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The usefulness of breathing and relaxation techniques influencing the autonomic nervous system state in psychiatry. A subjective review of contemporary research. Part 2 – Western tradition

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Summary

The authors present a subjective review of recent research on the use of selected techniques influencing the state of the autonomic nervous system, based on the Western tradition, i.e. autogenic training by Johannes Heinrich Schultz and progressive muscle relaxation by Edmund Jacobson. The basic assumptions of both methods are discussed, taking into account the modifications that have occurred since their creation, pointing to their consequences and the necessity of taking them into account in research. The importance of including as accurate descriptions of the used interventions as possible in publications was also pointed out. The current subjective review focuses on studies of adults from clinical populations, suffering from mental disorders. Selected studies from the period 2020–2023 (July 30, 2023) and earlier ones, including literature reviews, listed in the PubMed database were included. The most important results and conclusions of the authors of previous research and reviews were discussed, including pointing out the numerous modifications of the discussed techniques, which make it difficult to compare the results, and the need for further, better quality research. The results of this subjective review allow us to agree with previous suggestions of the potential usefulness of autogenic training and progressive muscle relaxation as additional techniques in the treatment of mental health disorders.

Key words: autogenic training, progressive muscle relaxation, mental disorders

Introduction

Contrary to Eastern tradition, in Western culture techniques involving voluntary regulation of autonomic state were developed without spiritual background [1, 2]. They include autogenic training (AT), progressive muscle relaxation (PMR), and biofeed-

back. In our opinion, to some extend also compassion-focussed therapy (CTF) may be included to such methods, taking into consideration that one of its key elements is soothing breathing rhythm, aimed at vagal nerve stimulation and increasing heart rate variability (HRV) [3, 4]. Also polyvagal therapy (PVT)[1], that emphasises the importance of the functioning of the autonomic nervous system is worth mentioning here [5, 6].

However, in the current subjective review we have decided to concentrate on two techniques with the longest tradition, i.e. autogenic training (AT) and progressive muscle relaxation (PMR). As there is a substantial number of studies which use mixed or different types of interventions, some of them are also mentioned. Basic information regarding methods rooted in Eastern culture, the role of the autonomic nervous system, connections between breathing and emotions, as well as physiological markers used in outcome research may be found in part 1 of our review [7].

Autogenic training

Autogenic training (AT) is commonly known as a relaxation technique. Its founder, Johannes Heinrich Schultz called it, a "self-hypnotic procedure" [8], and his well-known student and co-worker, Wolfgang Luthe described it as "psychophysiologic form of psychotherapy" [9]. The first publication on AT by Schultz was released in 1932 [10]. AT is a form of autonomic self-regulation, based on a phenomena of passive concentration. It consists of a set of six exercises concentrated on inner sensations of heaviness and warmth in the limbs, a calm heartbeat, slower breathing, abdominal warmth and a cool forehead. AT is supposed to result, among others, in reduction of excessive sympathetic tone and a better balance between sympathetic and parasympathetic activity, muscle relaxation, self-control of breath, and heart rate variability [11]. While AT is commonly associated with reduction of excessive autonomic arousal (i.e., as mentioned above, AT as a relaxation method), it should be remembered that it is based on a bidirectional homeostatic model, so may be also useful in raising dysfunctionally low levels of autonomic function (e.g. low heart rate variability, HRV) [8].

What is important from a practical point of view, over the curse of time the original assumption of "passive concentration" has diffused and the method has changed into more "hypnotic" than "self-hypnotic", and more active than passive in terms of stress put on conscious effort on exercises. Still, e.g. in the AT exercise of regulation of breathing any intentional influence on or modification of breathing is undesired, as associated with voluntary activity and tension. This assumption is reflected in the formula "It breathes me". It is worth noticing, that for some individuals it is easier to attempt voluntary changes of breathing, as in yoga, but such attempts in AT should be prevented [8].

[1] Interesting responses by S. Porges to other authors' critical comments regarding polyvagal therapy can be found on the Polyvagal Institute website: https://www.polyvagalinstitute.org/vagal-paradox.

Literature review

In 2020–2023 (July, 30th) there were as many as 112 articles listed in Pubmed, searched with the use of a keyword "autogenic training", but only a few of them referred to adult patients suffering from mental health problems or symptoms, including a protocol for a systematic review of RCT (*randomized controlled trial*s) [12]. In February 2023, Breznoscakova et al. [13] published a very interesting narrative literature review with elements of critical review of 29 studies on autonomic training. However, their review includes studies on non-clinical groups (e.g. "practitioners of AT"), as well as studies published over 50 years ago (on schizophrenia). Thus, we have decided to start our analysis of literature with previous reviews on AT application in psychiatric patients and then present some recent studies we found interesting.

In 2000, Ernst and Kanji [14] published a systemic review of eight controlled trials of autogenic training in "stressed and anxious" subjects. Interestingly, the authors noticed that very frequently AT techniques applied in those studies were different from the original one. Positive effects of AT in reducing stress were found in seven trials. Still, the authors concluded that the review results were not sufficient to draw clear conclusions and underlined that AT used in a proper way requires further, better-planned controlled trials.

Eight years later, Manzoni et al. [15] published a review of studies from 1997–2007 on effects of different relaxation trainings (Jacobson's progressive relaxation, autogenic training, applied relaxation, and meditation) for anxiety problems and disorders. They included 27 studies: RCTs, observational and without control group. Among them, three used AT: one in 30 patients undergoing coronary angioplasty and 29 controls [16], one in 21 anxiety and psychosomatic patients and 12 controls [17] and one in 18 patients with cancer [18]. Similarly to Ernst and Kanji [14], we differentiate them from a study which combined AT with other techniques [19]. In conclusions Manzoni et al. [15] stated that "clear" interventions were more effective than mixed ones, and that efficacy of relaxation training in reducing anxiety was "consistent and significant". All techniques were effective, with meditation as the most effective.

Effectiveness of AT in the National Health Service (NHS) outpatients with chronic health problems and sleep problems was examined by Bowden et al. [20]. The participants of that study suffered, among others, from anxiety/depression, cardiovascular disorders, insomnia, gynaecological problems, musculoskeletal and neurological disorders, as associated problems the authors listed family and relationship dysfunction, death or illness in the family and problems with employment. In that study, sleep-related problems before AT implementation were reported by 73% of participants. They linked those problems with different reasons, like worry, pain, irritable bowel syndrome or shift work. After a standard 8-week AT course, sleep quality improved, in terms of among others, faster falling asleep after night waking, feeling more refreshed and more energised on waking. Also wellbeing, anxiety and depression scores improved significantly, along with MYMOP symptom (MYMOP questionnaire refers to the two most important symptoms associated with a specific problem as assessed by a patient,

the way they affect one activity chosen by a patient, and general wellbeing [21]). The authors concluded that AT may be useful in treating insomnia in primary care.

Golding et al. [22], were interested in a duration of effects of AT in patients after a stroke. They found that reductions in anxiety in individuals who received a self-help autogenic relaxation CD appear to be maintained after one year. It is worth noticing, that even if using CDs or apps nowadays seems obvious, a recorded instruction is not in line with original approach to AT and in order to follow Schultz's ideas of self-hypnotic aspect of AT, it would be important to keep such recordings as simple and not suggestive as possible.

An example of implementation of such method is a study by Kiba et. al. [23] on 24 patients with functional somatic syndrome (including, e.g. irritable bowel syndrome, tension headache, premenstrual syndrome or chronic low back pain) and 23 healthy controls. The authors aimed at identifying changes in biological measures, i.e. the salivary amylase (sAMY) level and skin temperature of the finger, during AT sessions and examining relationships between these biological measures and the changes in physical and psychological measures. The form of AT used in this study was based on the style developed by Schulz and included two standard exercises that took place after the participant stated the following formula: "I am at peace". The first one was aimed at muscular relaxation via repetition of the formula "My arms are heavy", and the second at obtaining feeling of warmth via repetition of the formula: "My arms are warm". AT was performed in a sitting posture and a tape recording was used. The participants completed three individual AT sessions at an interval of around 60 days. Additionally, they were asked to complete 3 minutes of AT twice a day. The authors concluded that the practice of AT improved somatic symptoms (reflected in sAMY), as well as tension-anxiety symptoms.

Also the recently published pilot study by Krempel and Martin [24] referred to patients with somatic symptom disorder (SSD). The authors found that in the study group of 50 patients, both 4 sessions of AT and 4 sessions of HRV biofeedback led to an improvement in symptoms, although the improvement was more pronounced in the case of the latter technique.

The last interesting application of AT that we would like to mention, was researched by Stanton et al. [25, 26], who tested AT in women with sexual problems. In the first study [25], a sample of 25 premenopausal women who reported decreased or lack of sexual arousal for at least 6 months and met the clinical criteria for sexual dysfunction established by the Female Sexual Function Index (FSFI), listened one time to a 22-minutes recording of AT. AT was expected to increase the HRV (Heart Rate Variability). The authors assessed the effects of such single session of AT on sexual arousal, using a vaginal photoplethysmograph, subjective assessment of sexual arousal and perceived genital sensations measures, along with assessment of HRV with electrocardiography. They found that AT increased acute subjective sexual arousal and perceived genital arousal in the study group, and thus suggest that it may be a useful and easy to learn technique in treating women's sexual arousal problems. Also, women who experienced the greatest increases in subjective sexual arousal, had the greatest changes in rest-

ing HRV, what indicates HRV level as an important marker of the autogenic training intervention effects. The authors noticed that other interventions increasing HRV are of potential value in similar populations.

In the second study, based on previous findings, Stanton et al. [26] examined the efficacy of HRV biofeedback, with and without AT, as a treatment for sexual arousal dysfunction in an at-home setting. Their initial sample included 78 women, out of whom nine dropped out of the study after the first laboratory visit. 69 participants completed all three laboratory visits and 40 completed the one month follow up assessment. Participants were randomised into one of three groups: (1) receiving HRV biofeedback, (2) receiving HRV biofeedback and AT, or (3) waitlist control. Each condition included three laboratory sessions (each in around 14 days). Women in the two active conditions completed 4–6 biofeedback sessions at home, and those from the HRV + AT group listened to a 14-min autogenic training recording before completing the biofeedback. Across the three laboratory visits, participants in the groups differed significantly in their genital arousal, subjective sexual arousal and perceived genital sensations. Compared to women in the control group, women who engaged in HRV biofeedback at home, with or without additional autogenic training, experienced increases in genital arousal, subjective sexual arousal and perceived genital sensations. Again, the authors concluded that HRV biofeedback or the combination of HRV biofeedback and autogenic training may be useful in the treatment of female sexual arousal problems.

Progressive muscle relaxation

Progressive Muscle Relaxation (PMR) is a technique developed by Edmund Jacobson in the early 1900s [27] and published in two books: *Progressive Relaxation* [28] and *You Must Relax. A Practical Method of Reducing the Strains of Modern Living* [29][2]. PMR is based on active muscle contraction in one body segment, and then their relaxation, while focusing attention on the feelings generated focally. The basic assumption of PMR is that there is a link between physical and emotional tension/relaxation, so that muscular relaxation helps in decreasing psychological stress. In the original form PMR involved even 44 muscle groups, then it was shortened to 16 [30–32], and similarly to AT, coupled with elements of suggestion. Similarly, it happened contrary to the author of PMR who wanted it to be a solely muscular skill and who avoided suggestions [30]. Thus, in analysing results of existing studies, it is important to keep those differences in mind. Further, researchers should remember about detailed descriptions of methods they use or about providing study protocols.

[2] In Polish *You Must Relax. Praktyczna metoda zmniejszania napięć współczesnego życia*

Literature review

Our initial search of Pubmed database, with the use of the keyword "progressive muscle relaxation" revealed 130 articles published in 2020–2023 (July, 30th), but similarly to AT studies, we found only a few referring to patients suffering from psychiatric problems. Thus, we begin our subjective review with older studies, including previous reviews.

In 2020, Torales et al. [33], in a narrative review of usefulness of PMR in dealing with anxiety, concluded that it was found to be useful both in adults and in the paediatric population, in clinical and non-clinical samples and can be taken into account as a technique of routine care of people with anxiety. They also noticed that the fact that PMR is an easy technique to learn and practice (also by patients alone, at their homes), without any special equipment, is a clear advantage. As for studies involving psychiatric populations, their review included 5 articles: (1) a study by Zullino et al. [34] on patients with generalised anxiety disorder treated with venlafaxine, PMR or a combination treatment, (2) a study by Servant et al. [35], who tested effects of a 10-week relaxation programme consisting of breathing control, muscular relaxation, meditation, and mental visualisation in a group of 28 patients with generalised anxiety disorder or panic disorder, (3) a study by Merakou et al. [36], who studied long-term unemployed individuals suffering from anxiety disorders offered 8-week PMR programme and counselling services or just counselling services, (4) a study by Kumar et al. [37], assessing the effectiveness of PMR in decreasing anxiety in alcoholic patients, and (5) a study by Vancampfort et al. [38] on patients with schizophrenia. Interestingly, the latter found that only one session of PMR (25 minutes) resulted in decrease in acute feelings of stress and anxiety and an increase in subjective wellbeing in patients with schizophrenia.

In 2013, Vancampfort et al. [39], published a systemic review of three RCTs (overall 146 participants) on PMR in schizophrenia treatment. Again, their conclusions were very similar to the previous ones, i.e. that PMR seemed to be a useful additional treatment to reduce state anxiety and psychological distress and improve subjective wellbeing in individuals suffering from schizophrenia. A methodological comment to that review may be found in a letter to the editor [40].

Another interesting review, by Conrad and Roth [41], was published in 2007. It ended with a conclusion that even if patients with generalised anxiety disorder and panic disorder may exhibit elevated muscle tension and abnormal autonomic and respiratory measures during laboratory baseline assessments, there was no sufficient evidence to state that physiological activation decreases over the course of muscle relaxation training in such population, even when they report becoming less anxious. The authors underlined a need for better-designed studies which might enable identification of the mechanisms of muscle relaxation and thus advance clinical practice.

An attempt to identify such mechanisms was taken by Pifarré et al. [42], who also noticed that progressive relaxation action mechanisms are still not well understood because only few studies have assessed its physiological basis. Their research was

aimed at evaluation of changes in brain glucose metabolism induced by PMR in patients under a stressing state generated by a diagnostic medical intervention (84 oncological patients). The authors assumed that changes in brain metabolism were coupled to changes in brain activity, and anticipated a predominant reduction of glucose utilisation as a consequence of attenuating stress-related brain response. Maps of brain glucose distribution from 28 patients receiving PMR were compared with maps from 28 patients receiving sublingual diazepam and 28 patients with no treatment intervention. The relaxation intervention included three parts. During the first one the patient was told to focus on the breathing to achieve a respiratory slow and regular (natural) rhythm, not demanding any additional effort. In the second phase there was a visualisation technique implemented, and the last phase included the proper progressive relaxation technique where the respiratory natural pattern served as a guide and different muscle groups were tighten and relaxed (all lasted for 15 minutes). Results showed that relaxation induced by such procedure can be similarly effective as a reference anxiolytic (diazepam) in reducing brain activity during a stressful state (similar pattern of reduction in glucose utilisation), even if it was impossible to isolate the effect of placebo. Interestingly, in their call for further research, the authors suggest that one possible path should lead to identify treatment action separately for the "somatic" and "cognitive" components of anxiety.

In another very interesting study, Schröder et al. [43], investigated effects of an outpatient cognitive-behavioural therapy (CBT) treatment in comparison with PMR as another active control treatment and a waiting list control group (WLC) in 134 patients with multiple somatoform symptoms. CBT and PMR were conducted as an 8-session group training (4–11 members, 90 minutes). The PMR treatment was based on modifications of Jacobson's original programme by Bernstein and Borkovec. The authors measured the severity of somatisation (with *Screening for Somatoform Symptoms* inventory, SOMS), physical functioning (*Short-Form Health Survey*, SF-12), mental wellbeing (SF-12), anxiety and depression (the *Hospital Anxiety and Depression Scale*, German Version, HADS-G), and the number of medical consultations/healthcare utilisations (interviews at pre-test and follow-up). The results showed that cognitive-behavioural therapy was more effective than progressive muscle relaxation compared with no intervention (waiting list) in terms of symptom severity, number of symptoms and psychological wellbeing, but not in terms of depressive and anxiety symptoms or physical wellbeing. Both CBT and PMR led to significant reductions (but with small effect sizes) in symptom number and intensity for at least 6 months. Contrary to initial assumptions, CBT did not result in better outcomes than PMR and the authors discuss three possible explanations of that finding. In addition, we would like to point out that their CBT intervention included a short exercise in PMR to demonstrate the physiological effects of relaxation techniques, and the participants were introduced to the principles of PMR, and on the other hand, in the first session of PMR hyperarousal and symptom awareness were presented as precipitating factors for somatoform symptoms. Thus, it seems that each active intervention included at least a hint of the other one.

In 2019, Melo-Dias et al. [44], in their systemic review of 5 studies involving adult patients suffering from schizophrenia, concluded that PMR may be useful to decrease state anxiety, improve wellbeing and social functioning, but because of different number and length of sessions (e.g. only one session or six sessions once per week) and outcome measures, they found no strong evidence. Also Lu et al. [45] investigated effects of PMR in 80 patients suffering from chronic schizophrenia. They concluded that PMR may have a short-term effect on reducing anxiety, improving psychotic syndromes and QoL in such patients.

PMR in dental anxiety treatment was studied by Park et al. [46] in a group of 68 periodontal patients randomly assigned to either an intervention group or a control group. The intervention group received PMR for 20 minutes and health education for 15 minutes before periodontal treatment once per week for 4 weeks. The control group was provided with health education only. The authors assessed changes in dental anxiety, depressive symptoms, blood pressure, heart rate, and salivary cortisol 4 weeks and 3 months after the intervention. They found that patients from the intervention group reached greater reductions in all outcome criteria at both time-points.

The influence of PMR on biological markers was investigated also by Beddig et al. [47]. The authors examined changes in daily rhythm cortisol parameters in currently remitted individuals with recurrent depression and how they were linked to improvements in affective and cognitive functioning. Participants were randomised to a four-week mindfulness-based attention training (MBAT, n = 39) or a progressive muscle relaxation training (PMR, n = 39). The authors found, among others, that global cortisol increased irrespective of subjective improvement in PMR participants, while MBAT participants with larger reductions in negative affect and rumination maintained their initial cortisol levels, and subjects with lower improvement paralleled the PMR group.

Louvardi et al. [48], in a systemic review published in 2021 included only 4 out of initial 569 publications regarding individuals with addictive behaviours. They found that PMR, unlike AT and guided imagery, might lead to a decrease of stress levels. It is worth noticing that, according to those authors, quality of all trials was low.

In reference to patients suffering from social anxiety disorders, Cougle et al. [49] found that in PMR (as an active treatment) as well as interpretation bias modification (IBM [50, 51]) online programmes led to symptoms improvement. Similar conclusions resulted from an earlier study on PMR and IBM in body dysmorphic disorder [52].

Sayadi et al. [53] investigated effects of an intervention based on "movement therapy", comprising warm-up exercises, three stretching exercises, ten movements repeated several times with several deep breaths, and stretching movements to cool muscles again, followed by 15–20 minutes of PMR (30 sessions) in a group of 60 patients suffering from depression. As their intervention was quite complex, it is difficult to determine to what extend their results indicate PMR as beneficial. Nevertheless, patients in both intervention and control groups received routine treatments, but those from the intervention group showed greater decrease in depression scores.

Finally, in the recent study by Oehler et al. [54], web-based PMR was chosen as an active control condition compared with a 6-week guided, web-based self-management

intervention based on cognitive-behavioural therapy (iFightDepression tool, https://ifightdepression.com/en/) for individuals with depression or dysthymia. It is important to notice, that participants were recruited via the Internet, other media, newsletters of the German Depression Foundation and associated organisations. PMR sessions lasted from 13 to 33 minutes, and were built on one another, i.e. included more muscle groups every week. Participants were instructed to practice every day, at least 2 or 3 times a week and to integrate the practice into their daily routine. The authors found that both groups showed decrease in symptom severity, more prominent in the CBT group.

Conclusions

Despite relatively long history and popularity of discussed methods, existing studies involve numerous different sub-types of both of them which, similarly as in the case of breathing techniques rooted in Eastern culture [7], makes their results difficult to compare. Again, although many authors postulate the need for future, better-planned studies, it is indicated that both AT and PMR may serve as a useful augmentation to the treatment of a number of mental health problems, as well as cardiac problems that are common among patients with mental health disorders [13]. It is also worth noticing research results indicating the importance of respiratory and muscular symptoms reported by patients with neurotic or personality disorders [55, 56], in relation to which PMR in particular seems to be a technique that can support psychotherapeutic interventions.

From the practical point of view, as we previously mentioned [7], "relaxation" methods seem to be generally well perceived by their users. As for AT and PMR, Ozamiz-Etxebarria et al. [57] found that PMR as a technique easy to learn was preferred over AT by a group of university students (not psychiatric patients) who were volunteers in their study. Also Torales [33] and Melo-Dias et al. [44] state that PMR is easy to learn. Other authors [58] point out that AT should be tailored to individual's state of physical and mental health as well as capacity to follow instructions. Breznoscakova et al. [13] emphasise that it is important to conduct research aimed at identifying people who can best benefit from the use of AT, and that there are no studies regarding its use in patients suffering from bipolar disorder, psychotic disorders or an acute reaction to stress. Therefore, we also recommend that, especially in the case of patients with mental disorders, AT should be conducted at least at the beginning of practice by an experienced person, and we do not recommend using only recorded instructions for individual use by patients.

As a final remark, we would like to point out that to our best knowledge, there are no studies regarding application of AT or PMR in Polish psychiatric patients. We have found a case study by Daszkiewicz et al. [59], who describe the use of a complex intervention including hypnosis with elements of AT, and additionally a number of other techniques, e.g. self-hypnosis and visualisation in the case of a patient with neuropathic pain, and a study on the impact of a single fifteen-minute AT session on attention efficiency measured by the continuous performance test in a group of 20 patients with

recurrent depression and a control group of 22 individuals [60]. Therefore, it seems reasonable to explore this area of clinical practice in Poland, even taking into account the observation that the conclusions from narrative reviews are usually more positive than those from systematic reviews [61].

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