Response of Pulp Sensibility Test Is Strongly Influenced by Periodontal Attachment Loss and Gingival Recession

Cristiane Rutsatz, DDS, Simone Glesse Baumhardt, MSc,* Carlos Alberto Feldens, PhD,† Cassiano Kuchenbecker Rösing, PhD,‡ Renata Grazziotin-Soares, MSc,† and Fernando Branco Barletta, PhD‡*

Abstract

Introduction: To assess, *in vivo*, the influence of periodontal attachment loss and gingival recession on responses to pulp sensibility tests (PSTs) with cold stimuli in mandibular incisors in adult patients. **Methods:** This cross-sectional study included 45 patients aged 30 to 60 years treated at a university dental health service. In each patient, 1 mandibular incisor was randomly selected for analysis. One calibrated dentist performed all periodontal assessments. Periodontal attachment loss and gingival recession were measured at 6 sites of the selected tooth followed by application of the PST on the buccal surface of the tooth by an independent operator. Each patient was asked to indicate a score for pain intensity on a numeric visual analog scale. The Pearson correlation coefficient was used to investigate and quantify the correlation between predictor variables (periodontal attachment loss and gingival recession) and reported pain. Simple and multiple linear regression analyses were performed to determine the impact of periodontal attachment loss and gingival recession on PST pain scores. **Results:** Multivariate analysis showed that periodontal attachment loss contributed significantly to the prediction of pain in response to the PST ($P < .001$). Increases of 1 mm in periodontal attachment loss resulted in a decrease of approximately 0.5 score on the pain scale. Gingival recession also contributed as a predictor of the outcome ($P < .001$) with a decrease of approximately 0.7 in pain scores for every 1-mm increase in gingival recession. The correlations were in the opposite direction than expected. **Conclusions:** Periodontal attachment loss and gingival recession strongly influenced reported pain in response to PST with cold stimuli. The effect of both variables was constant (ie, responses to PST decreased gradually with increases in periodontal attachment loss and gingival recession). *(J Endod 2012;38:580–583)*

Key Words

Dental pulp test, gingival recession, periodontal attachment loss

Over recent years, several possible relationships between periodontal disease and dental pulp tissues have been investigated (1–3). For example, periodontal disease has been suggested to be a direct cause of pulpal degeneration (3). However, this hypothesis lacks consistent evidence once it is based on the findings of a critical literature review (4) and on the microbiological evaluation of isolated clinical cases (5). Conversely, the effects of pulp disease on the periodontium are well documented (3, 6–8).

In this context, assessing pulp status in patients with periodontally compromised teeth remains an important challenge in dental practice. It is possible that teeth with varying degrees of periodontal involvement may respond differently to pulp sensibility tests (PSTs) when compared with periodontally healthy teeth. Moreover, the inherent limitations of the different methods available for assessing pulp sensibility may be maximized by an additional factor, namely the presence of periodontal attachment loss. Nevertheless, literature devoted to the assessment of responses to pulp stimulation in teeth with varying degrees of periodontal attachment loss is scarce, and studies designed to investigate this association using multivariate analysis are currently lacking.

Therefore, the aims of this study were to investigate the correlation between periodontal attachment loss/gingival recession and responses to PST with cold stimuli and to quantify this correlation and propose a function to describe the variation in responses to PST as a result of different degrees of periodontal attachment loss and gingival recession. The null hypothesis was that there would be no correlation between the predictors and the outcome ($r = 0$).

Materials and Methods

Patient Selection and Study Design

All adults seeking treatment at the School of Dentistry of Universidade de Santa Cruz do Sul, Southern Brazil, between August 2010 and October 2010, were considered eligible for the present cross-sectional study. Adult patients presenting with 4 mandibular incisors without carious lesions were selected for inclusion. The following exclusion criteria were considered: the presence of systemic diseases; treatment with anti-inflammatory agents; and lower incisors with spontaneous pain, restorations, crowns or veneers, trauma history, previous root canal treatment, or tooth wear.

Sample size was calculated considering a 95% confidence level, 80% power, and the ability of the study to detect at least a moderate correlation ($r = 0.5$) between the

From the *School of Dentistry, Universidade de Santa Cruz do Sul (UNISC), Santa Cruz do Sul, Brazil; †School of Dentistry, Universidade Luterana do Brasil (ULBRA), Canoas, Brazil; ‡School of Dentistry, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Rio Grande do Sul, Brazil.

Address requests for reprints to Dr Renata Grazziotin-Soares, Faculdade de Odontologia, Universidade Luterana do Brasil, Av. Farroupilha 8001, Prédio 59, 3° andar, Canoas, RS, Brazil 92425-900. E-mail address: regrazziotin@gmail.com

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predictors (periodontal attachment loss and gingival recession) and the outcome (response to PST) as quantitative variables. These variables resulted in a minimum sample size of 29 subjects (9), which was increased by 50% for multivariate analysis purposes and to avoid a potential loss of information. The final sample comprised 45 subjects.

Tooth randomization was performed as follows: 4 numbers, corresponding to each 1 of the lower incisors, were placed in an opaque, sealed envelope. For each patient who agreed to participate in the study, 1 number was drawn, and the corresponding tooth was selected for periodontal examination and PST application.

The study was approved by the local ethics committee. All subjects signed an informed consent form before their inclusion in the study.

Periodontal Examinations

Periodontal examinations were performed by a calibrated dentist at the main university dental clinic. All teeth in the lower incisor region were subjected to clinical examination. During the periodontal assessment, teeth were isolated with cotton rolls, and measurements were made as follows: periodontal attachment loss and gingival recession were measured in millimeters at 6 sites per tooth: mesiobuccal, middle buccal, distobuccal, mesiolingual, middle lingual, and distolingual (10, 11). A manual periodontal probe, color coded at 1, 2, 3, 5, 7, 8, 9, and 10 mm (PCP10-SE; Hu-Friedy, Chicago, IL), was used. Periodontal attachment loss was defined as the distance between the cementoenamel junction (CEJ) and the bottom of the pocket/sulcus and was calculated as the sum of probing depth plus gingival recession. Gingival recession was defined as the distance between the CEJ and the free gingival margin (FGM). Gingival recession was scored as zero when the FGM was located at the CEJ and was assigned a negative value when the FGM was located coronal to the CEJ.

PST

A PST was also conducted under isolation with cotton rolls by an examiner who was not aware of the final measurements of attachment loss. A refrigerant spray (Endo-Frost-50°C; Coltene/Whaledent, Altstätten, Switzerland) was applied to the middle/incisal third of the buccal surface of the selected tooth using a cotton pellet tightly wrapped around the tip of a tweezer (12). Patients were asked to rate their pain on a 0 to 10 numeric visual analog scale, with 0 representing no pain and 10 indicating the worst pain the patient has ever experienced. A 0 score was defined as the absence of response after two 15-second applications of the refrigerant spray at a 2-minute interval.

Quality Control

A quality control protocol was followed to ensure a standardized examination environment and standardized equipment. Written instructions describing in detail all the clinical procedures involved in the study were provided to the examiners. Also, the examiner in charge of periodontal assessments was trained and calibrated before the beginning of the study. A total of 20 subjects were examined twice, at a 2-week interval, to allow reproducibility assessment. Periodontal attachment loss and gingival recession reproducibility measurements at the site level and at the subject (tooth) level were assessed using intraclass correlation coefficient (ICC) (13).

Statistical Analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences version 16.0 (SPSS Inc, Chicago, IL). Periodontal attachment loss and gingival recession results were analyzed considering the mean of the 6 sites measured for each tooth. The Pearson correlation coefficient was used to assess and quantify the correlation between periodontal attachment loss and gingival recession variables and pain reported on the PST.

Simple and multiple linear regression analyses were performed to determine the impact of periodontal attachment loss and gingival recession on PST pain scores. First, the B coefficients and 95% confidence interval (CI) of each variable were estimated separately. Because the effects of periodontal attachment loss and gingival recession on reported pain may be influenced by age and sex, these variables were included in the analysis. Multivariate analysis started with potential predictors and confounders for reported pain, and backward elimination was used whenever Wald P values were higher than .05. Age was retained in the models as a possible confounder regardless of statistical significance. Because periodontal attachment loss and gingival recession showed a high level of collinearity (Pearson $r = 0.943$, variance inflation factor = 9.01), 2 separate models were constructed, 1 for periodontal attachment loss (model 1) and another for gingival recession (model 2).

Results

All reproducibility measurements showed almost perfect agreement. At the subject level, ICC values for mean periodontal attachment loss and mean gingival recession were 0.93 (95% CI, 0.90–0.96) and 0.99 (95% CI, 0.98–1.00), respectively. At the site level, ICC values for periodontal attachment loss and gingival recession were 0.97 (95% CI, 0.93–1.00) and 0.99 (95% CI, 0.95–1.00), respectively.

The study population comprised 45 adults, of whom 40% were men (18/45). Patient age varied from 32 to 55 years (mean = 45, standard deviation [SD] = 6.5, median = 44). Table 1 shows periodontal attachment loss, gingival recession, and pain results obtained in the sample. Periodontal attachment loss and gingival recession results showed a wide variation among subjects, with a mean ± SD of 3.2 ± 1.8 mm and 2.3 ± 1.4 mm, respectively. Pain response to the PST ranged from 0 to 8, with a mean ± SD of 4.9 ± 1.5. Periodontal attachment loss, gingival recession, and pain response to the PST showed an approximately normal distribution (Kolmogorov-Smirnov test, $P > .05$). There were no statistically significant differences between male (mean ± SD = 4.50 ± 1.6) and female (5.11 ± 1.4) responses to the PST ($P = .180$) or between subjects <45 years and ≥45 years (5.26 ± 1.3 and 4.45 ± 1.5, respectively) ($P = .068$).

Table 2 shows a statistically significant negative correlation between periodontal attachment loss and reported pain; this predictor variable was found to explain 31.5% of the variance of the outcome. Gingival recession also presented a significant negative correlation with pain intensity, explaining 42% of its variance. Table 3 shows the

TABLE 1. Results Obtained in the Sample for the Predictor Variables (periodontal attachment loss and gingival recession) and the Outcome of Interest (pain response to the PST)

	Minimum	Median (P25 to P75)	Maximum	Mean	SD
Periodontal attachment loss (mm)	1.25	2.75 (1.87 to 3.87)	10.0	3.2	1.8
Gingival recession (mm)	1.00	1.75 (1.37 to 2.87)	7.5	2.3	1.4
Pain/pulp sensibility test	0	5.0 (4.0 to 6.0)	8.0	4.9	1.5