Diagnostic Accuracy of Quantitative Sensory Testing to Discriminate Inflammatory Toothache and Intraoral Neuropathic Pain

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Abstract

Introduction: A differential diagnosis between inflammatory toothache (IT) and intraoral neuropathic pain is challenging. The aim of this diagnostic study was to quantify somatosensory function of subjects with IT (acute pulpitis) and atypical odontalgia (AO, intraoral neuropathic pain) and healthy volunteers and to quantify how accurately quantitative sensory testing (QST) discriminates an IT or AO diagnosis. **Methods:** The sample consisted of 60 subjects equally divided (n = 20) into 3 groups: (1) IT, (2) AO, and (3) control. A sequence of 4 QST methods was performed over the dentoalveolar mucosa in the apical maxillar or mandibular area: mechanical detection threshold, pain detection threshold (PDT), dynamic mechanical allodynia, and temporal summation. One-way analysis of variance, Tukey post hoc analyses, and z score transformation were applied to the data. In addition, the receiver operating characteristic curve analysis, diagnostic accuracy, sensitivity, specificity, likelihood ratios, and diagnostic odds ratio of the QST methods were calculated (α = 5%). **Results:** Somatosensory abnormalities were found for the AO group, which is consistent with a low detection threshold to touch and pain and the presence of mechanical allodynia. For the IT group, no somatosensory abnormality was observed when compared with the control group. The most accurate QST to discriminate the diagnostic differences between IT and healthy individuals is the PDT. The diagnostic differences between AO and healthy individuals and between IT and AO are best discriminated with the mechanical detection threshold, PDT, and dynamic mechanical allodynia. **Conclusions:** The proposed QST methods may aid in the differential diagnosis between IT and AO with strong accuracy and may be used as complementary diagnostic tests. *(J Endod 2015;41:1606–1613)*

Key Words

Diagnostic accuracy, inflammatory toothache, intraoral neuropathic pain, persistent pain, quantitative sensory testing

Traumatic injuries such as endodontic therapy, apicectomy, tooth extraction, tooth preparation, and inferior alveolar nerve block may damage nerve fibers and disrupt peripheral afferent nerve impulses (1–4). Because of a possible lack of healing of the apical root tissues after some of these traumatic injuries, 3%–6% of patients who undergo endodontic management may experience chronic persistent pain, which is classified as a neuropathic condition (3–5).

Persistent pain after root canal therapy may be related to odontogenic and non-odontogenic etiologies (6, 7). Odontogenic causes result from an untreated or incompletely obturated root canal, root fracture, failure of the apical seal, or pain referred from an adjacent tooth or structure (6). Nonodontogenic causes are trigeminal neuralgia, maxillary sinusitis, temporomandibular disorders, tension-type headaches, and atypical odontalgia (AO) (3, 5, 8–10). AO is a continuous neuropathy of moderate to severe intensity; occurs in the orofacial region and is localized to the dentoalveolar region; is not caused by another disease; and can be identified by clinical, dental, neurologic, and image examination (1, 2, 8, 11).

Although infrequent, when AO cases manifest in the dental office, they are often treated through numerous dental procedures with no pain relief (2, 12). Patients with AO have difficulties accepting their pain condition because of misdiagnoses and repeated ineffective dental procedures that the patients endure (8, 13–15). The differential diagnosis between intraoral AO and inflammatory toothache (IT) is challenging. In patients with AO, pain is continuous, unchanging over weeks or months, with an absence of any local or systemic cause. Furthermore, local tooth provocation does not promote consistent alterations in pain, and repeated endodontic or dental procedures fail to relieve pain (10, 16–18).

Sensory abnormalities such as allodynia; hyperalgesia; and pain exacerbation by thermal, mechanical, and/or chemical stimuli are frequent in AO patients (9, 19). Quantitative sensory testing (QST) methods are appropriate tools to assess these abnormalities (9, 20). QST comprehensively evaluates the nervous system and may involve static or dynamic mechanical, thermal, electrical, and chemical tests (12, 21). Static mechanical tests detect thresholds to innocuous and/or harmful stimuli, whereas dynamic mechanical tests explore allodynia and temporal summation; thermal detection thresholds evaluate innocuous and/or harmful

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thermal stimulus (cold, warm, or hot) (22–24). Although QST methods are proposed to be used as diagnostic tools (21, 23), their accuracy for differential diagnosis between intraoral neuropathic pain and inflammatory toothache has not yet been tested.

Based on this information, the aim of this study was to quantify the somatosensory function of subjects with IT, AO, and healthy volunteers; to quantify how accurately QST discriminates tooth pain as IT or AO; and to learn if QST may assist the endodontic specialist in the assessment and differential diagnosis of such conditions.

Sample and Methods

Study Population

This diagnostic study was conducted from December 2013 to November 2014. Subjects were recruited at 3 different services at the Bauru School of Dentistry, University of São Paulo, São Paulo, SP, Brazil:

1. Emergency and Screening Service (Stomatology Department)
2. Orofacial Pain Service (Prosthodontics Department)
3. Integrated Service of Oral Rehabilitation and Dental Implants (Prosthodontics Department)

This study was conducted in accordance with Helsinki guidelines and was approved by the local ethics committee (Certificate of Presentation for Ethical Consideration #19840113.2.0000.5417). Written informed consent was obtained from all participants.

Before study enrollment, all subjects underwent anamnesis and physical examination. Anamnesis included a history taken about personal data, chief complaint, and medical and dental history. The dental history included questions related to the main complaint, pain severity and quality, worsening and improvement factors, accompanying symptoms, and previous treatments.

The initial sample consisted of 469 subjects, and then 346 subjects were excluded from the IT group, 26 from the AO group, and 37 from the control group (C). A flowchart of the exclusion criteria for the selected subjects can be observed in Figure 1. The remaining subjects were eligible and agreed to participate in the study.

The IT group consisted of 20 subjects (14 women, 35.1 ± 8.68 years old) with acute pulpitis. Individuals were assessed for the following mandatory diagnosis criteria (10, 16):

1. Acute pain was in dental pulp.
2. Pain was related to a dental inflamed pulp.
3. Pain was moderate or severe in intensity.
4. Pain intensity could vary over time, passing through asymptomatic periods.
5. Pain could be caused by a stimulus or occur spontaneously.
6. Pain was intermittent or continuous.
7. Pain was affected by time or body position.

Periapical radiography was always used for the differential diagnosis. The IT group consisted solely of cases with acute pulpitis; cases with apical periodontitis were excluded. Individuals previously using analgesics and/or anti-inflammatory agents were included in the study. Subjects were excluded if they had no pain at the time of evaluation or if they were taking analgesics and had residual pain <50 mm on a visual analog scale (VAS).

The AO group consisted of 20 subjects (15 women, 57.84 ± 13.42 years old) diagnosed with intraoral neuropathic pain by orofacial pain specialists (A.L.P., Y.M.C., or J.S.B.) during the first patient consultation, which was before enrollment in the study. Subjects with AO were diagnosed using the following currently published and accepted criteria (8, 10, 16):

1. Persistent pain was present at least 8 h/d ≥15 days per month for ≥3 months.
2. Pain was localized in the dentoalveolar area where the maximum pain is defined within an anatomic area.

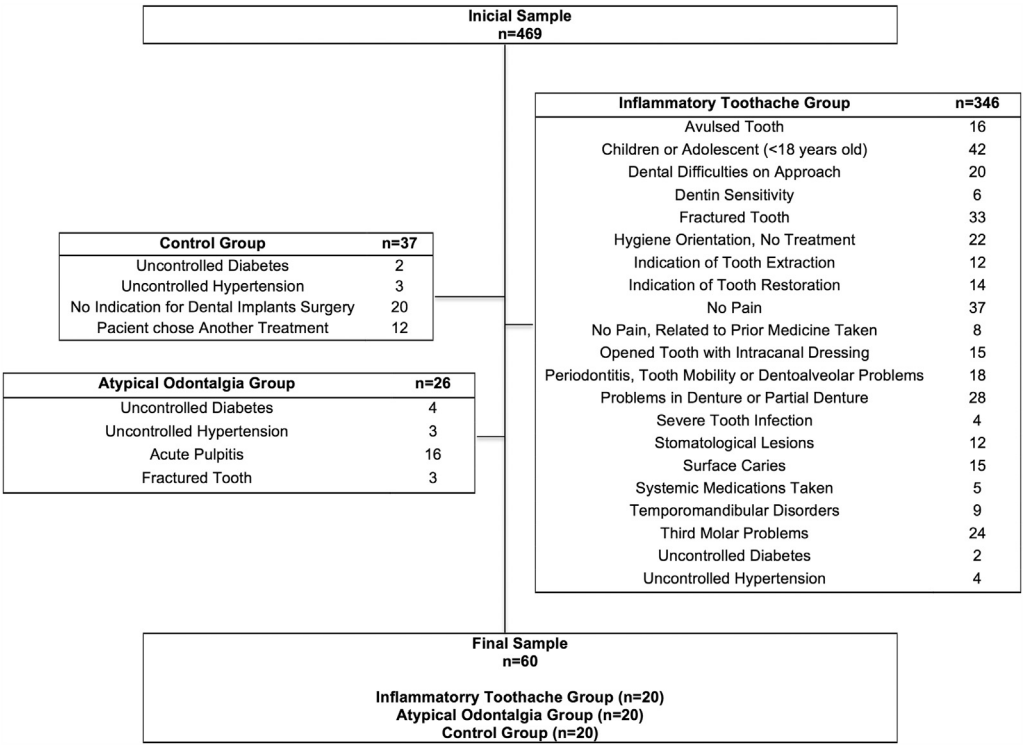

Figure 1. A flowchart of the exclusion criteria for the selected subjects.