

# Surgical Versus Non-Surgical Periodontal Treatment: Psychosocial Factors and Treatment Outcomes

Paul W. Kloostra,\* Robert M. Eber,† Hom-Lay Wang,‡ and Marita R. Inglehart†

**Background:** This research explored how patients with surgical versus non-surgical periodontal treatment differ in trait anxiety, depression, perceived stress, and well-being on the day of surgery and in their reported pain and use of pain medication 2 and 4 weeks after treatment. In addition, it was investigated how psychosocial factors affected reported pain, use of pain medication, and wound healing.

**Methods:** Data were collected from 70 dental patients (34 males and 36 females; average age: 54.79 years; SD = 13.206) on the day of their periodontal treatment and 2 and 4 weeks after this treatment. The psychosocial factors (i.e., trait anxiety, depression, perceived stress, and well-being) were measured with standardized scales. The patients' providers assessed their wound healing 2 weeks after treatment.

**Results:** On the day of treatment, non-surgical patients had higher anxiety, depression, and stress, and poorer well-being than surgical patients. However, surgical patients reported a higher level of pain during the second week, and greater consumption of analgesics during the second and fourth week. Anxiety, depression, stress, and well-being correlated with the reported level of pain, the use of pain medication, and wound healing after periodontal treatment.

**Conclusions:** Psychosocial factors (i.e., anxiety, depression, stress, and well-being) can affect the patients' quality of life on the day of periodontal treatment and the pain experience and medications used after surgical and non-surgical periodontal therapy (4-week period). Patient-provider communication should address the role of these factors in the treatment process. *J Periodontol 2006;77:1253-1260.*

## KEY WORDS

Anxiety; depression; pain; stress; wound healing.

The effectiveness of periodontal therapy has been well established in clinical studies that demonstrated the efficacy of surgical procedures in treating periodontal disease.<sup>1,2</sup> Longitudinal studies explored the outcomes of periodontal therapy such as scaling and root planing versus scaling and root planing followed by soft tissue surgery.<sup>2</sup> However, these studies focused primarily on objective clinical treatment outcomes such as gains in attachment levels, the efficacy of methods, and the relationship between periodontal pockets and periodontal attachment and only rarely on how these treatments affect the quality of life of patients and the amount of pain they experienced. If pain experiences after periodontal therapy were investigated, a rather short-term perspective was considered.<sup>3</sup> In addition, patients differ in the degree to which they experience anxiety, depression, stress, and impaired well-being when they face and experience periodontal treatment. Although research has explored the relationships between stress and coping styles and periodontal disease,<sup>4,5</sup> little is known about how treatment affects a patient's state of mind and how these psychosocial factors, in return, affect periodontal treatment outcomes such as wound healing, experienced pain, and the use of pain medications.

\* School of Dentistry, University of Michigan, Ann Arbor, MI.

† Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan.

‡ Graduate Periodontics, Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan.

### **Anxiety**

Research on patient responses to surgery showed that patients with increased preoperative anxiety and greater expectations of pain experienced greater postoperative pain.<sup>6</sup> Patients who were given psychological interventions aimed at reducing anxiety and stress reported significantly less postoperative pain when undergoing periodontal surgery compared to patients who did not receive these interventions.<sup>7</sup> Research also showed that patients who learned about non-pharmacological strategies to manage pain used less pain medication to reduce the pain.<sup>8</sup> In general, it seems justified to summarize the relationship between anxiety and pain as anxiety being a predictor of pain.<sup>9,10</sup>

There is also empirical support for the hypothesis that anxiety affects wound healing. For example, patients using relaxation-guided imagery exhibited less anxiety and less wound inflammation after surgical procedures than patients not using these techniques.<sup>11</sup> George et al.<sup>12</sup> and George and Scott<sup>13</sup> also demonstrated that giving surgery a more positive meaning improved patients' acceptance of their condition, made their expectations more positive, and reduced anxiety about recovery, which resulted in improved wound healing. In addition to reducing wound healing, higher levels of anxiety were associated with an increased severity of periodontal disease.<sup>14,15</sup>

### **Depression**

Research showed that depression was directly correlated with postoperative pain<sup>16,17</sup> and the amount of analgesics needed to arrest pain. Patients whose depression was treated with antidepressants reported a decreased severity of postoperative pain compared to depressed patients without medication.<sup>16</sup> Field et al.<sup>18</sup> found that patients receiving therapeutic massages prior to burn debridement reported less pain, decreased depression, and better long-term outcomes. Eggen<sup>19</sup> showed that depressed patients were likely to report more pain and to use more analgesic drugs than non-depressed patients.

Research showed that depression was not only related to the amount of pain patients reported<sup>16,17</sup> and the amount of medication used,<sup>19</sup> but that it also affected patients' wound healing. Cole-King et al.<sup>20</sup> were able to establish that depressed patients displayed delayed wound healing compared to non-depressed patients. In addition, Elter et al.<sup>21</sup> found that clinical depression had a negative effect on periodontal treatment outcome 1 year after therapy.<sup>21</sup> In a study exploring factors affecting patients with different types of periodontitis (rapidly progressive periodontitis, chronic periodontitis, and patients without any significant periodontal destruction), depression was found to be a significant factor in distinguishing between patients in these three groups.<sup>22</sup>

### **Stress**

Stress also played an important role in predicting severity of pain, periodontal disease, and wound healing. Presurgical distress contributed to the post-surgical outcomes of patients, including pain intensity.<sup>23</sup> Periodontal disease was affected by stress and the ability of patients to use effective coping methods.<sup>24,25</sup> Research also showed that stress affected wound healing and acute necrotizing ulcerative gingivitis.<sup>26</sup> Patients experiencing stress were less likely to recover as quickly from periodontal surgery compared to patients not experiencing stress.<sup>27</sup> In addition, healing after periodontal surgery was also negatively impacted by the inability of patients to use effective coping mechanisms.<sup>28</sup> Research also showed that increased stress modulated the progression of periodontal inflammation.<sup>29</sup> This result was due to increased interleukin 1, 4, and 8, which in turn resulted in greater periodontal destruction.<sup>30</sup> Research by Kiecolt-Glaser et al.<sup>31</sup> found reduced cellular immune responses under stress and, as a consequence, delayed healing of punch biopsies. Extensive research findings supported the hypothesis that there is a relationship between chronic stressors, such as caring for a debilitated relative, and delayed wound healing.<sup>32</sup>

In summary, prior research findings support the hypotheses that anxiety, depression, and stress affect the degree of experienced pain, the use of pain medication, and wound healing after surgical treatments. The purpose of this study was therefore to determine 1) whether patients receiving surgical versus non-surgical periodontal treatment differed in their anxiety, depression, stress, and well-being on the day of treatment; 2) whether they differed in their self-reported pain and use of pain medication 2 and 4 weeks after the treatment; and 3) whether there was a relationship between anxiety, depression, stress, and well-being and self-reported pain, the use of pain medication, and wound healing during the 4 weeks after the treatment.

## **MATERIALS AND METHODS**

The Institutional Review Board for the Health Sciences, University of Michigan, approved this case series prospective study of self-reported outcomes.

### **Respondents**

Seventy-three patients who arrived for regularly scheduled surgical or non-surgical periodontal treatment at the Graduate Periodontic Clinic, School of Dentistry, University of Michigan, were asked to volunteer to participate in this study. Seventy patients (34 males and 36 females) agreed to participate (response rate: 95.89%) and responded to a baseline survey. Fifty-five patients (78.57%) participated in

all three surveys (at baseline and weeks 2 and 4), 12 patients did not participate in the week 2 follow-up survey (two patients refused; 10 patients could not be reached by phone), and 11 patients did not respond to the week 4 follow-up survey (three patients refused; eight patients could not be reached by phone). Table 1 provides an overview of the frequencies of male versus female respondents at these three assessment points and information about their ages and types of treatment received. The ages of patients ranged from 19 to 81 years (average age = 54.79 years; SD = 13.206). Twenty-one patients (30%) were treated with scaling and root planing, and 49 patients received surgical treatment.

### Procedure

When patients arrived at the Graduate Periodontic Clinic for their regularly scheduled periodontal treatment appointments, they were informed about the study and asked to volunteer to participate. Upon obtaining written consent, patients responded to the baseline survey before their scheduled treatment. At the patients' 2-week follow-up appointment, they were asked to respond to the first follow-up survey. The wound healing of patients was assessed at the 2-week follow-up appointment by their providers. If the patients were not able to complete the survey at the 2-week follow-up appointment or did not have a follow-up appointment, they were contacted by phone. A final survey assessing pain and the use of pain medication was administered 4 weeks after surgery in a phone interview.

### Measures

Anxiety, depression, stress, and well-being were assessed with standardized, reliable, and valid instruments. Trait anxiety was measured (four-point answering scale ranging from 1 = "low" and 4 = "high

anxiety") with the state-trait anxiety inventory (STAI).<sup>33</sup> Depression was determined (three-point answering scale ranging from 1 = "hardly ever depressed" and 3 = "most of the time depressed") with the short version of the Center for Epidemiologic Studies depression scale.<sup>34</sup> Stress was measured (five-point answering scale ranging from 1 = "never" and 5 = "always stressed") with the perceived stress scale.<sup>35</sup> Subjective well-being was assessed (five-point answering scale ranging from 1 = "low well-being" and 5 = "high well-being") with the affect balance scale.<sup>36</sup> Pain was measured in two ways. First, pain severity was assessed using the present pain index from the McGill pain questionnaire.<sup>37</sup> This pain index consists of six words describing the severity of pain: 0 = "no pain," 1 = "mild," 2 = "discomforting," 3 = "distressing," 4 = "horrible," and 5 = "excruciating pain." The respondents had to choose the adjective that best described the severity of their pain on the days that the week 2 and week 4 surveys were given and during the previous weeks. Second, the respondents also described the level of their experienced pain on the days that the week 2 and week 4 surveys were given and during the previous weeks by using an 11-point scale ranging from 0 = "no pain" to 10 = "worst pain possible."

In addition, the patients indicated on the week 2 and week 4 surveys which pain medication they had used and how much 1) on the day the survey was given, and 2) during the week prior to that day. The providers responded to a survey at the week 2 follow-up visit and described their surgical patients' wound healing. They indicated the level of wound healing (primary, secondary, or tertiary), the degree of inflammation and swelling (none, mild, moderate, and severe), epithelialization (complete and incomplete), and wound integrity (no tissue sloughing, minor tissue sloughing at wound edge only, and major tissue sloughing).

**Table 1.**

### Frequencies and Percentages of Patients Responding to the Three Surveys and Personal Characteristics of These Patients

	Baseline Survey	Week 2 Survey	Week 4 Survey
N respondents	N = 70 (100%)	N = 58 (82.86%)	N = 59 (84.29%)
Gender			
Male	34 (48.57%)	28 (48.28%)	28 (47.46%)
Female	36 (51.43%)	30 (51.72%)	31 (52.54%)
Average age (years)	54.8 (SD = 13.21)	55.1 (SD = 12.92)	55.0 (SD = 13.19)
Age range	19 to 81 years	19 to 81 years	19 to 81 years
Non-surgical	21 (30%)	16 (27.59%)	16 (27.12%)
Surgical	49 (70%)	42 (72.41%)	43 (72.88%)

### Statistical Analyses

Two types of analyses were conducted. First, group comparisons between the patients in the non-surgical group (scaling and root planing) and the patients in the surgical group were conducted for each point in time (baseline and 2 and 4 weeks). Independent sample *t* tests were conducted to compare the average anxiety, depression, and stress scores (Table 2) of patients with surgical and non-surgical treatments. Second, correlations were computed to assess whether the psychosocial variables (anxiety, depression, and stress) and the outcome

measures (pain, use of pain medication, and wound healing) were correlated.

## RESULTS

The first objective was to assess whether patients receiving surgical or non-surgical periodontal treatment differed in their anxiety, depression, stress, and well-being on the day of treatment. As shown in Table 2, the patients who received surgical treatment had significantly less anxiety on average (1.55 versus 1.85;  $P = 0.018$ ), depression (1.31 versus 1.51;  $P = 0.013$ ), and stress (2.20 versus 2.50;  $P = 0.023$ ) than the patients in the non-surgical group. In addition, the patients in the surgical group experienced greater well-being than the patients in the non-surgical group (3.98 versus 3.40;  $P = 0.001$ ).

The second objective was to compare whether patients who had received surgical or non-surgical periodontal treatment differed in their self-reported pain and the use of pain medication 2 and 4 weeks after the treatment. As illustrated in Table 3, surgical patients reported significantly higher pain (both pain scales) at 2 weeks after treatment than the non-surgical group patients. However, no difference was noted on reported pain on the day that the week 2 and week 4 surveys were administered and during the week previous to the administration of the week 4 survey.

As demonstrated in Table 4, the two groups differed in the amount of pain medication used during week 2 after the treatment. A  $\chi^2$  test showed that the percentage of non-surgically treated patients who did not take medication was significantly higher than the percentage of surgically treated patients (93.3% versus 40.5%;  $P = 0.002$ ). The percentages of surgically treated patients

**Table 2.**

### Average Anxiety, Depression, Stress, and Well-Being Scores of Surgically and Non-Surgically Treated Patients on the Day of Treatment

Variable	Surgery	Non-Surgery	P
Anxiety*	1.55 (SD = 0.319)(N = 43)	1.85 (SD = 0.493)(N = 17)	0.018
Depression†	1.31 (SD = 0.249)(N = 47)	1.51 (SD = 0.353)(N = 20)	0.013
Perceived stress‡	2.20 (SD = 0.484)(N = 48)	2.50 (SD = 0.475)(N = 20)	0.023
Well-being§	3.98 (SD = 0.651)(N = 49)	3.40 (SD = 0.671)(N = 21)	0.001

\* The responses to the trait anxiety scale<sup>33</sup> were given on a four-point answering scale (from 1 = "low" to 4 = "high anxiety").

† The responses to the short version of the Center for Epidemiological Studies depression scale<sup>34</sup> were given on a three-point answering scale (from 1 = "hardly ever depressed" to 3 = "most of the time depressed").

‡ The responses to the perceived stress scale<sup>35</sup> were given on a five-point answering scale (from 1 = "never" to 5 = "always stressed").

§ The responses to the affective balance scale<sup>36</sup> were given on a five-point answering scale (from 1 = "low well-being" to 5 = "high well-being").

**Table 3.**

### Average Pain of Surgically and Non-Surgically Treated Patients After Treatment

	Surgery	Non-Surgery	P
Pain during week 2 after treatment	N = 42	N = 15	0.023
Severity*	1.31 (SD = 1.179)	0.53 (SD = 0.834)	0.046
Level of pain†	2.45 (SD = 2.716)	0.93 (SD = 0.580)	
Pain 2 weeks after treatment			
Severity*	0.55 (SD = 0.889)	0.40 (SD = 0.737)	NS
Level of pain†	0.76 (SD = 1.708)	0.73 (SD = 1.48)	NS
Pain during week 4 after treatment	N = 43	N = 16	NS
Severity*	0.26 (SD = 0.759)	0.06 (SD = 0.250)	NS
Level of pain†	0.54 (SD = 1.653)	0.00 (SD = 0.00)	
Pain 4 weeks after treatment			
Severity*	0.16 (SD = 0.574)	0.06 (SD = 0.250)	NS
Level of pain†	0.33 (SD = 1.210)	0.00 (SD = 0.00)	NS

NS = not statistically significant.

\* The pain severity was assessed with the present pain index from the McGill pain questionnaire.<sup>37</sup> The respondents chose which of the following six words described their worst pain severity experienced: no pain (0), mild (1), discomforting (2), distressing (3), horrible (4), and excruciating (5).

† The respondents described the level of their experienced pain by using an 11-point scale ranging from 0 = "no pain" to 10 = "worst pain possible."

who did not use medication increased from 2 to 4 weeks after the treatment. However, two surgically treated patients still consumed over-the-counter pain medication even 4 weeks after surgery.

**Table 4.**  
**Percentage of Patients Who Did Not Take Any Pain Medication Versus Over-the-Counter Pain Medication Versus Prescription Medication, the Average Reported Amount of Medication Used, and Frequency of Medication Use**

	Surgery	Non-Surgery	P
During week 2	N = 42	N = 15	0.002
Took pain medications: No	17 (40.5%)	14 (93.3%)	0.058
Over-the-counter	14 (33.3%)	0	0.006
Prescription	11 (26.2%)	1 (6.7%)	
How many?	1.70 (SD = 3.244)	0.07 (SD = 0.258)	
How often?	1.58 (SD = 2.022)	0.07 (SD = 0.258)	
After week 2	N = 42	N = 15	0.181
Took pain medications: No	33 (80.5%)	15 (100%)	0.092
Over-the-counter	5 (12.2%)	0	
Prescription	3 (7.3%)	0	
How many?	0.60 (SD = 1.289)	0.00 (SD = 0.00)	
During week 4	N = 43	N = 16	NS
Took pain medications: No	39 (90.7%)	15 (93.8%)	NS
Over-the-counter	3 (7.0%)	1 (6.3%)	NS
Prescription	1 (2.3%)	0	
How many?	0.16 (SD = 0.531)	0.13 (SD = 0.500)	
How often?	0.21 (SD = 0.773)	0.06 (SD = 0.250)	
After week 4	N = 43	N = 16	0.002
Took pain medications: No	41 (95.3%)	16 (100%)	0.051
Over-the-counter	2 (4.7%)	0	
Prescription	0	0	
How many?	0.16 (SD = 0.531)	0 (SD = 0.00)	

NS = not statistically significant.

The third objective focused on the relationships between anxiety, depression, stress, and well-being assessed on the day of surgery and the reported pain and pain medication use of surgical patients and the dentists' assessments of wound healing after the treatment. The results for medication use during week 2 showed that the more depressed patients were, the stronger the pain medication they used ( $r = 0.528$ ;  $P = 0.012$ ) and the more frequently they used pain medication ( $r = 0.497$ ;  $P = 0.030$ ) (Table 5). Two weeks after the treatment, depression was positively correlated with the type of pain medication used ( $r = 0.503$ ;  $P = 0.017$ ) and the amount of pills taken ( $r = 0.471$ ;  $P = 0.027$ ).

At the 2-week follow-up appointment, the providers evaluated the wound healing of patients. Table 5 shows that the trait anxiety of patients correlated significantly with the level of wound healing ( $r = -0.316$ ;  $P = 0.047$ ). In addition, depression correlated with wound epithelialization ( $r = -0.294$ ;  $P = 0.053$ ). There was also a ten-

dency for depression to be correlated with the level of wound healing ( $r = -0.256$ ;  $P = 0.094$ ), and with wound integrity ( $r = -0.288$ ;  $P = 0.064$ ). Stress was significantly correlated with wound integrity ( $r = -0.306$ ;  $P = 0.046$ ), and well-being was correlated with swelling ( $r = 0.311$ ;  $P = 0.035$ ). In summary, there were significant relationships between anxiety, depression, and stress and some of the indicators used to assess wound healing that showed that increased levels of anxiety, depression, and stress can negatively affect some aspects of wound healing.

During the fourth week after the treatment, the levels of depression of patients showed the strongest correlations with the reported severity of pain and level of pain ( $r = 0.561$ ,  $P = 0.007$ ;  $r = 0.569$ ,  $P = 0.006$ , respectively) and with the amount of medication used ( $r = 0.614$ ;  $P = 0.002$ ) and the frequencies of medication use ( $r = 0.689$ ;  $P = 0.000$ ). In addition, the stress levels of patients were also significantly correlated with the descriptions used to describe the pain experienced ( $r = 0.439$ ;  $P = 0.041$ ).

Four weeks after treatment, the depression scores of patients were still significantly correlated with the types of medication used ( $r = 0.650$ ;  $P = 0.001$ ) and the amount of medication used ( $r = 0.503$ ;  $P = 0.017$ ). The stress levels of patients correlated again with the pain descriptors chosen to describe the pain experienced ( $r = 0.423$ ;  $P = 0.050$ ).

## DISCUSSION

Psychosocial factors have been shown to impact wound healing and pain perception.<sup>7,12,16,19,32,38</sup> However, the connection between the body and mind is a topic of much controversy. Current theory suggests that psychosocial factors induce the activation of the peripheral sympathetic system and adrenal medulla. When stimulations are sustained, they can result in the release of glucocorticoids and mineral corticoids, which have direct effects on cellular physiology, leading to reduced wound healing and immune response.<sup>38</sup>

Data from the present study indicated that non-surgically treated periodontal patients had higher levels of psychosocial distress than surgically treated patients on the day of treatment. This finding

**Table 5.**

### Correlations Between Psychosocial Variables and Reported Pain and Pain Medication Use During Week 2, After 2 Weeks, During Week 4, and After 4 Weeks and Dentists' Assessments of Healing at ~2 Weeks After Treatment

	Anxiety	Depression	Stress	Well-Being
During week 2				
Medication: type*	0.385	0.528 ( $P = 0.012$ )	0.237	-0.032
Medication: amount <sup>†</sup>	-0.210	0.083	-0.319	0.425 ( $P = 0.055$ )
Medication: frequency <sup>‡</sup>	0.050	0.497 ( $P = 0.030$ )	0.160	-0.019
After 2 weeks				
Medication: type*	0.138	0.503 ( $P = 0.017$ )	0.071	0.167
Medication: amount <sup>†</sup>	-0.128	0.471 ( $P = 0.027$ )	-0.009	-0.095
Dentists' assessments				
Level of wound healing <sup>§</sup>	-0.316 ( $P = 0.047$ )	-0.256 ( $P = 0.094$ )	-0.196	0.134
Swelling <sup>  </sup>	-0.124	-0.166	-0.032	0.311 ( $P = 0.035$ )
Epithelialization <sup>¶</sup>	-0.214	-0.294 ( $P = 0.053$ )	-0.208	0.267 ( $P = 0.073$ )
Wound integrity <sup>#</sup>	-0.226	-0.288 ( $P = 0.064$ )	-0.306 ( $P = 0.046$ )	0.279 ( $P = 0.067$ )
During week 4				
Pain: severity**	0.363	0.561 ( $P = 0.007$ )	0.439 ( $P = 0.041$ )	-0.350
Pain level <sup>††</sup>	0.412 ( $P = 0.079$ )	0.569 ( $P = 0.006$ )	0.405 ( $P = 0.062$ )	-0.214
Medication: amount <sup>†</sup>	0.153	0.614 ( $P = 0.002$ )	0.354	-0.143
Medication: frequency <sup>‡</sup>	0.153	0.689 ( $P = 0.000$ )	0.271	0.253
After week 4				
Pain: severity**	0.391 ( $P = 0.098$ )	0.297	0.423 ( $P = 0.050$ )	-0.226
Pain level <sup>††</sup>	0.432 ( $P = 0.065$ )	0.301	0.345 ( $P = 0.116$ )	-0.033
Medication: type*	-0.158	0.650 ( $P = 0.001$ )	0.179	-0.130
Medication: amount <sup>†</sup>	-0.125	0.503 ( $P = 0.017$ )	0.060	-0.028

*P* values for the correlations have not been corrected for multiplicity. To apply Bonferroni's correction, multiply *P* values by 68.

\* 0 = none; 1 = over-the-counter; 2 = prescription medications.

† Number of pills taken per dose.

‡ Number of doses per day.

§ 1 = primary; 2 = secondary; 3 = tertiary.

|| 1 = none; 2 = mild; 3 = moderate; 4 = severe.

¶ 1 = complete; 2 = incomplete.

# 1 = no tissue sloughing; 2 = minor tissue sloughing at wound edge only; 3 = major tissue sloughing.

\*\* 0 = none; 1 = mild; 2 = discomforting; 3 = distressing; 4 = horrible; 5 = excruciating.

†† From 0 = no pain to 10 = worst pain possible.

contradicted the expectation that surgical treatment may evoke stronger reactions than non-surgical treatment. One possible explanation for this finding might be that patients presenting for surgery might have received non-surgical treatment previously and, therefore, might have spent more time with the clinician before the day of the surgical treatment. These multiple encounters with the provider may have increased their familiarity and trust in the provider, which in turn may have reduced the anxiety, depression, and stress of patients on the day of the treatment. If a chart review could have been conducted to assess the frequencies of contacts between the patients and their providers, this hypothesis could have been tested. However, these data were not available to the authors. In addi-

tion, if chart-review data were available, another potential explanation for these findings could have been explored. In their study of the treatment decision-making of patients, Patel et al.<sup>39</sup> showed that patients with periodontal disease who decided against recommended surgical treatment and, instead, received non-surgical treatment had higher general and dental anxiety than patients who decided to have surgical treatment. Chart-review data could have revealed if the non-surgically treated patients had decided against a recommended surgical therapy or whether non-surgical treatment was originally recommended to them.

Although the potential explanations for these findings cannot be empirically tested in the present

study, one conclusion seems quite obvious: Positive communication and good rapport between a provider and a patient can reduce a patient's anxiety and stress and thus need to be crucial components of a patient-centered approach to providing surgical and non-surgical treatment.

In addition, these findings also shed light on the long-term psychosocial outcomes of surgical versus non-surgical treatment. The surgical patients reported more pain during week 2 and more frequent use of pain medication than the non-surgical patients during the month after the treatment. Consistent with previous research, there were significant relationships between the psychosocial variables assessed on the day of surgery and various indicators of wound healing. The fact that the psychosocial variables were only assessed on the day of treatment but correlated significantly with pain reports and the reports of pain medication use and wound healing indicators measured during the 4 weeks after treatment should encourage future research that would continuously monitor the psychosocial status of patients and, thus, could provide evidence for an even more direct connection between these psychosocial factors and pain outcomes and wound healing.

One might potentially question whether the significant differences at weeks 2 and 4 were in any way affected by the types of patients who responded to the follow-up surveys versus those who did not respond and, especially, if patients who were more anxious or depressed or stressed at the baseline assessment might have been less likely to participate in the follow-up assessments. However, a comparison of the baseline anxiety, depression, and stress scores of the patients who responded at week 2 and those who did not respond at week 2 and, respectively, of the patients who responded at week 4 versus those who did not respond at week 4 showed that there were no significant differences in the psychosocial factors between the respondents and non-respondents at either point in time.

## CONCLUSIONS

It seems crucial to educate periodontists about the role that psychosocial factors can play in the treatment process. A recent survey with members of the American Academy of Periodontology showed that periodontists reported that their dental education had not prepared them well to consider the role of psychosocial factors such as depression when treating patients (unpublished data). Coping mechanisms and enhanced perceptions of positive outcomes can better a patient's level of wound healing,<sup>12</sup> and future research should focus on developing targeted interventions that periodontists could use to improve the quality of life of their patients during treatment and the treatment outcomes.

## ACKNOWLEDGMENTS

This research was supported by funding from the Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan (to PWK). The authors thank Dr. Laurie McCauley, Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, for her support and Bonnie Loepke and the graduate students in the Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, for their assistance with the recruitment of study participants and the collection of clinical data.

## REFERENCES

- Ramfjord SP, Knowles JW, Nissle RR, Shick RA, Burgett FG. Longitudinal study of periodontal therapy. *J Periodontol* 1973;44:66-77.
- Pihlstrom BL, McHugh RB, Oliphant TH, Ortiz-Campos C. Comparison of surgical and nonsurgical treatment of periodontal disease. *J Clin Periodontol* 1983;10:524-541.
- Pihlstrom BL, Hargreaves KM, Bouwsma OJ, Myers WR, Goodale MB, Doyle MJ. Pain after periodontal scaling and root planing. *J Am Dent Assoc* 1999;130:801-807.
- Genco RJ, Ho AW, Grossi SG, Dunford RG, Tedesco LA. Relationship of stress, distress and inadequate coping behaviors to periodontal disease. *J Periodontol* 1999;70:711-723.
- Hugoson A, Ljungquist B, Breivik T. The relationship of some negative events and psychosocial factors to periodontal disease in an adult Swedish population 50 to 80 years of age. *J Clin Periodontol* 2002;29:247-253.
- Fox E, O'Boyle C, Barry H, McCreary C. Repressive coping style and anxiety in stressful dental surgery. *Br J Med Psychol* 1989;62:371-380.
- Croog SH, Baume RM, Nalbandian J. Pain response after psychological preparation for repeated periodontal surgery. *J Am Dent Assoc* 1994;125:1353-1360.
- Pellino TA, Gordon DB, Engelke ZK, et al. Use of nonpharmacologic interventions for pain and anxiety after total hip and total knee arthroplasty. *Orthop Nurs* 2005;24:182-190; quiz 191-192.
- Feeney SL. The relationship between pain and negative affect in older adults: Anxiety as a predictor of pain. *J Anxiety Disord* 2004;18:733-744.
- Pud D, Amit A. Anxiety as a predictor of pain magnitude following termination of first trimester pregnancy. *Pain Med* 2005;6:143-148.
- Holden-Lund C. Effects of relaxation with guided imagery on surgical stress and wound healing. *Res Nurs Health* 1988;11:235-244.
- George JM, Scott DS, Turner SP, Gregg JM. The effects of psychological factors and physical trauma on recovery from oral surgery. *J Behav Med* 1980;3:291-310.
- George JM, Scott DS. The effects of psychological factors on recovery from surgery. *J Am Dent Assoc* 1982;105:251-258.
- Johannsen A, Asberg M, Soder PO, Soder B. Anxiety, gingival inflammation and periodontal disease in non-smokers and smokers - An epidemiological study. *J Clin Periodontol* 2005;32:488-491.
- Vettore MV, Leao AT, Monteiro Da Silva AM, Quintanilha RS, Lamarca GA. The relationship of stress and anxiety

- with chronic periodontitis. *J Clin Periodontol* 2003;30:349-402.
16. Eremenko AG, Vasserman LI, Leosko VA, Li VF. Postoperative pain syndrome and its relationship with individual psychological features of personality (in Russian). *Anesteziol Reanimatol* 2001;(4):24-25.
  17. Arpino L, Iavarone A, Parlato C, Moraci A. Prognostic role of depression after lumbar disk surgery. *Neurol Sci* 2004;25:145-147.
  18. Field T, Peck M, Krugman S, et al. Burn injuries benefit from massage therapy. *J Burn Care Rehabil* 1998;19:241-244.
  19. Eggen AE. The Tromso Study: Frequency and prediction factors of analgesic drug use in a free-living population (12-56 years). *J Clin Epidemiol* 1993;46:1297-1304.
  20. Cole-King A, Harding KG. Psychological factors and delayed healing in chronic wounds. *Psychosom Med* 2001;63:216-220.
  21. Elter JR, White BA, Gaynes BN, Bader JD. Relationship of clinical depression to periodontal treatment outcome. *J Periodontol* 2002;73:441-449.
  22. Monteiro da Silva AM, Oakley DA, Newman HN, Nohl FS, Lloyd HM. Psychosocial factors and adult onset rapidly progressive periodontitis. *J Clin Periodontol* 1996;23:789-794.
  23. Montgomery GH, Bovbjerg DH. Presurgery distress and specific response expectancies predict post surgery outcomes in surgery patients confronting breast cancer. *Health Psychol* 2004;23:381-387.
  24. Genco RJ, Ho AW, Kopman J, Grossi SG, Dunford RG, Tedesco LA. Models to evaluate the role of stress in periodontal disease. *Ann Periodontol* 1998;3:288-302.
  25. Wimmer G, Janda M, Wieselmann-Penkner K, Jakse N, Polansky R, Pertl C. Coping with stress: Its influence on periodontal disease. *J Periodontol* 2002;73:1343-1351.
  26. Horning GM, Cohen ME. Necrotizing ulcerative gingivitis, periodontitis, and stomatitis: Clinical staging and predisposing factors. *J Periodontol* 1995;66:990-998.
  27. Rozlog LA, Kiecolt-Glaser JK, Marucha PT, Sheridan JF, Glaser R. Stress and immunity: Implications for viral disease and wound healing. *J Periodontol* 1999;70:786-792.
  28. Wimmer G, Kahldorfer G, Mischak I, Lorenxoni M, Kallus KW. Coping with stress: Its influence on periodontal therapy. *J Periodontol* 2005;76:90-98.
  29. Takada T, Yoshinari N, Sugiishi S, Kawase H, Yamane T, Noguchi T. Effect of restraint stress on progression of experimental periodontitis in rats. *J Periodontol* 2004;75:306-315.
  30. Giannopoulou C, Kanna JJ, Mombelli A. Effect of inflammation, smoking and stress on gingival crevicular fluid cytokine level. *J Clin Periodontol* 2003;30:145-153.
  31. Kiecolt-Glaser JK, Marucha PT, Malarkey WB, Mercado AM, Glaser R. Slowing of wound healing by psychological stress. *Lancet* 1995;346:1194-1196.
  32. Marucha PT, Kiecolt-Glaser JK, Favagehi M. Mucosal wound healing is impaired by examination stress. *Psychosom Med* 1998;60:362-365.
  33. Spielberger CD. *Manual for the State-Trait Anxiety Inventory (Form Y)*. Palo Alto, CA: Consulting Psychologists Press; 1983.
  34. Radloff L. The CES-D Scale: A self-report depression scale for research in the general population. *Appl Psychol Meas* 1977;1:385-401.
  35. Cohen S, Williamson GM. Perceived stress in a probability sample of the United States. In: Spacapan S, Oskamp S, eds. *The Social Psychology of Health*. Newbury Park, CA: Sage; 1988:31-67.
  36. Bradburn NM. *The Structure of Psychological Well-Being*. Chicago: Aldine; 1969.
  37. Melzack R. The McGill pain questionnaire: Major properties and scoring methods. *Pain* 1975;1:277-299.
  38. Edwards S. Cellular pathophysiology. Part 1: Changes following tissue injury. *Prof Nurse* 2003;18:562-565.
  39. Patel AM, Richards PS, Wang HL, Inglehart MR. Surgical or non-surgical periodontal treatment: Factors affecting patient decision making. *J Periodontol* 2006;77:678-683.
- Correspondence: Dr. Marita R. Inglehart, Department of Periodontics and Oral Medicine, School of Dentistry, University of Michigan, Ann Arbor, MI 48109-1078. Fax: 734/763-5503; e-mail: mri@umich.edu.

Accepted for publication February 14, 2006.