaeili et al.'s [12] Brazilian report, more than half of the patients (60.4%) were moderately or highly anxious. Different studies also show different prevalence rates of dental anxiety. The dental phobia criteria (MDAS score >19) were met by 10.2% of participants in our study, which was comparatively higher than many other previous studies [13, 14]. The findings' incompatibility can be due to variations in the cultural background and the dental features of the patients in the above study.

The most important predictors of dental anxiety and phobia were age and a past negative experience in a dental clinic. Many studies have shown that females are more afraid of dental treatment than males [14, 15]. Other related research, however, found no gender differences in dental anxiety [16, 17]. In our study, no significant differences in dental anxiety were found between men and women, supporting the results of previous studies conducted in Tanzania and Nepal [16, 17]. The relationship between age and the level of dental anxiety is still uncertain in the literature, and researchers have suggested conflicting findings. In the current study, the effect of age on the MDAS score was significant, with older patients scoring significantly lower than younger patients. This finding is consistent with the findings of many other related studies [9, 14, 16, 18]. Patients seeking pain relief were always fearful of the pain they would experience during the assessment and treatment procedure. Invasive procedures include local anesthetic injection, drilling the tooth, and removing the dental pulp [19]. Pain is a significant factor in dental anxiety. According to the literature, the primary cause of dental phobia is anxiety regarding pain during dental treatment [20]. The effect of a previous bad experience in a dental clinic on the MDAS score was also significant, with patients who had a previous bad experience in their first dental visit or most recent dental visit scoring substantially higher than patients who had no such experience. This result is completely consistent with the results of other studies [21–23]. A significant difference was found in terms of the frequency of visits to a dentist and length of time since the recent dental visit. Other researchers have reported similar results, claiming that patients who visit the dentist daily are less likely to exhibit dental anxiety [15].

The current study's findings must be interpreted considering many methodological limitations. Because of the convenience sampling technique used to choose patients and the lack of randomization, there is a risk of selection bias. Within the limitation of this research, it should be noted that this is a cross-sectional study, which makes it impossible to analyse causal relationships. Dental practitioners play an important role in the treatment and prevention of dental anxiety. It has been reported that people who suffer from dental anxiety can have a detrimental impact on their tooth examination and oral health [11]. We can avoid problems by asking the factors that can cause distress in patients before dental examinations, and we can estimate the risk to people's oral health. Future research is recommended to allow for further investigation and confirmation of the study's findings. A prospective study will support both dentists and patients, with the potential to address the drawbacks of a cross-sectional study.

5. Conclusion

Dental anxiety is common among Chinese adult patients. The results of this study support the hypothesis that people who are predisposed to fearfully react to pain are more likely to become stuck in a vicious cycle of anxiety, fear of pain, and avoidance of dental care. Younger age people, first time dental treatment seekers, and having previous bad experience are the main risk factors for dental anxiety found in our study. Addressing these aspects can enhance the efficiency of strategies for reducing anxiety and phobia in adult dental patients.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Authors' Contributions

Rui Jiang participated in the drafting, data collection, data analysis, description of results, discussion, critical revision of the article, and evaluation of the final version of the manuscript. Jiali Yu participated in the drafting, data collection, data analysis, description of results, and discussion. Er-Min Nie participated in the drafting, data analysis, and description of results. Xiang Li and Chun-Yuan Zhang participated in the description of results and discussion.

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Research Article

The Relationship of Orofacial Pain and Dental Health Status and Oral Health Behaviours in Facial Burn Patients

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This study aims to examine the association of orofacial pain and oral health status and oral health behaviours in facial burn patients. The participants in this cross-sectional study were randomly recruited from the Burn Care Center, Institute of Medical Sciences, Islamabad, Pakistan. An intraoral evaluation was carried out to record the DMFT and OHI-S. A self-administered questionnaire was used to collect information on sociodemographic status, brushing frequency, and dental visits. Orofacial pain during mandibular movement was assessed using the Visual Analogue Scale (VAS). Psychological status was assessed using the Generalized Anxiety Disorder Scale and Impact of Events Scale. ANOVA and simple and multiple linear regression tests were used to analyse the data. From the 90 facial burn patients included, the majority were below 34 years of age, female, single or divorced, and unemployed. The mean DMFT was 10.7, and 71% had poor oral hygiene. 56% of the participants had moderate-to-severe anxiety, and 68% had posttraumatic stress disorder. 53% of the participants had moderate-to-severe pain during mouth opening or moving the mandible with a mean score of 41.5. Analyses showed that orofacial pain was associated with less frequent brushing, irregular dental visits, greater DMFT score, and more plaque accumulation (OHI-S). It was also associated with employment status, the severity of a burn, anxiety, and stress. The treatment and management of dental and oral conditions in burn patients need judicious balance in controlling and accurate assessment of the pain and improving psychological problems in burn patients.

1. Introduction

Burn injuries are an example of the most debilitating physical and traumatic injuries that can potentially lead to severe physical (scars, deformities, disfigurements, and disabilities) and psychological morbidity (distress, suicidal ideation, anxiety, and posttraumatic stress) and mortality [1]. The prevalence of burn cases is declining in the developed countries, but it remains a public health concern in developing countries [2]. According to the World Health Organization (WHO), approximately 11 million cases of burn injuries, including 180,000 fatalities, occur annually worldwide and 90% of them are in low- and middle-income countries [1].

Burn patients go through a long journey towards recovery which lasts for years or decades while enduring acute, healing, and rehabilitation phases [3]. The physical complications and impairments caused by burn injuries depend upon their cause, severity, depth, and location of the burn on the body, treatment, and postburn care [3]. The major focus of burn management includes pain, infection, hypertrophic scarring, wound healing, and psychological trauma [4]. Apart from the acute posttraumatic pain, the most frequent complaint by patients is the pain caused by mechanical hyperalgesia at the affected burn area. Over time, it can lead to paresthesia, dysesthesia, loss of sensibility, and chronic pain and further worsens the psychological impact [5]. Chronic pain is another significant problem and source of discomfort and concern among burn survivors in their journey towards recovery, affecting 52% over an average of 12 years after the incident [6].

A burn to the orofacial region involving the lips and mouth has compounding impacts. The skin contraction or tightening during the healing process and scarring can lead to lip distortion and microstomia [7]. This, in turn, limits mouth opening and subsequently causes pain and discomfort while performing daily activities such as speaking, mastication, swallowing, and oral hygiene care. In a study, facial burn patients were observed to be uncomfortable and in pain when asked to open their mouth wide during the oral examination but no pain assessment was performed [8]. Pain trajectories also worsen in orofacial burn survivors who have a high level of stress, anxiety, and depression and exacerbate the previously undermined psychological conditions caused by the event [9]. Despite this understanding, the literature lacks a discussion on the impact of orofacial pain related to facial burn complications on oral condition. Hence, this study aimed to investigate the relationship between orofacial pain and oral health status and oral health behaviours in facial burn patients.

2. Methods

In this cross-sectional study, burn patients who visited the Burn Care Center, Pakistan Institute of Medical Sciences, Islamabad, for follow-up were randomly recruited after the ethical approval was approved from the Ethics Review Board, Shaheed Zulfiqar Ali Bhutto Medical University, Islamabad, Pakistan (F.1-23/2020/ERB/SZABMU). Participants over the age of 15 years with a burn injury to the face and neck region for more than one year and able to feed exclusively by mouth were included in this study. The participants were briefed about the purpose of the study. Written informed consent was obtained before data collection from all the participants and their parents in case of minors. All the participants underwent an intraoral examination by one investigator to record the dental (DMFT) and oral hygiene (OHI-S) status using a standard survey method by the WHO [10, 11]. The DMFT is a dental caries severity index that expresses the total number of Decayed (D), Missing (M), and Filled (F) teeth, and the total score is calculated by adding all the individual teeth scores that range from 0 to 32 [10]. The Simplified Oral Hygiene Index (OHI-S) is used to record the level of oral hygiene by assessing the debris, stains, and calculus on specific surfaces of six index teeth, with total scores ranging from 0 to 6, the latter representing the worst oral hygiene [11].

The participants also completed self-administered questionnaires that included information related to sociodemographic (age group, gender, and marital status), tooth brushing frequency (none, once, twice, or more), and dental check-ups in the past year (Yes or No). The information regarding the severity of burn injury (first-, second-, and third-degree burn) and time elapsed after that burn injury was taken from the patients' medical records.

Pain assessment was carried out by asking the participants to open the mouth widely and perform mandibular movements and then rate the pain experience by making "*X*" on the Visual Analogue Scale (VAS) [12, 13]. The VAS, a simple and commonly used analogue scale, comprises a horizontal line measuring 100 mm with "no pain" marked at 0 mm and "worst pain imaginable" at 100 mm. The pain score is the distance measured from 0 mm to the point "*X*" and ranges between 0 and 100, with a higher score suggesting greater pain intensity. The score was categorized as no pain (0 to 4 mm), mild pain (5–44 mm), moderate pain (45–74 mm), and severe pain (75–100 mm) [13]. The psychological status was assessed using the Urdu version of the Generalized Anxiety Disorder Scale (GAD-7) and Impact of Events Scale (IES) [14, 15]. The 7-item GAD-7 questionnaire assesses anxiety symptoms on a four-point Likert scale, from 0 (not at all) to 3 (almost every day). The GAD-7 score is obtained by adding all the responses and ranges from 0 to 21, whereby a greater value indicates more severe anxiety. It was categorized into four severity levels: minimal (0–4), mild (5–9), moderate (10–14), and severe (14–20) for descriptive purposes [14]. The Urdu version of GAD-7 has been validated and shown to have excellent internal constancy (Cronbach's alpha: 0.92) [14]. The 15-item IES questionnaire assesses posttraumatic stress disorder (PTSD) caused by traumatic events. The revised Urdu version of IES-R used in this study contains 7 additional items that cover three clusters of PTSD symptoms: intrusion, avoidance, and hyperarousal. The response of each item is scored on a five-point Likert scale, from 0 (not at all) to 4 (extremely). The final score ranges from 0 to 88. A threshold score >20 indicates that the individual has PTSD [15].

2.1. Statistical Analysis. Descriptive analysis was carried out to describe the sample and summary statistics of measures included in the study. Associations between pain related to mouth opening, jaw movement, and the factors were examined using simple and multiple linear regression. All ordinal variables were treated as continuous variables to examine the effect linear trend of exposure variables. Analyses were performed at a 5% significance level and carried out using IBM SPSS software v26.0.

3. Results

A total of 95 patients with a facial burn were invited to participate and 90 patients had consented and completed the oral examination and self-administrated questionnaires with a response rate of 94.7%. The sample included a high percentage of females (67%), below 25 years of age (41.1%), single, divorced, or widowed (71%), and unemployed (70%) individuals (Table 1). Most subjects had second-degree burn injuries (60%) and had the injury for 2–4 years (71%). The participants had high DMFT (mean = 10.7), and 71.1% had poor oral hygiene. More than half of the sample practiced teeth brushing once a day (61%) and did not have a dental check-up in the past year (88%). Slightly more than half of the participants had moderate-to-severe anxiety (53%) and about two-thirds had posttraumatic stress disorder (68%). About half of the participants had moderate-to-severe pain

Table 1: Sociodemographic characteristics of the participants ($N = 90$).

Characteristics	Number (%)
Age	
15–24	37 (41.1)
25–34	22 (24.4)
35–44	17 (18.9)
45+	14 (15.6)
Gender	
Male	30 (33.3)
Female	60 (66.7)
Marital status	
Single/divorced/widowed	64 (71.1)
Married	26 (28.9)
Employment status	
Full-time job	18 (20.0)
Part-time job	9 (10.0)
Unemployed	63 (70.0)
Degree of burn injury	
First-degree burn	11 (12.2)
Second-degree burn	54 (60.0)
Third-degree burn	25 (27.8)
Time since burn injury	
1–2 years	16 (17.8)
2–3 years	38 (42.2)
3–4 years	26 (28.9)
4+ years	10 (11.1)
DMFT mean (SD)	10.7 (2.17)
OHI-S	
Good	8 (8.9)
Fair	18 (20.0)
Poor	65 (71.1)
Daily frequency of toothbrushing	
None	25 (27.8)
Once a day	54 (60.6)
Twice a day	9 (10.0)
More than twice	2 (2.2)
Dental check-ups	
Yes	11 (12.2)
No	79 (87.8)
GAD-7, mean (SD)	10.26 (4.18)
Normal	11 (12.2)
Mild	29 (32.2)
Moderate	32 (35.6)
Severe	18 (20.0)
IES, mean (SD)	36.3 (18.8)
No PTSD	29 (32.2)
Yes PTSD	61 (67.8)
Pain, mean (SD)	41.5 (20.6)
No pain	5 (5.6)
Mild	37 (41.1)
Moderate	39 (43.3)
Severe	9 (10.0)

during mouth opening or moving the mandible (53%) with a mean score of 41.5.

The simple linear regression analysis showed that pain during movement of the mouth was associated with employment status, the severity of the injury, and time since the incidence (Table 2). More severe pain is associated with less frequent brushing, visits to the dentist in the past year, and greater DMFT score, plaque accumulation, anxiety, and stress.

The standardised coefficient for the DMFT in the multiple linear regression analysis was the largest compared to other factors, indicating that caries experience was the most important factor associated with pain.

4. Discussion

This is the first study that examines the relationship between orofacial pain related to mandibular movement and dental health status and oral health behaviours in facial burn patients and it found a significant association between them. Greater pain levels are associated with poorer dental and oral hygiene status, less frequent tooth brushing, and no visit to the dentist in the past year. The dental health status and oral hygiene were similar to a previous study on facial burn patients (mean DMFT = 10.9; poor OHI-S: 66.1%) [8]. The strong contribution of caries experience in the multivariate analysis to explain the variation in pain suggests a plausible link between orofacial pain and poor oral health conditions in patients with a facial burn injury. A burn to the facial region causes disfigurement of appearance and, in severe cases, physical impairment as a result of skin, muscles, and mucosal scarring. Tissue contraction and scarring limit mouth opening and movement and cause pain on forced opening [16]. These limit access to the oral cavity and make it extremely difficult for the patients to maintain good oral hygiene practice. Limited jaw movement also affects their chewing ability, adversely affects saliva secretion, and impairs the natural mechanism of mechanical plaque removal with the help of food during chewing [17]. A high level of oral function impairment has been linked to pain in patients with temporomandibular disorders and it could be worse in facial burn patients whose temporomandibular joint is affected [18]. Impaired chewing capability is reported to be related to TMJ pain and limitation in mouth opening and poor oral and general health status [19, 20]. Thus, the orofacial pain, coupled with poor oral health behaviours of the participants, increases the risk of developing caries. A regular visit to the dentist is highly recommended for the patients because, besides providing restorative care, dentists also can help in improving oral hygiene care such as the appropriate tooth brushing techniques for their condition and provide counselling on the caries risk factors.

This study also found that pain is more severe in older participants and those with a more recent injury, anxiety, and stress. Being older does not lower pain tolerance, likely due to ineffective pain inhibitory processes [21]. Nevertheless, the pain tends to decrease as time passes as they get used to it over time [18, 21]. The associations between pain and anxiety and stress found in the study are in line with earlier reports; the pain may lead to prolonged stress response, delay in healing, and longer recovery time [22, 23]. Depression and negative thoughts are reported in burn patients with high-intensity pain [24]. Data from this study

Table 2: Association of pain with sociodemographic, burn characteristic, and psychological measures.

	Pain score Mean (SD)	SLR[1] RC[3] (se) *P*	MLR[2] RC[3] (95% CI) SC[4] *P*
Age			
15–24	42.6 (16.8)	2.76 (1.96)	1.61 (−0.17, 3.40)
25–34	31.5 (20.7)	0.163	0.09
35–44	42.5 (21.3)		0.08
45+	53.2 (23.6)		
Gender			
Male	41.4 (21.2)	0.13 (4.64)	—
Female	43.6 (20.5)	0.97	
Marital status			
Single/divorced/widowed	40.2 (19.4)	4.68 (4.81)	—
Married	44.9 (23.6)	0.3	
Employment status			
Full-time job	15.4 (7.57)	17.3 (1.9)	4.83 (1.73, 7.93)
Part-time job	33.2 (20.1)	0.001	0.19
Unemployed	50.2 (16.1)		0.003
Degree of burn injury			
First-degree burn	10.0 (7.08)	20.2 (2.85)	5.49 (1.89, 9.09)
Second-degree burn	41.7 (14.6)	0.001	0.16
Third-degree burn	55.0 (21.3)		0.003
Time since burn injury			
1-2 years	60.5 (19.3)	−13.4 (1.98)	−2.43 (−4.90, 0.04)
2-3 years	45.9 (13.6)	0.001	−0.11
3-4 years	30.8 (18.4)		0.05
4+ years	22.1 (20.2)		Om9
Tooth brushing			
None	62.2 (12.2)	−22.5 (2.21)	−5.96 (−9.90, −2.02)
Once	38.0 (15.1)	0.001	−0.19
Twice	12.2 (11.3)		0.003
More than twice	9.0 (4.24)		
Dental visits			
Yes	22.0 (22.1)	22.1 (6.25)	—
No	44.2 (19.0)	0.001	
		7.40 (0.63)	3.26 (2.11, 4.42)
DMFT	41.5 (20.6)	0.001	0.34
			<0.001
OHI-S			
Good	13.0 (9.29)	18.5 (2.77)	
Fair	27.8 (17.4)	0.001	—
Poor	48.8 (17.4)		
GAD-7			
Normal	24.2 (19.2)	14.1 (1.78)	4.24 (1.83, 6.65)
Mild	31.1 (19.6)	0.001	0.19
Moderate	43.1 (11.4)		0.001
Severe	65.9 (11.3)		
IES-R			
No PTSD	20.7 (13.9)	30.6 (3.36)	—
Existing PTSD	51.4 (15.3)	0.001	

[1]Simple linear regression. [2]Multiple linear regression. [3]Regression coefficient. [4]Standardised coefficient.

also suggests that poor dental health status, less frequent tooth brushing, and irregular dental visits are associated with anxiety and stress (Table 3), consistent with earlier reports [25, 26].

Unemployment is another social characteristic related to higher pain expression. Chronic pain can impair working lives through a sudden change in the working environment and job loss [27]. The change in the physical appearance of

Table 3: Association of psychological measures with oral health behaviours and dental status.

	Tooth brushing				Dental visits		OHI-S			DMFT
	None Mean (SD)	Once Mean (SD)	Twice Mean (SD)	More than twice Mean (SD)	Yes Mean (SD)	No Mean (SD)	Good Mean (SD)	Fair Mean (SD)	Poor Mean (SD)	RC 95% CI
Anxiety	13.8 (3.87)	9.37 (3.33)	6.56 (3.32)	6.50 (3.53)	7.18 (3.02)	10.6 (4.15)	6.13 (2.16)	7.94 (3.29)	11.4 (4.02)	0.27 (0.18, 0.36)
P value	<0.001				<0.001		<0.001			<0.001
PTSD	53.9 (14.1)	32.3 (15.7)	16.0 (7.74)	15.0 (1.41)	28.1 (17.3)	37.4 (18.8)	17.0 (8.14)	26.0 (16.6)	41.6 (17.7)	0.08 (0.06, 0.10)
P value	<0.001				<0.001		<0.001			<0.001

these patients makes it difficult for them to find a new job or return to an old one. About 10–30% of burn survivors either do not return to work or lose the ability to work due to physical impairments injury [28]. Unemployment, brought about by disfigurement in appearance and lack of job opportunities for burn survivors who are already suffering from financial burden due to expensive and long burn care treatments, further worsens the psychological conditions of burn victims who are already distressed by the incident and its sequela [28–30]. Factors including stress from the burn incident and unemployment, education level, and having low income and older age have been associated with greater risk of pain in the jaw and face region; they are also linked to a greater risk of having poor oral conditions [8].

The findings of this study should be interpreted with caution. Limited causal inference can be made due to the cross-sectional design and associations are based only on statistical analysis. The severity of pain in relation to the need for medication and whether it truly affects oral hygiene care were not assessed. A qualitative study to assess how pain influences oral hygiene care and the extent of its effect is recommended to justify the posit. Among the greatest challenges of this study is to gain the trust of the participants who suffer from physical and psychosocial problems that make them nervous, cautious, shy, hesitant, and scared and seek sensitive information related to the dire experience and ask them to perform manoeuvres that are uncomfortable and painful.

5. Conclusion

This study suggests that there is a link between orofacial pain from jaw movement and oral health behaviours and poor oral conditions in facial burn patients. Factors including burn severity, time since burn injury, and psychosocial problems are also associated with orofacial pain. The findings can raise the awareness of oral health care professionals regarding the complex and multifactorial nature of dental and oral health problems in burn patients and help in preparing safe and effective strategies and practice guidelines for the care of patients with a facial burn injury. Treatment and management of dental and oral conditions in these patients require judicious balance in controlling and accurate assessment of the pain while at the same time addressing the psychological issues. Further investigations on the negative impact of orofacial pain and psychological conditions on oral health status and behaviours in burn patients are recommended.

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

Farooq Ahmad Chaudhary and Basaruddin Ahmad conceived the idea, performed data analyses, and revised the manuscript; Muhammad Qasim Javed and Bilal Arjumand helped in collecting data and its analyses. Shaikh Shoeb Yakub, Asma Munir Khan, and Saeed Mustafa wrote the first draft of the manuscript and revised the final manuscript.

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Research Article

Analgesic and Antibiotic Prescription Pattern among Dentists in Guangzhou: A Cross-Sectional Study

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Aim. To assess the rational use of drugs and the pattern of prescribing of analgesics and antibiotics for dental management and the information given by dentists in Guangzhou to their patients about the use of these drugs. *Methods*. A questionnaire was distributed to 225 dentists working in Guangzhou. The questionnaires consisted of open-ended questions and were given to dentists about analgesic and antibiotic use in dentistry. The questionnaires were analyzed, and absolute frequencies were expressed in the answers to each question. The cases, the analgesics, and the antibiotics recommended by the dentists for each case were determined by the frequency analysis method of descriptive statistics. *Results*. Responses to the questionnaire were received from 164 (72.9%) dentists. Paracetamol and diclofenac were the most widely prescribed analgesics. It is also estimated that selective COX-2 inhibitors or opioid analgesics have not been administered by dentists. The antibiotics primarily used for treatment were amoxicillin and metronidazole, and amoxicillin was used for prophylaxis. While more than 80% of dentists indicated that they provided their patients with information on the use of antibiotics, the quality of the information was limited. Patients were primarily instructed by dentists to observe the dosage and dose intervals of the prescription drugs. *Conclusions*. The results of the present study demonstrated that dentists most commonly prescribe paracetamol and diclofenac as analgesics, amoxicillin, and metronidazole for the therapy of periodontal, endodontic, and surgical procedures. The results also showed that dentists informed their patients inadequately about analgesic and antibiotic use.

1. Introduction

Pain is a main reason for which dental care is sought by patients. Pain may be arisen from different structural or anatomical origins of odontogenic or nonodontogenic sources. Most cases are related to the treatment of the pulpal pathology. Diagnosing and eradicating the cause is the main task for a dental surgeon. Usually, pain management is followed by the 3 "D" principle of diagnosis, dental treatment, and drugs [1]. The dentist often prescribes analgesics and antibiotics to patients for multiple causes, which can be a surgical or non-surgical purpose [2].

Nonopioid analgesics: paracetamol is widely used in dental pain as an antipyretic analgesic along with nonsteroidal anti-inflammatory medications (NSAIDs). In the treatment of mild to extreme dental pain, opioid analgesics are often rarely used [3, 4]. NSAIDs are very helpful for initial inflammatory pain and offer outstanding analgesia for mild to moderate pain. These medications are widely used for dental pain due to their analgesic and anti-inflammatory effects [5]. The effects of NSAIDs are inhibited by cyclooxygenase (COX) enzymes that have a primary role in prostaglandin and other eicozanoid syntheses. In a recent publication, NSAIDs (both selective COX-2 and nonselective COX inhibitors) were advised to be used with caution in heart disease patients. The widespread use of these medications in the treatment of dental pain raises the risk of adverse reactions related to these drugs (including bronchopulmonary, gastrointestinal, renal, and hematological) [6].

In dentistry, prescribing antibiotics is typically empirical, i.e., because culture tests are not widely conducted, the clinician does not identify the responsible organism. As a result, broad-spectrum antibiotics are widely used, and the emergence of the antibiotic resistance for the oral microorganism has increased [4]. In addition to the development of resistance, other issues with the use of antibiotics include adverse reactions (including gastrointestinal, allergic, and hematologic reactions). For this purpose, the rational use of antibiotics in oral or dental practice is important for reducing the growth of resistance in oral pathogens and the risk of adverse effects while increasing efficacy. Informing patients properly about the prescription medications is another increasing effectiveness parameter. This information concerns not just the dosage and treatment times but also the adverse effects, medication interactions, conditions of storage, and the cost of the prescription medications. It also involved briefing of these explanations by patients when dentists told their patients about these subjects [7]. This prevents the information provided from being confused. On the contrary, perfect knowledge would improve the patient treatment's quality, patient compliance, quality of life, and cost-effectiveness [8, 9].

There is an irregularity among practitioners regarding the length, drug choice, frequency, and necessity of prescribing them based on the literature review [10]. Since a significant amount of dental pain originates from acute or chronic pulpal infections, a significant amount of information needs operative intervention and should be known with analgesics and antibiotics [11]. The need for analgesics and antibiotics is confusing for many practitioners [2]. Antibiotic therapy regulates infection pathways to establish, avoid, or create favourable conditions for species to remove bacterial and fungal contingents through their immunological mechanisms [12]. There is no standard universal prescribing regimen for antibiotics and analgesics before, during, and after dental treatment. Therefore, the purpose of this study was to evaluate the pattern of analgesics and antibiotics by a practicing dentist in and around the population of Guangzhou under different conditions.

2. Materials and Methods

2.1. Questionnaire. To analyze the analgesic and antibiotic prescribing practices of dentists, a structured questionnaire was developed. As the degree of dental antibiotic and analgesic prescribing is unknown in Guangzhou, by using standardized proportion for the most conservative estimate of the sample size and with a 0.05 standard error and 95% confidence interval, 224 responses were required for this study. Dentists who are fully engaged with academic and nonclinical work or retired from their services were excluded from this study. The questionnaire was unidentifiable for any dental surgeon's identity. The questionnaire comprised four sections. Section A: demographic and characteristic information (age, gender, years of experience, postgraduation level, and working place information), Section B: most common analgesic-prescribing pattern (common analgesic available in generic name and clinical condition), Section C: most common antibiotic-prescribing pattern (common antibiotic available in generic name and clinical condition), and Section D: the information given to patients about the use of these drugs.

2.2. Sample and Data Handling. This study was approved by the Ethics Committee of the First Affiliated Hospital, Sun Yat-sen University, and the list of the dentists was received from the local dental council. To produce a homogeneous distribution, dentists in the list were chosen from different regions of Guangzhou. The questionnaires were immediately emailed to the dentists after their consent for participation. In June 2020, the distribution of the questionnaires began via email, and the delivery and selection processes ended in July 2020.

2.3. Statistical Analysis. Data from questionnaires received were entered into Statistical Package for Social Sciences® (SPSS), version 25.0. From this database, the overall response rate was calculated, together with the percentage responses for each question. Frequency analysis was used for the determination of the demographic, analgesic, and antibiotic prescribing pattern. Multiple linear regression analysis was performed to find out the association between the demographic and prescribing pattern.

3. Results

3.1. Demographics and Characteristics. A total of 164 replies (out of 225 questionnaires sent) were received giving a response rate of 72.9%. Out of the 164 respondents, 89 (54.3%) were males and 75 (45.7%) were females. Demographic and professional characteristics of respondents are shown in Table 1. The number of respondents who had attended any postgraduate education is 88 (53.7%) with 6–10 years of experience (32.3%). And as seen in Table 1, a majority of the respondents work at dental practices (98 (59.7%)).

3.2. Analgesic Prescribing Pattern. Table 2 shows the prescribing pattern of analgesics by the dentist. Among the participants, 54.9% of participants prescribed paracetamol analgesics for acute pulpitis, 45.7% of them prescribed diclofenac, and 25.6% of them prescribed naproxen analgesics in the acute apical abscess. 42.7% of dentists prescribed paracetamol, and 31.3% of dentists prescribed diclofenac analgesics in chronic pulpitis and 45.7% in chronic apical periodontitis with a sinus tract. 79% prescribed analgesics, mainly diclofenac and paracetamol, combined with caffeine (16.5%) in diffuse swelling. Diclofenac (18.3%) commonly prescribed prior root canal treatment.

3.3. Antibiotic Prescribing Pattern. Table 3 shows that the dentist prescribed amoxicillin for acute pulpitis (25%), acute apical abscess (80.1%), chronic pulpitis (19.5%), chronic apical periodontitis with the sinus tract (28.0%), diffuse swelling (78%), and 21.3% before root canal treatment. Along with amoxicillin, metronidazole was the second most commonly prescribed antibiotic by the dentist. 89.6% of dentists prefer metronidazole in diffuse swelling following acute apical abscess treatment (76.0%).

Table 1: Demographics and characteristics of respondents.

Variable	N (%)
Gender	
Male	89 (54.3)
Female	75 (45.7)
Age	
21–30	50 (30.5)
31–40	71 (43.3)
41–50	34 (20.7)
51–60	9 (5.5)
Years of experience	
0–5	46 (28.0)
6–10	53 (32.3)
11–20	44 (26.9)
21–30+	21 (12.8)
Postgraduation education	
Yes	88 (53.7)
No	76 (46.3)
Postgraduation level	
Postgraduate courses	40 (24.4)
Masters	36 (21.3)
Doctorate	12(7.3)
Place of works	
Private dental practice	98 (59.7)
Private institution	19 (11.6)
University affiliated hospital	36 (22.0)
Government facility	11 (6.7)

3.4. Information Given to the Patients. The majority of the respondents (80.1%) reported they gave information to their patients about analgesic and antibiotic use. Table 4 shows the information given by respondents to their patients about analgesic and antibiotic use. As seen in the table, the most common information given by the respondents to their patients was "to obey the dose and dose interval rules given" (72.6%), "warning about the adverse reactions of these drugs on the gastrointestinal system" (64.7%), and "whether the drugs should be taken before or after the meal and the interactions between food and these drugs" (64.6%) (Figure 1).

3.5. Factors Associated with the Prescribing Pattern. Table 5 shows that demographic factors such as year experience and postgraduate education have a significant association with prescribing patterns. An experienced dentist without any postgraduate courses often prescribed inappropriate antibiotics and analgesics compared to the new trained and postgraduated dentist ($P = 0.001 - 0.004$).

4. Discussion

Prescribing of antibiotics and analgesics by endodontists was assessed in this questionnaire-based cross-sectional study. The questions and endodontic conditions suggested in the questionnaire are like those in India [7], Turkey [13], and Spain [14]. The study showed a response rate of 72.9 percent, which is considered appropriate for questionnaire-based study.

Different studies have shown that NSAIDs are effective in lowering the dental pain threshold at different doses after, before, or just before root canal treatment [15, 16]. Thus, it is not surprising that pain relief analgesics were recommended by dentists in our research. Paracetamol and diclofenac were the most frequently prescribed analgesics listed in the questionnaire for various dental conditions.

An acetic acid derivative of diclofenac offers excellent analgesia for dental pain and is consistently reported in several studies [17]. Study results indicate that respondents do not have a prescribing pattern that involves selective inhibitors of COX-2. Without the undesirable side effects, COX-2 inhibitors induce desired anti-inflammatory effects, particularly gastric irritation associated with COX1 inhibitors, but clinical use of these drugs has resulted in increased cardiovascular risk [18, 19].

One of the most widely prescribed analgesics by dentists is paracetamol, which has a low risk of GIT bleeding and has even been shown to have the least anti-inflammatory effects on peripheral tissues. In this research, paracetamol leads to much of the endodontists' analgesics alongside diclofenac. In the report, respondents did not recommend opioid analgesics for pain. Opioid analgesics are used because of their detrimental effects and abuse in cases of extreme pain rather than in moderate pain [15].

In the above research, analgesics were significantly prescribed in cases of acute pulpitis, acute apical abscess, followed by chronic apical abscess with the sinus tract that may lead to the timely release of pain, while analgesics do not help to reduce the inflammatory process supported by the literature that treatment may improve pain relief without medication. It is also an important treatment technique [20] for the management of these conditions. It is widely agreed that antibiotics are not indicated if infection, systemic involvement, or immune-compromised disease is not present [21, 22].

In dental cases such as acute pulpitis, diffuse swelling, acute apical abscess, and retreat events, amoxicillin was widely administered in the sample. Amoxicillin is a moderate spectrum, bacteriolytic, ß-lactam antibiotic, which represents a molecule of synthetic penicillin. It is easily digested and can be swallowed with food. It is better able to avoid stomach acid damage so that less oral dose is lost. It has a much wider spectrum against the Gram-negative cell wall, and the cell wall will last longer [23]. It is the principal antibiotics dentist prescribed in the USA [24].

In the review of many dentists, metronidazole was the next antibiotic of choice, having an outstanding activity against anaerobes but no activity against aerobes. Metronidazole has shown the greatest bacterial resistance and is only effective against anaerobes, so it should not be prescribed alone for the treatment of endodontic infections [23]. The dosage and length of antibiotics recommended in the clinical recommendations are most often based on the expert opinion [7].

To avoid side effects of resistant strains, antibiotics should also be administered at the required dosage, dose, and length to achieve good minimum inhibitory concentrations. A common trend of prescription of antibiotics found in the present study was that, in cases of periapical involvement with the presence of essential pulp, there was an

Table 2: Prescribing pattern of analgesics under different conditions.

Analgesic	Dental condition, *n* (%)					
	Acute pulpitis	Acute apical abscess	Chronic pulpitis	Chronic apical periodontitis with the sinus tract	Diffuse swelling	Prior to root canal treatment
Paracetamol	90 (54.9)	0 (0.0)	70 (42.7)	30 (18.3)	12 (7.3)	0 (0.0)
Naproxen	15 (9.1)	42 (25.6)	18 (11.0)	0 (0.0)	0 (0.0)	0 (0.0)
Diclofenac	35 (21.3)	75 (45.7)	51 (31.1)	20 (12.2)	60 (36.9)	30 (18.3)
Paracetamol-caffeine combination	10 (6.1)	40 (24.4)	7 (4.3)	20 (12.2)	27 (16.5)	0 (0.0)
Etodolac	9 (5.5)	7 (4.3)	15 (9.1)	5 (3.0)	30 (18.3)	0 (0.0)
Ketoprofen	5 (3.0)	0 (0.0)	3 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)

Table 3: Prescribing pattern of antibiotics under different conditions.

Variable	Dental condition, *n* (%)					
	Acute pulpitis	Acute apical abscess	Chronic pulpitis	Chronic apical periodontitis with the sinus tract	Diffuse swelling	Prior to root canal treatment
Amoxicillin	41 (25.0)	131 (80.1)	32 (19.5)	46 (28.0)	128 (78)	35 (21.3)
Clindamycin	2 (0)	25 (15.3)	0 (0)	0 (0)	0 (0)	18 (29.5)
Metronidazole	0 (0)	125 (76.0)	6 (3.7)	72 (0)	147 (89.6)	0 (0)
Erythromycin	0 (0)	4 (2.4)	0 (0)	12 (7.3)	2 (1.2)	0 (0)

Table 4: Information given to the patients by the dentist about prescribed antibiotics and analgesics.

Information provided to the patients	*N* (%)
Adverse effects of prescription medications on the GIT system	106 (64.7)
Drug use and administration information and advice to follow the rules of use and administration provided	119 (72.6)
When the drugs should be taken or fed quickly and the relationship between food and these drugs	106 (64.6)
Dental-medical interactions	17 (10.4)
Other adverse effects of prescribed drugs	31 (19)
Interactions with prescription analgesics and other medications	32 (19.6)
Inform his or her dentist if there is an adverse reaction during the use of these drugs	65 (39.6)
Storage conditions	2 (1.3)
Price	10 (6.2)

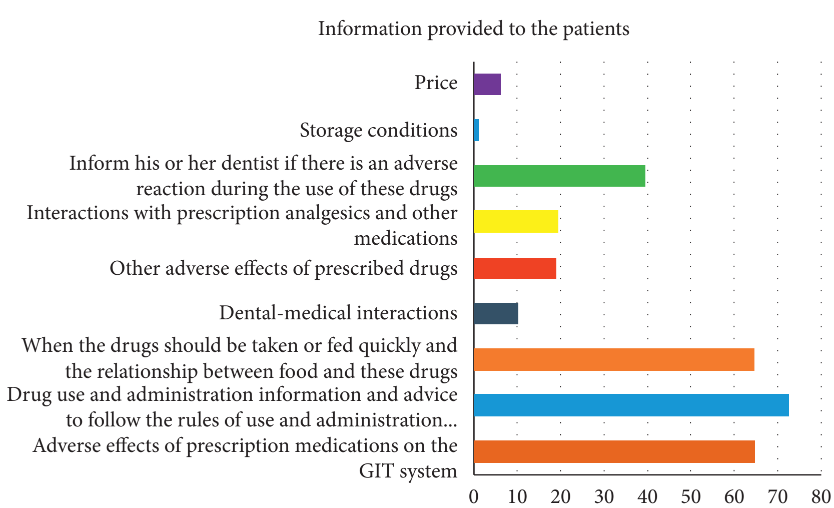

Figure 1: Information provided to the patients.

improper prescription of antibiotics that was not justified. In a survey conducted in Spain where 40 percent of respondents inappropriately administered antibiotics, similar findings were found [7]. The research showed a propensity towards overprescription and showed a lack of knowledge of the occurrence of adverse reactions among dentists [23].

Table 5: Demographic factors associated with the prescribing pattern under different clinical conditions.

Variable	Adjusted OR	95% confidence interval		P value
		Lower	Upper	
Acute pulpitis	2.79	1.16	4.54	0.004
Acute apical abscess	4.11	1.59	23.51	0.001
Acute apical abscess	2.53	1.02	6.25	0.006
Chronic apical periodontitis with the sinus tract	1.12	0.66	5.16	0.001
Diffuse swelling	0.33	0.18	0.61	0.001
Prior to root canal treatment	0.28	0.09	0.59	0.027

The research also showed a change in prescribing antibiotics and analgesics with years of specialty practice. In contrast to endodontists with more than 10 years of experience, a dentist with an experience from 1 to 5 years overprescribed analgesics and antibiotics instead of clinical treatment modalities, which may be due to the degree of functional experience and awareness of the root cause of the condition, supported by a related study by Marra et al. [11]. The study found that analgesics and antibiotics were overly prescribed by the majority of dentists, whereas 1/4th of the dentists appropriately prescribed. There is greater concern about the indiscriminate use of analgesics and antibiotics. For a well-defined sign in dental infection, the use of them should be judicial [25]. To avoid abuse and overuse of analgesics and antibiotics, the dentist should have a sound understanding of endodontic conditions, so as not to add to the global issue of antibacterial resistance and to prevent the adverse effects of these medications [26].

5. Conclusion

The present study suggested that most dentists overprescribe analgesics and antibiotics, but few prescribe them properly. The dentist's overprescription of analgesics and antibiotics in Guangzhou may be due to the lack of scientific awareness of the condition and pharmacology of the medication, patient demand, or other unknown factors. The fact that overprescribing medicines in Guangzhou should therefore be of concern. This research collaborates with other studies that recognize prescription protocol problems [11].

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

Authors' Contributions

Er-Min Nie participated in the drafting, data collection, data analysis, description of results, discussion, critical revision of the article, and evaluation of the final version of the manuscript. Jiali Yu participated in the drafting, data collection, data analysis, description of results, and discussion. Xiang Li participated in the drafting, data analysis, and description of results. Rui Jiang and Chun-Yuan Zhang participated in the description of results and discussion.

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