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# Progressive muscle relaxation in persons with schizophrenia: a systematic review of randomized controlled trials

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## Abstract

**Objective:** The aim of this systematic review was to assess the effectiveness of progressive muscle relaxation on psychological distress and anxiety symptoms and on response/remission for people with schizophrenia.

**Methods:** Randomized controlled trials were considered if they investigated progressive muscle relaxation in patients with schizophrenia. EMBASE, PsycINFO, PubMed, ISI Web of Science, CINAHL, PEDro and Cochrane Library were searched. The selection of studies, data extraction and quality assessment were performed independently by two reviewers.

**Results:** Three randomized controlled trials involving 146 patients met the inclusion criteria. Progressive muscle relaxation can acutely reduce state anxiety and psychological distress and improve subjective well-being. No studies investigated the evidence for progressive muscle relaxation as an add-on treatment for general psychopathology and for positive or negative symptoms. Also, no studies assessed the value of progressive muscle relaxation in longer-term treatment and for relapse prevention. There were no data to draw any conclusions about progressive muscle relaxation in comparison with other treatment modalities. None of the studies encountered adverse events. Dose-response relationships could not be determined.

**Conclusion:** Progressive muscle relaxation might be a useful add-on treatment to reduce state anxiety and psychological distress and improve subjective well-being in persons with schizophrenia.

## Keywords

Progressive muscle relaxation, physical therapy, rehabilitation, schizophrenia, state anxiety, well-being

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## Introduction

Schizophrenia is a pervasive psychiatric disorder that typically has its onset in early adulthood and persists for the remainder of the lifespan.<sup>1</sup> The Diagnostic Statistical Manual of Mental Disorders-*IV criteria for schizophrenia* include positive and negative symptoms severe enough to cause social and occupational dysfunction.<sup>2</sup> Positive symptoms reflect an excess or distortion of normal functions and manifest as delusions, hallucinations, and disorganised speech and behaviour. Negative symptoms reflect a reduction or loss of normal functions, consisting of symptoms, such as affective flattening, apathy, avolition, social withdrawal and cognitive impairments. The lifetime prevalence and incidence are 0.30%–0.66% and 10.2–22.0 per 100,000 person-years, respectively.<sup>3</sup>

The aetiology of schizophrenia is unknown, but is presumed to be genetic, combined with environmental risk factors.<sup>4</sup> There is compelling epidemiological evidence that psychological distress and associated anxiety are important environmental risk factors, especially in the case of cumulative exposure.<sup>5</sup> People with schizophrenia experience difficulties in coping with psychological distress and anxiety, and possess a relatively limited repertoire of coping strategies.<sup>6</sup> It is, therefore, not surprising that better functional outcomes might be achieved when psychological distress and anxiety are recognised and treated.<sup>7</sup> This underlines the need for multimodal care, including psychosocial therapies as adjuncts to antipsychotic medications.<sup>1</sup> Research on psychosocial approaches to treatment of schizophrenia has yielded incremental evidence of efficacy for cognitive behavioural therapy, social skills training, and psycho-education.<sup>8</sup> Additional research is needed to examine other therapeutic modalities that might help to improve the functional status of patients with schizophrenia. Recently, there has been a growing interest in relaxation techniques in the multidisciplinary treatment of patients with schizophrenia.<sup>9–12</sup> Relaxation techniques are a simple clinical rehabilitation method that can be administered after brief training. Probably the most common relaxation techniques are variants of progressive muscle relaxation, but other methods

include yoga and mindfulness-based stress reduction.<sup>9</sup> Progressive muscle relaxation can be defined as a successive tensing and relaxing of major muscle groups. The method originally developed by Jacobson<sup>13</sup> required dozens of sessions where the participant was taught to relax 30 different muscle groups. Bernstein and Borkovec<sup>14</sup> later shortened this technique and found it to be equally effective.<sup>15</sup> Previous systematic reviews on physical therapy interventions<sup>9,10</sup> indicated that progressive muscle relaxation might be an interesting relaxation technique in patients with severe mental illness. Its efficacy has, however, not yet been systematically assessed in patients with schizophrenia.

The aim of this systematic review, therefore, was to summarise the evidence from randomized controlled trials of progressive muscle relaxation as an add-on treatment for psychological distress and anxiety symptoms, and on response/remission compared with only care as usual (including waitlist), psychological treatments, medication and lifestyle, and other complementary treatments.

## Methods

The systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standard.<sup>16</sup> Only randomized controlled trials examining progressive muscle relaxation within a multidisciplinary management of patients with schizophrenia in patients with a formal diagnosis of schizophrenia<sup>2</sup> were included. We did not exclude trials because of the age, nationality, or sex of the participants. The primary outcome measures were:

- (a) the mean change in psychological distress and anxiety scores compared with baseline measures,
- (b) the mean change in total, positive, and negative symptoms compared with baseline measured with validated scales.

The protocol stipulated that a quantitative meta-analysis would be carried out if at least three analyses comparing progressive muscle relaxation with a

specific control condition on a specific validated outcome measure were found. Any type of control comparison group was included. Comparisons were classified as:

- (a) minimal treatment (care as usual) with wait list (contact with a treating person without a therapeutic element);
- (b) psychological treatment (cognitive behavioural therapy, interpersonal therapy, psychodynamic therapy, supportive therapy); and
- (c) lifestyle and complementary treatment (such as massage, aerobic exercise).

We performed an electronic search of EMBASE, PsycINFO, PubMed, ISI Web of Science, CINAHL, PEDro and Cochrane Library from the inception of these databases to 24 March 2012. Keywords were 'progressive muscle relaxation' AND 'schizophrenia' in the title, abstract, or index term fields. Details for the search strategy on PubMed is presented in a supplementary web appendix. The reference lists of all located articles were scanned for further relevant literature. Additionally, the bibliographies of relevant book chapters were hand-searched for further articles.

Assessments of quality were completed independently by two reviewers. Disagreements were resolved by discussion. If no consensus was achieved, a third reviewer made the final decision. Each study was evaluated with the previously validated five-point Jadad Scale<sup>17</sup> to assess the completeness and quality of reporting of randomized controlled trials, as well as to assess for potential bias in the trials. This widely used scale focuses on three dimensions of internal validity: quality of randomization, double blinding, and withdrawals. A score of 0 to 5 is assigned, with higher scores indicating higher quality in the conduct or reporting of a trial. A trial scoring at least 3/5 is considered to be of sufficient quality. A trial scoring below 3 is considered to be methodologically weak.

A data collection form was developed and used to extract data from the included studies. Data items extracted are listed in Table 1. The authors, DV and MP, extracted data from each study independently.

**Table 1.** Data extraction

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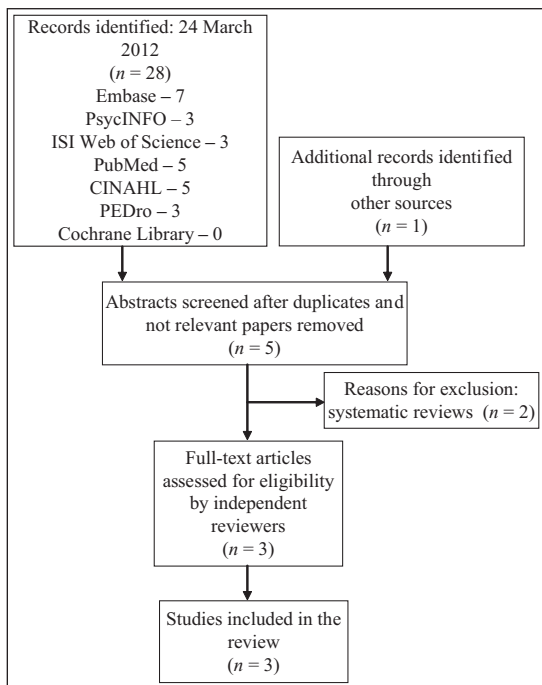
Design
• First author name
• Year published
Country
Participants
• Number, mean age or age range, gender proportion
• Setting (inpatients, outpatients, mixed)
Progressive muscle relaxation characteristics
• Duration and frequency
• Co-interventions
• Control conditions
Outcome measures
• Assessment tools
• Outcome measures
• Adverse effects
• Drop-out rates

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## Results

The initial electronic database search resulted in a total of 28 hits. Through an additional hand search of reference lists one other potentially eligible article was identified. Out of six potentially eligible studies, three were finally included in this review.<sup>18–20</sup> Reasons for exclusion of studies are shown in Figure 1.

According to the Jadad Scale,<sup>17</sup> two of the three included studies<sup>19,20</sup> were considered to be of sufficient methodological quality (see Table 2). The most important limitation was that no randomized controlled trial was conducted in a single- or double-blind fashion. For measuring outcomes, all trials included a self-report measure of state anxiety. Two randomized controlled trials<sup>19,20</sup> used the State Anxiety Inventory of Spielberger.<sup>21</sup> The range of possible total scores is 20–80. Higher scores indicate higher levels of anxiety. This instrument has been extensively validated and is the most widely used measure of anxiety in exercise research in clinical populations.<sup>22</sup> In the study of Chen et al.<sup>18</sup> the Beck Anxiety Inventory<sup>23</sup> and the finger temperature were assessed. The Beck Anxiety Inventory includes 21 questions, each question having four possible scores between 0–3. When the scores are summed, 0–7 points are normal, 8–15 points indicate mild anxiety,



**Figure 1.** Flowchart of systematic review inclusion and exclusion.

16–25 points indicate moderate anxiety, and 26–63 points indicate severe anxiety. The Beck Anxiety Inventory has been validated in clinical populations previously.<sup>24</sup> For measuring psychological distress and subjective well-being the Subjective Exercise Experiences Scale<sup>25</sup> was used. Both measures, psychological distress and subjective well-being, contain four items, which are scored on a scale from 0 (not at all) to 7 (entirely). Higher scores on a subscale indicate a higher perception for this factor. The Subjective Exercise Experiences Scale represents one of the most reliable and valid instruments for assessing subjective well-being in exercise settings.<sup>25</sup> All of the trials reported their data in terms of continuous scale scores. Of the secondary outcomes of interest, drop-outs were assessed consistently.

In total, 146 patients with a diagnosis of schizophrenia were included in the analyses. All studies only included inpatients. A small majority of included patients were male ( $n = 76/146$ , 52.0%). In two randomized controlled trials,<sup>19,20</sup> the medication

regimen remained unchanged during the experimental intervention. In all randomized controlled trials, patients who had received previous progressive muscle relaxation training were excluded. Detailed information on the characteristics of the participants is provided in Table 2.

All randomized controlled trials compared progressive muscle relaxation with quiet resting in a room for a same amount of time as the progressive muscle relaxation intervention. In two trials<sup>19,20</sup> patients in the control condition received the same amount of attention from the therapist. While in the study of Chen et al.<sup>18</sup> the experimental progressive muscle relaxation consisted of 11 sessions on consecutive days, the other two randomized controlled trials assessed a single progressive muscle relaxation session after two initiation sessions.<sup>19,20</sup> To ensure program standardisation, the progressive muscle relaxation in the study of Chen et al.<sup>18</sup> was recorded on an audiotape employing an adapted Jacobson's progressive muscle relaxation protocol,<sup>26</sup> which included progressive relaxation of groups of muscles and deep breathing for 25 minutes. The progressive muscle relaxation tape contained instructions for systematic tensing and relaxation of specific muscle groups, starting with the groups of muscles in the upper body and progressing down to the lower part of the body. In the other two randomized controlled trials,<sup>19,20</sup> progressive muscle relaxation training consisted of successive tensing and relaxing of at least five major muscle groups, beginning with the upper body and proceeding to the lower parts. In these trials, tensing for about 8 seconds and relaxing for about 30 seconds of each muscle group was practiced twice prior to proceeding to a subsequent muscle group.

All included randomized controlled trials found significant reductions in the state of anxiety in patients following progressive muscle relaxation, compared with those sitting quietly for the same amount of time. In the study of Chen et al.<sup>18</sup> the total Beck Anxiety Inventory Score dropped by 57.3% in acute inpatients (vs. -13.3% in the control subjects), while in other trials total State Anxiety Inventory Scores dropped by 26.1% (vs. +1.1%) in acute inpatients<sup>19</sup> and by 6.8% (vs.+2.7%) in chronic inpatients.<sup>20</sup> More detailed information is provided in Table 2.

**Table 2.** Details of the included randomized controlled trials

First author	Country	Participants	Duration (minutes)	Frequency	Control condition	Measurement instruments	Relevant outcomes (vs. controls)	Adverse effects	Co-intervention rates	Drop-out rates	Jadad score
Chen <sup>18</sup>	Taiwan	18 (10♀) inpatients with schizophrenia in an acute inpatient setting; age experimental group (n=9): 39.1±16.8 y (vs. 41.0±16.4 y)	40	11 consecutive day	Sitting in a quiet room	BAI finger temperature	BAI scores decreased from 16.4±4.4 to 7 (vs. from 15.0±3.9 to 13); significant group differences after 11 day (Z=-4.1, P<0.0001) and one weekpost (Z=-2.0, P=0.0446); increase in finger temperature after last session +0.4°C (vs. +0.2°C) (Mann Whitney U=29.5, P<0.05)	No	CAU	11%	2
Vancampfort <sup>19</sup>	Belgium	64 (26♀) inpatients with schizophrenia in an acute inpatient setting; age experimental group (n=32): 35.7±10.7 y (vs. 35.4±11.2 y)	25	Two initiation sessions followed by the experimental session	Sitting in a quiet room with possibility to read and same amount of attention by the therapist	SAI SEES	SAI scores decreased from 45.2±10.3 to 33.4±8.6 (vs. from 45.2±11.8 to 45.7±11.0); SEES psychological distress from 11.6±5.0 to 7.5±3.6 (vs. from 12.2±5.5 to 12.2±5.4) (P <sub>group-differences</sub> <0.05); SEES subjective well-being increased from 16.7±5.3 to 21.5±4.1 (vs. from 15.7±5.9 to 15.4±5.6); (P <sub>group-differences</sub> <0.05)	No	CAU	16%	3
Georgiev <sup>20</sup>	Bulgaria	64 (34♀) inpatients with schizophrenia in an acute inpatient setting; age experimental group (n=31): 43.0±8.8 y (vs. 41.1±9.0 y)	25	Two initiation sessions followed by the experimental session	Sitting in a quiet room with possibility to read and same amount of attention of the therapist	SAI SEES	SAI scores decreased from 51.2±6.0 to 47.7±4.7 (vs. from 47.9±7.8 to 49.2±7.8), SEES psychological distress from 10.5±5.3 to 7.8±3.8 (vs. from 11.9±3.9 to 12.2±5.3) (P <sub>group-differences</sub> <0.05); SEES subjective well-being increased from 14.3±4.8 to 19.9±5.2 (vs. from 14.7±4.1 to 15.2±4.0); (P <sub>group-differences</sub> <0.05)	No	CAU	3%	3

BAI, Beck Anxiety Inventory; CAU, care as usual; SAI, State Anxiety Inventory; SEES, Subjective Exercise Experiences Scale.

The randomized controlled trials of Vancampfort et al.<sup>19</sup> and Georgiev et al.<sup>20</sup> found significant reductions in psychological distress (−35.3% and −25.7% vs. −0% and +2.5%, respectively) and improvements in subjective well-being on the Subjective Exercise Experiences Scale (+28.7% and +39.1% vs. −1.2% and +8.0%, respectively) after a single session of progressive muscle relaxation compared with the resting control condition.

No study investigated the effectiveness of progressive muscle relaxation on positive or negative symptoms.

Adverse events were not reported in any of the included studies.

## Discussion

### General findings

To the best of our knowledge, this is the first systematic review on the efficacy of progressive muscle relaxation as an add-on treatment in patients with schizophrenia. Overall, the present review suggests that progressive muscle relaxation can reduce state anxiety and psychological distress, and improve subjective well-being. No studies investigated the evidence for progressive muscle relaxation as an add-on treatment for general psychopathology, and positive and negative symptoms in these patients. All studies were short-term, and the maintenance effect of progressive muscle relaxation is unclear. There were no data available to enable conclusions about progressive muscle relaxation in comparison with other treatment modalities.

All the included studies have been conducted within the last five years, which suggests that researchers are responding to calls for rigorous research on psychosocial therapies as an adjunct to antipsychotic medications.<sup>1</sup> The evidence from randomized controlled trials of progressive muscle relaxation in schizophrenia is very encouraging, but also very preliminary. Any definite conclusions should be avoided since the number of included randomized controlled trials and reported outcomes were very limited. Furthermore, the content of the included progressive muscle relaxation interventions differed across studies. While two randomized

controlled trials<sup>19,20</sup> investigated a single progressive muscle relaxation session after two initiation sessions, Chen et al.<sup>18</sup> examined a progressive muscle relaxation programme of 11 daily sessions.

### Implications for practice and future research

Since two studies<sup>19,20</sup> demonstrated already that after two initiation sessions beneficial results were obtained, our review data offers preliminary data that progressive muscle relaxation is a relaxation technique that is easy to learn. Moreover, no major adverse effects were reported. For this reason, progressive muscle relaxation can be viewed as a very simple intervention, which can be implemented at minimal cost. Our review also demonstrates that progressive muscle relaxation can be offered in both acute and chronic inpatient treatment settings. However, it is unclear if booster training sessions are needed and if patients continue engaging in progressive muscle relaxation over time or, even on an as-needed basis, when feeling more anxious or facing anxiety-provoking situations.

While progressive muscle relaxation appears to be a promising intervention for state anxiety and psychological distress, many questions remain unanswered. We need to know for which patients with schizophrenia, progressive muscle relaxation is most suitable, including the effects of age, and severity and stage of the disorder. It remains unclear whether progressive muscle relaxation is also beneficial for first-episode patients and for outpatients. If progressive muscle relaxation is to be used as a first line, stepped care for reducing psychological stress and anxiety, we need to know the dose-response and at what point other treatments should be included. Furthermore, we need data on the cost-effectiveness of progressive muscle relaxation compared with other relaxation and stress reduction techniques. This would allow a judgement of the extent to which a lower cost would justify the use of progressive muscle relaxation as a first-line intervention in place of, for example, a more complex cognitive-behavioural-based stress reduction programs. To date, there are no data on progressive muscle relaxation compared with such interventions. We also need to know to what extent

progressive muscle relaxation can add to the effects of antipsychotics and antidepressants, and in which way medication could be spared or used at lower doses when using progressive muscle relaxation.

More research is necessary on a broader range of outcomes besides psychological distress and anxiety symptoms. In particular, we need to know the effect of progressive muscle relaxation on positive or negative symptoms and on long-term outcomes, including relapse rates. It also needs to be demonstrated if the beneficial effects of progressive muscle relaxation can be translated into behavioural outcomes, for example through increasing rates of abstinence from nicotine or illegal drugs. The use of these substances is a common practice among individuals with schizophrenia.<sup>27</sup> It has been suggested that the mentioned unhealthy behaviours may be attempts to alleviate or to cope with unpleasant affective states and feelings of state anxiety.<sup>28–30</sup>

Also, the mechanism by which progressive muscle relaxation works is unclear. The study of Chen et al.<sup>18</sup> found evidence for physiological changes (i.e. increase in finger temperature) immediately after progressive muscle relaxation. Previous research in the general population already indicated that, when a patient is anxious, subcutaneous arteriole vasoconstriction reduces the amount of heat lost in the periphery, which results in a decreased skin temperature and cold extremities. If the individual is in a passive state, they can be guided to focus their concentration and to reduce their awareness of other stimuli, while maintaining a comfortable position. This process of physiologic slowing down results in reduced muscle tension, reduced metabolic rate, decreased blood pressure, decreased middle cerebral artery blood flow and an increase in finger temperature, and psychologically produces a feeling of emotional comfort free from anxiety.<sup>31</sup> Future research needs to examine other physiological mechanisms (e.g. increased norepinephrine, serotonin and beta-endorphins, increased parasympathetic activity)<sup>32</sup> and/or psychological mechanisms (e.g. increased self-efficacy, distraction)<sup>33</sup> that could be responsible for reductions in state anxiety and psychological distress.

Finally, all future trials of progressive muscle relaxation in persons with schizophrenia need to pay attention to the methodological and reporting

requirements for randomized controlled trials, as specified in the Consolidated Standards of Reporting Trials Statement.<sup>34</sup> In particular, studies should minimise threats to internal and external validity, such as lack of blinding of outcome assessors. Although researchers may not readily be able to mask participants to progressive muscle relaxation related interventions to remove the chance of performance bias, every attempt should be made to collect research data in a masked manner. For example, blinding of data collectors and outcome adjudicators is often achievable.

In conclusion, this systematic review demonstrated that providing progressive muscle relaxation might alleviate psychological distress and state anxiety, and might improve subjective well-being acutely in patients with schizophrenia. Future research is, however, needed before any firm conclusions can be drawn. Future studies should also collect and assess data on positive and negative symptoms to further validate the efficacy of the progressive muscle relaxation. Additional studies should pursue the elucidation of the underlying mechanisms for the beneficial effects of progressive muscle relaxation and compare these with other treatment options. Finally, studies are sorely needed that assess adherence to, and durability and outcomes of, longer-term progressive muscle relaxation treatment.

### Clinical messages

- Progressive muscle relaxation appears to be a promising intervention for reducing state anxiety and psychological distress in patients with schizophrenia.
- To further justify the use of progressive muscle relaxation as a first line of care for reducing psychological stress and anxiety in patients with schizophrenia, more research is highly needed.

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