IN BRIEF

- Psychological measures of pain are affected by anxiety.
- Reports of pain are associated with the type of treatment.
- Patients with acute dental pain can benefit from psychological intervention.

Psychological intervention in acute dental pain: review

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Acute dental pain is an unpleasant experience. This article studies acute dental pain and examines the role of psychological intervention. After identification of the psychological factors associated with dental pain we go on to assess the role of psychological interventions.

Acute dental pain is traditionally classified into three groups: toothache, perioperative pain and postoperative pain. The majority of studies conclude that psychological measures of pain are affected by anxiety.

Various psychological intervention techniques have been employed to try to relieve anxiety including distraction strategies, relaxation techniques, hypnosis, sensory information, perceived control, positive dental experience, systemic desensitisation, psychotherapy, support groups and dental phobia clinics. The success of these interventions is reviewed.

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INTRODUCTION

Pain is an unpleasant sensation ranging from mild discomfort to agonising distress; it is usually associated with real or potential tissue damage. Acute dental pain may involve toothache, dental sensitivity, perioperative pain or postoperative pain. Fear of pain may lead patients to avoid dental treatment; acute dental pain is a clinical problem.

Anxiety has been identified as being one of the major factors that impact on dental pain.[1,2] However, expected pain is less intense than unexpected pain.[3] Eighty-four percent of adults attending a dental clinic reported sudden discomfort.[4] In acute pain situations anxiety may lead to the perception that normally non-painful stimuli are painful; individuals differ in their pain perception and reaction according to culture, social environment, gender and individual cognitive and emotional factors; several questionnaires have been developed to measure pain and anxiety (Table 1).

Maggirias and Locker[5] found that patients with high scores on the Pain Tolerance Scale (PTS) were less likely to report painful dental experiences; those patients have previously agreed with the statement 'I would be angry if I felt pain during dental treatment' and disagreed with the statement 'If I am in pain I just put up with it', suggesting that patients may either interpret sensations and experiences as something other than pain or those patients are more successful at conveying concerns regarding pain to dentists. Dentists may then modify their clinical and interpersonal approach to minimise the possibility of pain or the perception of pain. Reports of pain were associated with the type of treatment received and a number of baseline sociodemographic and psychological factors.

Toothache does not affect perception of pain in any other part of the body. A study by Sigurdsson and Maixner[6] involved 17 subjects of whom 10 presented with painful toothache and the rest were healthy volunteers. They concluded that measures of thermal pain perception and forearm ischemic pain perception were not altered by the

Table 1 Questionnaires developed to measure pain and anxiety

BHS	Beck Hopelessness Scale
CISS	Coping Inventory for Stressful Situations
DAS	Dental Anxiety Scale
DBS	Dental Belief Survey
DDS	Descriptor Differential Scale
DFS	Dental Fear Scale
EPQ	Eysenck Personality Questionnaire
GHQ	General Health Questionnaire
IBES	Illness Behaviour Encouragement Scale
IBQ	Illness Behaviour Questionnaire
IDCI	Iowa Dental Control Index
PANAS	Positive and Negative Affect Scales
PAS	Pain Anxiety Scale
PCI	Patient Comfort Index
PCS	Pain Catastrophising Scale
POMS	Profile of Mood States
PTS	Pain Tolerance Scale
RLOC	Recovery Locus of Control
SHSS	Stanford Hypnotic Susceptibility Scale
STAI	State Trait Anxiety Inventory
TAQ	Tellegen Absorption Questionnaire
TAS	Toronto Alexithymia Scale
VAS	Visual Analogue Scale

occurrence of toothache. In contrast, sustained noxious forearm ischemia produced a marked reduction in the intensity, unpleasantness and spatial distribution of pulpal pain.

Forty-six dental patients experiencing pain due to acute irreversible pulpitis and 33 healthy controls were involved in a study[7] to determine whether the presence of pain could be influenced by gender. These data suggest that the gender difference in thermal pain sensitivity frequently reported in pain-free subjects appears to be absent in patients presenting with acute dental pain.

Karadottir *et al.*'s[8] assessment of pain experienced by 26 patients during periodontal maintenance treatment (probing and instrumentation) using the Visual Analogue Scale (VAS) and anxiety questionnaires, showed that patients showed low pain responses to both probing and instrumentation. However, by using an arbitrary threshold of pain frequency, approximately 15% of the patients had a painful experience. They concluded that recognition of patients who are likely to experience pain during periodontal treatment could be facilitated by the use of two questions on dental anxiety and the VAS response to probing during examination.

Postoperative pain can be associated with all dentoalveolar surgical procedures, which is considered to be a normal physiological response to surgical treatment.

Pain is common; the role of psychological factors associated with reports of dental pain (toothache, perioperative and postoperative pain) and psychological interventions employed to reduce dental pain will be reviewed.

DISCUSSION

Dental pain without psychological manipulation

Weisenberg *et al.*[9] studied the reaction of 75 black, white and Puerto Rican patients in an outpatient dental emergency clinic (Table 2). Pain measures showed no difference, while psychological measures showed that Puerto Ricans scored the highest level in State Trait Anxiety Inventory (STAI), Dental Anxiety Scale (DAS) and attitude differences. Antczak-Bouckoms and Bouckoms[10] studied 61 patients attending a dental hospital (DH) and found no significant difference on any scale of the Illness Behaviour Questionnaire (IBQ) between 'acute pain' and 'no pain' groups, while significant difference in the 'chronic pain' group was noted.

Kunzelmann and Dunninger[11] developed a questionnaire including DAS and the Dental Beliefs Survey (DBS) as subscales to examine the epidemiology of dental fear and dental beliefs in Germany; pain measures were self-reported. Four hundred and seventy-four patients were surveyed before treatment. It was concluded that patients attending in pain are more anxious and have more negative beliefs about the dentist than those not in pain.

Of the three studies[9-11] of patients with toothache, Weisenberg *et al.*[9] and Antczak-Bouckoms and Bouckoms[10] used fairly crude measures of pain. Kunzelmann and Dunniger[11] found patients attending in pain were more anxious and had more negative beliefs than those not in pain, which is unsurprising since it is those who are anxious who are more likely to put off a visit to the dentist until they are in pain.

Nine adult females attending DH were surveyed by Hargreaves *et al.*[12] using VAS to measure pain and anxiety pre and perioperatively (Table 3); plasma ß-endorphin was also measured. They found that individual perioperative pain, but not anxiety, correlated inversely with the pre- to perioperative rise in plasma endorphin-like immunoreactivity.

Table 2 Studies detailing patients' reactions in dental clinics

Study	Subject groups	Number Drop-out	Pain measures	Psychological measures	Findings
Weisenberg *et al.*	Emergency clinic adult attendees in pain; ethnic differences	75 1%	Direct questions of current and expected pain	STAI, DAS interview and dentist ratings	No reported differences in current or expected pain between ethnic groups
Antczak-Bouckoms and Bouckoms	Consecutive patients attending DH	61 10%	Simple report of pain and duration	IBQ	No significant difference on any scale of IBQ between 'acute pain' and 'no pain' groups; chronic group 'differed'
Kunzelmann and Dunninger	Random sample of GDP and DH adult patients	474 0%	Self-report	DAS, DBS	Patients attending in pain more anxious ($p < 0.001$), and having more negative beliefs about the dentist ($p < 0.001$), than those not in pain

Table 3 Studies detailing patients' reactions in dental clinics

Study	Subject groups	Number Drop-out	Pain measures	Psychological measures	Findings
Hargreaves *et al.*	Adult patients attending DH for wisdom teeth removal	9 0%	VAS (pre- and perioperatively)	VAS (pre- and perioperatively)	Individual perioperative correlated inversely with pre- to perioperative rise in plasma endorphin-like immunoreactivity ($p < 0.05$)
Kent and Warren	Adult patients attending general dental practice	125 25%	VAS (pre- and postoperative)	DAS (pre- and postoperative)	Patients reporting a high discrepancy between expected and experienced pain, but not anxiety, less confident about the typicality of the appointment ($p < 0.005$)
Chaves and Brown	Adult patients attending DH and GDP	75 10%	Likert-type scale	STAI, DAS, TAS, RLOC, Likert-like stress scale	No difference in pain ratings between patients using coping strategies and those who denied cognitive activity, nor between deniers and catastrophisers
Arntz *et al.*	Volunteer adult patients in GDP	40 23%	VAS	DAS, VAS	Anxious dental patients tend to expect more pain than fearless patients and require several disconfirmations to become more accurate in their predictions; dental anxiety not associated with pain experienced

One hundred and twenty-five patients reported a high discrepancy between expected and experienced pain, but not anxiety, when they were asked to complete a VAS and a DAS;[13] results showed that patients reporting a high discrepancy between expected and experienced pain, but not anxiety, were less confident about the typicality of the appointment.

Chaves and Brown[14] employed spontaneous cognitive strategies during a structured interview on 75 patients undergoing dental extractions or mandibular block injections. They found no differences in pain ratings between patients using coping strategies and those who denied cognitive activity, or between deniers and catastrophisers. In another study, the relationships between expectations and experiences of pain and anxiety were investigated in 40 dental pain patients using VAS and DAS.[15] It was suggested that anxious patients tend to expect more pain than fearless patients and require several disconfirmations to become more accurate in their predictions; dental anxiety was not associated with pain experienced.

Of the four studies on perioperative pain,[12-15] a consistent finding was that anxious patients had exaggerated expectations of pain whilst less anxious patients were more accurate in their predictions;[15] experience of pain, however, was not consistently related to anxiety. Arntz *et al.*[15] described the need for several disconfirmatory experiences in order for anxious patients to become more accurate in their predictions of pain during treatment. Kent and Warren's study,[13] however, found no direct associations of change in anxiety with expected/experienced pain discrepancy nor with confidence in the typicality of the appointment.

The lack of effect of coping strategies of pain in Chaves and Brown's study[14] was suggested to be due to the low pain levels involved in the treatment procedures (mean rating less than 2 on a 10-point scale). The study by Hargreaves *et al.*[12] was a small psycho-immunological investigation of individual variation in stress-provoked pain modulation.

Feinmann *et al.*[16] investigated the psychological factors influencing postoperative pain and analgesic consumption in 103 oral surgery patients attending DH (Table 4). Pain measures included VAS at one and three days postoperatively and analgesic use; while psychological measures included STAI, VAS (anxiety), General Health

Table 4 Studies detailing patients' reactions in dental clinics

Study	Subject groups	Number Drop-out	Pain measures	Psychological measures	Findings
Feinmann *et al.*	Adult oral surgery patients attending DH	103 6%	VAS and analgesic use	STAI, VAS, GHQ, EPQ, STAI	High trait anxiety ($p < 0.01$), neuroticism ($p < 0.001$) predicts persistent pain post-operatively
Hansson *et al.*	Consecutive adult patients attending DH for wisdom teeth removal	100 0%	VAS (postoperatively for 72hrs) and analgesic use	VAS; GHQ, BHS, preoperatively; VAS, immediately postoperatively	Personality characteristics unrelated to post-operative pain
Faucett *et al.*	Adult patients attending DH for wisdom teeth removal	543 0%	VAS (postoperatively)	Ethnic differences only	Women ($p < 0.001$) and younger patients ($p < 0.01$) reported more pain; subjects of European descent reported less pain than those of Black American ($P < 0.01$) and Latino ($p < 0.05$) descent
Gidron *et al.*	Adult patients attending DH for third molar removal	67 20%	Likert-like scale (for 6 days postoperatively)	PANAS, question regarding expectancy of functional recovery, IBES, CISS	Psychosocial factors did not predict pain

Table 5 Studies detailing patients' reactions in dental clinics

Study	Subject groups	Number Drop-out	Pain measures	Psychological measures	Manipulation	Findings
Morosko and Simmons	Dental students randomly selected from a group of volunteers	40 0%	Toothache detection and tolerance thresholds in response to electrical stimulation	SHSS	Audio-analgesia: music and 'white noise'	Pain detection and tolerance thresholds raised with audio-analgesia ($p < 0.05$) and especially with volume of white noise under the subject's control ($p < 0.01$); no effect of implicit vs. explicit suggestion nor of susceptibility to suggestion
Wardle	Adult patients attending general dental practice	73 0%	Likert-type scale	Anxiety: 5-points scales	Sensation information; distraction; perceived control; normal practice	Lower pain and anxiety ratings in sensation information group cf. normal ($p < 0.05$); lower pain ratings in perceived control group ($p < 0.05$); no group differences in dentist's ratings
Katcher *et al.*	Adult patients attending DH	42 ?%	Patient Comfort Index	DAS, observer ratings, SHSS, BP, PR	Aquarium contemplation; poster contemplation; poster contemplation with hypnosis; aquarium contemplation with hypnosis; non-intervention control	Aquarium contemplation ±hypnosis, poster contemplation with hypnosis produced greater patient comfort than poster contemplation and non-intervention control ($p < 0.001$ to $p < 0.06$). Hypnosis did not augment the relaxing effect of aquarium contemplation

Questionnaire (GHQ) preoperatively; and Eysenck Personality Questionnaire (EPQ) and STAI postoperatively. Following that it was revealed that high trait anxiety, neuroticism and psychiatric morbidity predict persistent pain postoperatively. A study by Hansson *et al.*[17] found that personality characteristics are unrelated to postoperative pain following a study on 100 patients undergoing surgical removal of impacted third molars.

Faucett *et al.*[18] conducted a study to examine differences in severity of postoperative pain among 543 patients from four ethnic groups (Asian, Black American, European and Latino). The results showed that women and younger patients reported more pain, and subjects of European descent reported less pain than those of Black American and Latino descent. Gidron *et al.*[19] examined the physical and psychosocial predictors of adolescents' recovery from oral surgery. Sixty-seven adolescents undergoing surgical removal of third molars participated in the study and the results showed that psychological factors did not predict pain.

Four studies focused on postoperative pain.[16-19] Of these, three examined the predictive capacity of psychosocial factors on postoperative pain and recovery following surgical removal of third molars. One study found psychological factors, including postoperative anxiety, to predict postoperative pain.[16] Two further studies failed to show any such prediction.[17,19] This discrepancy is likely to be due in part to the differing measures taken. Only Feinmann *et al.*[16] and Hansson *et al.*[17] used a standard validated psychological measure (GHQ) and only the former study specifically measured anxiety.

In Feinmann's study[16] a regression analysis, in addition to correlation, would have informed regarding the relative predictive powers of the psychological variables. Hansson's study[17] had the advantage of a standardised surgical procedure but, in recording on an hourly basis, may have incorporated too many measures. Gidron's study[19] failed to control for analgesic consumption.

Dental pain with psychological manipulation

Morosko and Simmons[20] conducted a study which involved 40 male dental students randomly selected to measure the effect of audio-analgesia on pain threshold and pain tolerance (Table 5).

Table 6 Studies detailing patients' reactions in dental clinics

Study	Subject groups	Number Drop-out	Pain measures	Psychological measures	Manipulation	Findings
Houle *et al.*	Student volunteers	28 0%	VAS	TAQ	Progressive muscle relaxation ±analgesia; hypnotic induction ±analgesia	Both conditions reduced the reported strength ($p < 0.001$) and unpleasantness ($p < 0.01$) of tooth pulp stimulation as well as pain detection threshold ($p < 0.01$)
Baron *et al.*	Endodontic patients	188 5%	VAS	VAS, STAI, IDCI	Emotional focus and sensory focus	High pain experienced by group high in desired 'dental control' but low in felt 'control', eliminated by sensory focus manipulation but not emotional focus
Logan *et al.*	Adult fee paying endodontic patients	330 1%	DDS (pre- and postoperatively), 0-4 rating of experienced pain	IDCI	Sensory focus; procedural information; combination of both; no intervention	Sensory focus reduced pain experience for the high desire/low felt control subgroup

Table 7 Studies detailing patients' reactions in dental clinics

Study	Subject groups	Number Drop-out	Pain measures	Psychological measures	Manipulation	Findings
Law *et al.*	Adult volunteer fee paying periodontal patients	110 5%	VAS	STAI, IDCI, VAS	Stress inoculation training; filler video	Expected pain unaffected; high desire/low felt patients in SIT condition experiences less pain than neutral condition ($p < 0.05$)
Enqvist and Fischer	Adult patients on DH waiting list for third molar removal	69 4%	VAS and analgesic use	VAS	Hypnotic relaxation induction audiotape with suggestion for healing; no intervention	Preoperative level of anxiety maintained on day of surgery after intervention, whereas anxiety increase in control group ($p = 0.002$)
Sullivan and Neish	Students for dental hygiene treatment	80 0%	VAS (postoperatively)	PCS, DAS, POMS	Disclosure of expected distress, thoughts and feelings; control	Catastrophisers reported more pain than non ($p < 0.001$) in control group only. Disclosure reduced catastrophisers' pain ($p < 0.01$)

They found that pain detection and tolerance threshold raised with audio-analgesia and especially with the volume of 'white noise' under the subject's control; there was no effect of implicit vs. explicit suggestion nor of susceptibility to suggestion.

Wardle[21] investigated the effect of psychological management of anxiety and pain during dental treatment of 73 adult patients attending general dental practice; pain was measured using a Likert-type scale (dentist and patient ratings), while anxiety was measured on a 5-point scale (dentist and patient ratings); these measurements were acquired in the postoperative phase. Manipulation was based on four conditions: sensation information (with specific reference to pain), distraction (visually interesting stimulus), perceived control (arm-raising encouraged as pause signal) and normal practice. Wardle concluded that the provision of sensation information was the most effective treatment.

Forty-two adult patients attending a DH for tooth extraction were recruited to compare contemplation and hypnosis for the reduction of anxiety and discomfort perioperatively.[22] Patient Comfort Index (PCI) for pain measures and DAS, observer ratings, SHSS, BP and pulse rate (psychological measures) were obtained from each patient. Manipulation was based on one of five conditions: aquarium contemplation (1), poster contemplation (2), poster contemplation with hypnosis (3), aquarium contemplation with hypnosis (4) and non-intervention control (5). The first, third and fourth conditions produced greater patient comfort and hypnosis did not augment the relaxing effect of aquarium contemplation.

Houle *et al.*[23] evaluated the efficacy of hypnosis- and relaxation-induced suggestions for analgesia for reducing the strength and unpleasantness dimensions of pain evoked by noxious tooth pulp stimulation (Table 6). Subjects made threshold determinations of pain and tolerance and used VAS to rate the strength and the unpleasantness of both noxious stimuli before and after receiving either hypnosis- or relaxation-induced analgesia. There were no significant differences in pain reductions between hypnosis- and relaxation-induced interventions. However, the percentage reduction in both strength and unpleasantness varied significantly as a function of the type of pain. In Baron *et al.*'s study,[24] 188 adult endodontic patients were attending a DH. Giving patients instructions to focus on sensory (vs. emotional) stimuli during a root canal procedure significantly reduced self-reported pain, but only among patients who were classified as having a strong desire for control but did not feel in control in dental situations. Among patients who did not feel in control and did not have a strong desire for control, sensory-focus instructions produced greater pain reports than emotion-focus instructions. Moreover, high desire but low control patients reported higher levels of expected pain before treatment than other patient subgroups.

Logan *et al.*[25] conducted a study which involved 330 adult endodontic patients attending a DH. Pain measures included Descriptor Differential Scale (DDS), 0-4 rating of experienced pain at one week; psychological measures included IDCI (Iowa Dental Control Index), and the manipulation condition involved sensory focus (physical sensations), procedural information, sensory focus and procedural information or no intervention. Patients in this study were categorised as to how much control they desired and felt. They concluded that sensory focus reduced pain experience for the high desire/low control subgroup; procedural information did not add to this.

One hundred and ten patients were categorised as to their desire for and feelings of control and were randomly assigned, just prior to dental treatment[26] (Table 7). VAS has been used to record expected and experienced pain (pain measures); STAI, IDCI and VAS for expected and experienced distress (psychological measures); then the volunteers were subjected to either stress inoculation training (training patients to cope with anxiety and stressful situations by learning more functional patterns of self-talk) or a filler video (neutral). The study showed that stress inoculation training significantly reduced pain and increased control only for patients who initially reported a high desire for control coupled with low perceived control. This finding supports the view that the discrepancy between high desire for control and low perceived control plays a casual role in the elevated distress and pain initially reported by patients with such control perceptions.

Table 8 Predisposition to pain
Most common psychological characteristics which predispose to pain
Dental anxiety
Fear of pain
Expectation and anticipation of pain
Negative dental experience
Attitudes towards the dentist
Attitudes towards the provision of dental care

Enqvist and Fischer[27] evaluated the effects of preoperative hypnotic techniques used by 69 patients in line for surgical removal of mandibular third molars. VAS has been used as a pain and psychological measure; manipulation involved either a hypnotic relaxation induction audiotape with suggestion for healing and analgesia or no intervention. The preoperative level of anxiety was maintained on the day of surgery after intervention, whereas anxiety increased in the control group; postoperative consumption of analgesics was significantly reduced in the experimental group compared to the control group.

Sullivan and Neish[28] examined the effects of emotional disclosure on the pain and emotional distress experienced by 80 'catastrophisers' and 'non-catastrophisers' during dental hygiene treatment. Manipulation was either disclosure of expected distress, thoughts and feelings or control (description of previous day's activity). Catastrophisers reported more pain; disclosure reduced catastrophisers' pain.

The discussed studies were generally well-designed with adequate blinding of experimenters and dental staff, and appropriate control groups. A wide variety of interventions were successful in producing some degree of analgesia, mostly for patients undergoing routine dental treatment. Successful manipulation included audio-analgesia, emotive imagery, coping skills and sensory information, perceived control, distraction, progressive muscle relaxation, hypnosis, behavioural therapy and stress inoculation training.

Essentially the above techniques are designed to reduce anxiety. These effects are achieved by relaxation or distraction or by attention to sensations. The relative merits of distraction and attention are unknown. Wardle[21] found attention to sensation to be more effective in reducing pain and anxiety than a visually interesting stimulus, but suggested that the latter was perhaps not adequately distracting. Wardle also used a non-validated measure of anxiety.

Individual differences in coping strategies may be influential, as in Sullivan and Neish's study;[28] disclosure of anticipated distress by writing down thoughts and feelings effectively reduced pain experience during dental hygiene treatment, in catastrophising patients.

Hypnosis would appear to have no additional benefit over simpler relaxation techniques.[22,23] The Houle study[23] also lacked a control group. In Morosko and Simmons' study,[20] the lack of control group prevented assessment of any practice effect through repeated procedures. The reported increase in pain threshold is likely to have been a function of anxiety reduction, in response to suggestion of analgesia (implicit or explicit), and of perceived control. The Enqvist and Fischer study[27] assessed pain solely by means of analgesic consumption, a crude measure and an active coping strategy in itself.

Psychological intervention in acute dental pain was found to be a very successful non-invasive measure to reduce pain induced by psychological factors (Table 8) pre-, peri- and postoperatively by employing various psychological interventions (Table 9 shows the most common interventions).

Table 9 Psychological intervention techniques	
Distraction strategies	Visually interesting stimulus, music
Relaxation techniques	Guided Imagery, deep breathing, progressive relaxation, biofeedback (coping with pain and stress)
Hypnosis	Hypnotic relaxation
Sensory information	Procedure and typical sensations to be expected, drill sound
Perceived control	Arm-raising encouraged as pause signal
Positive dental experience	Benefits of introduction to the management by the dentist
Systemic desensitisation	Gradual exposure to things inducing anxiety and stress
Cognitive behavioural therapy	Calm mind and body, change negative or harmful thinking patterns
Psychotherapy	Patients with sever anxiety and phobias
Support groups	Offer coping skills and emotional support
Dental phobia clinics	Clinics staffed by therapists who deal with severe anxiety

CONCLUSION

This review provides conclusive evidence that patients with acute dental pain do benefit from psychological intervention; how significant this benefit is when compared with those not receiving any intervention, remains the subject of debate.

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