

## **Electromyograph Feedback and Stress Inoculation: Treatment outcome in Anxiety Neurosis**

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### ***Abstract***

The authors evaluated the additive effect of stress inoculation training (SIT) with electromyograph (EMG) feedback assisted relaxation in a sample of 22 clients on psychological as well as physiological measures. There was pre, mid- and post-therapy assessments to monitor the effects of therapy. The addition of SIT into the treatment protocol could bring about significant psychological changes and significantly more self-control in the clients.

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Key words -

**Feedback control,  
Extra feedback control,  
Stress inoculation training**

Relaxation training targets the physiological component of anxiety. It has been proved to be a useful treatment technique in anxiety neurosis. Biofeedback procedures especially EMG biofeedback has focussed on enhancing its effectiveness with the use of the frontalis as the target muscle.

However, relaxation based treatments themselves may be insufficient in the management of chronic anxiety. The evidence and acknowledgment of the cognitive dimension of anxiety in recent years emphasize the need of a cognitive therapy for anxiety.

SIT is a cognitive behavioural treatment method pioneered by the work of Meichenbaum and his colleagues. It can be used in treating the subjective component of anxiety. But sufficient component of anxiety. But sufficient research has not gone into the efficacy of SIT in generalised anxiety. As a part of the study of EMG feedback and SIT in anxiety neurosis, the authors evaluated the additive effect of SIT with EMG feedback assisted relaxation.

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## **Materials and Methods**

### **Sample**

A sample of 22 clients was studied. They were selected from among those clients who were referred to

the Behaviour Therapy and Biofeedback Unit, NIMHANS, from the Outpatient Centre of NIMHANS.

The criteria for inclusion were:

- (i) A diagnosis of anxiety state - 300.0 ICD-9 [1]
- (ii) Literacy in either English, Kannada or Tamil languages, and
- (iii) Age between 20-45 years.

The criteria for exclusion were:

- (i) Presence of an additional psychiatric diagnosis
- (ii) Presence of any medical illness.
- (iii) Presence of anxiety symptoms during marked physical exertion or life threatening situations.
- (iv) Duration of anxiety neurosis of more than 10 years.

### **Tools: Psychological measures**

#### **Self-report measures:**

- (i) Symptom Rating Scale (SRS) [2]
- (ii) Cognitive Somatic Anxiety Questionnaire (CSAQ) [3]
- (iii) State Trait Anxiety Inventory (STAI-Forms Y1 and Y2) [4].

Therapist's report measures

- (1) Hamilton's Anxiety Rating Scale (HARS) [5]

Emphasis was given to the preceding 20 days. The Kannada and Tamil versions of the CSAQ and STAI were also used [6].

Physiological measures

- (i) Feedback dermograph - Autogen 3400 [1]
- (ii) Feedback myograph - Autogen 1700 [8].

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## **Procedure**

Each client was taught to relax using frontalis EMG feedback assisted relaxation [2], [8]. Ten sessions of therapy were spaced over 10 days. Five minutes for adaptation and two 5 minute periods both before and after the actual feedback sessions for obtaining pre- and post-session EMG baselines were given. The emphasis in the therapeutic programme was on the self-regulation of muscle tension using the feedback myograph as a passive learning device. Following this, the duration of EMG feedback assisted relaxation was reduced but the clients were told to practise relaxation in the home for about 15 minutes everyday, and SIT was incorporated into the treatment protocol. Ten sessions of therapy were spaced over 20 days. SIT was carried out along the lines of those given by Meichenbaum [9] and Meichenbaum and Deffenbacher [10]. The duration of each of the 20 therapy sessions was for about one hour.

Prior to commencing therapy (pre-therapy), each client was assessed on the SRS, CSAQ, STAI-Forms Y1 and Y2 and the HARS. The resting levels of skin conductance (GSR) and the frontalis muscle tension (EMG) were recorded using the feedback dermograph and feedback myograph respectively. After completing the initial 10 sessions of EMG feedback assisted relaxation (mid-therapy), the clients were re-assessed on the same measures. The clients were assessed again after the 10 sessions of EMG feedback assisted relaxation with SIT (post-therapy).

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## Analysis

Student's t statistic was computed to find out if there was a significant difference between the two means obtained from correlated groups on the psychological and physiological measures i.e., before and after biofeedback therapy; and before and after biofeedback therapy with SIT.

A repeated measures analysis of variance (ANOVA-R) across the first, fifth and tenth therapy sessions; and across the eleventh, fifteenth and twentieth therapy sessions were also computed to find out if there was a significant difference between the means of the EMG levels across these occasions for the group when feedback was given to the clients. In addition, pre-, and post-session mean EMG baselines across the first, fifth and tenth therapy sessions; and across the eleventh, fifteenth and twentieth therapy sessions were also computed to find out if there was a significant difference between the means of the EMG levels across these occasions for the group when feedback was not given to the clients.

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## Results

The results are shown in Tables I and II and Figures I-IV.

Table I depicts the mean and standard deviations of the group on the psychological and physiological measures at the pre- and mid-therapy assessments.

*Table I - Means and standard deviations of the group on the psychological and physiological measures at the pre- and mid-therapy assessments*

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Figure I illustrates the mean EMG values obtained by the group on session 1 ( $3.14 \pm 3.38\mu v$ ), session 5 ( $1.31 \pm 0.51\mu v$ ) and session 10 ( $1.15 \pm 0.50\mu v$ ) of therapy. The F ratios from the ANOVA-R ( $F(2,42)=8.50$ ,  $p<0.001$ ) was significant and ( $F(21,42)=1.81$ , NS) was not significant indicate that there was a significant reduction in frontalis EMG level across these occasions of therapy when feedback was given to the clients. There was, however, no evidence to say that some clients were consistently better than others regardless of occasion.

*Mean EMG values across therapy sessions 1, 5 and 10*

Figure II illustrates the pre- and post- session mean EMG baselines of the group obtained on session 1 ( $2.42 \pm 1.34\mu v$ ), on session 5 ( $1.37 \pm 0.53\mu v$  and  $1.50 \pm 1.08\mu v$ ) and on session 10 ( $1.24 \pm 0.59\mu v$  and  $1.13 \pm 0.38\mu v$ ). The F ratios from the ANOVA-R ( $F(2,42)=18.18$ ,  $P<0.001$ ), ( $F(21,42)=2.75$ ,  $P<0.01$ ) and ( $F(2,42)=10.41$ ,  $P<0.001$ ), ( $F(21,42)=1.40$ , NS) indicate that the clients experienced a significant reduction in frontalis muscle tension across these occasions when feedback was not given to the clients both before and after the sessions and that some clients were consistently better than others without regard to occasion before feedback was given.

*Pre-post-session mean EMG baseline values across therapy sessions 1, 5 and 10*

Table II depicts the means and standard deviations of the group on the psychological and physiological

measures at the mid- and post-therapy assessments.

***Table II - Means and standard deviations of the group on the psychological and physiological measures at the pre- and mid-therapy assessments***

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Figure III illustrates the mean EMG values obtained by the group on session 11 ( $1.11 \pm 0.42\mu v$ ), session 15 ( $1.05 \pm 0.35\mu v$ ) and session 20 ( $1.00 \pm 0.37\mu v$ ) of therapy. The F ratios from the ANOVA-R ( $F(2,42)=1.50$ , NS) was not significant and ( $F(21,42)=8.75$ ,  $P<0.001$ ) was significant. This indicates that although the mean EMG values decreased, there was no significant reduction in frontalis muscle tension across these occasions of therapy when feedback was given to the clients. There was evidence to say, however, that some clients were consistently better than others without regard to occasion.

***Mean EMG values across therapy sessions 11, 15 and 20***

Figure IV depicts the pre- and post-session mean EMG baselines of the group obtained on session 11 ( $1.18 \pm 0.47\mu v$  and  $1.27 \pm 0.81\mu v$ ) on session 15 ( $1.18 \pm 0.45\mu v$  and  $1.10 \pm 0.47\mu v$ ), and on session 20 ( $1.02 \pm 0.43\mu v$  and  $1.05 \pm 0.52\mu v$ ) of therapy. The F ratios from the ANOVA-R ( $F(2,42)=3.33$ ,  $P<0.05$ ), ( $F(21,42)=7.83$ ,  $P<0.001$ ) were significant and ( $F(2,42)=2.00$ , NS) was non-significant, ( $F(21,42)=6.14$ ,  $P<0.001$ ) was significant. This indicates that the clients experienced a significant reduction in frontalis muscle tension across these occasions when feedback was not given to the clients before the sessions and that some clients were consistently better than others without regard to occasion. Although the post-session mean EMG values obtained by the group across these occasions decreased, there was no significant reduction in the muscle tension level. There was evidence to show that some clients were consistently better than others were consistently better than others without regard to occasion.

***Pre-post-session mean EMG baseline values across therapy sessions 11, 15 and 20***

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## **Discussion**

EMG feedback assisted relaxation could bring about significant decreases in the symptom scores and anxiety as seen on the self-report measures. The therapist rated the clients as being significantly less anxious on the HARS. Though there was a significant decrease in the resting EMG levels, there was no significant decrease in the GSR of the clients (Table I). Clients could acquire feedback control and extra feedback control or self-control (Figures I and II).

Sargunraj et al [11] found that with an increasing amount of control of muscle tension i.e., even after 10 sessions of EMG feedback assisted relaxation, the clients can perceive changes in state anxiety and in their symptoms implying that EMG feedback assisted relaxation alone can induce these psychological changes. But the fact that in this study the authors found more reduction in the scores from the mid- to the post-therapy assessments i.e., after the incorporation of SIT into the treatment protocol (Table II) than that from the pre- to the mid-therapy assessments (Table I) on most of the psychological measures favours of the additive effect of SIT. The addition of SIT, a cognitive behavioural treatment method which imparts cognitive coping skills in facing anxiety arousing

stressful situations should have brought about significant decreases in the symptom scores and anxiety on the self-report measures and the therapist's report measure.

The additive effect of SIT with EMG feedback assisted relaxation had no significant effect on the electrodermal activity although a trend towards improvement was evident (Table II). Studies by Lavellee et al [12] and Sargunraj and Kumaraiah [13] report that there is very minimal change in frontalis muscle tension after 10 sessions of EMG feedback assisted relaxation. Hence any evidence of significant changes after the mid-therapy assessment in this study has to be attributed to the additive effect of SIT with EMG feedback assisted relaxation. Though there was no significant effect on the resting EMG levels nor on the EMG levels (Table II) during therapy when feedback was given (Figure III), the clients experienced a significant reduction in frontalis muscle tension when feedback was not given to them before the sessions (Figure IV) demonstrating that the additive effect of SIT with EMG feedback assisted relaxation could help in ensuring significantly more self-control in the clients.

The study highlights that in the treatment of generalized anxiety, biofeedback assisted relaxation will not lead to widespread success if used as the sole therapeutic intervention. A two-pronged approach is needed i.e., relaxation therapy for the physiological component of the disorder and a cognitive therapy for the subjective component. The study conducted shows that the addition of SIT to EMG feedback assisted relaxation is efficacious in the management.

1. World Health Organisation, *International Classification of Disease, 9th edn., Geneva* 1978
  2. Sargunraj D, Electromyograph feedback in anxiety neurosis: A therapeutic study  
*Doctoral thesis, Bangalore University, Bangalore* 1988
  3. Schwartz G E, Davidson R J & Goleman D J, Patterning of cognitive and somatic processes in the self-regulation of anxiety. Effects of meditation versus exercise  
*Psychosomatic Medicine* Page: 40: 321-328, 1978
  4. Spielberger C D, Gorsuch R L, Lushene R, Vagg P R & Jacobs G A, *Manual for the State Trait Anxiety Inventory (Form Y), Palo Alto C A, Consulting Psychologists Press* 1983
  5. Hamilton M, The assessment of anxiety states by rating  
*British Journal of Medical Psychology* Page: 32: 50-55, 1978
  6. Sargunraj D & Kumaraiah V, The reliability of translations of STAI, CSAQ, EPI and I-E Scale  
*Journal of Personality & Clinical Studies* Page: 31: 109-112, 1990
  7. Autogenic Systems Incorporated, *Instruction Manual for Autogen 3400 USA* 1975a
  8. Autogenic Systems Incorporated, *Instruction Manual for Autogen 1700 USA* 1975b
  9. Meichenbaum D, *Stress Inoculation training: Psychology Practitioner Guidebooks. Pergamon Press, New York* 1985
  10. Meichenbaum D & Deffenbacher J L, Stress inoculation training  
*The Counselling Psychologist* Page: 16: 69-89, 1988
  11. Sargunraj D, Kumaraiah V & Subbakrishna D K, EMG biofeedback II: The dose-response relationship  
*Indian Journal of Psychiatry* Page: 33: 20-26, 1991
  12. Lavellee Y J, Lamontagne Y, Pinard G, Annable L & Tetreault L, Effects of EMG feedback, diazepam and their combination of chronic anxiety  
*Journal of Psychosomatic Research* Page: 21: 65-71, 1977
  13. Sargunraj D & Kumaraiah V, EMG biofeedback I: Treatment outcome in anxiety neurosis  
*Indian Journal of Psychiatry* Page: 32: 345-350, 1990
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