Determination of the Influence of Chronic Periodontitis on Pulp Sensibility by Means of Electric and Thermal Cold Testing

Vanessa C.Q. Neves, DDS, MS, [*] *Benedicto E.C. Toledo, DDS, MS, PhD,* [†] *Gabriela A.C.G. Camargo, DDS, MS, PhD,* [‡] *Alessandra A. Souza, DDS, MS, PhD,* [‡] *and Elizangela P. Zuza, DDS, PhD* [‡]

Abstract

Introduction: Communication between pulp and periodontal tissue has been well established. However, it is unknown when periodontal disease begins to affect the clinical response of pulp tissue. The aim of this study was to assess the influence of periodontal severity on pulp sensibility by means of electric and thermal cold testing. **Methods:** The teeth assessed in this study were allocated into 3 groups considering radiographic alveolar bone loss (ABL) as follows: slight periodontitis (SP, ABL ≤7 mm without reaching the apex, n = 25), moderate periodontitis (ABL >7 mm without reaching the apex, n = 23), and severe periodontitis (SvP, ABL >7 reaching the apex, n = 8). Gingival recession (GR), probing depth (PD), and clinical attachment level (CAL) were also measured. **Results:** The results showed higher levels of PD and CAL in the SvP group compared with the SP group ($P < .05$), with no significant difference in GR ($P > .05$). The SvP group showed significant ABL compared with the other groups ($P > .05$). The SP group showed a significant number of teeth with a positive pulp response, whereas the SvP group showed a significant number of teeth with a negative pulp response ($P < .05$); no significant differences were observed between the thermal cold and electric tests ($P > .05$). **Conclusions:** Within the limits of this study, it can be concluded that pulp clinical involvement with a negative response to thermal cold and electric testing occurs only in the most advanced stage of chronic periodontitis with apical involvement. *(J Endod 2017;■:1–4)*

Key Words

Chronic periodontitis, dental pulp, endodontics

Significance

Chronic periodontitis was able to influence a negative pulp clinical response to thermal cold and electric testing only in severe cases reaching the apex.

The communication between pulp and periodontal tissues is well established in the literature. The effects of pulp alterations on the periodontium are well-documented (1, 2), whereas the influence of periodontal disease on pulp tissue needs further assessment, with new forms of clinical and histologic investigations being required. Injuries to the pulp tissues caused by lasting and continuous stimuli or chemical irritants that act directly on the dentin can alter pulp physiology (3). Periodontitis can be considered a chronic and continuous stimulus on the pulp (4). Some authors have assessed the pulp histopathologic condition in teeth with different severities of chronic periodontitis. It was reported that the gradual progression of the disease causes pulp alterations, such as reaction fibrosis, dystrophic mineralization, atrophy, and mononuclear inflammatory infiltration (4).

When the pulp is in the degenerative phase, it is unlikely that its condition improves, signaling an irreversible abnormality. In this context, the response of pulp can be influenced by electric and thermal stimuli. Therefore, the determination of vitality status and pulp health is the most commonly indicated approach for a differential diagnosis (5). The thermal cold vitality test can be used to reproduce the symptoms reported by patients when testing pulp sensibility (6). In this way, the diagnosis can be reliably made with limited false-negative results; specifically, a negative reaction represents necrotic pulp in 90% of cases (5, 7, 8).

The electric test provides microscale quantitative data by measuring the neural response to stimuli. Therefore, this test can be used as an auxiliary means to diagnose pulp health or necrosis. Negative responses are highly likely linked to necrotic or severely diseased pulp and represent irreversible stages of degeneration (9). Thus, it is important that clinicians understand and know how to interpret the electric test, which is performed using an electric charge, because false-negative or positive-responses might occur (10).

Because of the scarcity of studies that assess the influence of periodontal disease on the pulp, the assessment of this condition is believed to be important, not only when the destruction reaches the dental apex but also for different levels of attachment loss in chronic periodontitis (4). The optimal understanding of this interrelation is crucial and

From the *Department of Dentistry, Educational Foundation of Barretos (UNIFEB), School of Dentistry, Barretos, São Paulo, Brazil; [†]Department of Diagnosis and Surgery, São Paulo State University (UNESP), School of Dentistry, Araraquara, Brazil; and [‡]Department of Periodontology, Fluminense Federal University, School of Dentistry, Nova Friburgo, Rio de Janeiro, Brazil.

Address requests for reprints to Dr Elizangela P. Zuza, Department of Periodontology, Fluminense Federal University (UFF), Nova Friburgo, Rio de Janeiro, Brazil. E-mail address: elizangelazuza@yahoo.com.br

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may make it applicable in daily clinical practice, verifying the hypothesis that it is not necessary for periodontitis to reach the dental apex to cause pulp alterations (5).

Pulp sensibility testing is the most indicated approach for a differential diagnosis of the relationship between the pulp and the periodontium. However, according to some authors (5), a single test is generally insufficient to make a conclusive diagnosis; rather, 2 or more tests should be used to confirm the true condition of the dental pulp. The aim of this study was to assess the influence of chronic periodontitis on the pulp response by means of electric and cold thermal testing.

Material and Methods

This study was approved by the UNIFEB Research Ethics Committee (protocol no. 883.469/2014). This work was performed in accordance with the Code of Ethics of the World Medical Association (Declaration of Helsinki) for experiments involving humans. Informed consent was obtained for experimentation, and the privacy rights of human subjects were preserved. Fifty-six single-rooted teeth were assessed. The teeth were selected from 11 patients with chronic periodontitis (11) who sought treatment at either the dentistry course clinics at UNIFEB or private practices. Five patients were men, and 6 were women, with ages ranging between 31 and 66 years.

To be included in the study, teeth had to be single rooted. Patients with pacemakers and cardiac monitoring devices as well as those who had received periodontal treatment in the previous 6 months were excluded. Multirooted and carious teeth or those with restorations were also excluded. The selection criteria did not necessarily exclude all possible reasons, such as accidental trauma or cracks. An examiner (E.P.Z.) was trained to measure the periodontal parameters, and another examiner (V.C.Q.N.) was trained to assess pulp sensibility using electric and cold thermal testing. The criteria were explained, and training was performed, with an expert examiner being considered the "gold standard."

Assessment of Periodontal Parameters

The periodontal condition determination was based on the following clinical parameters (12): gingival recession (GR, the distance between the cementoenamel junction and the gingival margin, measured in millimeters), probing depth (PD, the distance from the edge of the gingival margin to the bottom of the gingival sulcus, measured in millimeters), bleeding on probing (BOP, present or absent until 30 seconds after probing), and clinical attachment level (CAL, the distance from the cementoenamel junction to the bottom of the pocket measured in millimeters, corresponding to the sum of the GR and PD). A periodontal probe (PCPUNC15BR; Hu-Friedy, Chicago, IL) was used to measure the PD, BOP, GR, and CAL in the following 6 sites for each tooth: mesiobuccal, medial, mesiolingual, distolingual, lingual, and distal vestibular.

Alveolar bone loss (ABL) assessment was performed by means of periapical X-rays using the paralleling technique. ABL was considered when the distance between the cementoenamel junction and the alveolar bone crest was >2 mm (13). The ABL extension was measured in the proximal surfaces (medial and distal) from the cementoenamel junction to the most apical point of the bone crest using a caliper rule (Mitutoyo, Tokyo, Japan) and an adequate negatoscope. Only the largest ABL measure was recorded on the chart. The radiographic ABL extension was classified as follows: slight periodontitis (SP, ABL $\leq$7 mm without reaching the apex), moderate periodontitis (MP, ABL >7 mm without reaching the apex), and severe periodontitis (SvP, ABL >7 mm reaching the apex). The groups of teeth were separated according to the ABL level based on the study by Zuza et al (4) (Table 1).

TABLE 1. Study Groups and Alveolar Bone Loss (ABL) Criteria

Groups	Criteria
Slight periodontitis (n = 25)	ABL $\leq$7 mm, without reaching the apex
Moderate periodontitis (n = 23)	ABL >7 mm, without reaching the apex
Severe periodontitis (n = 8)	ABL >7 mm, reaching the apex

Pulp Sensibility Assessment: Electric and Cold Thermal Testing

To assess pulp sensibility and thereby obtain a more conclusive diagnosis, pulp status determination was performed using both electric and cold thermal testing. The materials used for the tests were the Micro-Controlled Pulp Tester Digital TP-10 (Microeletrônica Ind. e Com. Ltda, Belo Horizonte, Brazil) and Endo-Frost cold spray (Roeko, Langenau, Germany).

To perform the thermal cold test, a cooling spray gas was used. After isolating the tooth crown with cotton rolls and drying its surface, clinical tweezers and a small cotton ball saturated by the cooling gas were applied to the central point of the cervical third of the anatomic crown (9, 14). The cotton ball was pressed on the tooth for approximately 3 seconds, and the stimulus position was maintained to determine either the immediate tooth response or the response up to 10 seconds later.

The electric test was conducted using an electric charge by means of a specific device that directly stimulates sensory fibers. This test has been shown to be effective in diagnosing pulp sensibility, and the stimuli are gradually microcontrolled, which alleviates the painful effects according to the manufacturer. There is a digital counter and an auditory beeper to indicate the level of stimuli. This device was used in the normal mode. Thus, the electric charge reading was performed using the device screen, considering the manufacturer's instructions for single-rooted teeth, and the tooth was considered vital if the charge was higher than 30. These parameters were carefully followed to prevent the electric charge from reaching the periodontal fibers, which could influence the research results (15).

The electric test was performed at the central point of the cervical third of the anatomic crown (14) using toothpaste as an electric conductor on the dental surface. The patients were instructed to release the handle of the test device as soon as they felt the electric stimulus, at which point the charge was registered.

To avoid individual sensitivity variation, thermal cold and electric tests were repeated on contralateral healthy teeth. There was a 5-minute interval between the tests performed in the same tooth. All the data were recorded on a form specially designed for the study.

Statistical Analysis

Continuous PD, GR, BOP, and CAL data were statistically analyzed using analysis of variance (1 criterion) followed by the Tukey test. The frequency of the pulp response to cold and electric stimuli and the comparison between the tests were calculated using the chi-square test. BioEstat 5.0 software (Mamirauá, Tefé, AM, Brazil) was used, and the significance level was set at 5%.

Results

Fifty-six teeth that met the inclusion criteria were assessed in the present study. The results showed that the MP and SvP groups presented similar PD and CAL values, whereas the SvP group presented significantly higher ABL values in comparison with the other groups