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ORIGINAL ARTICLE

Pain levels in patients during periodontal probing and mechanical non-surgical therapy

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Abstract The purpose of this study was to assess the degree of pain during periodontal probing and mechanical non-surgical therapy according to age, gender, and intersubject variation such as tooth type, tooth surfaces or regions of mouth, probing depth, and bleeding on probing. The study was carried out on 64 patients with chronic periodontitis. Pain/discomfort of patients during both periodontal probing and scaling and root planing (SRP) was measured using a visual analog scale (VAS). During periodontal probing and SRP, VAS scores decreased with increasing age for two procedures (Spearman ρ, −0.301 and −0.348, respectively; $P<0.01$). VAS scores were considerably lower for oral sites than for facial sites. VAS scores in probing were significantly higher in sites ≥4 mm deep than sites <4 mm deep. Sites bleeding on probing had a significantly higher VAS scores than sites no bleeding on probing ($p<0.05$). The results showed that although there is no difference between genders, the intensity of pain during periodontal probing and SRP was different dramatically between patients as well as vary between different locations in the same mouth. If pain responses for probing in different several regions in the same mouth during initial examination were noted into patient chart used for initial examination, the therapist will recognize patients with elevated pain responses. If need be, they will then apply some pain control medication or anesthetic for patients during probing and SRP.

Keywords Pain · Scaling and root planing · Periodontal probing · Periodontitis · Visual analog scale

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Introduction

Periodontitis is a chronic progressive disease that affects the gingiva, periodontal ligament, and bone around the teeth [1, 25]. It is characterized by the development of the inflammation in the gingiva that subsequently extends, resulting in the resorption of the alveolar bone. This bone resorption and the migration of the attachment of the periodontal ligament on the root of the tooth results in the formation of a space, the periodontal pocket. This pocket is a pathological site filled with large numbers of microorganisms (plaque), inflammatory cells, exudate, and calculus that is attached to the exposed root of the mouth [1, 4, 6, 21, 25]. Therefore, accurate measurement of periodontal pocket is important in the diagnosis of periodontal conditions and healing after treatment [14, 21, 31]. Periodontal probe is a commonly used instrument to assess periodontal conditions and the severity of periodontal lesions [23, 31]. However, patient discomfort and pain associated with the insertion of a periodontal probe into the periodontal pocket are common clinical events [14]. The intensity of pain or discomfort has been perceived by practitioners to differ dramatically between patients [14].

Mechanical non-surgical therapy or SRP is the most commonly used procedure for treating periodontitis [3, 5, 21, 25]. These procedures oftentimes may be perceived as painful [3, 10, 16, 18]. Although the available literature is limited, there is sufficient evidence to document that some patients may find both the probing procedure and the SRP painful [10, 13, 14, 16, 18]. However, in periodontics, periodontal probing is applied without anesthetic, while SRP is performed with or without anesthetic [3, 10, 14, 18]. Therefore, if the therapist knows the pain responses during periodontal probing and SRP, he or she may take precaution against pain and estimate the degree of pain according to gender, age, and different locations in the same mouth.

The purpose of the present study was to assess the degree of pain during periodontal probing and SRP according to age, gender, and intersubject variation such as tooth type (incisors and molars), tooth surfaces or regions of mouth (facial and oral), probing depth, and bleeding on probing.

Materials and methods

Patients

The present study was carried out on 64 patients (32 women and 32 men) with a mean age of 37.3±18.6 years (median, 37.1; range, 18–76 years) who presented to the department of Periodontology (Ataturk University, School of Dentistry) for the treatment of chronic periodontitis. The patients were a convenient sample from Turkish local population. The criteria used in selecting patients were: generally in good health, ability to understand verbal or written instructions, presence of incisors and two molars in all four maxillary/mandibular quadrants, no use of systemic medications (i.e., sedative, muscle relaxant, anti-inflammatory medication and narcotic analgesic within the past 3 months), no record of allergies, no dentin sensitivity as by thermal and tactile stimulation. Patients were excluded if they had received periodontal therapy up to 12 months earlier, contributing dental conditions (such as active orthodontic treatment, restoration, partial dentures, pulpal pathology), smoker, or were known to be pregnant. Informed consent was obtained, and each patient was given a detailed description of the procedure.

Clinical examination and measurements

All clinical periodontal measurements were made by an experienced periodontist. Probing pocket depth (PPD) was measured as the distance from the free gingival margin to the base of the pocket. Probing clinical attachment level (CAL) was determined by measuring the distance from the base of pocket to the cement–enamel junction. Dental plaque was scored as being present or absent at the four points (mesial, buccal, lingual, and distal) on each tooth. Bleeding on probing (BOP) was also recorded. BOP was expressed as the percentage of sites showing bleeding. PPD and CAL were measured using a Florida probe (Florida Probe Corporation, Gainesville, FL) exerting a constant force of 20 gr at the same six sites on each tooth (mesio-buccal, mesio-lingual, disto-buccal, mesio-lingual, mid-lingual, and disto-lingual).

Patient records were reviewed, and facial sites of incisor teeth and molar teeth in all four maxillary/mandibular quadrants were considered as test teeth. Then, VAS scores during periodontal probing for facial site of each test tooth were obtained. Intra-examiner variability in using the dental examination criteria was tested by performing duplicate examinations on 12 randomly selected patients on consecutive days. Corresponding percentages of agreement were 91% for probing depth and bleeding and 87% for clinical attachment level.

Treatment

After the clinical examination and VAS measurement during periodontal probing, instruction on how to brush the teeth was given to each patient. All root surfaces were treated with a standardized curette pack that consisted of Gracey 1–2, 3–4, 5–6, 7–8, 9–10, 10–11, and 13–14 curettes (Hu-Friedy), which were sharpened before use. Treatment continued until the periodontist felt that the root surfaces were hard and smooth. There were no time limits for treatment. Meanwhile, VAS scores during instrumentation with SRP for site of each test tooth were obtained.

Pain assessment

Pain of patients during both periodontal probing and SRP was measured using a visual analog scale. VAS was administered in standard manner, with the initial explanation given by the same periodontist. All patients were asked to define their level of pain during both periodontal probing and SRP for site of each tooth using a VAS consisting of equal units from 0 to 100. On this scale, 0 and 100 represented “no pain/ discomfort” and “worst pain/discomfort imaginable”, respectively. Each patient was allowed to rest quietly for 5 min between quadrants before both probing and SRP. Pain assessments were performed in the same clinic, free of extraneous noise, music or conversation, and in the morning. An individual VAS assessment required approximately 3 s. VAS assessments progressed from site to site at 20-s intervals. Reproducibility for the VAS was completed on two occasions by ten patients. There was strong correlation between the two responses of both procedures (Spearman’s $\rho>0.89$, $p<0.0019$).

Data analysis

The data were not normally distributed and, accordingly, non-parametric techniques were used throughout the statistical analysis. The Mann–Whitney U test was used for comparisons between the VAS scores for the level of pain during periodontal probing and SRP by gender. The Kruskal–Wallis one-way analysis of variance was used followed by the Mann–Whitney U test employing the Bonferroni correction to evaluate the differences among the age groups. An analysis of covariance was used to remove the influence of bleeding on probing (controlling for

Table 1 Demographic characteristics and clinical dental variables in patients

Variable	Male n=32	Female n=32	P value	Total n=64
Age (mean±SD)	37.6±18.3	38.1±18.1		37.3±18.6
18–34 (n)	10	10	NS	20
35–44 (n)	8	8	NS	18
45–54 (n)	7	7	NS	14
55–76 (n)	7	7	NS	14
Education n (%)				
High school or less	10 (31.3)	10 (31.3)	NS	20 (31.3)
Some college/university	13 (40.6)	13 (40.6)	NS	26 (46.6)
University graduate	9 (28.1)	9 (28.1)	NS	18 (28.1)
Dental parameters				
Number of teeth (mean±SD)	22.6±7.4	23.4±6.9	0.828	23.1±7.9
Decayed (mean±SD)	6.3±5.3	5.8±4.7	0.723	6.1±6.7
Periodontal parameters				
Mean PD (mm)	3.6±0.5	3.5±0.6	0.542	3.6±6.5
Mean CAL (mm)	3.9±0.6	3.8±0.5	0.653	3.9±0.7
% of sites				
PPD sites ≥4 mm	19.2±11.7	17.1±9.7	0.110	17.9±12.9
CAL ≥3 mm	22.5±13.2	20.7±11.9	0.103	20.4±14.2
% sites with plaque	57.9±21.4	54.9±22.8	0.343	55.4±25.2
% sites exhibiting BOP	24.6±13.9	22.7±11.8	0.257	23.1±15.2

p>0.05
PPD Probing pocket depth, *CAL* clinical attachment level, *BOP* bleeding on probing, *NS* not significant

percentage of bleeding on probing). The Wilcoxon signed rank test was used for comparisons of the mean VAS scores concerning the level of pain during periodontal probing and SRP according to tooth type, tooth surfaces or regions of mouth, probing depth, and bleeding on probing. Association between age and VAS responses was determined with Spearman rank correlation coefficient.

Results

Demographic characteristics and clinically dental variables in patients are shown in Table 1. There were no significant differences in mean age, age groups, and education level between female and male patients (p>0.05). Table 1 also displays the clinical dental and periodontal variables by gender. The number of present teeth, decayed teeth in female and male patients was similar (p>0.05). Similarly, no significant differences were found in all periodontal variables between female and male patients (p>0.05).

The mean VAS scores concerning the level of pain during periodontal probing and SRP by gender are given Fig. 1. The mean VAS score during periodontal probing in all patients was 14.3±13.6. Corresponding score for SRP was 15.2±14.7. The mean VAS scores during periodontal probing for female and male were 15.0±14.6 and 13.7±12.6, respectively. These values were not statistically different. Similarly, these scores during SRP were 17.7±13.9 in females and 14.9±15.6 in males (p>0.05).

Comparison of mean VAS scores among age groups of patients is shown in Table 2. We found that both patients aged 18–34 years and aged 35–44 years had increased mean VAS scores when compared to other two age groups after adjusting for bleeding on probing (p<0.05).

Spearman rank correlation coefficient was calculated between age and VAS scores (Table 3). The VAS scores decreased with increasing age for periodontal probing and SRP. Spearman ρ, −0.301 and −0.348, respectively (p<0.014 and p<0.005).

The mean VAS scores concerning the level of pain during periodontal probing and SRP according to tooth type, tooth surfaces or regions of mouth, probing depth, and bleeding on probing in female and male patients are given Table 4. The mean VAS scores for incisor sites and molar sites during probing in all patients were measured as 17.3±

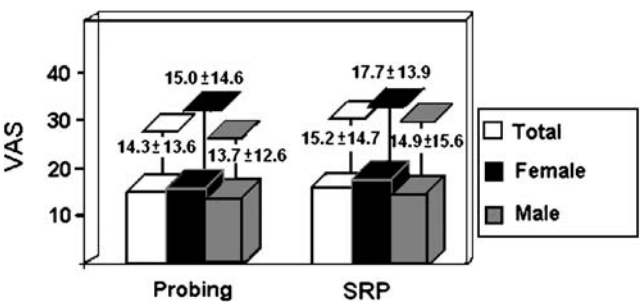

Fig. 1 The mean VAS scores concerning the level of pain during periodontal probing and SRP by gender. *VAS* Visual analog scale, *SRP* scaling and root planing

Table 2 Comparison of mean VAS scores among age groups: ANCOVA model controlling for bleeding on probing

Procedure	Age groups							
	(18–34)		(35–44)		(45–54)		(55–76)	
	(*n*)	mean±SD	(*n*)	mean±SD	(*n*)	mean±SD	(*n*)	mean±SD
Periodontal probing								
Total	(20)	19.1±9.6*	(16)	17.3±6.2*	(14)	10.6±6.3	(14)	10.1±5.7
Female	(10)	20.2±8.7*	(8)	19.1±6.7*	(7)	11.2±6.7	(7)	10.2±5.3
Male	(10)	17.2±7.2*	(8)	16.4±8.6*	(7)	10.5±5.6	(7)	9.9±5.6
SRP								
Total	(20)	20.1±9.0*	(16)	18.6±8.1*	(14)	11.6±6.7	(14)	10.9±6.3
Female	(10)	21.6±9.7*	(8)	19.6±9.7*	(7)	12.8±5.8	(7)	11.8±5.7
Male	(10)	18.1±7.6*	(8)	17.1±7.9*	(7)	10.1±5.9	(7)	10.3±6.6

VAS Visual analog scale, *SRP* scaling and root planing
*Significantly different as compared with age groups (45–54) and (55–76); $p<0.05$

14.2 and 11.3±12.2, respectively. During SRP, these mean VAS scores were 18.6±16.1 for incisors and 11.9±12.2 for molars. Differences between these scores for incisor sites and molar sites in both procedures were statistically important ($p<0.05$). Mean VAS scores during probing were considerably lower for oral sites than for facial sites (12.6± 12.9 and 16.4±14.1, respectively; $p<0.05$). The corresponding scores for SRP were 13.1±12.9 and 17.5±15.9, respectively ($p<0.05$).

Mean VAS scores in probing were significantly higher in sites ≥4 mm deep than sites <4 mm deep, 16.7±14.6 and 12.6±12.1,respectively ($p<0.05$). Similarly, sites ≥4 mm deep during SRP exhibited higher mean VAS score as compared to sites <4 mm deep (18.2±15.6 for sites ≥4 mm deep and 13.2± 13.7 for sites <4 mm deep, respectively ($p<0.05$).

In periodontal probing, sites bleeding on probing (mean VAS, 15.9±14.2) had a significantly higher VAS scores than sites no bleeding on probing (mean VAS, 13.9±13.1), which was statistically significant ($p<0.05$). This significant difference was also found between sites bleeding on probing and sites no bleeding on probing during SRP (16.9±13.9 and 14.0±11.4, respectively; $p<0.05$).

Table 3 Association between age and VAS responses

Procedure	ρ^a	*p*
Periodontal probing (total)	−0.301	0.014*
Female	−0.317	0.012*
Male	−0.294	0.015*
SRP (total)	−0.348	0.005**
Female	−0.357	0.005**
Male	−0.342	0.005**

VAS Visual analog scale, *SRP* scaling and root planing
*$P<0.05$
**$p<0.01$
[a] Spearman rank correlation coefficient

The VAS scores during both probing and SRP for same tooth type and tooth surface did not differ between female and male patients. These similar findings were also found in sites with the same probing depth and sites and with the same BOP between female and male patients.

Discussion

The present study provides information about pain experience of patients during the periodontal probing and SRP.

Pain measurement is inherently difficult, as it has both physical and psychological aspects. Subjectively, the true character of the pain experience is not directly accessible to the examiner. In this way, one must rely on the patient's ability to communicate his or her perception and interpretation of the pain. Additionally, physiologic variables may differ widely among individual subjects [33]. Reassurance and psychological support are important to increase patients' confidence and might play a role in their attitudes to pain expectancy. In the present study, considerable efforts were made to reduce patient anxiety during two procedures.

Standardized and controlled laboratory conditions are essential components of studies involving subjective pain evaluation. Environmental factors such as temperature, noise, and extraneous activity potentially influence pain perception [19]. In the present study, test day visits were scheduled at the same time of day. Pain measurements were performed within the same closed dental clinic with distraction-free surroundings. The controlled environment guaranteed an atmosphere conducive to total concentration. Patients were seated in dental chair and allowed an uninterrupted period of 5 min to relax before beginning pain response testing.

Table 4 The mean VAS scores concerning the level of pain during periodontal probing and SRP according to tooth type, tooth surfaces or regions of mouth, probing depth, and bleeding on probing in female and male patients

	Procedures					
	Periodontal probing			SRP		
Variable	Male n=32	Female n=32	Total n=64	Male n=32	Female n=32	Total n=64
Tooth type						
Incisors	16.9±13.3	17.1±12.6	17.3±14.2	18.6±15.3	19.6±15.6	18.6±16.1
Molars	11.0±12.3*	11.6±11.7*	11.3±12.2*	11.6±11.6*	12.3±11.9*	11.9±12.2*
Tooth surface						
Facial	16.1±13.6	16.6±13.3	16.4±14.1	17.1±14.3	17.8±15.3	17.5±15.9
Oral	12.2±12.3*	12.6±12.7*	12.6±12.9*	12.6±12.3*	13.4±12.3*	13.1±12.9*
Probing depth						
Sites ≥4 mm	16.2±13.3	17.0±13.7	16.7±14.6	17.9±14.3	18.6±14.6	18.2±15.6
Sites <4 mm	12.1±11.9*	12.9±12.3*	12.6±12.1*	12.8±13.3*	13.6±12.4*	13.2±13.7*
Bleeding on probing						
Sites with BOP	15.6±13.8	16.1±13.3	15.9±14.2	16.6±12.7	17.1±12.3	16.9±13.9
Sites with no BOP	13.2±12.9*	14.6±13.3*	13.9±13.1*	13.9±10.3*	14.6±10.9*	14.0±11.4*

VAS Visual analog scale, *SRP* scaling and root planing, *BOP* bleeding on probing
*$p<0.05$, significant differences between two tooth type, two different tooth surface, different probing depth, and sites with/with no BOP (bleeding on probing).

The VAS in this study was used to evaluate pain of patients. This scale has previously been shown to be simple to administer, reliable, and valid [2, 26] and has been used to evaluate dental pain [11, 28]. The VAS has also been employed in previous studies evaluating pain from periodontal therapies [10, 13, 18].

In the present study, the mean VAS score during periodontal probing in all patients was 14.3. Corresponding score for SRP was 15.2. Karadottir et al. [16] reported the mean VAS scores of 17.6 and 13.7 during probing by hygienist group 1 and hygienist group 2. They explained that these corresponding scores for SRP were 15.1 and 10.8, respectively. In one study performed by using VAS during SRP without anesthetic, Matthews and McCulloch [18] determined that VAS score was 10.6. The VAS score obtained from our study falls within these ranges.

The present study showed that there was no difference between genders during both periodontal probing and SRP. This is not in agreement with reports showing females to have greater sensitivity and lower tolerance of pain than males [19]. This difference between genders has been reported in periodontal probing [16] and experimental dental pain [15] and postoperative dental pain [27]. However, Strahan and Glenwright [29] could not find a statistically significant difference in pain between genders after periodontal surgery. Similar results were also obtained in response to SRP for periodontal practices [9, 16]. The reasons for the lack of difference between genders in the present study are not clear, but it is possible that the very low levels of discomfort reported mean that no significant differences exist within the Turkish patients studied.

The results demonstrated that the VAS scores decreased with increasing age for periodontal probing and SRP. In other words, the reported level of discomfort decreased with age in the patients studied. This study reflects that the VAS value is lower in older adult patients (aged 18–34 years and aged 35–44 years) compared the with other two age groups (45–54 and 55–76). A general clinical impression is that elderly people are usually more tolerant to pain. Age is one of the biological factors that have been discussed as important for pain experience [9]. A higher pain threshold in elderly subjects may be a consequence of tissue changes such as reduced vascularity, fatty degeneration of bone tissue [17], and secondary dentin formation [20]. Our finding is in accord with the previous reports.

One of the purposes of the present study was to evaluate to what extent the patients' pain responses were related to various clinical findings or intersubject variation such as tooth type, tooth surfaces or regions of mouth, probing depth, and bleeding on probing. In the present study, sites bleeding on probing had significantly higher VAS scores than sites no bleeding on probing during both periodontal probing and SRP. It is known that pain "experience" can be locally altered by thermal, chemical, or mechanical disturbances of the tissues in question [12, 14]. The presence of inflammation is an example of a noxious event, which can sensitize nociceptors and lower their threshold of activation. Within the gingiva, the presence of inflammation has been shown to increase pain sensitivity during periodontal probing by modifying the response properties of nociceptor [7, 13, 14]. Our results may be explained by the aforementioned studies.

Mean VAS scores during both probing and SRP were considerably lower for oral sites than for facial sites. Similarly, incisor sites (anterior tooth sites) had higher VAS scores than molar sites (posterior tooth sites). These conditions may be the result of differences in innervation patterns [14, 21, 24]. From classical previous knowledge, it is obvious that within gingival tissue, the density of nerve ending appears to be greater in the anterior region of the mouth than in posterior areas [8, 14, 21, 30]. These findings are similar and in agreement with Heins et al. [14] who reported that sulci in the anterior part of the mouth appear more painful to probing than sulci in the posterior part of the mouth.

Date from this study indicated that mean VAS scores in probing were significantly higher in sites ≥4 mm deep than sites <4 mm deep. During instrumentation, similarly, sites ≥4 mm deep exhibited higher mean VAS score as compared to sites <4 mm deep. It was reported that deep pocket might cause release of inflammatory mediators [22, 31]. In such condition where inflammation was present, the possibility of exceeding a patient's probing pain would become even more likely [31, 32]. Watts [32] reported that the pain threshold for untreated periodontal diseased sites during probing might be lower. Karadottir et al. [16] found out a positive relationship between percentage of probing depth ≥4 mm and the pain responses to SRP. In conclusion, the results of the present study showed that although there is no difference between genders, the intensity of pain during periodontal probing and SRP was different dramatically between patients as well as vary between different locations in the same mouth. Further studies are needed to clarify the parameters of the probing and SRP pain experience. If pain responses for probing in different several region (tooth types, different tooth surfaces, different probing depths and sites with/with no BOP) in the same mouth during initial examination were noted into patient chart used for initial examination, the dentists will recognize patients with elevated pain responses. If need be, they will then apply some pain control medication or anesthetic for these patients during probing and SRP.

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