EVALUATION OF INTRAOPERATIVE PAIN OCCURRENCE AND NEED FOR SUPPLEMENTAL ANESTHESIA DURING EMERGENCY DENTAL CARE

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ABSTRACT

Aims: This study aimed to evaluate the intraoperative pain (IOP) occurrence in situations of symptomatic irreversible pulpitis (SIP) and symptomatic apical periodontitis (SAP).

Materials and Methods: Patients who sought emergency care presenting a diagnosis of SIP or SAP were included. IOP was measured with a Visual Analogue Scale (VAS) after five minutes of local anesthesia, during access to the pulp chamber, root canal exploration and at the end of procedures. In cases where pain was reported during treatment, supplementary anesthesia was performed. Pain scores were recorded and analyzed using a generalized estimating equation model with posthoc comparisons.

Results: 56 patients were included. 35 had a diagnosis of SIP; and 21 a diagnosis of SAP. Mean preoperative pain scores for SAP and SIP were 6.69 (±1.54) and 6.39 (±1.48), respectively ($p>0.05$). In patients with SIP, significant differences were observed between: preoperative scores and other time points; scores after five minutes of local anesthesia and other time points; scores during pulp chamber access and at the end of procedures; and scores during root canal exploration and at the end of procedures ($p<0.05$). In patients with SAP, significant differences were observed between preoperative pain scores with all other time points ($p<0.05$). Chi-square test indicated an association between diagnosis and the need for supplementary anesthesia ($p<0.05$).

Conclusions: In conclusion, there is a strong relationship between reduction of moderate/severe pain after application of local anesthesia. The need for supplemental anesthesia is significantly associated to the diagnosis of symptomatic irreversible pulpitis.

KEYWORDS: Local anesthesia. Pain. Periapical periodontitis. Pulpitis. Visual analogue scale.
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INTRODUCTION

According to the International Association for the Study of Pain (IASP), pain is characterized as a subjective, uncomfortable, sensory and emotional experience associated with an actual or potential tissue damage[1].

Endodontic emergencies usually involve acute circumstances that require immediate intervention.

During endodontic procedures, the control of intraoperative pain (IOP) is a common challenge, even when an adequate anesthetic technique is performed[2]. The most current mistakes associated to the failure of local anesthesia are related to technical errors during anesthetic administration, anatomical variations, patient anxiety and presence of inflammation[3].

Clinical studies suggest anesthetic success rates ranges of 75-90% in patients with clinically asymptomatic teeth. However, in situations where the patient presents preoperative pain, specially related to the diagnosis of symptomatic irreversible pulpitis (SIP), local anesthesia is less effective[4,5].

Mainly due to the high percentage of anesthetic failure in symptomatic patients and due to the difficulties in controlling pain during interventions, supplementary anesthesia is indicated, such as the intraligamentar technique, aiming to increase the anesthetic success rate[6]. Still, in some cases, intraligamentar anesthetic injections do not produce pulpal anesthesia[6]. In such situations, intrapulpal anesthesia is indicated.

Intrapulpal anesthesia main disadvantage is related to the extreme painful sensation cause during introduction of the needle into the dental pulp, being only recommended when all other supplementary techniques have already been tried and failed[7].

Pain control remains a challenge during endodontic interventions, since local anesthesia do not always provide the expected effect. Therefore, the aim of this study was to evaluate the occurrence of intraoperative pain and the need for supplemental anesthesia during emergency care of patients with diagnosis of symptomatic irreversible pulpitis and symptomatic apical periodontitis.

MATERIALS AND METHODS

This pre- and post-intervention study was approved by the Institution Ethics Committee (96418218.5.0000.5347). Written informed consent was obtained from all the enrolled participants.

Study sample

The study sample was obtained from the population that sought for emergency care at the Faculty of Dentistry of the Federal University of Rio Grande do Sul and at the Emergency Room of Cruzeiro do Sul – Porto Alegre.

Inclusion criteria

Male and female patients, over 18 years, presenting a diagnosis of SIP or SAP, with moderate to severe pain at baseline (score equal to or greater than 40 mm according to VAS) were included.

Diagnosis of SIP and SAP were determined as follows:

- SIP: spontaneous, continuous, pulsatile, diffuse and/or irradiated pain; sensitivity increased or relieved by thermal tests; positive responses to cold thermal test; negative responses to pressure, vertical percussion and apical palpation; no periapical alterations observed in periapical radiographic exams.
- SAP: spontaneous, continuous and localized pain; negative responses to cold thermal test; positive responses to pressure, vertical percussion and apical palpation; thickening of the apical periodontal ligament observed in periapical radiographic exams.

Exclusion criteria

- Patients who reported being allergic to the anesthetic drugs used in the present study;
- Patients who were previously anesthetized before emergency attendance;
- Patients who reported pain in multiple teeth requiring root canal treatment;
- Patients who reported symptoms of non-odontogenic pain;
- Teeth diagnosed with combined endo-periodontal lesion,
- Patients with pain due to traumatic injuries,
- Patients with cognitive deficiencies.

Pain measurements

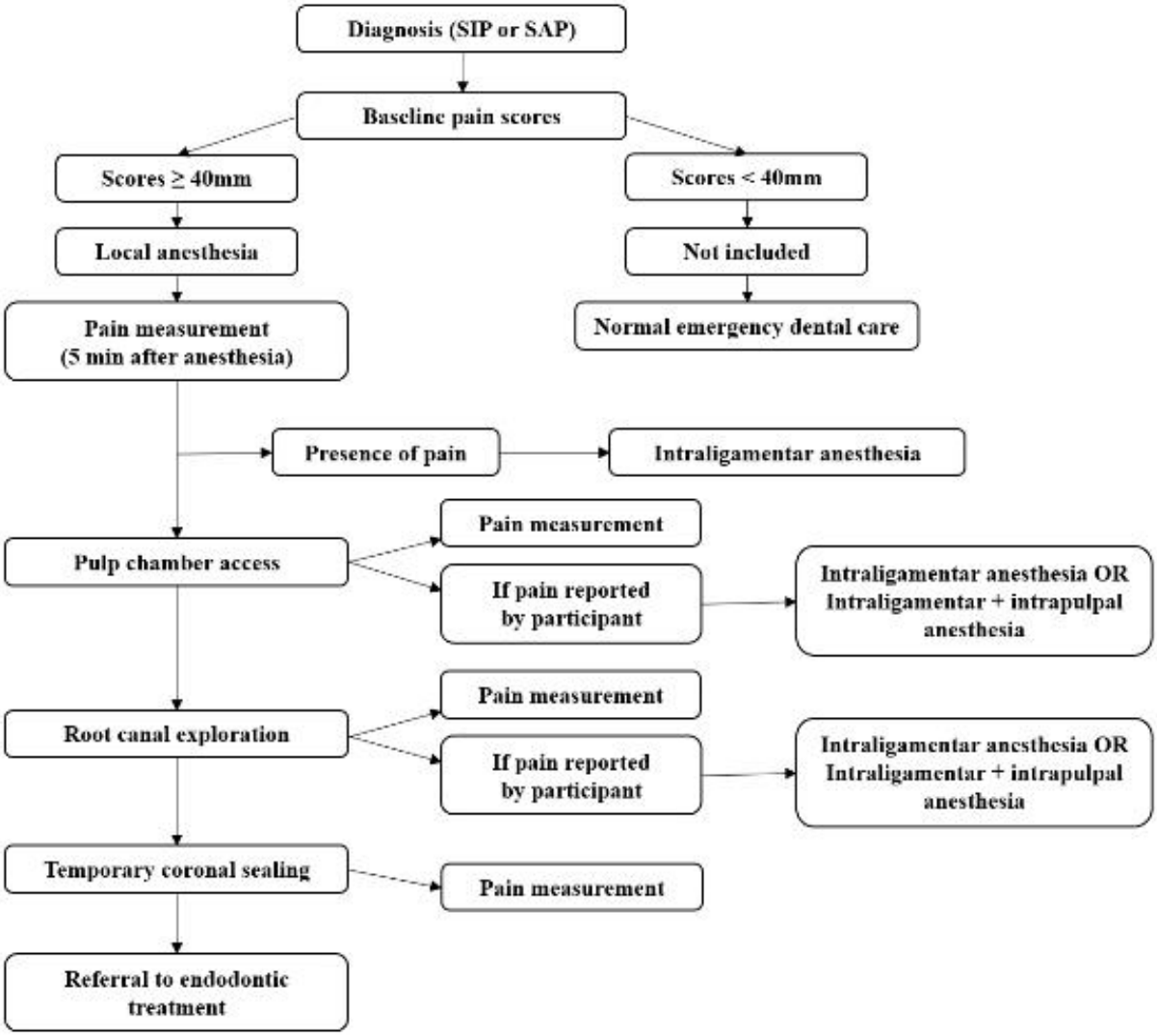
Prior to the study initiation, operator calibration to the use of VAS was performed.

Baseline measurements were performed after diagnosis establishment by using VAS. Patients were instructed to make an intersection in a 0-100mm line, being "0" the absence of pain and "100" the greatest pain intensity. The intersection point was the representation of the patient's pain intensity.

VAS scores were categorized according to a previous study[8]:
0 mm (absence of pain);
10 - 30 mm (mild pain);
40 - 60 mm (moderate pain);
70 - 100 mm (intense pain).

Emergency procedures

Inferior alveolar nerve block (IANB), for mandibular teeth, or supraperiosteal injection, for maxillary teeth, was performed with 2% lidocaine and 1:100.000 epinephrine. Under rubber dam isolation, pulp chamber access was performed with diamond burs (#1012, #1014 or #1016; Kavo Brazil, Joinville, Brazil) and Endo Z burs (Kavo Brazil, Joinville, Brazil) followed by removal of the coronal pulp with a dental excavator and irrigation with 2.5% sodium hypochlorite (Asfer Indústria Química Ltda., São Caetano do Sul, Brazil). Root canal exploration was performed with size #10 and #15 C-Pilot files (VDW, Munich, Germany) at the foramen,



determined by using an electronic apex locator (Apex D.S.P, Septodont Brasil LTDA, Barueri, Brazil). Irrigation was performed with 5ml of 2.5% sodium hypochlorite (Asfer Indústria Química Ltda., São Caetano do Sul, Brazil). If the patient referred pain, gesturally and/or verbally, 5 minutes after local anesthesia, during pulp chamber access and/or root canal exploration, a supplementary intraligamentar or intraligamentar + intrapulpal injection was performed with 2% lidocaine and 1:100.000 epinephrine.

Subsequently, root canals were dried with sterile absorbent paper points (Tanari, Tanariman Industrial LTDA, Manacapuru, Brazil) and, in cases of SIP, a sterile cotton pellet with a Neomycin/polymyxin B/hydrocortisone medication (Otosporin, FQM, Rio de Janeiro, Brazil) was placed in the pulp chamber as an intracanal medication and, in cases of SAP, a sterile cotton pellet without medication was placed in the pulp chamber. Temporary coronal sealing was performed with glass ionomer (Biodinâmica Química e Farmacêutica LTDA, Ibiporã, Brazil).

No systemic medications were prescribed in cases of SIP.

In cases of SAP, an analgesic prescription of acetaminophen 1g, oral tablet, every 6 hours for three days was given. In presence of systemic manifestations (e.g., fever, lymphadenopathy, trismus, and/or edema), amoxicillin 500mg, oral tablets, every 8 hours for seven days was prescribed. In cases of allergies to amoxicillin, clindamycin 300mg, oral tablets, every 8 hours for seven day was prescribed.

Intraoperative pain assessment

Figure 1 depicts the study flow chart.

Pain scores were evaluated after diagnostic procedures (baseline) to determine the participant's inclusion or exclusion (VAS ≥ 40mm). Pain scores were revaluated 5 min after local anesthesia (IANB or

Table 1. Demographic data and clinical characteristics of study patients.

		Symptomatic Irreversible Pulpitis n (%) N = 35	Symptomatic Apical Periodontitis n (%) N = 21
Sex – n (%)			
Woman: n = 36		24 (68,58)	12 (57,15)
Man: n = 20		11 (31,42)	9 (42,85)
Age in years - (mean ± SD)	33.161 ±11.9724		
Education level – n (%)			
Low		13 (37,14)	11 (52,38)
Medium		21 (60)	10 (47,62)
High		1 (2,85)	0
Affected tooth – n (%)			
Anterior: n = 2		0	2 (9,53)
Pre-molar: n = 19		11 (31,42)	8 (38,09)
Molar: n = 35		24 (68,57)	11 (52,38)

supraperiostal injection). Additionally, pain scores were evaluated after pulp chamber access, root canal exploration, and at the end of procedures.

Data analysis

Quantitative data were described as mean, standard deviation, and minimum and maximum values. Categorical data were described as number of participants and percentages.

Pain scores at different moments were compared using a generalized estimating equations (GEE) model with an exchangeable correlation matrix and a link function based on the Gamma distribution (logarithmic distribution). Due to the presence of zero scores, all data received a constant value (+0.5) for analyzes purposes, which was later removed. Post hoc comparison was performed by using the Sidak multiple comparisons test. The significance level was set at 5%. Data were analyzed using the SPSS software (SPSS Statistics for Windows, version 22.0, SPSS Inc., IBM, Chicago, IL, USA).

RESULTS

Table 1 presents the demographic data and clinical characteristics of the included participants. In total, 56 participants were included. Of these, 21 (35.7%) were men, and 35 (64.3%) were women, with a mean age of 33 (±11.9) years.

Thirty-five (64.5%) participants were diagnosed with SIP, and twenty-one (37.5%) were diagnosed with SAP. The most affected group of teeth were molars, with 24 (68.57%) teeth diagnosed with SIP and 11 (52.38%) with SAP; and premolars, with 11 (31.42%) teeth diagnosed with SIP and 8 (38 .09%) with SAP. Only 2 anterior teeth (9.53%) were diagnosed with SAP and no anterior teeth were diagnosed with SIP.

Regarding medication intake prior to the interventions, 25 (44.6%) participants reported using non-opioid analgesics; 12 (21.4%) reported using non-steroidal anti-inflammatory drugs (NSAIDs); 11 (19.6%) reported using an association of NSAIDs and opioid analgesic, or NSAIDs and other medications (not specified by the participant); and 8 (14.3%) participants did not use any medication.

Figure 2 depicts the mean pain scores at different times of measurement. Pre-intervention pain score was moderate for 36 (64.3%) participants and severe for 20 (35.7%) participants. Mean pain scores at baseline for SIP were 6.39 (±1.48); and 6.69 (±1.54) for SAP ($p>0.05$). According to sex, mean pain scores in men were 6.23 (±1.49) and 6.53 (±1.57) for SIP and SAP, respectively; and 6.46 (±1.50) and 6.81 (±1.59) for SIP and SAP, respectively, in women ($p>0.05$).

Pairwise comparisons of pain scores are shown in **Table 2**.

In patients diagnosed with SIP, significant differences were observed when comparing preoperative pain scores and all other time points; pain scores after 5 minutes of anesthetic injection and all other time points; pain scores during pulp chamber access and scores at the end of procedures; and pain scores during root canal exploration and scores at the end of procedures ($p<0.05$). In patients diagnosed with SAP, significant differences were observed when comparing preoperative scores with all other time points, with a significant decrease in pain scores ($p<0.05$). Other comparisons were not statistically significant ($p>0.05$).

The need for supplemental anesthesia according to the diagnosis is shown in **Table 3.** Chi-square test indicated an association between the diagnosis and the need for supplemental anesthesia ($p<0.05$).

DISCUSSION

Pain is one of the main reasons for patients to seek emergency dental

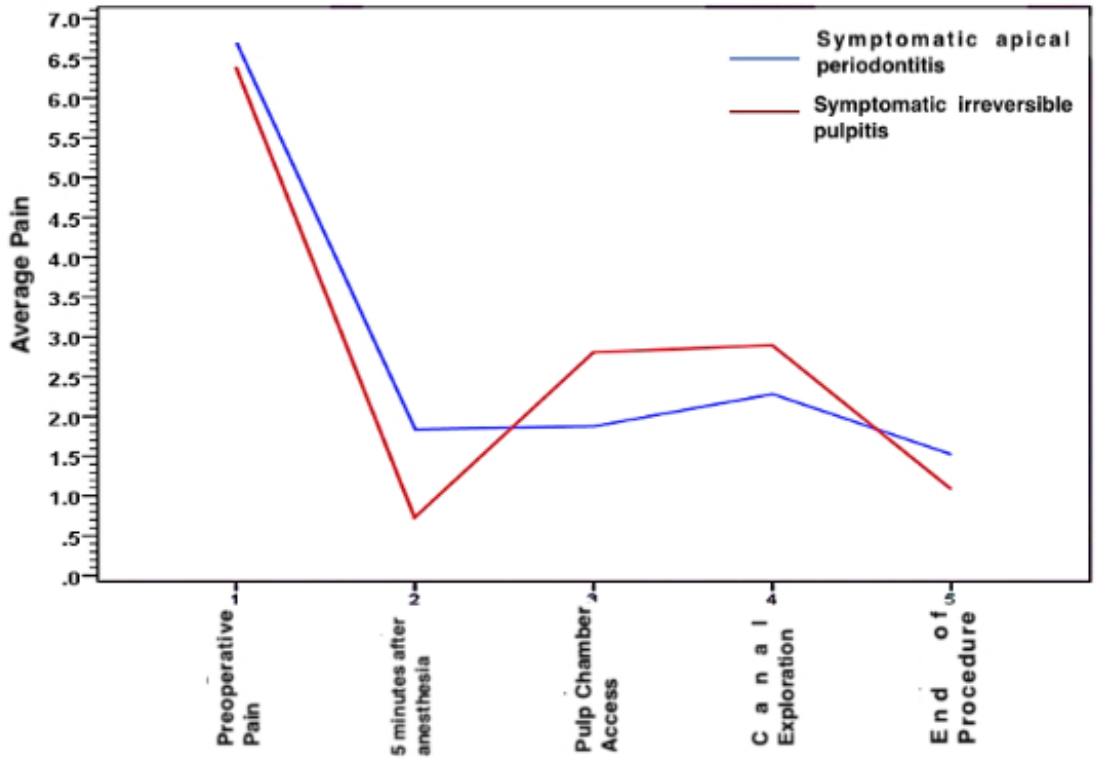


Figure 2. Mean pain scores at different times of measurement.

care. An adequate pain management in endodontics include controlling preoperative, intraoperative and postoperative pain control[9]. In the present study, pain scores were accessed by using the Visual Analogue Scale (VAS), This scale has a greater reproducibility, reliability and validity, allowing the comparison of pain scores in different moments of the study[10,11]. Nevertheless, VAS has some limitations. It is conceptually complex and requires the ability to translate a sensory experience into a linear scale, thus, patients may interpret the scale differently. In addition, patients with lower levels of instruction may present some difficulty to understand the numerical scale[5].

Based on our findings, molar teeth, women, and medium level of education (complete high school) were more prevalent in situations of higher pain intensity. These findings are in agreement with previous studies performed[12,13].

Few studies have analyzed IOP during endodontic treatment. This study evaluated IOP in five different moments: preoperative pain scores (baseline); pain scores 5 minutes after local anesthesia; during pulp chamber access; during root canal exploration; and after the end of the procedures. Based on our findings, diagnosis of SIP was more prevalent than SAP. It was possible to observe that the mean pain scores for SIP and SAP at baseline (6.39 and 6.69, respectively) decreased 5 minutes after local anesthesia (0.73 and 1.83, respectively). However, in cases of SIP, it significantly increased during pulp chamber access (2.80) and during root canal exploration (2.89), with the need for supplemental anesthesia during these steps. Pain remained constant, until the end of the procedures, resulting in decreased pain scores (1.08). In participants with a diagnosis of SAP, a different pattern was observed, with no significant difference among the different moments of intraoperative pain evaluation after local anesthesia.

In general, 57.14% of the included patients required supplementary anesthesia. This finding diverges from those of a previous study[12], in which only 22% of the participants needed supplemental anesthesia. Nevertheless, this may be related to the participants included in both studies. While in the present study only participants requiring emergency dental care due to the presence of preoperative pain were included, in the previous study[12], it was included mostly patients that do not needed emergency dental care. In contrast, when compared to another that also included only patients who sought for emergency dental care[13], the need for supplemental anesthesia was of 44%, corroborating our findings.

Table 2. Pairwise comparisons of mean pain scores for symptomatic irreversible pulpitis and symptomatic apical periodontitis.

	Measure moment	Pairwise comparison	Mean pain scores	95% CI	P value
Symptomatic Irreversible Pulpitis	Preoperatively (Baseline)	-	6.39	6.542-7.39	-
		After 5 minutes			0.000
		Pulp chamber access			0.000
		Root canal exploration			0.000
		After procedures			0.000
	After 5 minutes	-	0.73	0.93-1.62	-
		Pulp chamber access			0.000
		Root canal exploration			0.000
		After procedures			0.043
	Pulp chamber access	-	2.80	2.56-4.26	-
		Root canal exploration			0.842
		After procedures			0.001
	Root canal exploration	-	2.89	2.51-4.59	-
		After procedures			0.001
	After procedures	-	1.08	1.49-1.68	-
Symptomatic Apical Periodontitis	Preoperatively (Baseline)	-	6.69	6.57-7.87	-
		After 5 minutes			0.000
		Pulp chamber access			0.000
		Root canal exploration			0.000
		After procedures			0.000
	After 5 minutes	-	1.83	1.51-3.61	-
		Pulp chamber access			0.929
		Root canal exploration			0.890
		After procedures			0.890
	Pulp chamber access	-	1.87	1.53-3.67	-
		Root canal exploration			0.764
		After procedures			0.890
	Root canal exploration	-	2.28	1.81-4.25	-
		After procedures			0.665
	After procedure	-	1.52	1.65-2.47	-

Table 3. Percentage scores of needs for supplemental anesthesia based on diagnosis.

Diagnosis	Supplemental anesthesia	Number of participants (%)
Symptomatic Irreversible Pulpitis		35 (100)
	None	8 (22,9)
	Intraligamentar	1 (2,9)
	Intrapulpal	3 (8,6)
	Both	23 (65,7)
Symptomatic Apical Periodontitis		21 (100)
	None	16 (76,2)
	Intraligamentar	3 (14,3)
	Intrapulpal	1 (4,8)
	Both	1 (4,8)

The major limitation of the present study was the inclusion of patients that used medications to control pain prior to treatment. Despite being difficult to control for such factor, since the majority of patients will self-administer some medication to control pain prior seeking for dental care, this may have some impact in the pain scores at baseline, since these medications can modulate pain intensity[14]. Additionally, it is known that pain is also associated with emotional and psychological factors[15,16], which can influence the patients' responses to the tests performed during this study.

CONCLUSION

Based on the presented results, it was possible to verify a strong relation between reduction of moderate/severe pain after application of local anesthesia during emergency dental care. Additionally, it was possible to determine an association between diagnosis of SIP and the need for supplemental anesthesia.

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