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Title: Relaxation and chronic pain: A critical review

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Abstract

Background/Aims: Chronic non-malignant pain is a global condition with a complex biopsychosocial impact on the sufferers. Relaxation skills are commonly included as part of a pain management programme, which is currently the recommended evidence-based intervention for this group of patients. However, there is little evidence behind the choice of relaxation method implemented, or their effectiveness. The aim of this study was to investigate the effectiveness of relaxation skills in the management of chronic non-malignant pain, related to pain intensity and health-related quality of life.

Methods: A systematic literature review was conducted using MEDLINE, CINAHL, AMED, PEDro and PsycARTICLES. The Cochrane, DARE and Trip databases were also accessed, and searches were carried out using the terms (relaxation OR relaxation therapy OR relaxation training) AND (pain OR chronic pain).

Findings: Following critical appraisal, ten studies met the inclusion criteria. Three studies reported a decrease in pain intensity as a result of the relaxation intervention, whilst only one study reported an improvement in health-related quality of life. Progressive muscle relaxation was the most commonly implemented method throughout, although its method of delivery differed between studies.

Conclusions: There is little evidence for the use of relaxation as a stand-alone intervention for pain intensity and health-related quality of life for patients with musculoskeletal chronic non-malignant pain. More research is needed to determine its effectiveness.

Introduction

The definition of chronic non-malignant pain is commonly accepted to refer to pain of more than three months duration (Cimminio et al, 2011; British Pain Society, 2013), and can be attributed to a variety of pathologies. This paper will focus on musculoskeletal chronic non-malignant pain alone, alternatively known as persistent pain (Moore et al, 2015), which may be insidious, or may be attributed to arthritis, fibromyalgia, or other musculoskeletal pathology. The current estimated prevalence of patients suffering with chronic non-malignant pain in the UK is 14 million (Bridges, 2012) with global incidence estimated at approximately 20% (Cimminio et al, 2008), placing a huge strain on national economies. These patients have complex biomedical, psychological and social needs, requiring intervention from many members of the multidisciplinary team (Turk et al, 2008).

The current evidence-based, and most commonly implemented intervention in the United Kingdom is an interdisciplinary pain management programme, incorporating both cognitive and behavioural strategies (Scottish Intercollegiate Guidelines Network (SIGN), 2013; British Pain Society (BPS), 2013). Despite this, the National Pain Audit carried out by the Chief Medical Officer for England (Price et al, 2012) reported only 40% of pain services in England met these interdisciplinary requirements. Relaxation skills, such as progressive muscle relaxation (Benson et al, 1974), are commonly taught as a component of these programmes (Keefe et al, 2008; Hasset and Gevirtz, 2009; Jensen 2011). However, on inspection of the findings from Savigny et al (2009) and the Cochrane collaboration (Henschke, 2010), who inform clinical guidelines in this area, there appears to be minimal evidence as to why these have traditionally been included, nor is there clarity as to which method of relaxation is most effective (Jensen, 2011).

Background

The gate-control theory of pain proposed by Melzak and Wall (1965) was integral in the acknowledgement that pain is more than an isolated sensory experience. They identified the importance of the dorsal horn of the spinal cord in the processing of nociception, and proposed that descending messages from the brain also influenced the pain experience. Melzak and Wall's theory began to explain the contributions played by thoughts, moods and behaviours in the overall experience of pain. The link between chronic pain and psychological factors, such as thoughts,

moods and beliefs, is now widely acknowledged (Scascighini 2008, Turk 2008, Henschke, 2010). Patients suffering from chronic non-malignant pain have reported changes in social status, job loss and a resultant impact on their finances, which can have a negative effect on both them and their families, leading to an estimated 49% of these patients in the UK experiencing depression (Donaldson 2008). This impact has contributed to a need for rehabilitation to

become both multifaceted and multidisciplinary, to address the physical, psychological and social impact of the condition (Keefe et al, 2008; Hassett and Gevirtz, 2009).

Current evidence supports the provision of an interdisciplinary pain management programme, which typically includes education, exercise and behaviour modification, along with cognitive techniques to challenge unhelpful thoughts and moods (BPS, 2013; SIGN, 2013), and can be delivered on an inpatient or outpatient basis.

A systematic review by Scascighini et al (2008) provided an overview of interventions and outcomes for chronic pain, and concluded that multidisciplinary therapy is more effective than medical or other non-multidisciplinary treatments. However, they did recognise that future studies needed to have more robust methodology and should compare components of these programmes to ensure the most effective content. In 2011, a report for the Cochrane Collaboration suggested that programme components could be categorised into three main strategies: operant, cognitive and respondent (Henschke, 2010). Operant conditioning considers how external factors can impact on the pain experience; cognitive conditioning uses methods to address thoughts, beliefs or feelings that may contribute to the pain experience (Jensen, 2011); and respondent conditioning uses techniques such as relaxation to produce a reduction in the pain experience through a reduction in muscle tension (Benson et al, 1974).

The Scottish Intercollegiate Guidelines Network (SIGN) have produced some evidence-based guidelines for the individual components of a pain management programme (SIGN, 2013), however the BPS acknowledge the difficulty of quantifying the level of evidence attributed to each component of such programmes (BPS, 2013). This difficulty may be partly attributed to the varied number of outcomes associated with management of chronic non-malignant pain, but may also be influenced by the large number of tools utilised globally to measure meaningful clinical changes in these outcomes (Chapman et al, 2011).

This systematic literature review explores the effectiveness of relaxation techniques in the management of musculoskeletal chronic non-malignant pain. Outcome measures were explored in accordance with Dworkin et al (2005), who suggested which measures should be considered in clinical trials. Results from two of the outcomes identified in the systematic review, pain intensity, and health-related quality of life, will be discussed in this paper in order to inform future practice.

Search strategy

An initial mapping exercise was carried out, as suggested by Popay et al (2006) in order to try and clearly define the components of the final research question: what is the effectiveness of relaxation methods in the management of chronic non-malignant pain, in relation to pain intensity and health-related quality of life?

Due to the multidisciplinary nature of chronic non-malignant pain, a variety of databases were selected: MEDLINE, CINAHL, AMED, PEDRO and PsycARTICLES, Search terms from a previous systematic review were replicated (Persson, 2008), as more detailed search terms were limited in their effectiveness and suitability.

The terms (relaxation OR relaxation therapy OR relaxation training) AND (pain OR chronic pain) were applied to titles and abstracts. The Cochrane Library, DARE and Trip databases were also accessed in order to identify as many relevant studies as possible. Reference lists of the full text articles assessed for eligibility ($n=16$) (*Figure 1*) were hand searched and grey literature was obtained from online sources.

Professional organisations searched online included the British Pain Society, the Chartered Society of Physiotherapy and Healthcare Improvement Scotland, as these have all published guidelines into the management of chronic pain within the last 2 years. Google Scholar was also used as it is one of the largest search engines freely available, with access to many different sources across the health care disciplines, and is used in citation analysis.

Limiters applied

As randomised controlled trials are the gold standard of research, and potentially offer the most robust clinical evidence (CRD, 2009), this was applied as a limit to the searches. The initial intention of this review was also to limit the date to information available after 2008, as this was the date of the previous systematic review into this question (Persson et al, 2008). However, this strategy did not yield sufficient data, therefore the searches were expanded back to the year 2000. The final limiter

applied was language, with information written only in English considered. This could have introduced bias into the review, as chronic pain is truly a worldwide condition, and therefore relevant information published in another language may have been missed.

Inclusion and exclusion factors

Inclusion and exclusion factors related to the population, intervention, comparators, outcomes and study type, in accordance with the Centre for Reviews and Dissemination (CRD, 2009), can be seen in *Table 1*. The titles and abstracts were then systematically reviewed in accordance with the inclusion and exclusion criteria, and 16 appropriate studies were identified from the initial 593.

Critical appraisal

The Critical Skills Appraisal Programme (CASP, 2013) was chosen to critique the studies, as it is a readily available resource, widely used in health and social care, is regularly updated and is also recognised by the Cochrane collaboration as a validated appraisal tool (Henschke, 2010). Following critical appraisal 10 studies were deemed suitable for inclusion into the review, as can be seen in *Figure 1*.

Findings

A data extraction tool was created following the guidance of the CRD (2009). The fields identified were purely descriptive, and applied without any analysis to all of the 10 studies, in an attempt to reduce bias and increase reliability of the review. Preliminary synthesis involved translating the data into a thematic analysis, which allowed for the systematic identification of the main recurrent themes across multiple studies (CRD, 2009). Within each of the identified themes, studies that had presented relevant information were identified, along with the outcome measures applied, and a summary of their findings in that area. The thematic analysis was tabulated to present a clearer visual representation; this can be seen in *Table 2*.

Relationships between the data gathered from the thematic analysis were then explored using conceptual mapping, in order to construct grouping and relationships within the identified themes, as suggested by Popay et al (2006). Here studies were not only identified as presenting relevant information with regard to a particular theme, but they were further grouped in accordance with the findings they presented

and assimilated into identified concepts. The visual representation of this process can be found in *Table 3*.

Traditionally a systematic review of randomised controlled trials would be synthesised using a meta-analysis, due to the quantitative nature of its data (CRD, 2009). However the studies in this review lacked homogeneity, hence a narrative synthesis within the outcome themes was used, following the guidance from Popay et al (2006).

Pain intensity

Reduction of pain was found in three of the studies as a result of the relaxation intervention (Baird and Sands, 2004; Poole et al, 2007; Lauche et al, 2013), although the only one to show significant differences between study groups was Baird and Sands (2004). While all three applied the progressive muscle relaxation method, described by Jacobson (1938), the intervention delivered by Baird and Sands (2004) also included a personalised guided imagery relaxation script (Bowering et al, 2013). In this small study with only 28 participants, the intervention group reported a significant reduction in pain and disability after 12 weeks, compared to a control group receiving 'usual care'. However, these results should be interpreted with caution, both due to the size of the study, and the fact that the authors failed to clearly define what standard care involved, thus affecting its repeatability.

The other two studies to show reduction in pain levels did not find any difference between groups (Poole et al, 2007; Lauche et al, 2013). Despite the studies being randomised controlled trials, there were limitations in both their methodologies.

Poole et al (2007) did not standardise the interventions, allowing therapists to choose their own practice, and again did not clearly detail 'usual care'. With five therapists delivering reflexology and four delivering relaxation this could have introduced discrepancies in the interventions, making comparisons less valid.

Lauche et al (2013) compared an intervention carried out at home by family members or friends with self-directed relaxation techniques. This could have also have resulted in a lack of control in the standardisation of the interventions.

Despite no significant change in pain levels following a 7-week applied relaxation intervention, Gustavsson and von Koch (2006) identified a reduction in use of analgesia in patients with chronic neck pain. Again, this was a small randomised controlled pilot study, with only 37 participants and an approximate 22% attrition rate. The authors identify these factors as limitations of the study, along with inequalities

in the groups at baseline. However, the results suggest that participants in the study may have either used the relaxation skills to enhance their control over the pain, thus requiring less medication, or realised the limitations of medication, which is suggested may only give 30–40% reduction in pain for 50% of pain sufferers (Turk et al, 2008). This highlights the difficulty of measuring pain, which relies on subjective reporting tools (Chapman et al, 2011). It could be suggested that, although overall self-reported pain may stay the same, pain during movement may have reduced to allow increased range. On a similar note, the participants in the study by Menzies et al (2006) reported an increased ability to manage the pain, but no change in pain intensity. This is consistent with Turk et al (2008), the BPS (2013) and SIGN (2013), who advocate that control of pain is a more appropriate outcome than pain intensity itself.

Overall, this review shows that there is limited support for the use of relaxation as a standalone intervention for pain intensity. However, the importance of the pain gate theory (Melzak and Wall, 1965) should not be discounted. Consideration needs to be given as to how the physiological response to relaxation techniques could be incorporated as an evidence-based component in the management of chronic non-malignant pain.

Health-related quality of life

It could be suggested that, due to the biopsychosocial impact of chronic non-malignant pain, health-related quality of life might be the most valued outcome for patients (Dworkin et al, 2005). Health-related quality of life is a subjective, multidimensional concept, incorporating physical, social and emotional functioning, and hence an important concept in monitoring overall improvement in patients with chronic non-malignant pain (Isoqol, 2014).

The SF36 (Ware and Sherbourne, 1992) is one of the most commonly used outcome measures to assess health-related quality of life, and has been shown to have good reliability and validity in all its eight domains (Chapman et al, 2011; Hawker et al, 2011; White et al, 2011). The two studies to implement this outcome measure were Poole et al (2007) and Lauche et al (2013). These were both randomised controlled trials, with progressive muscle relaxation as the comparator for their main intervention; however, neither were able to show any clinically significant differences between any of the groups related to health-related quality of life. Despite clearly documented methodology, both studies may have had insufficient power to detect

results, as under recruiting and loss of participants throughout the studies could have led to attrition bias (CRD, 2009).

Four out of the ten studies in this review chose not to use health-related quality of life as an outcome (Viljanen et al, 2003; Baird and Sands 2004; Gustavsson and von Koch, 2006; Menzies et al, 2006), although they failed to give a reason for this decision. It may have been an attempt to avoid multiple outcomes; however, given the fact that it is one of the key outcomes recommended by the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (Dworkin et al, 2005), it could be argued that this should have been included. The remaining four studies all used a different outcome measure, which makes pooling of data and comparison of results difficult, and hence clear conclusions difficult to draw (Chapman et al, 2011).

Interestingly, the only study to report any improvement in this domain was a fully supervised inpatient programme (Schweikert et al, 2006) suggesting that chronic pain patients might need additional support and instruction. A systematic review by Scascghini et al (2008) reported evidence of inpatient programmes being more effective than outpatient ones in the management of chronic pain. Indeed in their recommendations for pain management programmes, the BPS (2013) concurred with this point, stating that, despite good evidence of outpatient programmes, more intensive programmes achieve greater improvement which is maintained one year later. This brings into question the cost implications of providing an intensive inpatient programme versus a more standard outpatient one. Further research should be done in this area in order to provide the most effective and affordable management for this group of patients.

Conclusions

Interdisciplinary pain management programmes have been shown to be the most effective intervention for the management of chronic non-malignant pain (Keefe et al, 2008; BPS, 2013; SIGN, 2013).

Anecdotally, relaxation skills such as progressive muscle relaxation and guided imagery have become a standard component of these programmes; however, given the results of this review, the evidence base does not support their inclusion. There was some evidence of improved pain intensity in three out of the eight studies (Baird and Sands, 2004; Poole et al, 2007; Lauche et al, 2013), although flaws in the methodology of all three studies may have affected the robustness of the results.

The only evidence for improved health-related quality of life was from an inpatient programme, incorporating other aspects of pain management and delivered over a short but intensive period.

Most of the studies demonstrated flaws in their methodology, with attrition and data loss a common theme, and many also failed to carry out an accurate power calculation for their multiple outcomes, leaving them underpowered and unable to produce accurate and reliable data. No studies reported any worsening symptoms or adverse reactions to any of the relaxation methods.

Throughout this review process it has become apparent that the recording and reporting of changes in the pain experience is a challenge for all researchers. Most of the outcome measures selected for these studies had good reliability and validity; however, there was little consistency as to which were chosen, making comparison of data difficult at times.

Overall, there is a lack of consensus surrounding the use of relaxation techniques in the management of chronic non-malignant pain. More focused research needs to be done using more robust and accurate methodology in order to draw reliable conclusions about its overall effectiveness and more specifically, which methods should be recommended for inclusion into pain management programmes.

Key Points

- Relaxation is recommended as a component of pain management programmes for patients with chronic non-malignant pain.
- Progressive muscle relaxation is the method most commonly implemented in the current research.
- There is no consensus for the effectiveness of one method of relaxation over another.
- There is minimal evidence for changes in pain intensity or health-related quality of life following relaxation interventions for patients with musculoskeletal chronic non-malignant pain.
- There is a need for more robust clinical trials to strengthen the evidence base surrounding relaxation for chronic non-malignant pain.

Tables & Figures:

Figure 1

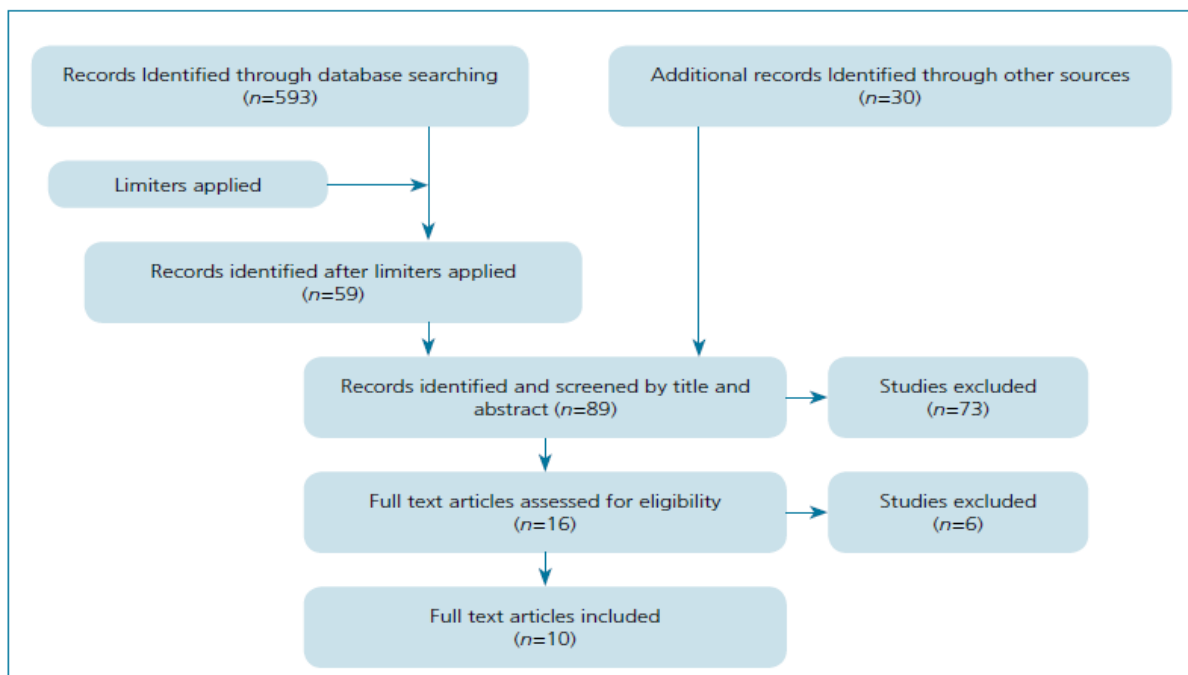


Figure 1. Flow diagram adapted from the PRISMA guidelines (Moher et al, 2009)

Table 1

Table 1. Inclusion and exclusion criteria		
PICOS	Inclusion	Exclusion
Population	Adults 19+ years 3 month + history of chronic non-malignant musculoskeletal pain	Children and adolescents under 18 years of age Malignancy and other comorbidities Pain with a specific diagnosis
Intervention	Relaxation techniques as an intervention: progressive muscle relaxation, breathing techniques, biofeedback, autogenic training	Hypnosis, mindfulness, meditation, unspecified interventions
Comparator	Alternative management to relaxation or standard/usual treatment	Studies with no comparison or control group
Outcomes	Pain Intensity, physical function, emotional function, patient-rated overall well-being, cost implications	Less than three outcome measures
Study type	Randomised controlled studies, randomised clinical studies	Cohort studies, systematic reviews, case studies

Table 2

Table 2. Thematic analysis			
Theme	Study	Outcome measure	Findings
Pain intensity	Poole et al (2007)	Visual analogue scale (0–100)	No significant difference between the groups (relaxation, reflexology and usual care) pre and post; however, a main effect of pain reduction was found irrespective of group
	Schweikert et al (2006)	Visual analogue scale (1–6)	This was a secondary variable in the study. Post-treatment pain showed no significant differences between interventions (standard treatment and standard treatment with cognitive behavioural therapy). After 6 months, there was no significant difference between groups
	Lauche et al (2013)	Visual analogue scale (0–100)	Both groups (cupping massage and progressive muscle relaxation) showed significantly less pain compared to baseline, however without significant group differences
	Thorsell et al (2011)	Visual analogue scale (0–10)	The applied relaxation condition did not produce significant changes in pain intensity at any period, whereas the acceptance and commitment therapy condition produced significant reduction in pain intensity from pre-treatment to post-treatment
	Baird and Sands (2004)	Pain Scale from Arthritis Impact Measures	A significant difference was found between the two groups (standard treatment and guided imagery with progressive muscle relaxation) in how much change in pain they experienced over the 12 weeks. The intervention group (guided imagery with progressive muscle relaxation) reported a significant reduction in pain at week 12 compared to the control group, whose members reported no change in their pain at week 12
	Gustavsson and von Koch (2006)	Visual analogue scale (0–10)	There was no statistically significant differences between the groups (relaxation and treatment as normal) regarding self-reported pain, and there was also no significant differences in pre and post pain within groups for this measure
		Consumption of neck pain analgesics	Consumption of neck pain analgesics was lowered in the applied relaxation group compared to treatment as usual at both follow-ups. Consumption of analgesics increased in the treatment as usual group at follow-ups
	Vijanen et al (2003)	Visual analogue scale (0–10)	No significant differences were found between the two training groups (muscle training and relaxation) and the control group for changes in pain intensity between baseline readings and 12-month follow-up.
	Van Stanten et al (2001)	Visual analogue scale (0–100) and Tender Points Myalgic score	No intervention led to statistically significant or clinically relevant improvements in pain outcome measures
	Menzies et al (2006)	Visual analogue scale (0–10) and McGill Pain Questionnaire	When comparing guided imagery and control group (usual care). Pain did not significantly change over time or by group
Hasson et al (2004)	Visual analogue scale (0–100) reported as %	There was significant improvement in the massage group immediately post treatment, however at 3 months post-treatment there was significant worsening. There were no significant changes in the relaxation group at either time	
Health-related quality of life (HRQoL)	Poole et al (2007)	36-item Short Form Health Survey (SF-36)	Repeated measures ANCOVA revealed a main effect for the SF-36 mental health dimension but an absence of any significant differences between groups on all remaining SF-36 dimensions.
	Schweikert et al (2006)	EuroQoL (HRQoL Questionnaire)	Due to different combinations of quality of life questionnaires not being completed, numbers for analysis differed across themes. The HRQoL scores improved similarly in both groups during rehabilitation. After 6 months, HRQoL in both groups was lower compared to discharge values, with the decline being less pronounced in the cognitive behavioural therapy group. While HRQoL in complete cases was significantly different, it became insignificant when accounting for missing data. Also between groups, there were no significant differences in quality-adjusted life-years
	Thorsell et al (2011)	Satisfaction With Life Scale	There was a marginally significant interaction between condition and time regarding satisfaction with life. The applied relaxation condition did not produce significant changes in satisfaction with life at any period. Conversely, the acceptance and commitment therapy condition produced significant improvements of medium effect size
	Van Stanten et al (2001)	Arthritis Impact Measurement Scale and Sickness Impact Profile	There were no statistically significant differences or clinically relevant changes among the groups irrespective of intervention
	Hasson et al (2004)	Self-Rated Health scale 0-100	There was a significant improvement in the massage group immediately post treatment, however at 3 months post treatment there was significant worsening. There were no significant changes in the relaxation group at either time

Table 3

Table 3. Conceptual mapping table		
Theme	Concept	Studies
Pain intensity	Greater reduction in pain in relaxation group than comparison	Baird and Sands (2004)
	Main effect of pain reduction, but no difference between groups	Poole et al (2007); Lauche et al (2013)
	No reduction in pain as a result of any intervention	Van Stanten et al (2001); Hasson et al (2004); Gustavsson and von Koch (2006); Menzies et al (2006); Schweikert et al (2006); Thorsell et al (2011)
Physical function	Significant differences in function in the relaxation intervention compared to comparison group	Baird and Sands (2004); Menzies et al (2006)
	No significant difference in function between the groups pre and post interventions	Vijanen et al (2003); Gustavsson and von Koch (2006); Schweikert et al (2006); Poole et al (2007); Lauche et al (2013)
Health-related quality of life (HRQoL)	No significant improvements in general health within relaxation group, or between groups	Van Stanten et al (2001); Hasson et al (2004); Poole et al (2007); Thorsell et al (2011); Lauche et al (2013)
	Report an improvement in HRQoL	Schweikert et al (2006)

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