Efficacy of an EMG-biofeedback therapy in fibromyalgia patients. A comparative study of patients with and without abnormality in (MMPI) psychological scales

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Abstract

Objective

The aim of the present study was to investigate the efficacy of EMG-biofeedback in female fibromyalgia patients with and without abnormality in the MMPI.

Methods

According to their MMPI profile out of a total of 24 patients, 12 patients were classified as 'psychologically abnormal' (at least one scale with a T-score higher than 70) and 12 as 'normal'.
In a quasi-experimental setting, all patients underwent EMG-biofeedback therapy (12 sessions, twice weekly), after a waiting period of six weeks. Clinical symptoms (pressure point sensitivity, secondary symptoms), subjective pain dimensions as well as quality of life were assessed before and after the waiting period, immediately after the biofeedback training and at a three month follow up.

Results

Within the 'psychologically abnormal' patients primarily depressive, hypochondriacal and hysterical symptoms were found. Statistical evaluation showed that 'psychologically normal' patients experience long-term relief from pain measured in terms of pressure point sensitivity; vitality and mental health. 'Psychologically abnormal' patients, on the other hand, showed improvements in all the measured parameters (clinical symptoms, sensory and affective pain components, quality of life) after EMG-biofeedback. Long-term improvement, however, was observed only in pressure point sensitivity and the sensory pain dimension.

Conclusion

The results suggest, that assessment of FM-patients should not only consist of commonly used ACR diagnostic criteria but should also include psychodiagnostic criteria, as these may co-determine treatment outcome. One approach to treating FM patients with additional psychological abnormality might be combining EMG-biofeedback that enhances self-efficacy with psychotherapy that helps patients to become aware of their basic psychological problems.

Key words
EMG biofeedback, fibromyalgia, MMPI abnormality.

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Introduction

Treatment modalities for patients suffering from fibromyalgia (FM) range from tricyclic antidepressants, clorpromazine, nonsteroid anti-inflammatory medication and trigger point injections to administration of heat, massage, physical therapy, exercises, electrotherapy, therapeutic ultrasound, hydrotherapy as well as relaxation programs, cognitive-behavioral therapy and biofeedback training. All of these very diverse treatment procedures have shown only limited success (1).

In his overview, Leventhal (2) has pointed out that studies with antidepressants and commonly used analgesics show the most consistent positive results. In two other, recently published reports by Sim and Adams (3) and Berman and Swyers (4), a clear need for further systematic evaluation of the effectiveness of nonpharmacological treatment approaches in fibromyalgia has been underlined. Since in our setting, EMG-biofeedback is often employed as an alternative to pharmacological treatment, we were especially interested in controlled studies on this topic. In a study published by Buckelew *et al.* (5), biofeedback training, exercise and a combined treatment were compared with an education/ attention control program. All three treatment groups improved especially in self-efficacy for function (one can competently cope with a challenging situation) relative to the control group. There is also a somewhat older report by Ferraccioli *et al.* (6), who found that fibromyalgia patients, who were depressed or had an overt psychosomatic background did not benefit from EMG-biofeedback. However, this observation must be regarded as a post-hoc finding, since this aspect was not the primary issue of their investigation.

Aim of the following study was to evaluate the efficacy of an EMG-biofeedback therapy in FM-patients under special consideration of abnormality in the MMPI. Due to the results of Ferraccioli one would expect, that patients with psychological abnormality profit less in various measurements of pain perception and quality of life than patients with no psychological abnormality.

Materials and methods

Subjects

Out of 47 female patients with FM seen at the rheumatological outpatient unit of the Department of Internal Medicine at the Innsbruck University Hospital during a period of six months, 24 women who fulfilled the criteria of a fibromyalgia syndrome (pressure points, widespread pain according to the criteria of the American College of Rheumatology, 7), gave informed consent and participated in the study.

Pressure point sensitivity was measured with the help of the 'pressure thresholdmeter'of the Pain Diagnostics and Thermograph Company. Measurements were performed according to the method of Fischer (8), results are presented as kg/cm^2.

Procedure

A quasi-experimental mirror image design was chosen for this study. Instead of a control group, there was a treatment-free waiting period for six weeks for all patients. Before and after the waiting period, all patients were examined with regard to clinical symptoms (pressure point sensitivity, secondary symptoms), subjective pain experience as well as quality of life.

After the waiting period, patients were asked to fill in the short form of the Minnesota Multiphasic Personality Inventory (MMPI, German version, 9). The MMPI is a questionnaire with 221 items assigned to 10 clinical-psychiatric/psychological factors: hypochondria, depression, hysteria, psychopathic deviancy, masculine/feminine, paranoia, psychastenia, schizophrenia, mania and social introversion. Should at least one scale of the MMPI show a T-score above 70, a patient is classified as 'psychologically abnormal'. According to this criterion, patients were grouped as 'psychologically abnormal'(group 1) or 'psychologically normal" (group 2).

Subsequently, both groups received biofeedback therapy. At the end of the biofeedback training program as well as after a follow-up period of three months, clinical symptoms, subjective experience of pain and quality of life were assessed again. The design is shown in Figure 1.

Additional psychological measures

The Pain Perception Scale (SES, 10) draws special attention to the multidimensional aspects of pain (11). It is a questionnaire similar to the McGill questionnaire of Melzack and Torgerson (12). It separately assesses the affective and sensory dimensions of pain during the last three days. Items such as 'the pain is agonizing, depressing, frightening" characterize the affective pain dimension, items such as 'burning', 'throbbing', 'pounding', 'stabbing' the sensory pain dimension. The questionnaire contains 24 items, each of which can be rated on a scale from 1-4, ranging from 'does not apply' to 'fully applies'.

The SF-36 (13) assesses quality of life, especially vitality, general health, social functioning, physical functioning, bodily pain, mental health, role-physical and role-emotional. The scales comprise 2 to 10 items, rated on scales varying from 2 to 6 response categories. According to Goossens *et al.* (14), rating scales have been proven useful in uncovering changes of quality of life in fibromyalgia patients.

Biofeedback training

Biofeedback therapy was performed as an EMG-reduction training, using a computer-supported appliance by Insight Instruments (Vienna, Germany).

Self-adhesive electrodes were placed on the right trapezius muscle (15). Feedback information on changes in muscle tension is visualized either as progressive lines or by disks with changing colors (red = high, to blue = low EMG values). Additionally, an auditory feedback signalizes higher muscle tension with higher pitchtones.

Each patient underwent a total of 12 treatment sessions, each session, performed twice a week, lasted 45 min. After each session, patients were advised to continue performing the muscle relaxation exercises at home.

Statistics

Statistical analysis was performed with SPSS, version 8.0. For comparison of pressure point sensitivity, affective and sensory pain components within and between the groups, repeated measures analysis of variance were used. Changes of quality of life data of each group were analyzed with the Friedman test. The McNemar test was used to calculate changes in the secondary symptoms. To evaluate changes during the treatment-free waiting period, t-tests, Wilcoxon tests and McNemar tests were employed. An alpha ≤ 5% was considered to be significant.

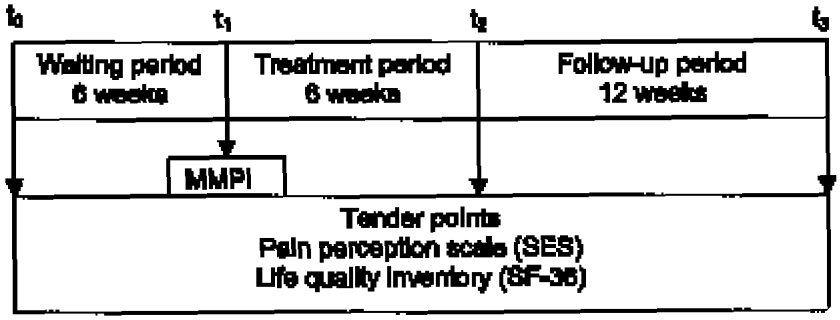

Fig. 1. Study design.

Table I. Demographic data.

Demographic data	'Psychologically abnormal' group, n = 12	'Psychologically normal' group, n = 12
Age	mean=48 (sd=6) years	mean=51 (sd=7) years
Family status	50.0% married 41.7% divorced 8.3% single	33.3% married 66.7% divorced
Living with	58.4% husband 16.6% husband and children 8.3% parents 16.7% alone	16.7% husband 50.0% husband and children 33.3% children
Education	Compulsory schooling: 75.0% Vocational training: 16.7% High school: 8.3%	Compulsory schooling: 33.3% Vocational training: 66.7%
Profession	Skilled worker: 16.7% Unskilled worker: 66.7% Retired: 8.3% Housewife: 8.3%	Self employed: 16.7% Skilled worker: 16.7% Unskilled worker: 33.3% Retired: 16.7% Housewife: 16.7%

Results

The demographic data, the clinical and secondary symptoms of the patients are presented in Tables I and II. The subjects in group I had somewhat less vocational training and there were more unskilled workers than in group II, but the sample is still too small to evaluate socioeconomic influences.

Within group I ('psychologically abnormal', according to MMPI criterion), 58.3 % of patients showed more than one elevated scale in the MMPI. The elevations were found mostly in 'hypochondria' (91.7%), 'depression'(66.7%) and 'hysteria' (50%). The clinical data confirmed these results. Within group I more people complained about stress intolerance, chronic headache and anxiety.

There were no significant changes during the 6-week treatment-free waiting period, neither in pressure point sensitivity, the diagnostic criterion of 'widespread pain', nor in subjective pain experience and quality of life in the whole sample.

Comparison of pressure point scores of the two groups

There were statistically significant improvements in pressure point sensitivity in both groups over the three time points of measurement since the beginning of the treatment ($F = 8.789$; $df = 2$;

Table II. Clinical data.

Clinical data	'Psychologically abnormal group, n=12	'Psychologically normal group, n=12
Fibromyalgia in the family	None 58.3% Sibling 16.7% One parent 25.0%	None 66.7% One parent 33.3%
Illness-triggering event	None 66.7% Yes 33.3%	None 66.7% Yes 33.3%
Duration of pain	mean=8.4 (sd=5.9) yrs	mean=6.4 (sd=3.4) yrs
Secondary symptoms		
Morning stiffness	Yes 91.7% No 8.3%	Yes 66.7% No 33.3%
Mean duration of morning stiffness	20 minutes (sd=16)	30 minutes (sd=32)
Poor ability to bear stress	Yes 91.7% No 8.3%	Yes 50% No 50%
Chronic headache	Yes 75.0% No 25.0%	Yes 33.3% No 66.7%
Anxiety	Yes 58.3% No 41.7%	Yes 33.3% No 66.7%
Worsening of symptoms under stress, noise and physical efforts	Yes 100%	Yes 83.3% No 16.7%
Improvement of symptoms by resting, warmth and on vacation	Yes 75.0% No 25.0%	Yes 50.0% No 50.0%

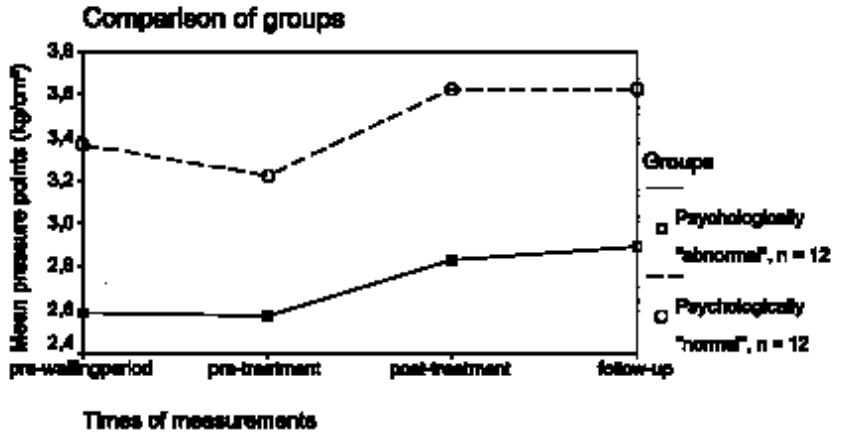

Fig. 2. Changes in the pressure points.

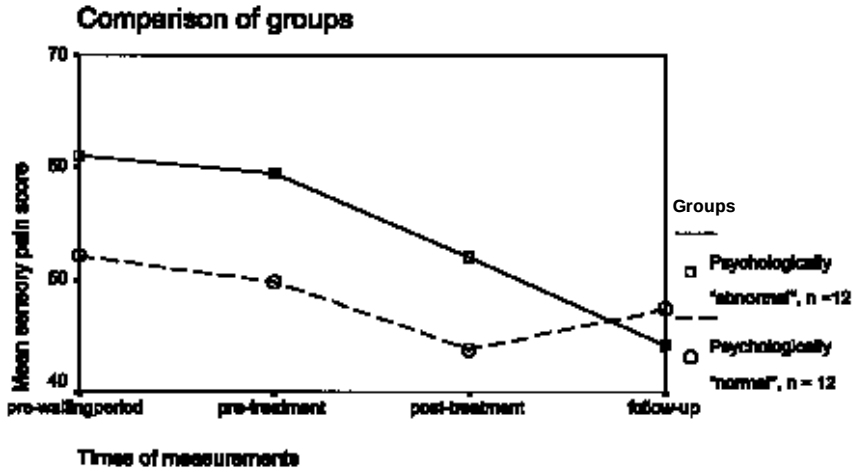

Fig. 3. Changes in the sensory pain components.

p = 0.01). The initial tender point values differed significantlly between the two groups (p = 0.036). Changes were observed in both groups during the treatment period, with the 'psychologically normal' group deriving grater benefit. The effect was maintened during the follow-up period in both groups (Fig. 2).

Secondary symptoms

Improvements in secondary symptoms were observed after treatment in both groups; however, only group I ('psychologically abnormal' patients) experienced a statistically significant (p = 0.031) improvement in one such symptom, namely chronic headache.

Sensory pain dimension

Prior to treatment, group I dispayed a sensory pain score of 59.6 (percentage ranking = 85) and group II a score of 49.8 (percentage ranking = 58.5). At the beginning of the treatment both groups differed significantly in the sensory pain dimension (p = 0.045). The 'psychologically abnormal' group had a significant and persisting decrease from 59.6 to 42.5 points (p = 0.004). In contrast, the 'normal' group II had a slight decrease from 49.8 to 43.8 post-treatment, and edged back up to 47.3 points at follow-up. Group II displayed no significant changes over the three time points of measurement (Fig. 3).

Affective pain dimension

The average initial values at pre-treatment for the affective pain components are 52.5 (percentage rank = 61.5) in group I and 41.8 (percentage rank = 27) in group II. The difference was statistically significant (p = 0.002). The 'psychologically abnormal' group derived greater benefit from the treatment than the normal group (p = 0.008), but went back to 48.9 points (p = 0.342) during the follow-up period. Group II almost reached the baseline values during the follow-up. In both groups no significant changes were observed over the three time points of measurement since pre-treatment (Fig. 4).

Quality of life

Within group I, there were significant

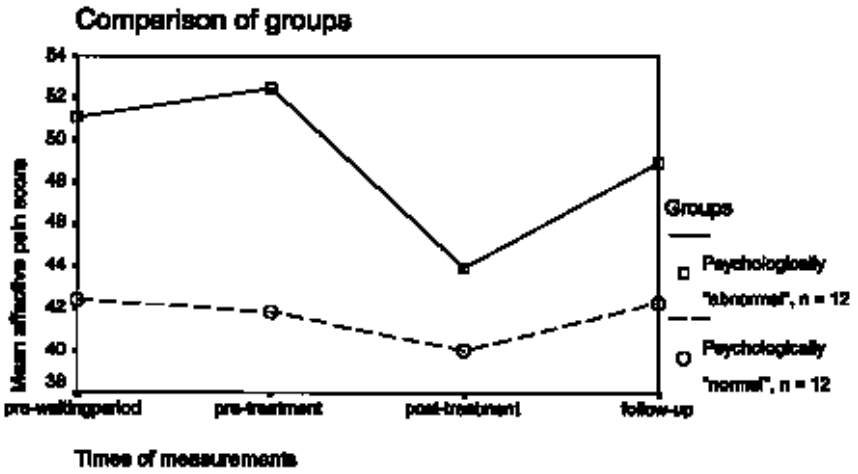

Fig. 4. Changes in the affective pain components.

Table III. Changes in the scales of the life quality inventory Short Form-36 (SF-36) for the 'psychologically abnormal' group.

SF-36	Median of the 'psychologically abnormal' group, n=12			
	Pre-treatment	Post-treatment	Follow-up	p-value
Physical ability	18.5	22.0	23.0	0.004
Physical role-functioning	4.0	6.0	6.0	0.034
Bodily pain	4.2	6.1	6.65	0.022
General health	12.2	15.9	15.4	0.007
Vitality	9.5	14.0	15.0	0.009
Social functioning	6.0	7.5	8.0	0.026
Emotional role-functioning	4.0	6.0	6.0	0.054
Mental health	16.0	23.0	21.0	0.014

Table IV. Changes in the scales of the life quality inventory Short Form-36 (SF-36) for the 'psychologically normal' group.

SF-36 scales	Median of the 'psychologically normal' group, n=12				
	Pre-waiting period	Pre-treatment	Post-treatment	Follow up	p-value
Physical ability	22.5	24.0	24.5	24.5	0.670
Physical role-functioning	6.0	6.0	7.0	6.0	0.197
Bodily pain	6.6	6.1	6.6	7.1	0.121
General health	17.2	18.7	16.4	18.9	0.729
Vitality	15.5	15.5	17.0	17.5	0.036
Social functioning	9.0	8.5	9.0	9.5	0.195
Emotional role-functioning	5.5	6.0	6.0	6.0	0.751
Mental health	23.0	23.5	25.5	26.5	0.030

improvements in the following factors of the SF-36 (Table III): physical ability (p= 0.004), physical role-functioning (p= 0.034), bodily pain (p = 0.022), general health (p = 0.007), vitality (p = 0.009), social functioning (p = 0.026), and mental health (p = 0.014). In group II, we only found improved scores in vitality (p= 0.036) and mental health (p = 0.03) (Table IV). This shows, that the psychologically 'abnormal' patients had twice as great improvements in the dimensions 'vitality' and 'mental health' than the 'normal' patients.

Discussion

At the initial examination, prior to the start of the EMG-biofeedback therapy, 'psychologically abnormal' patients were much worse off in all of the variables assessed: pressure point sensitivity, sensory and affective pain dimensions and quality of life. Both groups demonstrated significant improvements in pressure point sensitivity after EMG-biofeedback training, a result similar to the findings of Ferraccioli *et al.* (6) and Buckelew *et al.* (5). These effects were maintained in both groups throughout the follow-up period. However, after treatment, psychologically impaired patients didn't even reach baseline values of the 'psychologically normal' patients in mean point tolerance (Fig. 2).

Furthermore, vitality and mental health, aspects of quality of life, improved significantly in 'psychologically normal' patients, while no improvements were achieved in this group by EMG-biofeedback concerning subjective sensitivity to pain, that is in the sensory and affective pain dimensions.

In the 'psychologically abnormal' patients the situation was different. They showed improvements not only in pressure point sensitivity, but also in the sensory pain component (in the sense of burning, stabbing, pounding, throbbing).This effect was maintained during follow-up. In contrast, while clear improvement was also observed in the affective pain component during therapy, this was lost at follow-up. Thus, these patients benefited from biofeedback treatment in their physical but not in their emotional wellbeing. This assumption is strengthened by the results of the quality of life questionnaire. Improvements in the dimension of physical wellbeing were maintained beyond the end of therapy, whereas 'psychological well-being' (mental health) slightly deteriorated after the end of training. These differential effects also argue against a placebo effect, where one would expect more global changes.

Small sample size and the lack of a parallel, placebo like comparison group are the major limitations of our study. The former precluded us from running more sophisticated analyses, as for instance relating to MMPI derived subgroups. Including a third group without a specific treatment would clearly have substantiated our results, although as discussed above, it is unlikely that placebo effects are responsible to our find-

ings, especially with regard to the follow-up period.

In summary, we have shown that FM patients benefit from biofeedback in a differentiated fashion. The subgroup of 'psychologically normal' patients experienced a longer-lasting pain relief as measured by pressure point sensitivity and benefits in vitality and mood. These patients remained unchanged in the sensoric and affective pain dimension, which was almost normal at baseline. In contrast, 'psychologically abnormal' patients derived long-term pain relief from the training program in all of the parameters investigated, except the affective pain dimension. While getting better during biofeedback training, affective pain rebounded after the termination of therapy.

The results of our pilot study suggest to add weight to the considerations of psychological background problems in FM-patients. Primarily depressive and somatoform (hypochondriacal-hysterical as by MMPI categories) symptoms were found in our sample, an observation that has been reported previously (16, 17). Therefore a global assessment of FM-patients should not only consist of commonly used ACR diagnostic criteria but should also include psychodiagnostic and standardized psychiatric criteria (e.g. according to the DSM IV), as these may co-determine treatment outcome and prognosis. This should ease the development of more specific treatment strategies.

One approach to treating such patients might be combining EMG-biofeedback that enhances self-efficacy (5), a major goal of pain management, with psychotherapy that helps patients to become aware of and overcome their basic psychological problems. Clearly, the efficacy of such a combined treatment needs to be evaluated in further studies.

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