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Effect of topical anaesthesia in patients with persistent dentoalveolar pain disorders: A quantitative sensory testing evaluation

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ABSTRACT

Objective: The aim of this study was to test the hypothesis that patients with persistent dentoalveolar pain disorder (PDAP) expresses somatosensory abnormalities through quantitative sensory testing (QST), when compared to healthy controls; and that individuals with PDAP do not have somatosensory alterations after application of a topical anaesthetic gel.
Design: QST was performed in 25 subjects with PDAP (19 women and 6 men), at baseline and after topical application of benzocaine 2% (Benzotop 200 mg/g, DFL) and compared to 25 matched healthy controls. After "Z" score transformation, results were analyzed using the paired "t" test and "t" test with significance level of 5%.
Results: PDAP subjects have lower pain detection thresholds confirmed through mechanical tests; and higher pain intensity report through thermal stimuli tests (heat and cold) when compared to healthy subjects. Topical anaesthesia partially reduces in 60% pain intensity of PDAP patients; and anaesthetic gel increases mechanical detection thresholds and reduces pain intensity report in dynamical mechanical allodynia tests.
Conclusions: PDAP patients had abnormal thermal sensory and mechanical allodynia, which is indicative of central sensitization. Moreover, topical anaesthetic incited a significant reduction in pain intensity, and an increase in mechanical and pain detection thresholds, which could be also suggestive of a peripheral disorder.

1. Introduction

PDAP (persistent dentoalveolar pain disorder) is a chronic neuropathic condition that is characterized by a continuous and severe pain located in the dentoalveolar region innervated by the trigeminal nerve that is not caused by any other disease and is identified through clinical and image examination.[1–4] PDAP occurs in 3–6% of patients who receive dentistry management. Traumatic injury, periodontal surgery, endodontic therapy, apicectomy, tooth extraction or the slightest trauma during tooth preparation or inferior alveolar nerve

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block that damage nerve fibres may disrupt peripheral afferent nerve impulses.[5–11] Sensory deficits due to a deprivation of afferent impulses is known as deafferentation,[12] and it is expressed clinically by somatosensory abnormalities, such as allodynia, hyperalgesia and pain exacerbation by thermal, mechanical and/or chemical stimuli.[13,14]

The role of peripheral or central sensitization mechanisms in neuropathic disorders is complex and not fully understood. Diagnostic local anaesthesia is recommended to elucidate the source of pain and its mechanisms.[13,15] One previous study demonstrated neuropathic pain relief after a peripheral anaesthesia block with lidocaine,[16] but the effect of a topical anaesthetic gel in patients with PDAP has not been investigated. Evidence indicates that a peripheral lidocaine injection may block sodium channels because of its deep penetration.[17,18] However, whether the same effect occurs after an anaesthetic gel application, which likely has a more superficial action, is not known.

Somatosensory abnormalities may be assessed using QST (quantitative sensory testing), which comprehensively evaluates the nervous system.[12,19] QST uses mechanical (static or dynamic), thermal, electrical and chemical tests. The static mechanical test detects thresholds to innocuous and/or harmful stimuli, and the dynamic mechanical test explores allodynia and temporal summation. Thermal detection thresholds evaluate innocuous and/or harmful thermal stimuli (cold, warm or hot).[20–22]

This study tested the hypotheses that patients with PDAP express somatosensory abnormalities compared to healthy subjects (controls) that are detectable using QST and that patients with PDAP do not have somatosensory alterations after the application of a topical anaesthetic gel.

2. Materials and methods

This controlled clinical trial was conducted from September 2011 to December 2012. Somatosensory abnormalities were investigated in a sample of clinical patients with PDAP before (baseline) and after topical anaesthesia and compared to healthy controls.

2.1. *Sample*

Patients with PDAP were selected at the Orofacial Pain Service of the Bauru School of Dentistry, University of São Paulo, Brazil. All patients who were seeking treatment for dental pain and were aged 18–65 years were invited to participate. All patients with a suspected initial diagnosis of PDAP underwent an anamnesis, physical examination and panoramic and periapical radiographs. Anamnesis included personal data history, chief complaint, and medical and dental histories. Medical history included questions relating to the pain severity and quality of the main complaint, worsening and improvement factors, accompanying symptoms and previous treatments.

Orofacial pain specialists (ALP, YMC, JSB) diagnosed PDAP during the first patient consultation, which was prior to enrollment in the study. PDAP was diagnosed according the following criteria[1]:

- Persistent pain that is present at least 8 h per day for ≥15 days or more per month for ≥3 months duration.
- Localized in dentoalveolar area in which the maximum pain is defined within an anatomical area.
- Not caused by another disease or disorder after dental, neurological examination and imaging.

A CBCT (cone beam computed tomography) was requested in patients when some diagnostic doubt remained after the complementary exams and radiographs.[23]

Patients taking pain medications were also included in the study. Exclusion criteria included the presence of previously diagnosed systemic conditions, such as diabetes, uncontrolled hypertension, leprosy and/or disabling neurological and psychological disorders.[13,24,25]

For a more accurate trial, psychosocial features were evaluated thought specific questionnaires. Depression and anxiety symptoms were assessed using the Beck Depression Inventory (BDI)[26–29] and Beck Anxiety Inventory (BAI),[26,27,30] respectively. Pittsburgh Sleep Quality Index (PSQI) was used to assess sleep quality.[31–33]

Controls were selected from volunteers who had undergone dental therapy in the Prosthodontics Section of Bauru School of Dentistry, University of São Paulo. Controls could not have previously received a PDAP diagnosis and needed to be free from any type of pain, dental pathology or therapy for at least 6 months.[34]

All participants signed an informed consent form that was approved by the Academic Investigation Review Board (Protocol 081/2011).

Initially, a total of 47 patients with a diagnostic hypothesis of PDAP were selected, but only 25 patients met the inclusion criteria. Nineteen patients were excluded because they did not meet the required diagnostic criteria for PDAP, 16 patients had a diagnosis of acute irreversible pulpitis, and three patients had tooth fractures. Three patients were excluded because they fulfilled one or more exclusion criteria (two patients had uncontrolled diabetes, and one patient had hypertension) (Fig. 1).

An age- and gender-matched control group of 25 healthy subjects was formed after selection of the 25 consecutive eligible patients with PDAP.

2.2. *Methods*

A sequence of seven QSTs was performed at baseline for both groups. QSTs were applied over the alveolar mucosa in the apical tooth area for the PDAP group. This dentoalveolar area was approximately 7 mm.[2] Maxillar or mandibular regions were matched in the control group. The dentoalveolar mucosa used was the closest region to the tooth (attached gingiva).[20,35]

QST was also performed in the PDAP group 5 min after the topical application of an anaesthetic gel (benzocaine – Benzotop 200 mg/g – FL®). Approximately 5 mg of benzocaine was applied on the dentoalveolar mucosa and dried with compressed air. Benzocaine remained on the mucosa for 10–15 s, and it was removed. QSTs were performed again after 2 min. The temperature of the topical anaesthetic gel was 25 °C.