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Level of anxiety and dental pain at different times in root canal treatment during the COVID-19 pandemic

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ABSTRACT

Objective: To evaluate the level of dental anxiety (DA) and dental pain (DP) at different times in root canal treatment during the COVID-19 pandemic. **Materials and methods:** Observational, descriptive, and longitudinal study. The sample consisted of 68 participants from the Stomatology Clinic of the Hospital Militar Central (HMC), who met the inclusion and exclusion criteria. The procedure consisted of recording the level of AD and DP of the patients at different times during root canal treatment using a visual analog scale (VAS). **Results:** Before the procedure, participants showed 3.66±1.83 of DA and 4.54±1.79 of DP; during the procedure, they obtained values of 3.13±1.96 and 2.09±1.39 of DA and 2.96±1.57 and 1.82±1.09 of DP; and at the end of the procedure, they had 0.75±0.74 of DA and 0.53±0.72 of DP. **Conclusions:** DA and DP were found to be present before starting treatment, but as the procedure progressed their levels decreased.

Keywords: dental treatment anxiety, odontalgia, root canal treatment, COVID-19.

INTRODUCTION

Coronavirus 2019 or COVID-19 is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) (1-3). Its clinical features are varied, ranging from asymptomatic cases to clinical conditions such as respiratory failure, systemic and multi-organ manifestations leading to death (4). In Peru, the preventive measure ordered by the government was quarantine. In that context, people in isolation during quarantine present a higher prevalence of psychological harm, including higher levels of anxiety compared to those who are not in such a situation (5).

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Anxiety has been defined as an emotion experienced in threatening situations, where "the mental state of fear is accompanied by physiological changes that prepare people for defense or flight, such as increased heart rate, blood pressure, breathing, and muscle tension" (6). In that sense, different life events may be involved in the occurrence of anxiety episodes. One of them can be attributed to traumatic dental events during childhood (7), which is known as dental anxiety (DA), defined as "an emotional state of worry in anticipation of a certain feared stimulus of dental treatment" (8). Several factors can influence DA levels, such as age, gender, previous treatment experiences, or pain during dental visits (7, 9-11).

When we talk about experiences prior to any dental treatment, we include diagnostic or therapeutic procedures conducted in dental offices. These can be stressful for patients, as they will be continuously exposed to auditory stimuli, such as metal sounds from instruments, high-speed piece noises, as well as sharp instruments (12). These stimuli are precisely present in root canal treatments, so patients undergoing root canal treatment may have some level of anxiety related to the procedure itself or to negative experiences from family and friends (13). Patients associate these episodes with fear and pain and anticipate this event as a negative experience. Historically, DA and pain expectancy have been related (9).

Pain is "a multidimensional phenomenon composed of physiological and psychological variables associated with actual or potential tissue damage" (14). Thus, odontalgia or dental pain (DP) is defined as an unpleasant sensory and emotional experience associated with dental tissues (15). It has been reported that patients with anxiety tend to have lower pain thresholds, especially in the oral cavity (11). Dental pain has been a very frequent emergency in dental care and, many times, the indicated therapy is root canal treatment. This process includes anesthesia, opening, pulp excision, canal shaping, cleaning, disinfection and obturation, which could cause fear of dental treatment in patients and, consequently, generate a certain level of anxiety (10).

DA and DP evaluations are important for the dentist as they help treat the patient and, in this way, anxiety and pain during root canal treatment decrease.

In that sense, the purpose of this study was to measure DA and DP at different moments in root canal treatment during the COVID-19 pandemic.

MATERIALS AND METHODS

The study was observational, descriptive and longitudinal. The sample included patients who were treated in the Endodontics area of the Cariology and Endodontics Service between February and July 2022. The sample selection was probabilistic and simple random. To determine the minimum proportion, a Fisterra statistical calculator was used with a confidence level of 90%, a margin of error of 10%, and a prevalence of 50%.

There were 68 patients who met the following inclusion criteria: over 18 years of age, who signed the informed consent, who had no history of previous root canal treatment, monoradicular teeth without radiographic periapical lesion; and patients diagnosed with any psychic alteration (13), pregnant women, intellectual deficit, visual decrease that did not allow the use of the visual analog scale (VAS), patients with retreatment or endodontic surgery (9), and those who consumed anxiolytics, antidepressants or antihypertensives (1) were excluded.

Data collection began on the day of the checkup. In the waiting room, patients were provided with an informed consent form in which they authorized their participation in the study. After that, a (VAS) scale related to DA and DP (t1: in the waiting room, preoperative time) was given, where participants marked with an X the levels of anxiety and pain present in that moment, ranging from "totally calm and relaxed" to "worst imaginable fear" and "absence of pain" to "intense pain", respectively. The obtained score determined the DA and DP present before root canal treatment.

During the root canal procedure, two VAS measurements were used at two different times (t2: after the canal opening; t3: after the biomechanical preparation; both considered intraoperative times), where the same process of marking with an X on the scale was followed, obtaining the results of this evaluation time. After the treatment (t4: after removal of absolute isolation, postoperative time), a new VAS was used, obtaining the levels of DA and DP at the end of the procedure. Root canal treatments were administered by postgraduate students supervised by medical doctors from the Endodontics area of Hospital Militar Central (HMC). The study was conducted after receiving approval from the Institutional Ethics Committee of Universidad Peruana Cayetano Heredia (CIE-UPCH) on January 26, 2022. Participants' information has been kept confidential.

Data were processed in SPSS version 25. Absolute and relative frequencies were used for qualitative variables (time of evaluation, life stage, sex) and measures of central tendency (mean and median) and dispersion (standard deviation, minimum, maximum) for quantitative variables (dental anxiety, dental pain). The corresponding tables and graphs were made from these data. After evaluating the assumptions (normal distribution, homogeneity of variances), it was decided to apply the Friedman test. After that, the Nemenyi *post hoc* test was applied. All statistical tests were used at a confidence level of 0.95 and a significance level of 0.05.

RESULTS

In this study, 68 patients (16 women and 52 men) participated with a mean age of 27.85 years (18-59 years). Before root canal treatment (t1), women obtained a DA level of 4.25 ± 1.80, while in men it was 3.48 ± 1.82. During the procedure, women presented a DA level of 3.56 ± 1.96 (t2) and 2.06 ± 1.12 (t3). In contrast, in men it was 3.00 ± 1.96 (t2) and 2.10 ± 1.47 (t3). At the end of the treatment (t4), women showed a DA level of 0.63 ± 0.50, while men showed a level of 0.79 ± 0.80 (Table 1).

Table 1. Comparison of dental anxiety by evaluation times according to sex.

Sex	Treatment	n	Mean	SD	Friedman's x^2	p
F*	t1[a]	16	4.25	1.80		
	t2[b]	16	3.56	1.96		
	t3[c]	16	2.06	1.12		
	t4[d]	16	0.63	0.50	42.6	<0.001
M*	t1[a]	52	3.48	1.82		
	t2[b]	52	3.00	1.96		
	t3[c]	52	2.10	1.47		
	t4[d]	52	0.79	0.80	118.0	<0.001

* Overall analysis with Friedman's test and pairwise analysis with Wilcoxon rank. Different letters represent groups with statistically significant differences ($p < 0.05$).

Before root canal treatment (t1), women presented a DP level of 4.75 ± 1.84 and in men it was 4.48 ± 1.67. During the procedure, women obtained a DP of 3.13 ± 1.66 (t2) and 1.81 ± 0.98 (t3), while in men it was 2.90 ± 1.56 (t2) and 1.83 ± 1.13 (t3). At the end of treatment (t4), women showed a DP level of 0.50 ± 0.63 and in men it was 0.54 ± 0.75 (Table 2).

Table 2. Comparison of dental pain by evaluation times according to sex.

Sex	Treatment	n	Mean	SD	Friedman's x^2	p
F*	t1[a]	16	4.75	1.84		
	t2[b]	16	3.13	1.66		
	t3[c]	16	1.81	0.98		
	t4[d]	16	0.50	0.63	42.5	<0.001
M*	t1[a]	52	4.48	1.67		
	t2[b]	52	2.90	1.56		
	t3[c]	52	1.83	1.13		
	t4[d]	52	0.54	0.75	137.9	<0.001

* Global analysis with Friedman test and Wilcoxon rank peer analysis. Different letters represent groups with statistically. Different letters represent groups with statistically significant differences ($p < 0.05$).

With respect to life stage, before root canal treatment (t1), the level of DA in young people had a level of 3.88 ± 1.97; and in adults it was 3.36 ± 1.59. During the procedure, young people obtained a DA level of 3.30 ± 2.06 (t2) and 2.20 ± 1.48 (t3), while in adults it was 2.89 ± 1.81 (t2) and 1.93 ± 1.24 (t3). At the end of the procedure (t4), young people had a DA level of 0.68 ± 0.73 and adults had a DA level of 0.86 ± 0.75 (Table 3).

Table 3. Comparison of dental anxiety by evaluation times according to life stage.

Age	Treatment	n	Mean	SD	Friedman's x^2	p
18-29*	t1[a]	40	3.88	1.97		
	t2[b]	40	3.30	2.06		
	t3[c]	40	2.20	1.48		
	t4[d]	40	0.68	0.73	95.2	<0.001
30-59*	t1[a]	28	3.36	1.59		
	t2[b]	28	2.89	1.81		
	t3[c]	28	1.93	1.24		
	t4[d]	28	0.86	0.75	65.2	<0.001

* Overall analysis with Friedman's test and pairwise analysis with Wilcoxon rank. Different letters represent groups with statistically significant differences ($p < 0.05$).

Table 4. Comparison of dental pain by evaluation times according to life stage.

Age	Treatment	n	Mean	SD	Friedman's x^2	p
18-29*	t1[a]	40	4.50	1.76		
	t2[b]	40	2.93	1.50		
	t3[c]	40	1.78	1.12		
	t4[d]	40	0.45	0.71	107.9	<0.001
30-59*	t1[a]	28	4.61	1.64		
	t2[b]	28	3.00	1.70		
	t3[c]	28	1.89	1.06		
	t4[d]	28	0.64	0.73	72.7	<0.001

*Overall analysis with Friedman's test and pairwise analysis with Wilcoxon rank. Different letters represent groups with statistically significant differences ($p < 0.05$).

At the same time, young people before root canal treatment (t1) presented a DP level of 4.50 ± 1.76, and in adults it was 4.61 ± 1.64. During the procedure, young people obtained a DP level of 2.93 ± 1.50 (t2) and 1.78 ± 1.12 (t3), and in adults it was 3.00 ± 1.70 (t2) and 1.89 ± 1.06(t3). At the end of the procedure (t4), the DP level in young people was 0.45 ± 0.71 and in adults it was 0.64 ± 0.73 (Table 4).

At the beginning of the treatment (t1), DA and DP presented a level of 3.66 ± 1.83 and 4.54 ± 1.96, respectively; however, as the procedure progressed, the results of both decreased, showing levels of 3.13 ± 1.96 and 2.09 ± 1.39 at t2, and 2.96 ± 1.57 and 1.82 ± 1.09 at t3. At the end of the treatment (t4), the following DA and DP levels were obtained, respectively: 0.75 ± 0.74 and 0.53 ± 0.72.

We compared DA at evaluation times using Friedman's nonparametric test and observed significant differences ($p = 0.001$). To identify between which groups there were significant differences, the Nemenyi *post hoc* or multiple comparisons test was applied, which determined that these differences occurred between times t1 vs. t3, t1 vs. t4, t2 vs. t3, t2 vs. t4, t3 vs. t4. On the other hand, when comparing DP in evaluation times by means of Friedman's non-parametric test, significant differences were also observed ($p = 0.001$); and, when applying Nemenyi's *post hoc* test, it was observed that these occurred between times t1 vs. t2, t1 vs. t3, t1 vs. t4, t2 vs. t3, t2 vs. t4, t3 vs. t4 (Table 5).

Table 5. Comparison of anxiety and dental pain by evaluation times.

Variable	Treatment	n	Mean	SD	Friedman's x^2	p
Dental anxiety*	t1[a]	68	3.66	1.83		
	t2[b]	68	3.13	1.96		
	t3[c]	68	2.09	1.39		
	t4[d]	68	0.75	0.74	160.3	<0.001
Dental pain*	t1[a]	68	4.54	1.70		
	t2[b]	68	2.96	1.57		
	t3[c]	68	1.82	1.09		
	t4[d]	68	0.53	0.72	180.3	<0.001

Nemenyi *post hoc* test (dental anxiety)

	t1	t2	t3
t2	0.11644	---	---
t3	5.9e-14**	0.00059**	---
t4	3.8e-14**	3.6e-14**	1.7e-05**

Nemenyi's *post hoc* test (dental pain)

	t1	t2	t3
t2	2.7e-05**	---	---
t3	6.4e-14**	0.0039**	---
t4	2e-16**	8.7e-14**	5.1e-05**

* Overall analysis with Friedman's test. Different letters represent groups with statistically significant differences ($p < 0.05$).
** Nemenyi *post hoc* test (statistical difference: $p < 0.05$).

DISCUSSION

Over the years, dentists have understood the importance of patients' perception of anxiety in relation to dental procedures (16), among which root canal treatment is one of the procedures that generates the highest level of anxiety (7, 11, 12, 17-20). DA has been associated with pain and occurs with greater incidence in invasive treatments, such as extractions and non-surgical root canal treatment (7, 21, 22). The emergence of the COVID-19 pandemic increased reactions of fear, anxiety, and psychological stress due to the increase in new cases reported every day and the high mortality rates resulting from the increased spread of the virus (23).

In this regard, we could think that patients' levels of DA and fear would increase due to the fear of contagion added to the anxiety they would already have due to the procedure itself. However, the results of this study differ from this premise, as patients did not report high levels of DA in comparison with other studies conducted in a non-pandemic setting, such as that of Coolidge et al. (24) and the meta-analysis by

Khan et al. (7), where participants similarly did not report high levels of DA, except in the preoperative stage. There are two reasons for this: 1) most of the study participants, being members of the Army, already had the vaccine inoculation; and 2) the HMC Stomatology Clinic followed all biosecurity protocols which increased their safety with respect to the risk of virus transmission.

The level of DA was evaluated according to sex at different operative times. Differences were found between both sexes just before starting root canal treatment, with women presenting higher levels of anxiety compared to men. This result is consistent with the study conducted by Wali et al. (25), in which women were classified as "highly and severely anxious" before root canal treatment, while men were classified as "without anxiety". One explanation for these gender differences in anxiety could be that women express their fears more freely when taking tests or surveys, based on the different social roles and expectations for each gender assigned culturally and traditionally (26).

With respect to the evaluation of the DA level according to age at different operative times, it was found that, during treatment, anxiety levels decrease as people get older. Similar results were obtained by Caltabiano et al. (22), who concluded that anxiety decreases with age. This could be due to the experience gained over time in different invasive treatments, which allows patients to develop tolerance and thus reduce anxiety with age. However, studies conducted by Del Pozzo et al. (21), Monardes and Peña (26), and Dou et al. (10) showed no significant differences in terms of age. This is because the minimum age in these studies was 18 years and older, and high levels of anxiety occur mainly in adolescence (21).

Many studies have investigated preoperative and postoperative anxiety, as is the case of Rosas et al. (17), Del Pozzo et al. (21) and Wali et al. (25), but few have analyzed it intraoperatively, as it was done in this study. Taking into account that the intraoperative time is when the patient is exposed to more auditory and visual stimuli, such as the sensation of suffocation caused by the use of the rubber dam (12), the fear of radiation when taking radiographic films (27) and the instrumentation of the root canal, it could be thought that the level of anxiety would increase at this stage compared to the times before and after treatment. Taking as a reference the scale used by Georgelin-Gurgel et al. (28), in which a value greater than or equal to 3 in VAS determines the presence of anxiety, the presence of anxiety was found only in one of the intraoperative times, which includes the anesthesia and the canal opening. The same results were found by Hamedy et al. (27), during the same procedures followed: use of local anesthetics and canal opening, thus increasing the anxiety level of their patients. This can be attributed to the patient's high speculation about the treatment, while at the end of the treatment there was no anxiety, possibly because the treatment is less invasive and painless than initially expected, which reduces the initial speculation (11).

On the other hand, the assessment of DP was also performed with VAS. When evaluating the level of DP according to sex, women obtained higher DP values. This is consistent with previous findings where women reported more intense pain than men (9, 29). Watkins et al. (29) attribute this to women anticipating sensory pain more than men due to greater autonomic arousal. Unruh (30) researched the impact of gender on pain assessment and reported that women tended to report more intense pain located in the head and more somatic problems. Liddell and Locker (31) reported a reduction of pain thresholds in women. At the same time, there is a higher level of mechanical allodynia in women with irreversible pulpitis and symptomatic apical periodontitis (32).

With respect to the evaluation of DP according to age at different operative times, it was found that adults presented DP before and during treatment. This finding is related to studies such as that of Gomes et al. (33), where age was significantly associated with preoperative pain, with younger individuals (<60 years) having a higher incidence of moderate/severe pain. However, there are no conclusive data that progressive loss of sensitivity to nociceptive stimuli occurs with age, and it has been suggested that age-related decline in pain may not be attributable to changes in the physiological system of pain (34).

DP was also evaluated at different operating times. Prior to treatment, participants presented DP, which is comparable to the results of Rosas et al. (17) and Pak and White (35), where they showed a moderate to severe level of pain. This could be due to the initial diagnosis they presented, such as irreversible pulpitis and/or symptomatic apical periodontitis. However, it was observed that DP was gradually decreasing. At the end of the treatment, the pain decreased. This result is similar to that obtained by Rosas et al. (17), where, before the endodontic treatment, 50.6% of patients reported a high level of pain, and at the end of treatment, 59.1% reported no pain at all. Previous studies of post-operative pain, such as

that of Perković et al. (36), relate it to endodontics procedures performed in one session, obturation materials and techniques, use of medication, and presence of preoperative pain.

Among the limitations, the sample could not be homogeneous among age groups or gender, since they were attended according to how they were referred by the oral medicine service, especially in the context of the pandemic in which this study was conducted.

CONCLUSIONS

DA levels present at the start of treatment decrease as the root canal procedure is performed. Similarly, the initial DP level disappears when the root canal treatment is completed. Women had higher DA and DP values in comparison with men. Finally, according to life stage, the DA level was present in young people and DP was present in adults.

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