

# Visual analogue measurement of pain

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## SUMMARY

*Two separate studies were carried out to determine if three visual analogue scales for various feelings including pain could be marked consistently by patients, without reference to previously completed scales.*

*Sixty patients undergoing extraction of their lower third molars had measurements of acute preoperative anxiety, expected postoperative pain and postoperative perceived pain three times in quick succession. There was no significant difference between the three measurements for any of the feelings. Although a correlation was detected between expected pain and preoperative anxiety, there was no meaningful relationship between perceived postoperative pain and expected pain or preoperative anxiety.*

*Eighty patients suffering from a wide range of chronic painful states completed three identical scales for pain, anxiety, depression and mood during their first visit. These measurements were repeated at a later time following a treatment, with the addition of a visual analogue scale for pain relief. Mean scores for anxiety, mood and pain relief were consistent, but mean pain scores were more variable. There was a very close correlation between any two feelings expressed on these visual analogue scales during both the initial and second visits. Litigation or social problems were not associated with increased pain scores.*

## INTRODUCTION

It is widely accepted that subjective methods of determining the "pain experience" are the most valid.<sup>1, 2</sup> Various mood changes occur in the chronic pain situation, in particular depression.<sup>3, 4</sup> Anxiety, on the other hand, tends to be associated with acute pain.<sup>5, 6</sup> Visual analogue scales have been shown to be a simple, reliable means of allowing patients to express their feelings with a high degree of resolution, without resorting to cumbersome questionnaires.<sup>1, 7</sup> The primary aim of this study was to determine if these scales can be marked consistently by patients suffering pain in various situations and to determine if any relationship exists between the expressed emotions and pain.

## METHODS — Study 1

Sixty consecutive patients requiring surgical extraction of their lower third molars were admitted to the study. Patients with mental or physical disabilities rendering them incapable of using a visual analogue scale were excluded. Informed verbal

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consent was obtained. They were not premedicated with a sedative. Immediately prior to the induction of anaesthesia the patients indicated their anxiety and their expected pain using a 10 cm visual analogue scale. Each patient completed these scales twice more without visual reference to the previous scores, so that a total of three independent measures of anxiety and expected pain was obtained in quick succession. Anaesthesia was induced with propofol followed by muscle relaxants to facilitate intubation. Maintenance of anaesthesia was with halothane in nitrous oxide and oxygen. In the recovery room, approximately 30 minutes after the operation, postoperative pain was measured three times, in quick succession, prior to any analgesia being given. The visual analogue scales were : –

Anxiety	: Totally relaxed	— Extremely anxious.
Expected pain	: No pain expected	— Worst pain possible expected.
Postoperative pain	: No pain	— Worst pain possible.

When the operation was over the surgical difficulty was graded — 1. Simple elevation without bone removal, 2. Simple elevation with minimal bone removal, 3. Wide bone removal or tooth section, 4. Wide bone removal and tooth section.

## **METHODS — Study 2**

Eighty consecutive patients referred to a pain clinic were studied. All had suffered pain for four or more weeks but had received little or no benefit from their current therapy. Following interview and examination, the patients were asked to indicate their present pain intensity and psychological state on four 10 cm visual analogue scales. The scales were arranged so that all good experiences were to the same (left) side to avoid confusion during use. Each visual analogue scale was explained as a “thermometer of feeling” and a means of conveying these feelings to others. They were asked to mark the line between the two extremes of experience, to indicate how they felt at that moment. The scales were : –

Pain	: No pain	— Worst pain experienced.
Anxiety	: Totally relaxed	— Extremely anxious.
Depression	: Elated	— Extremely depressed.
Mood	: Feeling great	— Feeling rotten.

Immediately on completion of the four scales the procedure was repeated twice more in quick succession, without visual reference to previous scales. A treatment was then carried out and the three sets of four scales were again completed at a later time, with the addition of a pain relief scale which ranged from complete pain relief to no pain relief. A record was also kept of the diagnosis, pain duration, sleep disturbance, co-existing problems such as litigation, social and psychiatric factors and employment status.

The marking of visual analogue scales can lead to skewing of results at either end of the scale. To correct this and promote a normal distribution, arcsin transformation was carried out on all visual analogue data, permitting parametric statistics to be used.<sup>7</sup> Following transformation, the data was analysed using one-way analysis of variance. Pearson correlation coefficients for untransformed data was used to detect relationships between pairs of variables.

## **RESULTS**

In Study 1 there were 39 female and 21 male patients aged 16–33 years (mean  $22.4 \pm 3.8$  years). There were no significant differences on the first visual

analogue scale presentation between the sexes, between preoperative expected pain or anxiety or postoperative pain. In view of this, the data for males and females has been pooled for all subsequent analyses. Neither was there significant drifting in the marking of the visual analogue scales for any of the three feelings observed, so that the first measure could be used in each case in subsequent analyses.

For each of the four grades of surgical difficulty the mean scores for preoperative anxiety and expected pain and postoperative perceived pain varied from 41 to 68 but analysis of variance showed no significant differences (Table I). There was a trend, which did not reach significance, for the mean expected pain scores to be higher in the more difficult cases. The only significant correlation between the three variables was obtained between preoperative expected pain and preoperative anxiety ( $r = 0.27$ ,  $p = 0.02$ ), but this accounted for only 7% of the total variation.

TABLE I — Study 1

*Mean results ( $\pm$  SD) on each visual analogue scale by the four grades of increasing surgical difficulty ( $n = 60$ ). Untransformed scores; the analysis of variance was carried out on arcsin transformed scores*

	Surgical difficulty				Analysis of variance	
	1	2	3	4	F	p
n	5	32	17	6		
Expected pain ( $\pm$ SD)	43 ( $\pm$ 3)	52 ( $\pm$ 4)	63 ( $\pm$ 7)	68 ( $\pm$ 10)	1.91	0.14
Preoperative anxiety ( $\pm$ SD)	50 ( $\pm$ 3)	58 ( $\pm$ 6)	41 ( $\pm$ 8)	45 ( $\pm$ 2)	1.91	0.14
Postoperative pain ( $\pm$ SD)	49 ( $\pm$ 4)	52 ( $\pm$ 7)	51 ( $\pm$ 7)	46 ( $\pm$ 10)	0.08	0.97

In Study 2, the chronic pain population aged 17 to 78 years, the 80 patients included 19 (24%) with neuralgias, 16 (20%) with back pain and 8 (10%) with carcinoma. The pain had been present for more than one year in 56 (70%) of patients. No obvious co-existing problems were detected using standard clinical interviews in 49 (61%) of the patients, but 12 (15%) were in the process of litigation related to their pain. A further 16 (20%) had social problems such as marital difficulties. Thirty-one (39%) reported a sleep disturbance and in nine (11%) sleep was grossly upset. Thirty-six were in employment (two self-employed), three were unemployed, 15 were housewives, 16 retired and 10 were receiving sickness benefit. The mean time interval between the first and second consultation was 32 days (range 1 hour — 260 days).

There were some significant differences between the first, second and third tests both at the first and second visits. The first result was lower than the other two for pain scored at the initial visit (Table II). Using transformed scores, analysis of variance showed  $F = 4.49$ ;  $df = 2,158$ ;  $p < 0.05$  between the first, second and third tests. The mean depression scores showed a different pattern before and after treatment,  $F = 5.98$ ;  $df = 2,158$ ;  $p < 0.005$ , the first test result being raised in comparison with the two subsequent tests at the initial visit but not at the second visit. Anxiety, mood and estimated pain relief scores were stable throughout the three tests on both visits and the second set of tests has been used for subsequent analysis.

TABLE II — Study 2

Mean scores ( $\pm$  SD) for each feeling ( $n = 80$ ). Tests 1—3 were carried out at the initial visit and tests 4—6 during the second visit. (Untransformed data)

Test	Pain	Anxiety	Depression	Mood	Pain relief
1	51 ( $\pm$ 28)	49 ( $\pm$ 26)	55 ( $\pm$ 22)	52 ( $\pm$ 26)	—
2	52 ( $\pm$ 26)	49 ( $\pm$ 23)	52 ( $\pm$ 24)	51 ( $\pm$ 23)	—
3	52 ( $\pm$ 25)	49 ( $\pm$ 23)	51 ( $\pm$ 23)	52 ( $\pm$ 23)	—
4	44 ( $\pm$ 25)	45 ( $\pm$ 24)	51 ( $\pm$ 23)	49 ( $\pm$ 23)	49 ( $\pm$ 26)
5	47 ( $\pm$ 24)	48 ( $\pm$ 24)	51 ( $\pm$ 23)	49 ( $\pm$ 25)	49 ( $\pm$ 25)
6	47 ( $\pm$ 24)	46 ( $\pm$ 23)	51 ( $\pm$ 23)	51 ( $\pm$ 25)	49 ( $\pm$ 26)

A stepwise regression was carried out on the variables measured on the first visit with pain as the independent variable. Depression was eliminated as it did not contribute significantly to the regression ( $p = 0.65$ ). The final relationship was expressed as: Pain =  $0.51$  (Mood) +  $0.32$  (Anxiety) +  $10.49$ . (t-test for significance, Mood  $p = 0.001$ ; Anxiety  $p = 0.007$ ; constant  $p = 0.105$ ). This regression accounted for 38% of the variance. Similarly, the relationship for pain relief was determined, eliminating depression ( $p = 0.49$ ); Pain relief =  $0.45$  (Mood) +  $0.24$  (Anxiety) +  $15.35$ . (t-test for significance, Mood  $p = 0.001$ ; Anxiety  $p = 0.051$ ; constant  $p = 0.007$ ), this regression accounting for 37.1% of the variance. Pearson correlation coefficients for the untransformed data from these sets of tests indicated a very close relationship between all combinations of the feelings measured, ( $r = 0.48$  to  $0.79$ ,  $p < 0.001$  in each case).

The mean scores on each of the scales in relation to litigation and social problems are shown in Table III. Although there was a tendency for less pain and anxiety in the litigation group, none of the differences reached significance. Analysis of variance to consider differences due to age, duration of pain, employment status or sleep disturbance revealed no significant effect.

TABLE III — Study 2

Untransformed mean ( $\pm$  SD) scores of each visual analogue scale for legal or social coexisting factors. ( $n = 77$ , 3 unclassified). The analysis of variance was carried out on transformed data ( $df = 2, 74$ )

	<i>n</i>	Pain	Anxiety	Mood	Depression
Nil	49	54 ( $\pm$ 29)	49 ( $\pm$ 26)	49 ( $\pm$ 26)	48 ( $\pm$ 26)
Legal	12	46 ( $\pm$ 24)	45 ( $\pm$ 16)	54 ( $\pm$ 14)	55 ( $\pm$ 14)
Social	16	52 ( $\pm$ 20)	53 ( $\pm$ 18)	51 ( $\pm$ 18)	58 ( $\pm$ 21)
Total	77	52 ( $\pm$ 26)	49 ( $\pm$ 23)	50 ( $\pm$ 23)	51 ( $\pm$ 24)
F		0.58	0.52	0.16	0.85
p		0.56	0.60	0.86	0.43

## DISCUSSION

The study of acute pain patients indicated that the visual analogue scales for each feeling were marked consistently and that one scale for each variable should suffice. This was not the case in the study of patients suffering chronic pain, where anxiety, mood and pain relief were consistently marked but pain and depression were not. Although the change detected for the latter two modalities was small (approximately 2–3% in each case), this may be of practical importance in attempting to detect small but meaningful changes which may be important in assessing chronic pain.

It was surprising that the difficulty of the surgical procedure did not correlate with postoperative pain. This may be because psychological factors play the major role in pain perception, or because the surgical grading scale was too insensitive. Correlation between expected pain and anxiety was not significant, which differs from the results observed by Martinez-Urrutia,<sup>6</sup> possibly because our scales didn't measure what was intended. Although there was a significant correlation ( $p = 0.02$ ) between expected pain and anxiety, this relationship is not likely to be clinically significant as it only accounted for 7% of the variance. Postoperative pain did not correlate with either preoperative expected pain or preoperative anxiety, but might have correlated with postoperative anxiety had this been measured. These results do not necessarily contradict the well established relationship between pain and anxiety.<sup>8</sup> In the study of acute pain the patients all knew its cause. In many previous studies individuals have had to interpret the meaning of their pain, and their anxiety may have been related to the significance and meaning of the pain itself, whereas in this study anxiety was more likely to have been directed towards the procedure.

In the chronic pain study, a relationship was found between pain and anxiety. Here the patients did have to interpret the meaning of the pain, even though there may have been some explanation. The relationship obtained between pain, pain relief and depression would correspond with previous studies, where a depressive affect accounted for a third of pain or pain relief. All of the variables correlated in the chronic pain study and these were analysed to determine if a relationship existed between depression and pain during the first visit, and pain relief during the second visit. A depressive affect was eliminated in each case, perhaps due to patients preferring to express the depression associated with chronic pain as poor mood and not as frank depression.

It is often assumed that in the presence of litigation pain may be exaggerated, perhaps unconsciously.<sup>9</sup> There is increasing evidence that the persistence of pain symptoms is a function of the delay in the settlement of litigation.<sup>10,11</sup> The present results would indicate that pain is expressed as no more severe by those awaiting a court case than in those with social problems, or by those with no other contemporary problems. It would be important to extend the study of the perception of pain to include the time period both before and after the court case.

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