

ABSTRACT

Background. Although periodontal scaling and root planing, or SRP, is one of the most common procedures used in dental practice, there is little information available about the degree of postprocedural pain associated with it. The authors undertook this study to document the intensity and duration of pain after SRP with a view toward helping practitioners and their patients manage postprocedural discomfort.

Methods. Using the Heft-Parker self-assessment pain scale, 52 adults with moderate periodontitis evaluated their pain before and after SRP conducted with local anesthetic.

Results. After SRP, 28 percent of all patients reported faint-to-weak pain, 18 percent experienced weak-to-mild pain, 28 percent experienced mild-to-moderate pain, 8 percent had moderate-to-strong pain and 8 percent reported strong-to-intense pain. The average time to onset of maximum pain was approximately three hours after SRP, and the average duration of mild or greater pain was about six hours. Upon awakening the morning after SRP, subjects found that pain had returned to pre-SRP levels. Overall, 23 percent of all patients reported self-medicating with analgesics to relieve postprocedural pain. Women self-medicated earlier ($P < .05$) and more often than men (43 percent vs. 10 percent; $P < .05$).

Conclusions. Patients experienced significant duration and magnitude of pain after SRP. This pain peaked between two and eight hours after SRP, lasted about six hours, and returned to pre-SRP levels by the morning after the procedure. Almost 25 percent of all patients self-medicated to relieve pain after SRP, and women took analgesic medication earlier and more often than men.

Clinical Implications. Practitioners should consider using appropriate analgesic drugs to alleviate mild-to-moderate pain after SRP. On the basis of this study, it would appear that an analgesic that has a peak effect two to eight hours after the completion of SRP would be the most appropriate medication. Moreover, it is unlikely that analgesic medication would be needed by most patients beyond the day on which SRP was performed.

COVER STORY

Pain After Periodontal Scaling and Root Planing



Periodontal scaling and root planing, or SRP, is one of the most common procedures used to treat the periodontal diseases. Most practitioners have heard anecdotal reports of pain and discomfort from their patients after undergoing SRP, but there are relatively few data available concerning the specific magnitude or duration of discomfort after these procedures. Matthews and McCulloch¹ used visual analogue scales to compare the perceptions of pain that patients recalled having experienced during previous surgical and nonsurgical periodontal treatments. They reported that surgical procedures resulted in significantly more discomfort than nonsurgical treatment for several outcome measures.

However, the specific magnitude, duration and variability of postprocedural pain perceived by patients in the immediate hours after undergoing periodontal SRP has not been reported. Therefore, we undertook a study to document the intensity and duration of pain immediately after periodontal SRP with a view toward helping practitioners and their patients manage postprocedural discomfort.

BRUCE L. PIHLSTROM, D.D.S., M.S.; KENNETH M. HARGREAVES, D.D.S., PH.D.; OTIS J. BOUWSMA, PH.D., D.M.D.; WILLIAM R. MYERS, PH.D.; MARY BETH GOODALE, B.S., R.D.H.; MATTHEW J. DOYLE, PH.D.

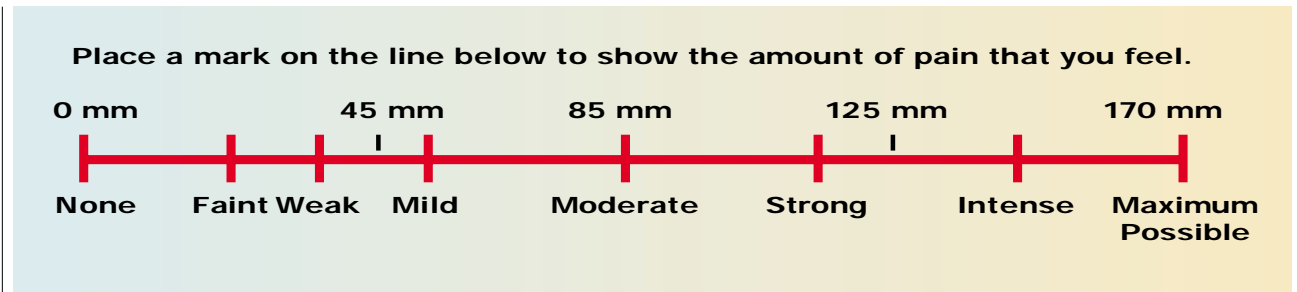


Figure 1. Heft-Parker pain scale³ used for self-assessment of pain. The millimeter demarcations were not shown on pain assessment forms completed by patients.

SUBJECTS AND METHODS

We recruited systemically healthy adult periodontal patients from the predoctoral periodontal clinic at the University of Minnesota School of Dentistry, Minneapolis. All volunteers were required to have 5- to 7-millimeter pocket depths at three nonadjacent proximal sites in at least one quadrant (defined by the American Academy of Periodontology² as Case Type III moderate periodontitis) that required subgingival SRP. Subjects were excluded if they needed antibiotic prophylaxis for subgingival SRP or were taking analgesics, steroids or nonsteroidal anti-inflammatory drugs. Subjects with denture-related soreness of the mouth, gross caries or sensitive teeth also were excluded from participation. We classified subjects as either maintenance or new periodontal patients. Fifty-two patients, 18 to 70 years of age, enrolled in and completed this study, which was approved by the University of Minnesota Institutional Review Board.

Before SRP, each subject completed a dental and medical history and underwent an oral soft-tissue and periodontal examination. Each subject was individually instructed by a single trained research assis-

tant in the use of the Heft-Parker pain scale³ (Figure 1). Using this scale, each subject assessed his or her pain before SRP at time zero (baseline) and at regular intervals after undergoing the procedure.

Each patient who had three

Each patient who had three nonadjacent 5- to 7- millimeter proximal pockets, as specified in the enrollment criteria, underwent scaling and root planing in a single quadrant.

nonadjacent 5- to 7-mm proximal pockets, as specified in the enrollment criteria, received SRP in a single quadrant. This procedure was accomplished, using only hand instruments, by third- or fourth-year dental students under faculty supervision. Local anesthetic (2 percent mepivacaine with 1:20,000 levonordefrin) was administered via infiltration or a nerve block to all patients in varying doses as required for patient comfort.

The criterion for completion

of SRP was complete removal of all supra- and subgingival calculus as judged in a visual and tactile examination by a faculty supervisor using a dental mirror and explorer. The duration of SRP, as well as the time and dose of each anesthetic injection, were recorded. After receiving SRP, patients were comfortably seated in reclining lounge chairs in a room adjacent to the clinic where they could read or watch television. A timer prompted subjects to evaluate their pain at intervals of 15, 30, 60 and 120 minutes after having received SRP. Subjects were dismissed from the clinic two hours after SRP was completed or three hours after the last anesthetic injection, whichever period was longer. They were given take-home pain assessment forms and instructed to complete them at three and four hours after completion of SRP, and every two hours thereafter until bedtime. A final pain assessment was completed by all patients after awakening the following morning. Seven to 10 days after their SRP appointment, subjects returned to the clinic with their pain assessment forms and received a brief oral and periodontal examination to document the occurrence of any possible adverse events associated with the procedure.

TABLE

PATIENTS' PAIN EXPERIENCE.									
PATIENT CATEGORY	PATIENTS REPORTING MAXIMUM PAIN BY CATEGORY (%) [*]						MEAN DURATION OF MILD OR GREATER PAIN (HOURS)	MEAN TIME TO ONSET OF MAXIMUM PAIN (HOURS) [†]	PATIENTS USING ANALGESIC MEDICATION (%)
	0	1	2	3	4	5			
All Patients (n = 52)	10	28	18	28	8	8	6.1	2.8	23
Mandible (n = 26)	12	38	23	15	4	8	5.6	2.7	19
Maxilla (n = 26)	8	17	12	42	13	8	6.3	2.9	27
Maintenance Patients (n = 42)	7	30	20	30	8	5	5.4	2.9	24
New Patients (n = 10)	20	20	10	20	10	20	8.4	2.5	20
Male Patients (n = 31)	10	35	10	32	10	3	6.7	2.6	10
Female Patients (n = 21)	10	16	32	21	5	16	4.9	3.1	43

* Pain categories: 0 = none to faint; 1 = faint to weak; 2 = weak to mild; 3 = mild to moderate; 4 = moderate to strong; 5 = strong to intense.
† As measured on the Heft-Parker pain scale.³
‡ Bracket indicates statistically significant ($P < .05$) difference. (All other comparisons between groups are not statistically significant.)

We used statistical modeling techniques to identify factors that had a significant effect on a given outcome variable, while controlling for other variables in the analysis. Standard linear regression was applied to maximum pain, overall pain and duration of mild pain because of the continuous nature of the responses pertaining to these factors. Logistic regression was used to analyze the probability of taking pain medication. We used survival analysis (log-rank test) to analyze the time to onset of maximum pain and time to taking pain medication. In addition, we used a Wilcoxon signed-rank test at each postprocedural time point to analyze the change in pain from baseline to that time. A step-down Bonferroni method⁴ was used to account for

multiple testing in this latter analysis. We adjusted pain scores for subjects who took analgesic medication by using the pain assessment score from the time interval just before the time of medication for each subsequent interval up to and including the 12-hour time interval. The following factors (independent variables) were considered in the study: procedure site (maxilla or mandible), patient type (new periodontal patient or periodontal maintenance), length of procedure and amount of preprocedural pain.

RESULTS

The Heft-Parker pain scale results are shown in the table. After SRP, 28 percent of all patients reported faint-to-weak pain, 18 percent experienced

weak-to-mild pain, 28 percent experienced mild-to-moderate pain, 8 percent had moderate-to-strong pain and 8 percent reported strong-to-intense pain. The mean duration of mild or greater pain was 6.1 hours, the mean time to onset of maximum pain was 2.8 hours after SRP, and 23 percent of all patients reported using analgesic medication to relieve postprocedural pain. The mean duration of mild or greater pain was marginally, but not statistically significantly, longer in the maxilla than in the mandible (6.3 hours vs. 5.6 hours). New patients tended to have mild or greater pain for a longer mean duration than did maintenance patients (8.4 hours vs. 5.4 hours), but this difference was not statistically significant.

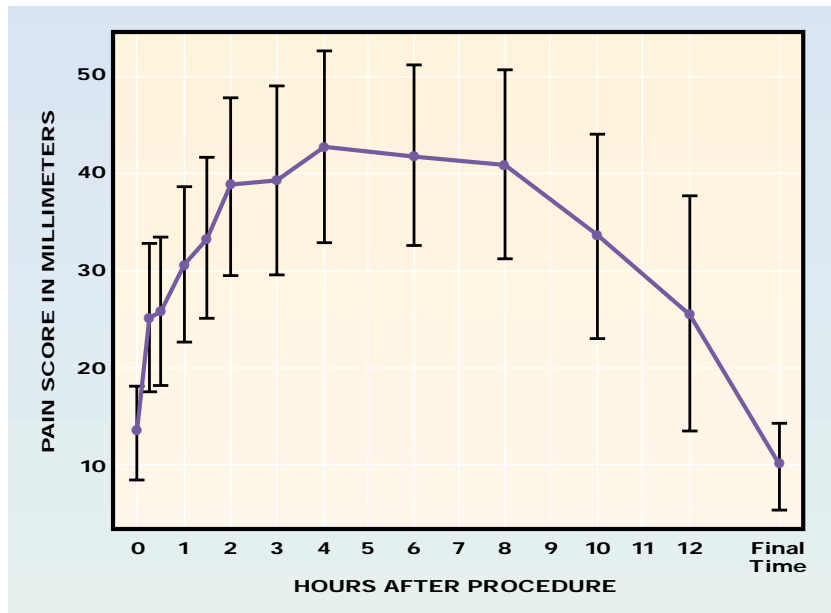


Figure 2. Postprocedural mean pain scores \pm 2 standard errors (95 percent confidence interval) as measured in millimeters using the Heft-Parker pain scale.³ Final time indicates pain reported by patients upon arising on the day after undergoing scaling and root planing.

More women (21 percent) than men (13 percent) reported moderate-to-strong or greater pain (score of 4 or higher), but this difference was not statistically significant. More women took analgesic medication than men (43 percent vs. 10 percent; $P < .05$). The regression coefficient for a sex effect on taking postprocedural analgesic medication was 2.3, which translates into an odds ratio of approximately 10:1. In other words, the odds of women's taking analgesics was about 10 times the odds of men's taking analgesics. Survival analysis indicated no significant differences between men and women in time to maximum pain, but women took medication earlier than men ($P < .05$).

Standard regression analysis indicated that neither the duration of the SRP nor the amount of preprocedural pain was related to the intensity or duration of postprocedural pain. Follow-up examinations, con-

ducted seven to 10 days after completion of SRP, revealed no adverse events associated with this procedure.

Neither the duration of the scaling and root planing nor the amount of preprocedural pain was related to the intensity or duration of postprocedural pain.

Figure 2 displays a pain profile that plots mean pain scores measured in millimeters on the Heft-Parker pain scale over time. Pain peaked between two and eight hours after SRP, with mean scores in the weak-to-mild categorical range, or between 40 and 50 mm to the right of "None" on the 170-mm

linear pain scale (Figure 1). Postprocedural pain was significantly greater ($P < .05$) than that at baseline at all assessment points except at 12 hours and at the final assessment the following morning. Figure 3 shows the frequency distribution of Heft-Parker pain scores. It illustrates, for example, that by one hour after SRP, 10 of the 52 patients (19 percent) experienced mild-to-moderate or greater pain. Four hours after the procedure, 19 of 52 subjects (37 percent) had mild-to-moderate pain or greater. By the time they arose the next morning, only two of the 52 subjects (4 percent) reported at least mild-to-moderate or greater pain. Regarding Figure 3, we should note that limited data are available for the 10- and 12-hour time periods. This is because SRP was performed in both the morning and the afternoon and a full 10 to 12 hours was not available after the late afternoon appointments for assessment of pain. Many patients had retired for the evening before completing their 10- and 12-hour pain diaries. However, all 52 patients completed their final pain assessment diaries on awakening the next morning. Therefore, the time of the final pain assessment varied considerably, depending on the time at which the procedure was completed and the time at which the patients arose the next morning.

DISCUSSION

The perception of pain is highly subjective and varies considerably among individual people. Moreover, as pointed out by Melzack,⁵ the word "pain" refers not only to the intensity of sen-

sation, but also to the unique qualities of pain that render the perception of pain as being different from a variety of sources (that is, pain resulting from a pinprick is perceived as different from pain resulting from a toothache).

Measuring pain's intensity. Regardless of such differences in the perception of pain, intensity is an important dimension of the phenomenon, and a number of methods have been used to measure it.⁵ The categorical scale and the visual analogue scale, or VAS, are two common ways of measuring pain. Huskisson⁶ reviewed the VAS and noted that "it is a simple, robust, sensitive, and reproducible" means of expressing pain numerically, and that the uniformity of its measurements has an advantage in terms of scale sensitivity. However, it was also noted that problems with the VAS include the possible failure of subjects to understand it conceptually, variations in reproducibility along the length of the line, and questions about the relationship of VAS scores to the true pain experience. Based on experimental data relating verbal pain descriptors to intensity of painful stimuli delivered by electrical current, Heft and Parker³ proposed a hybrid scale that incorporated a categorical scale with the VAS. We used the Heft-Parker method³ in this study because it uses elements of both the categorical scale and the VAS.

SRP and intensity of pain. Although periodontal SRP is one of the most common procedures used in dental practice for the treatment of the periodontal diseases, we could find only one study that measured the inten-

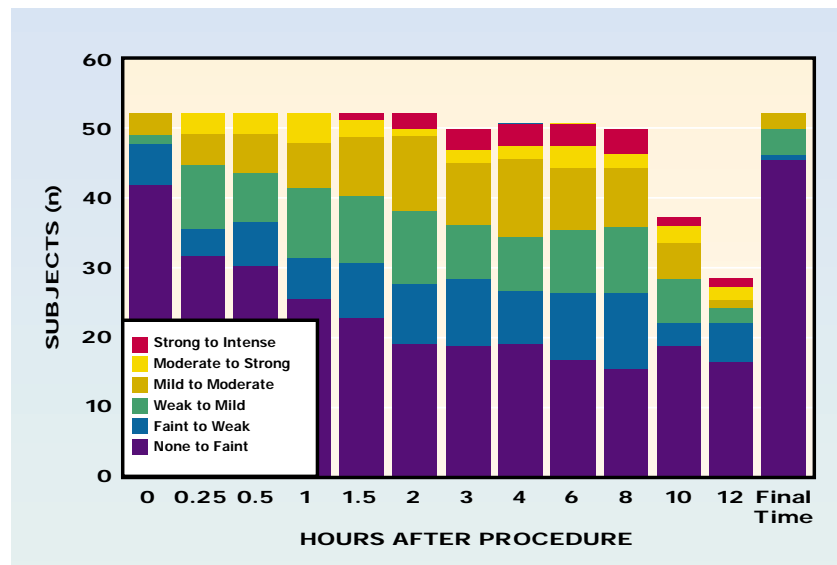


Figure 3. Number of subjects experiencing each category of pain intensity at each postprocedural checkpoint, as indicated on the Heft-Parker pain scale.³ Final time indicates pain reported by patients upon arising on the day after undergoing scaling and root planing.

sity of pain associated with these procedures. Matthews and McCulloch¹ reported that patients undergoing SRP without local anesthesia had

Most people experienced some pain after undergoing scaling and root planing, generally in the faint-to-moderate intensity range.

less pain than when they underwent various types of periodontal surgery. On the basis of our study, it is clear that most people—90 percent—experienced some pain after undergoing SRP and that this pain was generally in the faint-to-moderate intensity range of

the Heft-Parker scale.³ However, it is important to consider that 16 percent of all subjects characterized their pain as being moderate-to-strong or greater. Moreover, 23 percent of all subjects in our study self-medicated to relieve postprocedural pain. Matthews and McCulloch¹ reported that only 6.5 percent of nonsurgical patients in their study took analgesics postoperatively.

The explanation for these studies' differing results may be that only about one-third of the patients in the nonsurgical group described by Matthews and McCulloch¹ received local anesthetic before undergoing SRP. The other two-thirds received no anesthetic before undergoing either an examination or SRP—procedures that resulted in somewhat less postoperative pain than SRP with local anesthesia.¹ In our study, all patients received local anesthetic because it was needed for patient comfort. This may indicate that patients in our study



Dr. Pihlstrom is the Erwin M. Schaffer Professor of Periodontal Research and director, National Institutes of Health/ National Institute of Dental and Craniofacial Research Oral Health Clinical Research Center, 17-116 Moos Tower, School of Dentistry, University of Minnesota, 515 Delaware St. S.E., Minneapolis, Minn. 55455. Address reprint requests to Dr. Pihlstrom.



Dr. Hargreaves is a professor and chair, Department of Endodontics; and a professor, Department of Pharmacology, The University of Texas Health Sciences Center at San Antonio.

required more extensive SRP than those in the study by Matthews and McCulloch.¹

Differences in the use of local anesthetic or in SRP procedures between the two studies, therefore, may account for the differences in analgesic use.

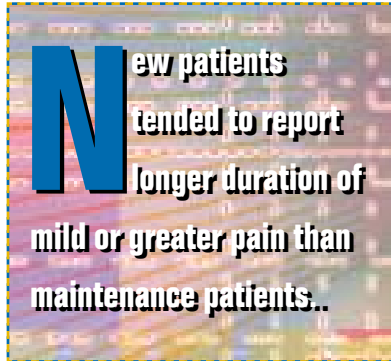
Duration of pain. Pain after SRP exceeded baseline levels as soon as 15 minutes after the procedure and did not return to baseline levels until approximately 12 hours after the procedure. The intensity of pain peaked between two and eight hours after SRP and, although this finding was not statistically significant—new patients tended to report longer duration of mild or greater pain than maintenance patients. This is consistent with the results reported by Matthews and McCulloch,¹ who found that patients with a history of having received periodontal treatment experienced fewer days of pain than those who had not previously received periodontal therapy. Marginal differences in pain between the maxillary and mandibular sites in our study may have been attributable to the use of



When this article was written, Dr. Bouwsma was a senior clinical research scientist, Regulatory and Clinical Development, Worldwide Clinical Investigations, The Procter & Gamble Company, Mason, Ohio. He now is in private practice in Brownsville, Texas, and McAllen, Texas.

mandibular block anesthetic, which creates more profound and longer-lasting anesthesia than does maxillary anesthetic.

The effect of the operators' experience. SRP was performed by dental students using local infiltration or block anesthetic. Therefore, it is pos-



sible that patients in this study had more postprocedural discomfort than they would have had if more experienced operators had performed the SRP. This study was not designed to investigate differences in pain after treatment by operators with varying clinical experience. The influence of operator experience on pain after SRP remains unknown. Pain diaries completed in the first few hours after the last anesthetic injection are influenced by the post-



Dr. Myers is a senior statistician, Department of Biometrics and Statistical Sciences, The Procter & Gamble Company, Mason, Ohio.



Ms. Goodale is an associate scientist, Worldwide Clinical Development, The Procter & Gamble Company, Mason, Ohio.

procedural duration of local anesthesia, which also likely contributed to the average time required for patients to reach onset of maximum pain (2.8 hours).

The need for a control group. Because patients knew they were participating in a pain study, it is possible that their responses may have been exaggerated. They could have been "sensitized" to pain simply by knowing that they were participating in a study of it. In this regard, the use of a control group to assess pain retrospectively might provide a useful comparison. However, questionable recall of relative pain intensities at precise postprocedural time intervals would be a severe limitation of using a retrospective control group.

The sexes and pain perception. It is important to note that female subjects self-medicated earlier ($P < .05$) and more often (43 percent vs. 10 percent; $P < .05$) than male subjects. Also, although this finding is not statistically significant, there was a tendency for more women than men (21 percent vs. 13 percent) to report moderate-to-strong or greater pain. This finding is in accord with those of many other studies that indicate differences in clinical pain experiences between



Dr. Doyle is an associate director and senior researcher, Health Care Research and Development, Procter & Gamble Worldwide, The Procter & Gamble Company, Mason, Ohio.

men and women (see reviews by Unruh⁷ and Miaskowski⁸). Based on a comprehensive review of the literature, Unruh⁷ concluded that women report more severe levels of pain, more frequent pain and pain of longer duration than do men. Women reported a greater magnitude of pain sensation than men in the first few days following cardiac and abdominal vascular surgery.⁹ A study of postoperative pain in children and adolescents noted that although female subjects tended to report a higher intensity of pain, the difference was statistically significant only on the first day after surgery.¹⁰

The mechanism responsible for differences in pain perception between the sexes is unclear. However, there is evidence that sex-related variation in pain perception may be related to sensory factors rather than to attitude or emotional response¹¹ and that increased pain in females, associated with nociceptive stimuli, is associated with pain-related differences in brain activation.¹²

CONCLUSION

In view of our findings, we feel that practitioners should consider using analgesic drugs to alleviate mild-to-moderate pain after SRP. We did not investigate the effect of various analgesic regimens on postprocedural pain. However, the preprocedural use of nonsteroidal anti-inflammatory

medication such as ibuprofen has been recommended for patients undergoing procedures that consistently produce at least moderate pain.¹³

As the magnitude of pain in our subjects did not consistently reach the moderate range, it is unknown if preprocedural dosing would be beneficial for pain after SRP. However, on the basis of this study, it appears that the practitioner should select an analgesic medication whose peak effect occurs two to eight hours after completion of the procedure. Moreover, it would be unusual for an analgesic to be needed by most patients beyond the day on which SRP was performed. For the mild-to-moderate intensity of pain reported by most subjects in this study, over-the-counter analgesic agents such as aspirin, acetaminophen and nonsteroidal anti-inflammatory drugs should be sufficient to control most post-SRP pain. However, the practitioner should bear in mind that some patients experience more severe pain than others. ■

The research reported in this article was supported by the Procter & Gamble Company, National Institutes of Health/National Institute of Dental and Craniofacial Research grant DE09737 and the Erwin M. Schaffer Chair in Periodontal Research, University of Minnesota School of Dentistry, Minneapolis.

Many thanks are due to Michael P. Meredith, Ph.D., and Jiten Sheth, D.D.S., for their assistance in design and analysis; to Lisa F. Schmidt, B.S., and Beverly Huso, C.R.D.A., for their assistance in executing and coordinating this study; to Brandon

Sparks, M.S., for his assistance with graphical presentation of data; and to James Hodges, Ph.D., for his critical reading of the manuscript.

1. Matthews DC, McCulloch CA. Evaluating patient perceptions as short-term outcomes of periodontal treatment: a comparison of surgical and non-surgical therapy. *J Periodontol* 1993;64(10):990-7.

2. American Academy of Periodontology. Current procedural terminology for periodontics and insurance reporting manual: a glossary of terms and procedures designed as a guide for reporting and interpreting periodontal services to third party agencies. 7th ed., rev. Chicago: American Academy of Periodontology; 1997:15.

3. Heft MW, Parker SR. An experimental basis for revising the graphic rating scale for pain. *Pain* 1984;19(2):153-61.

4. Holm S. A simple sequentially rejective multiple test procedure. *Scand J Statistics Theory Applications* 1979;6:65-70.

5. Melzack R. Concepts of pain measurement. In: Melzack R. Pain measurement and assessment. New York: Raven Press; 1983:1-5.

6. Huskisson EC. Visual analogue scales. In: Melzack R. Pain measurement and assessment. New York: Raven Press; 1983:33-7.

7. Unruh AM. Gender variations in clinical pain experience. *Pain* 1996;65(2-3):123-67.

8. Miaskowski C. Women and pain. *Crit Care Nurs Clin North Am* 1997;9(4):453-8.

9. Puntillo K, Weiss SJ. Pain: its mediators and associated morbidity in critically ill cardiovascular surgical patients. *Nurs Res* 1994;43(1):31-6.

10. Savedra MC, Holzemer WL, Tesler MD, Wilkie DJ. Assessment of postoperation pain in children and adolescents using the adolescent pediatric pain tool. *Nurs Res* 1993;42(1):5-9.

11. Feine JS, Bushnell MC, Miron D, Duncan GH. Sex differences in the perception of noxious heat stimuli. *Pain* 1991;44(3):255-62.

12. Paulson PE, Minoshima S, Morrow TJ, Casey KL. Gender differences in pain perception and patterns of cerebral activation during noxious heat stimulation in humans. *Pain* 1998;76(1-2):223-9.

13. Jackson DL, Moore PA, Hargreaves KM. Preoperative nonsteroidal anti-inflammatory medication for the prevention of postoperative dental pain. *JADA* 1989;119(5):641-7.