Statistical Analysis of Exponential and Polynomial Models of EMG & GSR Biofeedback for Correlation between Subjects' Medications Movement & Medication Scores

Rohit Rastogi, D.K. Chaturvedi, Santosh Satya, Navneet Arora, Mayank Gupta, Parv Singhal, Muskan Gulati

Abstract: Stress and TTH are the problem which are treated by using biofeedback therapy from longtime. Nowadays TTH is almost common in everyone's life and if this problem occurs continuously and with more impact then it is known as "distress". Stress is a problem which is faced by almost every age group and this problem is increasing day by day. It hampers the peace, happiness in every individual's life. So to measure the level of stress and TTH we are going to introduce EMG and GSR biofeedback. Analyzing both, we will get that which therapy is better and we will also get the best mode of therapy.

These biofeedback therapies utilize scientific instrument to evaluate the stress level of the subject. Under these therapies, the three modes that are used to check the level of stress are audio mode, video mode, audio-visual mode.

To get the best result the subjects are divided into two groups. One group will be introduced under EMG and the other will be handled under GSR. The change in the behaviour of subject i.e. the change in the stress level are measured at the interval of one month, three months, six months and twelve months. Mental, physical and total scores are calculated by performing this experiment and the last result that we will get after twelve months will be treated as final result.

Through this study, it has been concluded that there is a high correlation between Movement of Medication of Subjects v/s Average Subject Medication Score (EMG), Movement of Medication of Subjects v/s Average Weightage Medication Score (GSR) and Movement of Medication of Subjects v/s Average Weightage Medication Score.

The Whole Analysis is being done in Tableau software which is a data Analytics tool and gives data analysis in different visualizations and was designed by 3 Professors of Standford university in their research work in 1996-97 and was launched in 2003.

These therapy formula may be used in future to work for different health issues and also for other dependent variables like blood pressure, heart rate, sugar level, etc.

As it works at microscopic level, so we get very precise and accurate result.

Authors have tried best to verify the hypothesis and establish the fact that is which kind of therapy is more useful through comparison between both therapies in audio mode. The Study protocols have been registered with Clinical Trials Registry with ref. No. REF/2018/06/020361 of India affiliated to national institute of Medical Statistics, authoritative body of Indian Council of Medical Research. The dataset and obtained results are under process of registration. The Related project is also under process with DST-Ministry of Health to better deal with the TTH issue for public welfare.

I. INTRODUCTION

Analgesic Consumption

Combination drugs and plain analgesics (NSAIDs, other analgesics Given as the Main Rating (second least rating as 5). In the study of Analgesic Consumption, during the entire period subjects were allowed to take medicine which helped them to reduce their headache pain, stress problem. They were provided with sufficient amount of analgesic which was a part of treatment for them. These set of analgesics consist of many drugs like NSAIDs, aspirin, ibuprofen.

These were the drugs that were taken during the time of intense pain which the subject could not bear (Rastogi, R. et al., 2018a) and (Rastogi, R. et al., 2018b). The intensity of the pain was measured each time before and the use of analgesic and the records of difference of pain was maintained in the pain diary properly.

PM

Prophylactic Medication, other Anti-Depressants and AM- Alternative Medicines

Prophylactic id basically a Greek word which means "an advanced guard". A prophylactic medication of a treatment or a medication which is designed to prevent a

disease which a subject is suffering from. The subjects involved under this studies were provided with this Prophylactic medication and the anti-depressant to reduce their pain caused due to TTH (Fumal, A. et al., 2008).

OM

i.e. Other Medication – Muscle Relaxants, Triptans

For the treatment purpose, the subject were provided with various other treatment facilities like physical exercises which reduces their body stress to a large extent. These exercise consist of yoga, meditation and various other therapies which provide internal peace to the subjects so that they can feel stress free all the time without any side effects. It also include treatment like body massage which results in muscle relaxation and finally works in the direction of reduction of stress pain (Bouraue, F. et al., 1991).

Use of triptans are also the best ways for its cure, as triptans are basically the drugs which are used for the treatment of cluster headaches and migraines.

Background and Purpose of Study with Experimental Setup

Our Proposed study comprise of about 230 to 250 subjects which were taken in a fine observation of a given amount of time having an interval of 3, 6, 12 months. These subjects were asked to maintain their record of frequency, duration and average intensity of the headache in a diary commonly known as the "pain diary" (Rubin, A., 1992).

The subjects were divided into 7 groups the take the reading of EMG and GSR where EMG measures muscle tension and GSR measures the body sweat during that time period. These groups include the set of audio, visual and audio-video for both EMG and GSR and a Control group on which no experiments were made.

This experimental study was mainly conducted to know the best way among EMG and GSR of the treatment of TTH which is the most common among the current generation. It also provided the correlation between different parameters like Movement of Medication, Average Weightage Medication Score (GSR) etc (Rastogi, R. et al., 2017a) and (Rastogi, R. et al., 2018c).

II. PREVIOUS STUDIES (LITERATURE REVIEW)

Biofeedback

The term "Biofeedback" was voted against the term Auto regulation in 1969. The organization who coined this word was named the Biofeedback Research Society (BRS). The BRS was renamed as Biofeedback Society of America (BSA) in 1976. The present name of the society, the Association for Applied Psychophysiology and Biofeedback came into existence in 1989.

Edmund Jacobson, a physician was one of the earliest contributors in the field of biofeedback. In 1938 he monitored electromyography (EMG) of patients practicing progressive muscle relaxation to find out if the muscles actually relaxed (Rastogi, R. et al., 2019a).

Previously, it was believed that autonomic responses could not be controlled voluntarily. Miller and Leo DiCara in 1962 demonstrated that curarized rats could learn to control their autonomic functions (breathing patterns, muscle tone, blood pressure, salivation, GSR, etc.).

In 1966, Joe Kamiya, who is popularly known as "the father of biofeedback" found that some subjects could learn to discriminate the presence of alpha waves when electroencephalography (EEG) was performed on them. He also found that they could learn to manipulate their alpha frequency by about 1Hz, thus establishing that subjects could control their own neuro-biological rhythm (Rastogi, R. et al., 2018d).

Physicians Whatmore and Marinacci practiced biofeedback even before the term was founded. They used EMG biofeedback to treat stroke patients. But their work on neuromuscular re-education was not continued by others and remained undeveloped till it was rediscovered. Significant contributions to this field have been made by researchers in the clinical aspects like (a) Basmajin, who used surface EMG to study role of different muscles in movements and used the information for rehabilitation, (b) A. Kegel, who used pneumatic biofeedback devices to train pelvic floor muscles, (c) Johan Stovya used biofeedback for treating anxiety and (d)Thomas Budzynski used SEMG for treatment of headaches. (Carlson, Neil , 2013)

The Association for Applied Psychophysiology and Biofeedback (AAPB), the Biofeedback Certification Institute of America (BCIA), and the International Society for Neurofeedback and Research (ISNR) summon a task force of renowned clinicians and scientists in late 2007, they worked together to design a standard definition for biofeedback. According to them biofeedback can be defined is "a process that enables an individual to learn how to change physiological activity for the purposes of improving health and performance." Instruments measure physiological activity such as muscle activity, heart function, breathing, skin-temperature etc. These biofeedback instruments quickly and precisely gives "feedback" information. The information is used, often in combination with changes in thinking, emotions and behavior supports needed physiological changes. Patients with the use of this information (biofeedback) learn increased control over the physiological process (operant learning model). Over time, these changes can be preserved without continuous use of an instrument (Carlson, Neil, 2013). Any learning is facilitated by feedback. The same principle is used in biofeedback therapy whose main aim is to assist the patients in self-regulation of psycho-physiological factors, thereby allowing them to gain voluntary control over physiological parameters. After learning behavioral control over physiological responses was first published in 1961. In the 1960s and 1970s, human studies revealed that through various operant feedback methods, voluntary control could be learnt over many physiologic responses (e.g., heart rate, muscle tension, blood pressure, skin conductance, skin temperature, evoked potentials and various rhythms of EEG) (Rastogi, R. et al., 2017b) and (Rastogi, R. et al., 2018d).

Biofeedback is apparently free of any adverse side effects and therefore seemingly the preferable choice for treatment of psychosomatic disorders. Biofeedback therapy has evolved over the last 30 years, and today there are innumerable disorders for which biofeedback therapy has been used. Biofeedback therapy is now used for a variety of disorders, such as headache (migraine, tension and mixed), urinary incontinence, essential hypertension etc. with reliable results.

Biofeedback also called as neurotherapy it is a self-regulating and an accelerating relaxation technique that is used to control a person's stress level (Wenk-Sormaz, 2005). It works by preventing illness by the help of stress management methods. The treatment enhances the quality of life and sharpens coping skills. In other words, it is a psycho physiological technique used to enhance the overall wellness of the body and mind.

One idea of biofeedback is to reduce stress via self-control (Cassel, 1985).As mentioned earlier it uses a set of definite techniques for the reduction of tension. These techniques include efficient decision making capability, twilight learning/permissive concentration and autogenic feedback training. If a person can use these techniques to gain self-control they have a better chance of overall wellness. Biofeedback can help in reducing chronic pain symptoms (Turk, Swanson, & Tunks, 2008) also the stress symptoms, and serves as an alternative method of healthcare as opposed to drugs. In 1992 Wolf and in 2013 Carlson, Neil said that if biofeedback proves beneficial, it is often preferred over prescript drugs due to the high cost of the medication and its possibility of dependency (Rastogi, R. et al., 2018e) and (Rastogi, R. et al., 2018f).

Many previous studies have shown that biofeedback does indeed work, especially in children and young adults (Smith, & Womack, 1987). A study focused in a college setting, showed beneficial to students who practice the biofeedback technique. They attended workshops and worked in individual sessions. Along with attending workshops, they also kept a daily diary (Haddock CK, Rowan AB, Andrasik F, Wilson PG, Talcott GW, Stein RJ, 1997).

Along with a stress-control log, and changing their sleeping patterns. The information will be collected and assessed and the students/ technocrats who participated increased their focus and GPA considerably. Another case study which focused on biofeedback as a form as relaxation training also reduced stress in its participants. The group of volunteers was measured on a self-report scale along with temperature and an EMG. Although the temperature had no effect, the volunteers retained their improvements weeks after their biofeedback training (Scott, D.S. et al., 1980).

Tension Type Headache and Stress

According to (Haynes, S.N. et al., 1975), it is a state of physiological or psychological due to undesirable stimuli, physical, mental or emotional; internal or external that could likely disturb the functioning of an individual. Acute stress generally is short lived and causes no actual damage, whereas chronic stress can cause a sustained response to stress causing damage and chronic pain. Stress reactions (response to stress) cause amplification of physiological parameters such as blood pressure, increased sweating, muscle tension etc. This causes disorders in the body like headaches, ulcers, irritable bowel syndrome, chest pain, hyperhidrosis etc. Eventually, it results into a vicious cycle wherein stress causes pain or stress related disorders and increased pain or other symptoms, which leads to further amplification of stress (Rastogi, R. et al., 2018g).

Mental stress and tension are the most frequently recorded activator of chronic TTH tension-type headache. Genetic or family-related social and environmental factors are also associated with TTH. (Kropotov, J. D.,2009) In addition to physical variables like muscle tension, electro-dermal activity, temperature, etc. and other demographic variables of pain, occurrence of headache is empirically associated with psychological risk factor. According to Cohen MJ and team in 1980 these comprise hypnotizability, social support, life events, and negative thinking. Genetically negative affectivity is raised in chronic headache causing over reporting of somatic symptoms like irrespective of organic disease, headache. This indicates that mental health is largely affected in patients with TTH and therefore a good deal of attention should be paid to the psychological component in terms of assessing and taking measures to improve the mental health of patients with TTH.

Headache is a clinical syndrome affecting ninety-one percent of males and ninety-six percent of females at some time during their life span. The World Health Organization recognized that primary headaches are among the first 20 major causes of disability. In the primary care practice, tension type headache is the most commonly diagnosed variety of primary headache. Due to tension, formerly called tension headache or muscle contraction headache is the most frequently occurring headache disorder. It is the commonest among primary headaches (Rastogi, R. et al., 2019b).

It is the most dominant and costly headache. Tension type headaches are responsible for nearly 90% of all headaches. According to the International Headache Society (IHS), its lifetime occurrence in the overall population observed in different studies varies from 30% to 78%. In spite of its high prevalence and regardless of the fact that it has the highest socio-economic impact, it is still the least studied of the primary headache disorders.

Published estimates of the prevalence of tension type headache vary over a wide range from 1.3% to 65% in men and 2.7% to 86% in women. According to Holroyd JC, Penzien DB in 1986, the World Health Organization (WHO) statement released in 2000 on headache disorders and public health quotes that the onset of TTH is often in the teen and prevalence peaks in the fourth decade and subsequently declines (McCrory D, Penzien DB, Hasselblad V, Gray R, 2001), whereas the average age of onset of TTH was found to be 25–30 years in cross-sectional epidemiological studies. The prevalence peaks between the age of 30 to 39 and decreases slightly with age.

Some of the risk factors for developing TTH have been reported to be poor self-rated health, unable to relax after work and sleeping few hours per night.

The number of workdays missed was three times higher for TTH than for migraine in the population this was shown by Two Danish studies, and a US study has also found that non-presence due to TTH is considerable. In a study by Fuh et. al, 2008, where a cohort study was conducted to study the outcome of elderly patients with chronic tension type headache (CTTH) in a span of 13 years, the authors found 30% of patients with CTTH evolved to chronic migraine (CM) or episodic migraine (EM). Therefore, it is important to curb the tension type headache before it transforms to migraine which could lead to difficulty in treating due to its complex nature. Tension type headache is clinically and patho-physiologically heterogeneous. The complex interrelation of the various pathophysiological factors of TTH; makes this disorder often difficult to treat. Various therapeutic measures have been recommended to be used in sequence or in combination. Therapies for TTH can be subdivided into short term, abortive treatment of each attack (mainly pharmacological) and long term, prophylactic treatments (pharmacological and/or non-pharmacological) (Rastogi, R. et al., 2018h).

Several non-pharmacological treatments have been recommended for management of TTH, them being physical therapy,(McCrory D, Penzien DB, Hasselblad V, Gray R,2001) craniocervical training, oro-mandibular treatment acupuncture, relaxation therapies, cognitive-training biofeedback etc. However, the scientific evidence for efficacy of most treatment modalities is sparse.

Biofeedback is one of the most prominent behavioral headache treatments. It is a non-pharmacologic technique commonly used in the treatment of migraine and TTH. Many published studies have conveyed that biofeedback is effective in decreasing the frequency and severity of headaches, thereby limiting the patient's dependence on medication. Conforming to this, studies have also proposed that biofeedback may affect a reduction in medical utilization in headaches (Rastogi, R. et al., 2018i).

III. RESULTS, INTERPRETATION AND DISCUSSION

About the Study & Analysis

The Whole Analysis is being done in Tableau software which is a data Analytics tool and gives data analysis in different visualizations and was designed by 3 Professors of Standford university in their research work in 1996-97 and was launched in 2003.

The Microsoft had also various data visualization tools but Tableau is more powerful among all. Now MS has launched Power BI as latest data visualization tool which has more features and very less cost than Tableau(one seventh). But the data integrity and facility in Tableau are more popular with 10 + years of research experience.

The Current Study has been done with 95% Confidence interval and on different trend models.

where m is the slope of data pattern and c is intercept on Y-axis.

Linear $\qquad$ y= mx+c

Logarithmic $\qquad$ y=m*ln x + c

Exponential $\qquad$ y=m*e^x+ c

Polynomial $\qquad$ y=ax^3+bx^2+cx+d –Cubic polynomial was used here but the degree may vary from 2 to 8 as per need.

(Here the Cubic Polynomial is most suitable)

Power $\qquad$ y=m*a^x+c

In whole study the p-value and R^2 value of analysis model has been evaluated.

The P-value teels the significance of the model when the P-value<0.05

The R-value tells the Correlation and its value is between -1 and +1.

where the two values are +vely correlated when the R-value is between 0 to 1.

where the two values are -vely correlated when the R-value is between -1 to 0.

where the two values are not correlated or less correlated when the R-value is near to 0 in both sides.

The Trends on Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of EMG
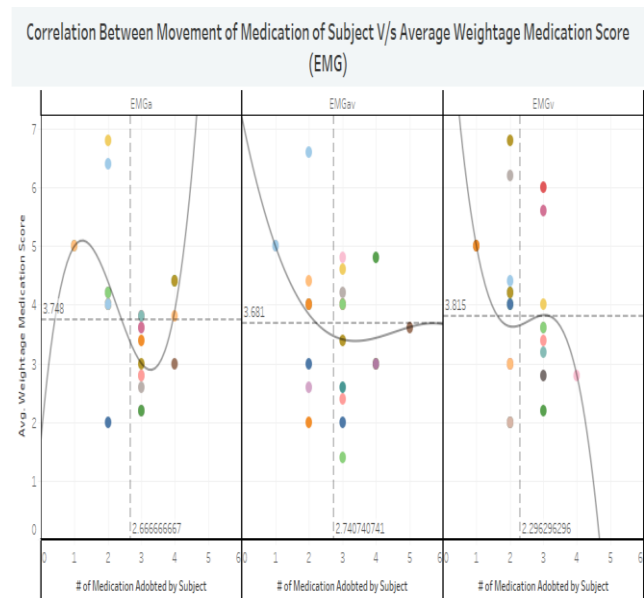

Fig. 1 The Cubic Polynomial Trend of Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of EMG Biofeedback

The Above Graph shows the comparative study of the three groups/ modes of EMG therapy.

The X axis shows the number of medications (average) adopted by individual subject in that particular mode in the stipulated time period.(By Fig. 1)

The Y –axis shows the average of the Weigtage of the Medication Score where the weight of the medication score is provided below.

Weightage Medication Score	
Medication	
AC	5
AM	2
NA	8
No Medication	0
OM	1
PM	4
Null	0

Fig. 2 The Allotments of Average Medication Scores

(By Fig. 2) To Understand the Correlation of subjects shifting from one medication to other in the period of stipulated time of experiment (12 months here), the different medications ave been allotted the weights.

1/ AC ie. Analgesics – Combination drugs and plain analgesics (NSAIDs, other analgesics) Given as the Main Rating(second least rating as 5)

As per Figure 1.

0/ No Medication ie. No analgesics (Given the Highest Rating or 0 score)

NULL ie. Considered as No analgesics (Given the Highest Rating or 0 score)

So out of 3 modes of EMG therapy, EMGav has best performance

Trend Lines Model for EMG Therapy

A polynomial trend model of degree 3 is computed for average of Weightage given distinct count of Medication.
Model formula: Individual Technique Slope*(
 Distinct count of Medication^3 +
Distinct count of Medication^2 +
Distinct count of Medication + intercept)

 # Observations Used in the Model: 81 ,

 # Observations filtered : 0

DoF in Model: 12

DoF in Residue: 69

Obtained SSE in model: 92.9593

Obtained MSE in model: 1.34724

Value of R-Square in model: 0.208872

Observed Standard error value in model: 1.16071

Level of significance value (p-vale) justified: 0.102534
Checking of the value Variance:

PM ie. Prophylactic medication, other anti-depressants etc (given as Third Rating as 4)

OM ie. Other medication – muscle relaxants, triptans etc (given as Fifth Rating as 1)

AM ie. Switched to Alternative Medicine (given as Fourth Rating as 2)

NA ie. Information not available which shows that particular subject has dropped out or switched to previous medicine during the experiment so given the lowest ratings(highest Score as 8)

The Cubic polynomial best fit was used in the study of the three modes(a, v and av) of EMG therapy and the EMGa had avg. no. of medication adopted by individual subject as 2.666666 And Average weightage medication score for EMGa as 3.748 EMGv had avg. no. of medication adopted by individual subject as 2.296296

And Average weightage medication score for EMGv as 3.815.

And EMGav had avg. no. of medication adopted by individual subject as 2.740740 And Average weightage medication score for EMGav as 3.681 were recorded.

It is very much clear from the analysis shown above that EMGav has best scores in terms of Average weightage medication score and that was for EMGav as 3.681.

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Field   Value of SSE Value of MSE F-value p-value Degree of Freedom

Individual Technique Slope

8	8.1614502	1.02018	0.75724	0.641143

Individual trend lines:

Panes Line Coefficients

Row Column	p-value	DF	Term Value	StdErr	t-value	p-value
Weightage EMGa	0.0094982	23				
Distinct count of Medication^3			0.516667	0.257027	2.01017	0.0562836
Distinct count of Medication^2			-3.5	1.99258	-1.75652	0.0923083
Distinct count of Medication			6.28333	4.81197	1.30577	0.20454
Intercept			1.7	3.5947	0.472918	0.640729
Weightage EMGav	0.305247	23				
Distinct count of Medication^3			-0.0486636	0.153222	-0.317603	0.753652
Distinct count of Medication^2			0.663834	1.35463	0.490048	0.628742
Distinct count of Medication			-2.82233	3.70737	-0.761275	0.454228
intercept			7.21558	3.13925	2.2985	0.0309584
Weightage EMGv 0	.393794	23				
Distinct count of Medication^3			-0.463492	0.389763	-1.18916	0.246508
Distinct count of Medication^2			3.56349	2.79588	1.27455	0.215196
Distinct count of Medication			-8.81746	6.28716	-1.40245	0.174134
intercept			10.7175	4.43057	2.41898	0.023879

The Trends on Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of GSR
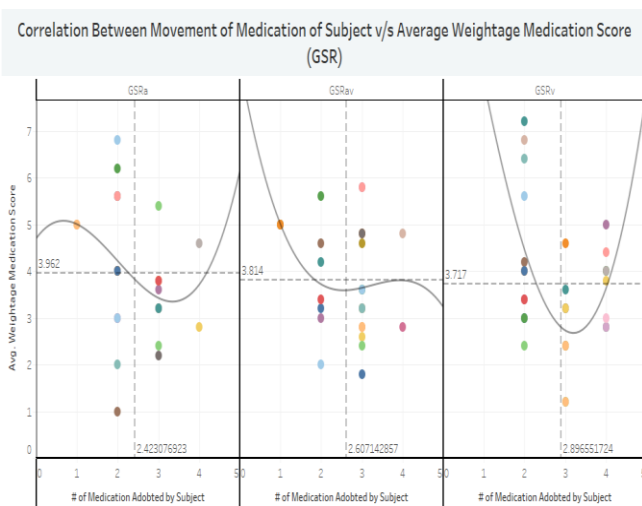

Fig. 3 The Cubic Polynomial Trend of Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of GSR Biofeedback

The Cubic polynomial best fit was used in the study of the three modes(a, v and av) of GSR therapy and the GSRa had avg. no. of medication adopted by individual subject as 2.42307 And Average weightage medication score for GSRa as 3.962, GSRv had avg. no. of medication adopted by individual subject as 2.8965 And Average weightage medication score for GSRv as 3.717, GSRav had avg. no. of medication adopted by individual subject as 2.6071 And Average weightage medication score for GSRav as 3.814 were recorded.(By Fig. 3)

It is very much clear from the analysis shown above that GSRv has best scores in terms of Average weightage medication score and that was for EMGav as 3.717.

So out of 3 modes of GSR therapy, GSRv has best performance

Trend Lines Model for GSR therapy

A polynomial trend model of degree 3 is computed for average of Weightage given distinct count of Medication.

Formula applied in the model:
Individual Technique Slope*(Distinct count of Medication^3
+ Distinct count of Medication^2
+ Distinct count of Medication + intercept)

 # Observations Used in the Model: 83 ,

 # Observations filtered : 0

DoF in Model: 11

DoF in Residue: 72

Obtained SSE in model: 118.939

Obtained MSE in model: 1.65193

Value of R-Square in model: : 0.178039

Observed Standard error value in model: 1.28528

Level of significance value (p-vale) justified: 0.136587
Field   Value of SSE Value of MSE F-value p-value
Degree of Freedom

**Individual Technique Slope   7 6.9510197 0.993003 0.601116
0.753016**

Panes Line Coefficients

Row Column	p-value	DF	Term Value	StdErr	t-value	p-value
Weightage GSRa	0.422892	22				
Distinct count of Medication^3			0.179915	0.383624	0.468986	0.643694
Distinct count of Medication^2			-1.08376	2.88065	-0.376221	0.710356
Distinct count of Medication			1.20726	6.79397	0.177697	0.860587
intercept			4.69658	5.06699	0.926897	0.364038
Weightage GSRav	0.325701	24				
Distinct count of Medication^3			-0.161607	0.312803	-0.516642	0.610134
Distinct count of Medication^2			1.57411	2.37701	0.662221	0.514139
Distinct count of Medication			-4.87679	5.60253	-0.870461	0.392672
intercept			8.46429	3.96633	2.13404	0.0432595
Weightage GSRv	0.065869	25				
Distinct count of Medication^3	0.123849					

 The trend line model estimation requires a near singular matrix inversion. Full model statistics are unsupported.

Distinct count of Medication^2 0.196473

Distinct count of Medication -5.06049
intercept 12.7943

The Trends on Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of EMG & GSR
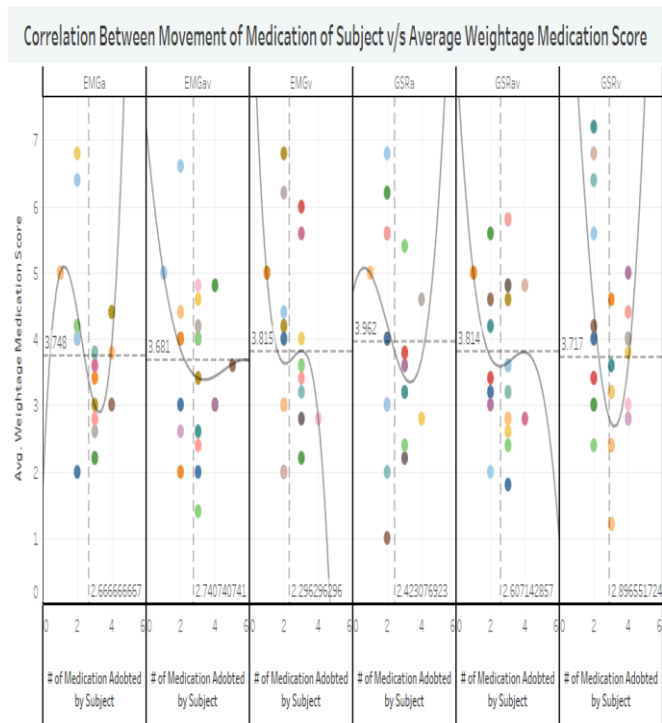

Fig. 4 The Cubic Polynomial Trend of Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of EMG & GSR Biofeedbacks

Correlation has been done with Cubic Polynomial trend Model

From the Above discussion, we may easily conclude that among best of all three modes of EMG therapy and GSR Therapy,

EMGav

EMGav had avg. no. of medication adopted by individual subject as 2.740740

And Average weightage medication score for EMGav as 3.681(By Fig. 4)

GSRv

GSRv had avg. no. of medication adopted by individual subject as 2.8965

And Average weightage medication score for GSRv as 3.717

So there was a neck to neck competition out of which EMGav has been found as the best mode among all the 6 modes of 2 therapies of EMG and GSR for the Average weightage medication score recorded as EMGav as 3.681.

So EMGav has been affecting the patients in most specific significant manner in long experimental period.

The Trends on Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of EMG & GSR by Exponential trend Model
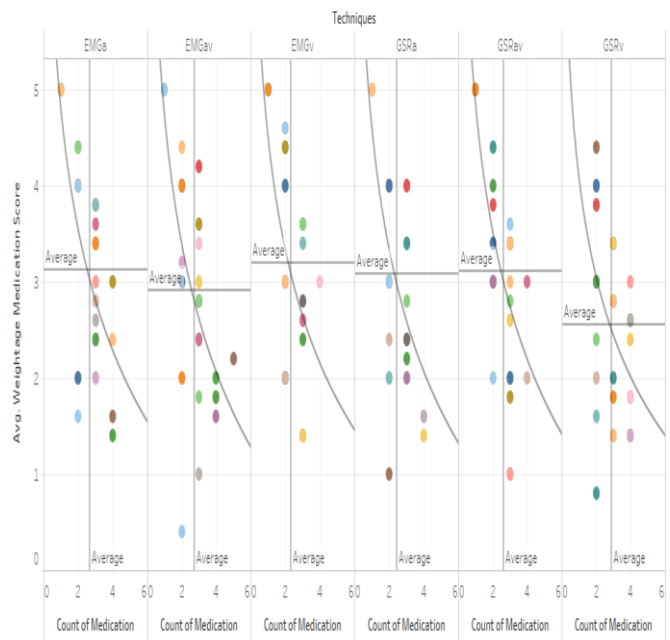

Fig. 5 The Exponential Trend of Correlation Between Movement of Medication of Subject V/s Average Weighted Medication Scores for all Three modes a, v and av of EMG & GSR Biofeedbacks

Medication	Weightage Score
No Medication	0
NA	0
OM	2
AM	3
PM	4
A C	5

During the observation period, movement of subject from taking one type of medication to other has been observed. This movement is quiet significant. In order to understand the significance of movement, a weighted score has been given to the medication type with the thought of lower the score better the medication is; weightage score is given in below table: (By Fig. 5)

For all the techniques the p-value shows that there exist statistical significance between the parameters of analysis (weightage score v/s Count of medication a patient has been shifted during a therapy period). It can be easily understood from the graph trend for weightage is decreasing there by it is showing the subject is shifting towards the better medication with the passes of time. As compare to GSRav, EMGav has shown more number of shifting in subject from one medication to other with lesser average weight score than GSRav. Also, in GSRav, more number of dropout has been occurred which is indicating that subject is losing the interest / trust on the technique which may be due to lack in continuous improvement of their health conditions. Also when comparing average of weight score it seems GSRv has lesser average even than the EMGav but the p-value is far much higher than the EMGav (although it is less than <0.05) therefore we can say while considering

these parameters EMGav has better performance and correlations.

IV. NOVELTY IN OUR WORK

In this study, EMG and GSR are introduced to measure the level of TTH. In our daily life we use the word "stress" very commonly but it is not so simple to describe. The word 'stress' is very complicated and it is used to describe force, problem pressure, etc. Today's busy and competitive life is the root of the stress.

Nowadays people don't have time for their friends, family and even for themselves which is increasing the mental pressure, hence stress.

Here we have used three modes i.e. audio mode, video mode and audio-visual mode to measure stress level. According to the behavior of subjects after the test, we have provided them scores. These scores at last will give the progress of different subjects (Rastogi, R. et al., 2018j).

In this study, EMG and GSR therapies used to measure the stress level with 230-20 subjects shows the efficient result and improvement/reduction in TTH was recorded.

V. FUTURE SCOPE, LIMITATIONS AND POSSIBLE APPLICATIONS

These studies are performed on large demography for better scope of generalization.it must be considered that environment plays a vital role in such studies. This research has been done in short period of time and small masses due to some limitations.

-Study the physiological, psychological and therapeutic effect of positive thinking. -Study of its effect on exclusion and inclusion criteria (Rastogi, R. et al., 2018k).

-Effect of this practice can be studied on other dependent variables i.e. Blood Pressure, Heart rate, Haemoglobin, ESR, TLC (Totally leukocyte count), DLC (Differential Leucocytes count), Sugar Level,

Lipid Profile and different lung functions.
-Study meditation effect at microscopic level
-Study its effect not only on mental and physical but at consciousness level too.
-Large sample should be selected for research
-Another tool of measure may be used to measure the variables
-Select a large sample size
-research may be conducted on adolescence of two other state and different gender.

However, the process of biofeedback is not affordable as of now. To successfully take advantage and apply IOT stakeholders must make it economic otherwise it will remain in the hands of high class.

There is variety of application of MMBD in Big data and IoT in healthcare which can be implemented. The rise of IoT has various scopes which has made it exciting.In Healthcare it has several applications like tracking of patients, staffs .availability of hardware, reducing emergency room wait time.

In other filed it can be used for: -
- Maintaining record of biofeedback machine
- Predicting the future possibilities of TTH level in the patient.

- Using the data of EMGa, EMGav, EMGv, the treatment of patient can be improved.

IoT has introduced many portable wearing devices that has made life easier for patient. Some of these are as follows (Millia, J.P. et al., 2002).

Hearable are new devices which have changed the world for the people who suffered hearing loss. Nowadays, they are compatible with your smart phone and sends the data directly to your phone.

Ingestible are really a hard thing to believe. They are small sized sensors which go inside body and wars for any irregularities.

These sensors are boon for diabetes patients as they provide early warning. Proteus Digital Health is one example. There are few devices like Moodables that changes our mood. It may look like science fiction but its real.

Thync and Halo Neuroscience has made significant progress in it. Moodables are attached to our brain that sends low intensity voltage and enhance our mood.

The advancement in AI has grown the drone technology which takes decision by making visual perception.

Drones like Skidoo uses computer vision to navigate by finding obstacles. Same technology can be used by visual impaired person for navigation (Mullaly, J.W. et al., 2009).

Healthcare charting in IoT devices such as Aude mix has reduced the work of doctor while sketching. It uses voice commands to capture the patient's data. Make is accessibly and saves doctors time.

VI. CONCLUSIONS

It was observed that the person who goes under EMG BF therapy based on audio mode has noticed better result than the person gone under EMG visual and audio-visual mode based on intensity and durability. We have seen that person who goes under EMG therapy deal with stress with good and cool state of mind and the one in (control group) has seen no effort. The stress in life is also essential but in limited quantity and stress is harmful for physical and mental health. The person response depends on how the stress appear in his life whether as a threat or as a challenge. After the therapy the person has no good copping capacity in dealing stress. This intelligence and copping capacity is effective in performing at workplace and home beside the peer factor, family factor. Higher intelligence level leads to a better performance than that of low intelligence. Low intelligence level person lack in learning and understanding.

In this study, it was seen that group has seen significant improvement in TTH and stress level as compared to EMGa and EMGav BF therapies.

Comprehensive Conclusion

Through this study it has been concluded that

There is a high correlation between Movement of Medication of Subjects v/s Average Subject Medication Score (EMG).

There is a high correlation between Movement of Medication of Subjects v/s Average Weightage Medication Score(GSR).

There is a high correlation between Movement of Medication of Subjects v/s Average Weightage Medication Score

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Bibliographical Notes: Rohit Rastogi received his B.E. degree in CSE from C. C. S. Univ. Meerut in 2003, the M.E. degree in CS from NITTTR- Chandigarh, Punjab Univ. in 2010. Currently he is pursuing his Ph.D. from Dayalbagh Educational Institute, Agra, India. He is a Associate Professor in CSE Dept. in ABES Engineering. College, Ghaziabad, India. He has been awarded in different categories for improved teaching, significant contribution, human value promotions and long service etc. He is strong believer that transformation starts within. He keeps himself engaged in various competitive events, activities, webinars, seminars, workshops, projects and various other teaching Learning forums.

D.K Chaturvedi is working in Dept. of Elect. Engg, Faculty of Engg, D.E.I., Dayalbagh, Agra since 1989. Presently he is Professor. He did his B.E. from Govt. Engineering College Ujjain, M.P. then he did his M.Tech. and Ph.D. from D.E.I. Dayalbagh. He is gold medalist and received Young Scientists Fellowship from DST, Government of India in 2001-2002 for post doctorial research at Univ. of Calgary, Canada. He is fellow of The Institution of Engineers (India), Aeronautical Society of India, IETE, SMIEEE, USA and Member of IET, U.K., ISTE, Delhi, ISCE, Roorkee, IIIE, Mumbai and SSI etc. and The IEE, U.K.

Santosh Satya has been Professor in Center for Rural Development and Technology in Indian institute of Technology, Delhi. She is Hardworking and reputed lady in the field of Rural development. She has 75 research works with 2238 citations and 33379 reads. She has keen interest in human Health and psychology domain.

Navneet Arora is serving as Professor at Indian Institute of Technology, Roorkee. He received Best Paper Presentation award ACMME 2016, Kuala Lumpur, Malaysia, Adjudged Institute Star Performer-2004, at IIT Roorkee, best Application Paper Award for Res. Work from an Int. Advisory Board, U.S.A., 1997, University Gold Medal from University of Roorkee, for standing First in M.E., 1990. GATE Scholarship awarded by I.I.T. Kanpur, in 1988, National Merit Scholarship Awarded by MHRD, supervised many Ph.D. and M.E. Thesis and Research Publications, Sponsored Research Project and Industrial Consultancy.

Mayank Gupta is acting as System and IT Analyst in Tata Consultancy services, Noida and expert of Data sciences and Business Analytics. He has skill to visualize the situations from different perspectives and explore the real facts through critical Analysis. He has deep interest in Human health domains.

Parv Singhal is B.Tech. Second Year student of CSE in ABESEC, Ghaziabad, He is working presently working on bigdata and blockchain. His hobbies are skating and sketching. He is young, talented and dynamic

Muskan Gulati is M.Tech. First Year student of CSE in ABESEC, Ghaziabad, She is working presently working on DataMining and Machine Learning. Her hobbies are singing and reading books. She is young, talented and dynamic .