

## A COMPARATIVE STUDY OF EFFICACY OF EMG BIO-FEEDBACK AND PROGRESSIVE MUSCULAR RELAXATION IN TENSION HEADACHE<sup>1</sup>

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### SUMMARY

The aim of the present study was to find out efficacy of frontalis EMG Biofeedback therapy, deep muscular relaxation therapy and compare the efficacy of both in cases of tension headache. During two week basal-data recording period all patients were taught deep muscular relaxation by Jacobson's technique. Simultaneously patients were instructed to keep headache diary. Headache diary yielded three different parameters a) number of headache-free days per week, b) peak headache intensity for each week and c) average daily headache activity score per week. These parameters were used to find out therapeutic efficacy of each treatment. Patients were randomly divided in two groups. EMG Biofeedback group was given frontalis EMG feedback through EMG J 33 muscle trainer of Cyborg Corporation (U. S. A.). Patients in each group were given 20 sessions (two sessions per week); each session lasting 30 minutes. Patients were instructed to practice at least one 30 minute session of relaxation at home. The data were subjected to statistical evaluation. The results indicate that frontalis EMG Biofeedback therapy and deep muscle relaxation therapy are significantly effective in cases of tension headache. Both treatments are equally effective. The findings are discussed in relation to Indian situation.

Although headache is a minor health problem in comparison to such disorders as heart disease, cancer or schizophrenia, it nevertheless is a major problem when considered from an epidemiologic point of view. In one large survey, it was found to be one of the top 14 problems, in terms of frequency for which individuals seek out-patient medical care (DeLozier and Gagnon, 1975); in a survey of complaints at a prepaid medical plan, it was third most frequent complaint (Leviton, 1978). Ogden (1952) found in a sample survey of 4634 individuals from a non-clinical population that 65 per cent periodically suffered from headache. In surveys of the general population estimates run from 14 per cent of males and 28 per cent of females with frequent and/or distressing headache to 31 per cent of males and 44 per cent of females with severe headache (Leviton, 1978). Andrasik *et al.* (1979) found over half (52 per cent) of a large college student population admitted to headaches at least once or twice per week.

Given the ubiquitous nature of the disorder, it comes as no surprise that a large body of research on the psychological assessment and treatment of headache has developed as part of the field of behavioral medicine. The past 10 years have witnessed an ever-growing literature on the non-pharmacological treatment of headache (Blanchard *et al.*, 1979. Adams *et al.*, 1980). The two principal non-pharmacological treatments for headache are varieties of biofeedback therapies and several types of relaxation therapies.

The possibility of using biofeedback therapy in the treatment of tension headache was first advanced by Budzynski *et al.* (1970). Subsequently various workers demonstrated a similar encouraging results in uncontrolled studies (Wickramasekera, 1972; Mckenzie *et al.*, 1974; Epstein *et al.*, 1974). In the controlled study, Budzynski *et al.* (1973) and Wickramasekar (1973) have demonstrated superiority of biofeedback therapy over verbal relaxation therapy. Several other workers have shown that

<sup>1</sup>Paper presented at 14th conference of Indian Psychiatric Society-West Zone, held at Maroli, November 1983.

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both frontalis EMG biofeedback therapy and verbal relaxation therapy reduce tension headache equally (Cox *et al.*, 1975; Haynes *et al.*, 1975; Chesney and Shelton, 1976).

From India, Kumariah (1980) reported that in 20 cases of tension headache, EMG biofeedback and progressive muscular relaxation treatment were equally effective. Sethi *et al.* (1981) found biofeedback and Shavasana (Yoga) equally effective in 13 cases of tension headache. Bagadia *et al.* (1982) reported similar results in 36 cases of tension headache where biofeedback was given in a modified way using Grass polygraph machine and audiometer.

#### AIMS

The present study was undertaken with following aims :

1. to study the therapeutic effects of frontalis EMG biofeedback therapy in cases of tension headache.
2. to study the therapeutic effects of progressive muscular relaxation therapy in cases of tension headache
3. to compare the therapeutic effects of EMG biofeedback therapy and progressive muscular relaxation therapy in cases of tension headache.

#### MATERIAL AND METHOD

Cases referred for headache as main presenting symptom and headache of at least one year's duration were, screened for the study. These patients were evaluated by obtaining a clinical history and then conducting detailed cardiovascular, neurological, ENT, ophthalmic examination. Those cases who were found to be having headache of secondary character were excluded. Diagnosis of headache type was made on the basis of the criteria of Ad Hoc Committee on the Classification of Headache (1962). Cases of migraine

headache and combined tension and migraine headache were excluded. Cases thus selected were randomly assigned to one of the two groups i. e. EMG biofeedback therapy group and progressive muscular relaxation therapy group.

#### Procedure:

Initially all the patients were trained for 4 sessions (two sessions per week) so as to familiarise them with relaxation by Jacobson relaxation technique (Jacobson, 1938). During this baseline period of two weeks, headache data was recorded on headache diary.

#### EMG Biofeedback Therapy :

This group was given frontal electromyograph (EMG) biofeedback therapy modeled after the procedure of Budzynski *et al.* (1973). Use of EMG biofeedback from a forehead placement is recognized as the standard biofeedback treatment for tension headache by the Biofeedback Society of America (Budzynski, 1978).

Patient was made to lie comfortably on a couch. The electrodes were applied to forehead, approximately 2.5 cm. above each eye-brow centered on the eye. A ground electrode was attached midway between the two active electrode. Auditory feedback was provided by converting the averaged frontal EMG signal into a tone that varied in pitch depending upon the input voltage. Feedback was provided in a binary fashion using a voltage level detector which turned the feedback signal off when the muscle-tension level decreased to a predetermined level. Subjects were instructed to keep their eyes closed throughout the session.

EMG J 33 muscle trainer of Cyborg Corporation U. S. A. was used for EMG biofeedback.

Patients were given half an hour session twice a week for 10 weeks.

#### *Progressive Muscular Relaxation Therapy:*

The patients in this group were given deep relaxation therapy by Jacobson relaxation technique (Jacobson, 1938). Patient was made to lie comfortably on a couch. The patients were then taught progressive muscular relaxation. These patients were given half an hour session twice a week for 10 weeks.

The patients in both the groups were instructed to practice relaxation at home for at least one half an hour session per day.

#### *Assessment :*

After the initial selection, patients began headache diaries. The patients were asked to rate their headache activity three times daily at approximately breakfast, lunch and dinner time using following 6 point scale;

- 0 no headache;
- 1 only aware of headache when attention devoted to it,
- 2 headache could be ignored at times;
- 3 headache painful but can continue to work;
- 4 very severe headache, difficult to concentrate; can do undemanding tasks;
- 5 intense, incapacitating headache.

Diaries were reviewed at each session. Repeated explanations and feedback were given about headache diaries until the patient was making regular and reliable diary recording. 4 patients were dropped because of seeming inability to master the diary recording procedure.

The headache diary yielded three different parameters (Blanchard *et al*, 1978) :

- (a) number of headache-free days per week (a measure of much signifi-

cance to the patient).

- (b) the highest or peak single headache rating for each week (this measure indicates whether the more debilitating headaches are being relieved).
- (c) the average daily headache activity score per week (ranging from 0 to 15) termed the "headache index". This is the most sensitive and frequently used measure (Budzynski *et al*, 1973; Blanchard *et al*, 1978), however it is less readily interpretable by the patient.

The above informations from headache diary during first two weeks of relaxation training were considered as basal or pretreatment findings. Similar findings of last two weeks of EMG biofeedback therapy and progressive muscular relaxation therapy were considered as post-treatment findings. The improvement was calculated using following formula % of Average headache index during first two week (baseline) improvement—

$$\frac{\text{(Average headache index during last two week of treatment)}}{\text{(Average headache index during first two week)}} \times 100$$

The data was subjected to statistical evaluation. Within groups Wilcoxon MPSR test was used and between group Mann Whitney test was used.

#### RESULTS

Initially 69 patients were included in the study. 4 patients were excluded as they could not master the diary recording procedure inspite of repeated explanations and feedback. Out of 65 patients 7 patients dropped out, three from EMG biofeedback therapy group and four from progressive muscular relaxation therapy group. Thus, 58 patients completed full treatment period. The

data about these 58 patients are presented herewith.

#### Demographic Variables.

There was no statistical significant difference between the two groups in age, sex, average daily headache score, peak single headache intensity and headache-free days per week (Table I).

TABLE I. Demographic Comparison

	Biofeedback therapy	Relaxation therapy
Total number of patients	30	28
Number of males	11	8
Number of females	19	20
Average age (Years)	35.2	36.4
Average daily Headache Score	5.50	5.15
Peak single headache intensity	3.56	3.50
Headache-free days per week	2.86	2.75

#### EFFICACY

##### Average Daily Headache Scores

By the end of tenth week the average daily headache score in EMG biofeedback therapy group had dropped from 5.5 to 2.4 and in the progressive muscular relaxation therapy group from 5.2 to 2.5 (Table II). At the end of tenth week, average daily headache scores for both groups revealed significant improvement.

There was no significant difference between the two groups on average daily headache scores.

##### Peak Headache Intensity

By the end of tenth week, the peak headache intensity in EMG biofeedback therapy group had dropped from 3.6 to 2.1 and in progressive muscular

TABLE II. Average Daily Headache Score

Treatment Group	Before treatment	After treatment	Change
Bio-feedback Therapy (n=30)	Mean 5.5 S. E. 0.36	2.4 0.40	-3.1** 0.28
Relaxation Therapy (n=28)	Mean 5.2 S. E. 0.37	2.5 0.47	-0.7** 0.28
Difference	Mean 0.3 NS		0.4 NS

NS—Not Significant, \*— $p < 0.05$

\*\*— $p < 0.01$

relaxation therapy group from 3.5 to 2.0 (Table III). At the end of tenth week, peak single headache intensity revealed significant improvement.

There was no significant difference between the two groups on peak single headache intensity.

TABLE III. Peak Headache Intensity

Treatment Group	Before treatment	After treatment	Change
Bio-feedback Therapy (n=30)	Mean 3.6 S. E. 0.18	2.1 0.21	-1.5** 0.20
Relaxation Therapy (n=28)	Mean 3.5 S. E. 0.19	2.0 0.22	-1.5** 0.20
Difference	Mean 0.1 NS		0 NS

NS—Not Significant \*— $p < 0.05$

\*\*— $p < 0.01$

##### Headache Free Days

By the end of tenth week, the headache free days in EMG biofeedback therapy group had increased from 2.9

to 4.1 and in progressive muscular relaxation therapy group from 2.8 to 4.0 (Table IV). At the end of tenth week the headache free days revealed significant improvement.

There was no significant difference between the two groups on headache free days.

TABLE IV. *Number of Headache Free days*

Treatment Group.	Before treatment	After treatment	Change
Bio-feedback Therapy (n=30)	Mean 2.9 S. E. 0.31	4.1 0.36	+1.2** 0.22
Relaxation Therapy (n=28)	Mean 2.8 S. E. 0.32	4.0 0.39	+1.2** 0.27
Difference	Mean 0.1 NS		0 NS

NS—Not Significant \*— $p < 0.05$

\*\*— $p < 0.01$

Summarising the findings it is observed that statistically significant improvement was obtained in both EMG biofeedback therapy and progressive muscular relaxation therapy groups on all the three parameters of assessment. There was no significant difference between the two group in efficacy on all the three parameters of assessment.

#### DISCUSSION

Various methodological issues need discussion in planning such a study. The majority of the controlled research has evaluated the effects of a fixed amount of training, while one investigator (Fahrion, 1977) has recommended administering biofeedback on a "training to Criterion" basis, that is continuing training until patients demonstrate certain physiological responses. The present study is based on a fixed

regimen of progressive muscular relaxation therapy.

In the present study 19 out of 28 patients in progressive muscular relaxation therapy group i. e. 67.9 per cent showed 60 per cent or more improvement in average daily headache score. Tasto and Hinkle (1973) and Mckenzie *et al.* (1974), using the similar method have also reported a very good result. Wickramasekera (1973) using Wolpe-Lazarus relaxation training observed reduction in headache intensity in tension headache cases. In the EMG biofeedback therapy group, 20 out of 30 patients showed sixty per cent or above improvement in average daily headache score. While Epstein and Abel (1977) have reported positive results in three out of six patients by frontalis EMG biofeedback training, Peck and Kratt (1977) reported even higher improvement rate. Sturgis *et al.* (1978) employing frontalis EMG and temporal artery blood volume pulse biofeedback sequentially, found tension headache to be reduced during and after the EMG feedback.

Results of the present study show that both groups EMG biofeedback therapy and progressive muscular relaxation therapy are equally effective in the treatment of tension headache. Similar results have been reported by Kumaraiah (1980), Sethi *et al.* (1981), and Bagadia *et al.* (1982). from India and Cox *et al.* (1975), Haynes *et al.* (1975), and Martin and Mathews (1978) from the other parts of the world.

Since most of the reports suggest both therapeutic measures to be equally effective, issue of cost effectiveness becomes especially important in country like India. Progressive muscular relaxation therapy requires essentially only a comfortable couch and a practiced instructor, whereas EMG biofeedback therapy demands the addition of specialised

equipment. Thus progressive muscular relaxation therapy appears to be more cost effective particularly in Indian situation.

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