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Memories of chronic pain and perceptions of relief

Jocelyne S. Feine[a,b,c,*], Gilles J. Lavigne[d,e], T.T. Thuan Dao[f], Chantal Morin[a], James P. Lund[a,e,g]

[a]*McGill University Faculty of Dentistry, 3640 University Street, Montreal, QC H3A 2B2, Canada*
[b]*McGill University Faculty of Medicine, Department of Epidemiology and Biostatistics, and Occupational Health, Montreal, QC, Canada*
[c]*Lady Davis Institute for Medical Research, Jewish General Hospital, Montreal, QC, Canada*
[d]*Université de Montréal, Faculté de médecine dentaire, Montreal, QC, Canada*
[e]*Université de Montréal, Centre de recherche en science neurologiques, Montreal, QC, Canada*
[f]*University of Toronto Faculty of Dentistry, Toronto, ON, Canada*
[g]*McGill University Faculty of Medicine, Department of Physiology, Montreal, QC, Canada*

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Abstract

Clinicians and researchers often ask patients to remember their past pain. They also use patient's reports of relief from pain as evidence of treatment efficacy, assuming that relief represents the difference between pretreatment pain and present pain. We have estimated the accuracy of remembering pain and described the relationship between remembered pain, changes in pain levels and reports of relief during treatment. During a 10-week randomized controlled clinical trial on the effectiveness of oral appliances for the management of chronic myalgia of the jaw muscles, subjects recalled their pretreatment pain and rated their present pain and perceived relief. Multiple regression analysis and repeated measures analyses of variance (ANOVA) were used for data analysis. Memory of the pretreatment pain was inaccurate and the errors in recall got significantly worse with the passage of time ($P < 0.001$). Accuracy of recall for pretreatment pain depended on the level of pain before treatment ($P < 0.001$): subjects with low pretreatment pain exaggerated its intensity afterwards, while it was underestimated by those with the highest pretreatment pain. Memory of pretreatment pain was also dependent on the level of pain at the moment of recall ($P < 0.001$). Ratings of relief increased over time ($P < 0.001$), and were dependent on both present and remembered pain (Ps < 0.001). However, true changes in pain were not significantly related to relief scores ($P = 0.41$). Finally, almost all patients reported relief, even those whose pain had increased. These results suggest that reports of perceived relief do not necessarily reflect true changes in pain.

Keywords: Chronic pain; Memory; Relief; Psychophysics

1. Introduction

The diagnosis of many chronic musculoskeletal pain conditions is based in part on the medical history, and a report of chronic pain has traditionally been accepted as the cardinal symptom of these syndromes (Pain and Disability, 1987). Because patients often seek treatment after a particularly painful episode or after a prolonged period of pain, their memory of that pain is frequently used to establish the diagnosis and the treatment regime (Chapman and Brena, 1990). However, there is evidence that the memory of past pain is often inaccurate (Linton and Melin, 1982; Linton and Götestam, 1983; Eich et al., 1985) and that systematic biases in reporting can occur. For instance, (Holroyd et al., 1993) found that recurrent headache sufferers who were experiencing pain reported more frequent headaches during the previous month than did others who were not in pain, although the true incidence of headaches was the same in both groups. Inaccuracies like these could delay definitive diagnosis and lead to inappropriate treatments.

Patients' reports of relief following treatment are often used to establish the effectiveness of a therapeutic approach.

* Corresponding author. Tel.: +514 398 7203/23; fax: +514 398 8900; e-mail: feine@medcor.mcgill.ca

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As well as being routinely used in daily clinical practice, reports of perceived relief have often been used as a primary measure of efficacy in trials of treatments for fibromyalgia (Mathias et al., 1995), low back pain (Marks et al., 1992), craniofacial pain (Benoliel et al., 1994) and arthritis (Berry et al., 1992). Intuitively, memory of pretreatment pain should be a factor in determining the degree of relief that people report when a treatment is felt to be successful. We have formalized what clinicians must believe when they ask patients if they feel better following an intervention: that patients remember their pre-treatment pain, compare this with the current pain and calculate the appropriate level of relief. However, if the remembered pain were exaggerated, as is sometimes the case (Linton and Melin, 1982; Jamison et al., 1989), this may lead to greater feelings of relief and an overestimation of treatment efficacy.

To address this problem, we investigated how a group of chronic pain patients with the myalgic form of temporomandibular disorders remember their pretreatment pain and how they rated their level of relief. This study was part of a randomized controlled clinical trial to determine the efficacy of intraoral appliances (occlusal splints), a common form of treatment for this condition (Dao et al., 1994). We have already reported on the effects of treatment on the sensory and affective dimensions of pain (Dao et al., 1994). In this paper, we present data on memory and relief. In addition, we discuss the effect of memory on perceived relief and the relationship between these variables and true changes in levels of pain.

2. Methods

All patients gave an informed consent to the project that was approved by the Human Ethics Committee of the Université de Montréal. Details on the population, exclusion criteria, design and data analysis can be found in the first publication that reported on treatment efficacy (Dao et al., 1994). In brief, 61 patients (51 women and 10 men, age range: 16–45 years) rated the intensity and unpleasantness of the pain that they were experiencing on 100 mm visual analogue scales (VAS) seven times over a period of 10 weeks. The anchor words were ‘no pain at all’ and ‘the most intense pain you can imagine’; ‘not unpleasant at all’ and ‘the most unpleasant you can imagine’. Patients were randomly assigned to one of three groups, then pretreatment levels of pain were recorded at three weekly sessions. All patients were given acrylic oral appliances, and two groups were instructed to wear their appliances for 24 h/day except at mealtimes. The treatment group received appliances that cover the biting surfaces of the upper teeth. These were supposed to relieve symptoms because they alter the occlusion of the teeth (Ramfjord and Ash, 1983). Another group wore devices that covered only the hard palate (control group 1), while the third (control group 2) wore their appliances for only 30 min at each treatment session. The treating clinician was blind to patients’ reports, and measurement and analyses were conducted by those blind to the treatment assignment.

Fig. 1 shows the time sequence for the different pain measurements. At the beginning (week 0), subjects rated their present pain. At week 1, they were also asked to rate the intensity of the pain on VAS that they were experiencing at week 0 (remembered pain). Following delivery of the appliances at week 2, patients also reported their perceived pain relief during the next four sessions (week 3, 5, 7 and 10) on a 100 mm VAS divided in two by the words ‘no change’. The lower anchor was ‘the worst it could become’ and the upper read ‘complete relief’. When relief ratings were made to the right of the ‘no change’ line, patients were given another 100 mm VAS with anchors of ‘No relief’ and ‘Complete relief’.

VAS scores were analyzed using multiple regression analysis. Memory of pain was used as the dependent variable, while pretreatment pain rating, time (weeks), and pain at the moment of recall (present pain) were the independent variables. To model ratings of relief, true change in pain (pretreatment pain minus present pain), treatment group (treatment, control group 1 and control group 2), time (weeks), remembered pretreatment pain and present pain, were used as independent variables. Relationship between error in remembered pain and the level of pretreatment pain was examined with regression analysis. Two-way repeated measures analyses of variance (ANOVA) were used to verify the effect of time on perceived relief and ‘true’ relief (change in pain intensity). Differences between explanatory variables were considered to be significant when $P < 0.05$.

3. Results

In the first publication, it was shown that the intensity and the unpleasantness of the pain experienced by the three groups of patients decreased throughout the trial, but that there were no significant differences between the treatment

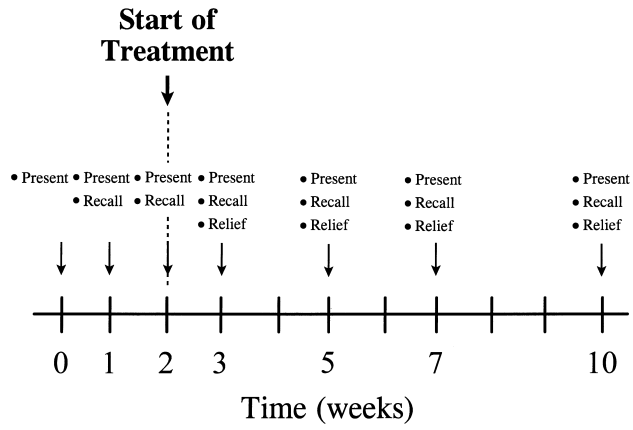

Fig. 1. Measurement sequence. Pretreatment pain intensity was rated at week 0 and recalled at all subsequent appointments. Following delivery of occlusal splints at week 2, present pain and perceived relief were recorded.

Table 1
Predictive variables for memory

Explanatory variables for memory	Coefficient (mm)	SE	*P*-value	95% CI
Time (weeks)	2.1	0.33	0.0001	1.45, 2.76
Pretreatment pain	0.37	0.05	0.0001	0.27, 0.46
Present pain	0.34	0.05	0.0001	0.25, 0.43

Adjusted $r^2 = 0.34$, $F = 62.09$, $P < 0.0001$. Multiple regression model and confidence intervals (CI) for variables significantly related to remembered pain (from week 1 to 10). Time is measured from week 1.

and control groups (Dao et al., 1994). In the current paper, pain intensity ratings are used again.

3.1. Memory of pain

Table 1 depicts a multivariate model that quantifies the influence of time, pretreatment pain and present pain on remembered pretreatment pain for all subjects. When treatment was included in the model, its effect was not significant. As expected, pretreatment pain was a significant predictive variable (Table 1; $P < 0.0001$). However, present pain also had a significant effect, and memory also changed significantly with time (Table 1; Ps < 0.0001).

Pretreatment pain level also had a significant effect on the accuracy of memory. This is seen clearly when the difference between mean remembered pain averaged over the trial and mean pretreatment pain are plotted for each patient (Fig. 2, Pearson correlation: –0.52, $P < 0.001$). Patients whose pain ratings were low remembered pain as much greater than it had been. On the other hand, there was a tendency for those who rated their pretreatment pain as high to remember it as slightly less intense than it really was.

3.2. Relief from pain

No patients reported that their condition got worse during the trial, and only a few reported no change (no relief). This was surprising, because present pain was worse than pretreatment pain for many patients, particularly at week 3 when 19 subjects whose pain had worsened reported relief (Table 2).

Table 3 shows the effects of true change in pain, treatment group, pretreatment pain, remembered pain and time on the estimates of relief. True change in pain (true relief) did not significantly contribute to perceived relief (Table 3; $P = 0.41$). On the other hand, treatment had a strong effect: there was a large and significant difference between control group 2 and the treatment group (Table 3; $P = 0.004$) and also between control group 2 and control group 1 (Table 3; $P = 0.0001$). The difference between control groups 1 and treatment was not significant ($P = 0.49$). As expected, present pain (Table 3; $P = 0.0001$) and remembered pretreatment pain (Table 3; $P = 0.0001$) were also highly significant factors in determining relief. Relief increased by about 4 mm for each 10 mm of remembered pain and decreased by about 5 mm for each 10 mm of present pain. There was also a strong effect of time that increased relief scores by about 2 mm/week (Table 3; $P = 0.0001$).

Fig. 3 illustrates that both perceived and 'true' relief (pretreatment pain minus present pain) increased with time ($F = 17.4$, $P < 0.001$; ANOVA, repeated measures), and that perceived relief was significantly greater than 'true' relief ($F = 352.7$, $P < 0.001$; ANOVA, repeated measures).

4. Discussion

In this study, remembered pain and perceived relief were investigated over a 10-week treatment period in patients suffering from chronic masticatory muscle myalgia. It was found that errors in remembering pain increased with the passage of time, and were dependent on the levels of pretreatment pain, and of pain at the moment of recall. Additionally, it was found that relief was often perceived when pain had actually increased.

We believe that the significant effect of time on recall and on relief was not due to systematic changes in the way that ratings were made. In the original paper on this trial, we described how patients rated the darkness of a grey board of 2 cm^2 at each visit and showed that the mean rating of darkness remained unchanged throughout the 10-week trial. (Dao et al., 1994). In addition, the differences found in the memory of patients who reported high pretreatment pain versus those with low pretreatment pain cannot be explained by a ceiling effect. Pretreatment pain ratings were 80 mm or less on the 100 mm VAS, so it was possible for subjects to have reported greater pain if they had wished.

4.1. Memory

Our general finding on memory confirms that chronic pain is remembered inaccurately and often overestimated in chronic pain patients (Linton and Melin, 1982; Linton and Götestam, 1983; Eich et al., 1985; Roche and Gijsbergs, 1986; Jamison et al., 1989). In addition we showed that the

Table 2
Comparison of true changes in pain and perceived relief

True change in pain (pretreatment, current pain)	Reported change in pain			
	Week 3		Week 10	
	Relief	No relief	Relief	No relief
Decrease	29	19	46	0
No change	3	2	2	0
Increase	19	2	8	0

Perceived and true relief. Note that in many cases relief was perceived even when pain had become worse.

Table 3
Predictive variables for relief

Explanatory variable for relief	Coefficient (mm)	SE	*P*-value	95% CI
True change in pain	0.07	0.08	0.41	–0.1, 0.24
Control group 1	14.52	4.03	0.0001	6.59, 22.45
Treatment group	11.78	4.01	0.004	3.88, 19.68
Present pain	–0.52	0.11	0.0001	–0.74, –0.29
Remembered pain	0.39	0.09	0.0001	0.22, 0.57
Time (weeks)	2.37	0.67	0.0001	1.05, 3.69

Adjusted $r^2 = 0.34$, $F = 20.35$, $P < 0.0001$
Multiple regression model and confidence intervals (CI) for variables contributing to perceived relief. Time is measured from week 3.

accuracy of recall decreased over the 10-week period of this investigation.

(Jamison et al., 1989) found differences in the ability to remember past pain between groups of patients with different chronic pain conditions. Patients with lower and upper back pain recalled earlier pain relatively accurately, while patients with pain in another part of the body (abdomen, face, lower and upper extremities, head and middle back) tended to overestimate their earlier pain experiences. Our results support their hypothesis that these differences between groups were due to the relative level of pain in the various groups and not to differences in pathology, because the mean pain scores of the groups that remembered pain accurately or that tended to underestimate their pretreatment pain in the Jamison et al., study was higher than those of the groups that exaggerated their earlier condition.

In contrast to our finding, (Salovey et al., 1993) concluded that pain is remembered accurately. They asked chronic pain patients to complete pain diaries during 30 consecutive days, recording their daily usual pain level with 10-point scale or pain-related behavior (medication, use of heating pad, etc.). Patients were asked at the end of

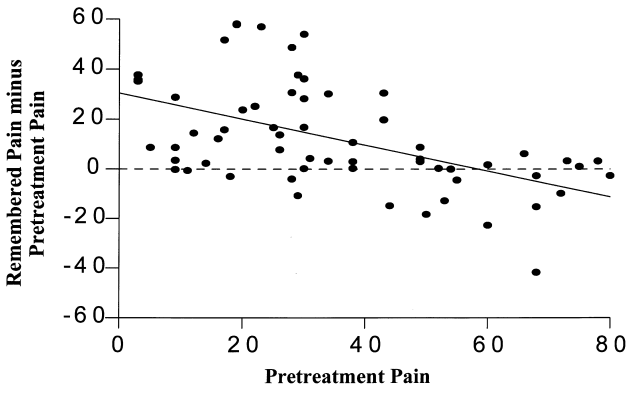

Fig. 2. This graph depicts the relationship between the error in remembering pain (remembered pain minus pretreatment pain) and pretreatment pain intensity. Each point represents the mean of six occasions per subject (weeks 1–10). $n = 61$.($y = -0.52x + 30.46$).

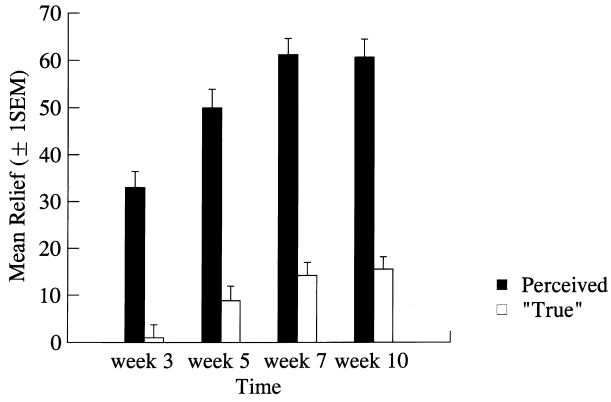

Fig. 3. Mean (±1 SEM) of perceived relief and 'true' relief (pretreatment pain minus present pain) from weeks 3–10. Perceived and true relief increased during the 10-week treatment period.

the trial to recall the number of days on which they experienced various levels of pain, or the number of days on which they engaged in certain pain behaviors. They found that there was no significant difference between mean diary and mean recall ratings. The authors concluded that memory of chronic pain is accurate. We believe that our discovery of the relationship between pretreatment pain level and accuracy of recall might explain the discrepancy between their findings and results from this and from most other studies (Linton and Melin, 1982; Linton and Götestam, 1983; Eich et al., 1985; Roche and Gijsbergs, 1986; Jamison et al., 1989). Mean diary and recall ratings in the study by Salovey et al., could be similar because the negative errors of recall in the patients with high pretreatment pain may have canceled the positive errors of the patients with lower pretreatment pain.

Our results also confirm earlier findings that the level of pain at the moment of recall (current pain) also influences the accuracy of remembered pain (Eich et al., 1985; Salovey et al., 1993; Smith and Safer, 1993). In this study, patients with lower levels of pain at the moment of recall tended to underscore their pretreatment pain levels, while those with higher levels of pain tended to overestimate their past pain.

4.2. Relief

Although it seems reasonable to assume that a patient's perception of relief can be influenced by many factors, such as expectation or coping, it is presumed a priori that relief reflects a reduction in pain and that it is strongly dependent on remembered pain. Our model shows that this is only partly true: when pretreatment pain is remembered as having been greater, relief does go down. However, true changes in pain did not have a significant effect on relief and relief was often reported when pain had, in fact, got worse. It is likely that inaccurate recall of pretreatment pain contributes to the tendency to report relief from pain even when none has occurred. Patients whose pretreatment pain was low seem particularly prone to overestimate treatment

efficacy, in large part because their pretreatment condition is exaggerated in memory. Since the pain associated with many chronic pain conditions is often low to moderate, i.e. less or equal to 50 mm on a 100 mm VAS (Portenoy et al., 1992; Bush et al., 1993; Dao et al., 1994), it seems probable that most of these patients will report high levels of relief no matter how little the pain has decreased.

Other factors could have influenced ratings of relief. For instance, it is plausible that in clinical practice patients might tend to exaggerate their reports of relief to 'please' their clinician. However, we do not think that this phenomenon contributed to the reports of relief scores in this study because the patients knew that the clinicians would not see their ratings (Dao et al., 1994).

Expectation is another factor that might influence ratings of relief. While there was no effect of the treatment on remembered pain, there was a significant effect on ratings of relief. Even though patients who had previously been treated with occlusal splint were excluded from our study (Dao et al., 1994), it is possible that those patients who only wore the appliance in the dental office suspected that they were receiving some kind of placebo. The amount of time that the appliances were worn could also be the factor that explains why there were significant differences between the two control groups. Feine and Lund (1997) recently reviewed the evidence for the efficacy of various forms of physical therapy and physical modalities in the treatment of chronic musculoskeletal pain disorders, including temporomandibular disorders. They found that when therapies were compared in clinical trials, there was a significant tendency for the treatment arm (including placebos) that involved more time with the healer or more treatment to give the best outcome. This could also explain why the relief scores were much higher for the two appliances worn most of the day (treatment and control group 1), than for the appliances worn for 30 min during visits (control group 2).

We conclude that reports of relief do not necessarily reflect therapeutic efficacy and are poor indicators of true changes in chronic pain, partly due to distortions in pain memory. We suggest that diagnostic and treatment regimes for chronic musculoskeletal pain conditions should be based on patients' pain measured at the time of the consultation or from pain diaries, rather than on verbal reports of past pain or of perceived relief.

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