

# Trends Observation during Different Medications by Subjects under EMG & GSR Biofeedback

Rohit Rastogi, D.K. Chaturvedi, Santosh Satya, Navneet Arora, Mayank Gupta, Himanshu Verma, Parul Singhal, Ayush Pratap Singh

**Abstract:** Tension is one of the most common problems found in people now a days. With upcoming of problem, stress level increases and headache is the most common problem faced during stress. The common headache found is tension type headache (TTH). The present study aim at studying the effect on TTH of various biofeedback technique like EMG and GSR on various mode like audio and audio visual the experiment was conducted on 90 people out of which 78 remained till end (out of which 46 females and 32 males) these groups were randomly assigned groups like EMGa, EMGv, GSRa, GSRv and the control group (the group which was not treated with any of the therapy). The control group was only given the medication given by doctor. The session of the biofeedback therapy was conducted for over a time of 20 minutes in an isolated chamber. The therapy continues for over a period of 12 months. The results were taken after 1 month, 3 month, 6 month and 12 months. 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.

**Keywords:** Stress, Meditation, Audio, Visual, SF36, EMG, GSR, Mental and physical scores, mental health, biofeedback, Analgesic Consumption, TTH, PM Prophylactic Medication, Anti-Depressants, OM- Other medication, Muscle Relaxants, Triptans, AM- Alternative Medicine.

## I. INTRODUCTION

### A. Biofeedback

The term “Biofeedback” is a technique which can be used to control our body function such as heart rate.

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With biofeedback we relate to our body part and receive electrical signals about them. It helps us to control our body

such as reducing pain, relaxing pain. This technique is often used to improve our health.<sup>1</sup>

### B. Tension Type Headache and Stress

Tension type headache is widely spread type of headache found in most of the people about 90 percent of the headache are of tension type. It is called by various names like including tension headache, muscle contraction, stress headache, ordinary headache, essential headache etc. TTH usually last for about 30 minutes to 7 days, depending on its intensity. The pain level is generally ranging from mid to moderate. It is accompanied by vomiting and nausea.<sup>2</sup>

### C. Analgesic Consumption

Analgesic is also known as a pain killer it is basically a type of drug which is used to achieve pain relief (analgesia). The word analgesia itself means “the absence of the sense of pain while remaining conscious”. Analgesic drug affects our mind and nervous system in different ways. They are different from anesthetics. Which either temporarily and in some cases completely vanish the sensation. Analgesics include paracetamol, NSAIDs such as the salicylates, and opioid drugs. Nonsteroidal anti-inflammatory drugs are kinds of drug which lower the fever, reduces the pain and in case of Higher dose decrease inflammation. Some of the common drugs are aspirin, naproxen, ibuprofen. These all are available across all the countries easily. So basically, it was the group that consumed analgesic medicines to get relief from the stress and headache.

### D. PM

Along with traditional headache medication there are other drugs that help to reduce headache these are antidepressants. In medical this approach is referred as prophylaxis. A analysis published in 2014 proposed that antidepressants also reduce the depression in the people suffering from hepatitis c by 40 percent. Some studies even depict that is the person is pretreated with anti-depressants there are likely less chance to have depression symptom. Even the person which take depressants after them stroke is less likely to get depression.<sup>3,4,5</sup>

### E. AM- Alternative Medicines



Alternative medicine is also known as pseudo medicine or questionable medicine. Alternative medicine is claimed to have the healing effect like that of medicine which is unproven or impossible to prove and are likely to be harmful.

According to scientist a therapy is said to be unproven and not working when it does not follow the natural laws and violate it. Alternative medicine is not same as traditional medicine. alternative medicine is a bit dangerous as it does not give proper results .it is used my significant number of people, but still large amount of funding is raised by united state government. The industry of alternative medicine is highly profitable. This fact is overlooked, or we can say that hidden by media, with alternative medicine portrayed positively when compared to big pharma. The license for practicing varies based on different health care provider and different countries. Though the practice of alternative medicine is illegal, yet it is promoted by various practitioner in cancer treatment. Alternative medicine is criticized for taking advantage of the weakest members of society.

**F. OM**

This was the group which was called as OM (Other medication) which include muscle relaxants and use of triptans. Triptan is a drug of the family tryptamine which is used as abortive medication in the treatment of headache and migraines. This drug is effective in treating individual headache, but it is not a cure for tension type headache especially for a person suffering from migraine. they are sometime effective in disabling the tension type headache. Triptans do not relieve other kinds of pain.

Triptans are highly efficient in reducing the chances of attack in 70 to 80 percent people within 3 to 90 minutes. Triptans are not recommended to a person with skin sensitivity .it is advisable to take triptan after twenty minutes of headache’s onset. Most of the triptan are advised not to be used during pregnancy, breastfeeding and for the patient younger 18 years; but there are triptan like sumatriptan and zolmitriptan nasal spray approved for young once like over 12. Despite the opinions of expert drug governing bodies suggest that monoamine oxidase inhibitor and FDA are contraindicated for sumatriptan, rizatriptan and zolmitriptan and with combination like ergotamine. Triptan also have some side effect, the most common is recurrence of migraine.<sup>6,7,8</sup>

While a muscle relaxant is a drug that decrease muscle tone by affecting skeletal muscle. They are used to decrease muscle pain and hyperflexes. It may have following effects on our body.

- Dependency
- Allergic reactions
- Sleepiness
- Tapering off

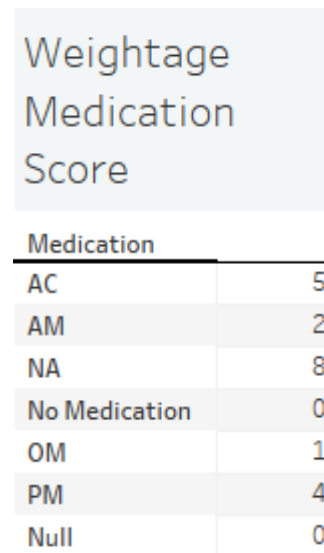
**II. RESULTS, INTERPRETATION AND DISCUSSION**

**A. 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

Stanford university in their research work in 1996-97 and was launched in 2003.<sup>9,10</sup>

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.



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

**Fig. 1 The Allotments of Average Medication Scores**

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 ever been allotted the weights.

**AC i.e. Analgesics Consumption**

Combination drugs and plain analgesics (NSAIDs, other analgesics) Given as the Main Rating (second least rating as 5) (As per Figure 1.).

**No Medication**

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

**PM i.e. Prophylactic medication**

Other anti-depressants etc. (given as Third Rating as 4)

**OM i.e. Other medication**

Muscle relaxants, triptans etc. (given as Fifth Rating as 1)

**AM**

Switched to Alternative Medicine (given as Fourth Rating as 2)

**NA**

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



**B. Summary of Drug Consumption**

Summarized Drug Count Report								
Medication	Period	Grand To.	EMGav	GSRv	EMGa	EMGv	GSRa	GSRav
<b>Grand Total</b>		<b>820</b>	<b>135</b>	<b>145</b>	<b>135</b>	<b>135</b>	<b>130</b>	<b>140</b>
AC	Total	391	58	57	64	74	69	69
	1 Month	96	12	13	15	22	17	17
	3 Month	69	9	9	10	14	13	14
	6 Month	57	11	7	10	9	9	11
	12 Month	37	9	5	6	4	7	6
	Baseline	132	17	23	23	25	23	21
AM	Total	16	3	2	2	5	1	3
	1 Month	1				1		
	3 Month	4	1			2	1	
	6 Month	4		2	1			1
	12 Month	7	2		1	2		2
	Baseline	132	17	23	23	25	23	21
NA	Total	95	16	24	12	12	16	15
	1 Month	3	1	2				
	3 Month	17	4	4	3	2	1	3
	6 Month	27	5	5	3	5	5	4
	12 Month	48	6	13	6	5	10	8
	Baseline	132	17	23	23	25	23	21
No Medication	Total	158	24	31	28	29	25	21
	1 Month	28	6	6	6	2	5	3
	3 Month	43	5	11	8	8	5	6
	6 Month	46	6	9	8	9	7	7
	12 Month	36	4	5	6	10	6	5
	Baseline	132	17	23	23	25	23	21
OM	Total	91	21	22	10	7	12	19
	1 Month	14	3	5		1	2	3
	3 Month	17	5	4	1		3	4
	6 Month	22	4	6	2	1	4	5
	12 Month	31	6	6	6	4	3	6
	Baseline	132	17	23	23	25	23	21
PM	Total	67	13	9	19	8	7	11
	1 Month	22	5	3	6	1	2	6
	3 Month	14	3	1	5	1	3	1
	6 Month	8	1		3	3	1	
	12 Month	4			2	2		
	Baseline	132	17	23	23	25	23	21
Null	Total	2						2
	12 Month	1						1
	Baseline	1						1

**Fig. 2 The Summary of Drug Consumption of different Subjects in Different Groups**

Below is the Summary of Drug Consumption of different Subjects in Different Groups (out of 6 i.e. EMGa, EMGv, EMGav, GSRa, GSRv, GSRav) (By Fig. 2)

It shows the Switching of subjects from one medication to other in different groups in due course of time period of 12 months.

The readings have been observed in start of the experiment (Baseline), at 1 month, 3 months, 6 months and 12 months.<sup>11, 12</sup>

The Color combination shows the intensity of the counting of total subjects (on the scale of 1 to 25) in different groups out of 6 designed over the time period of 12 months.

The total 820 subjects were analyzed and their medication details group wise, time period wise are as below which shows that subjects in EMGav=135, GSRv=145, EMGa=130, EMGv=130, GSRa=135, GSRav=140 were measured.

If we see the AC—Analgesic Consumption, It is a clear demarcation that Biofeedback Therapy has been extremely fruitful in reduction of Analgesic in subjects.

The base line data for Total 132 subjects EMGav=17, GSRv=23, EMGa=23, EMGv=25, GSRa=23, GSRav=21 were measured which was reduced to total 37 which as EMGav=9, GSRv=5, EMGa=6, EMGv=4, GSRa=7, GSRav=6 in 12 months of time period.

Many Subjects have been also reduced from PM zone to other lighter zones of medicine consumption due to benefits of therapies.

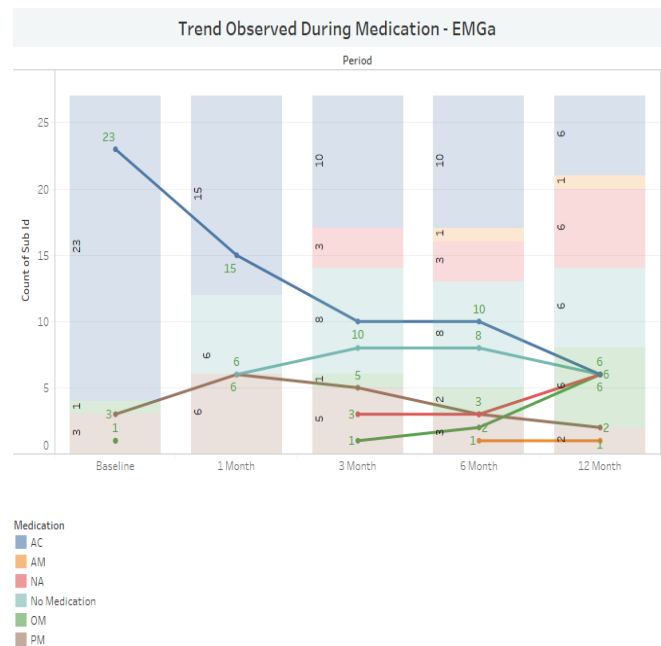
In PM criteria the initial baseline data was total 19 initially EMGav=4, GSRv=5, EMGa=3, EMGv=1, GSRa=1, GSRav=5 were measured which was decreased to total 4 which as EMGav=0, GSRv=0, EMGa=2, EMGv=2, GSRa=0, GSRav=0 were measured.

Also its sure that, in OM criteria the initial baseline data was total 7 initially EMGav=3, GSRv=1, EMGa=1, EMGv=1, GSRa=0, GSRav=1 were measured which was increased to total 31 which as EMGav=6, GSRv=6, EMGa=6, EMGv=4, GSRa=3, GSRav=6 were measured. It is clearly Understood that these subjects have shifted from AC Zone to OM Zone which were lighter medicines.

It is obvious that subjects were shifted to AM—Alternative medicine and No Medicine Zone due to benefits of Biofeedback Methods.

In No Medication the Criteria for baseline was total 5 initially EMGav=3, GSRv=0, EMGa=0, EMGv=0, GSRa=2, GSRav=0 were measured which was increased to total 36 which as EMGav=4, GSRv=5, EMGa=6, EMGv=10, GSRa=6, GSRav=5 were measured in the completion of experimental period.

If we check the effect of Biofeedback therapy in the longer range that any subjects have left the medications permanently and completely shifted to Alternate Therapy and Medications. Which is a clear indication of the success of the applied therapies in stipulated time period and proves the high social impact on the long-term subject health, monetary benefits, avoidance of side effects due to Analgesic consumptions and slow but steady effect of alternate therapies



**Fig. 3(a) Trend Observed During Medication in EMGa Mode (Separate)**

In Alternate Medication the Criteria for baseline was total 1 initially EMGav=0, GSRv=0, EMGa=0, EMGv=1, GSRa=0, GSRav=0 were measured which was increased to total 7 which as EMGav=2, GSRv=0, EMGa=1, EMGv=2, GSRa=0, GSRav=2 were measured in the completion of experimental period. Also, in study of NA criteria where we have studied the dropouts of the different therapy subjects.



## Trends Observation during Different Medications by Subjects under EMG & GSR Biofeedback

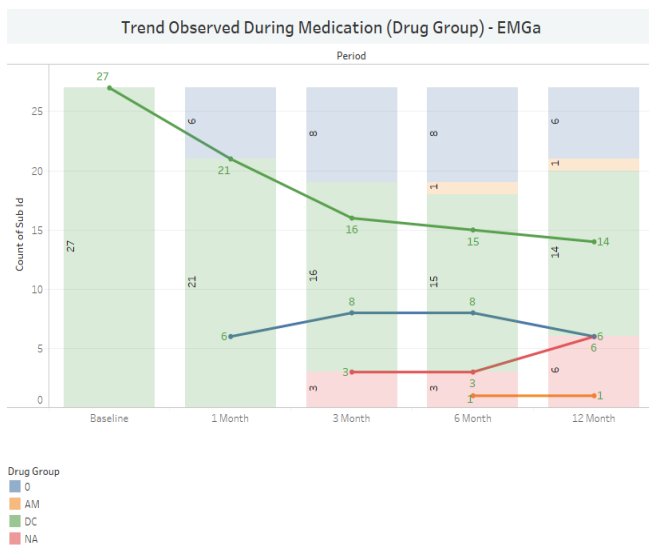
Initially NA Criteria for baseline was total 3 initially EMGav=1, GSRv=2, EMGa=0, EMGv=0, GSRa=0, GSRv=0 were measured which was increased to total 48 at the end of the study which as EMGav=6, GSRv=13, EMGa=6, EMGv=5, GSRa=10, GSRv=8 were measured in the completion of experimental period.

The above facts are clear Indicator that EMGav and GSRv has a neck to neck competition in effectiveness on the subjects. Seeing the NA criteria to show the dropouts, the EMGav has clear cut better impact over GSRv methodology.

### C. Trend Observed During Medication in different Modes of EMG Biofeedback Therapy

Trend Observed During Medications (all types of Medications individually) and Trend Observed (Drug Groups Combined and Alternative Medications, No Medications and Dropouts-NA)

#### a) EMGa Mode



**Fig. 3(b) Trend Observed During Medication in EMGa Mode (Combined)**

The trend observed during the study with the number of subjects moving from one medication bucket to other has been drawn to visualize the effectiveness of techniques.

In the EMGa subject group, during baseline period 100% of subject were on medication out of which all subjects were on Analgesic consumption. After the 1 month of therapy period 22.22% increase in count of subject has been observed who stopped taking the medicines. Also 22.22% drop is observed in the analgesic consumption patient. With the passage of time it has been observed that alternative medicine (AM) consumptions has been started and increased but also the trends of decreasing the analgesic consumption continues during the therapy with some minor fluctuations. Few subjects left the therapy in between when they gain the health and analgesic consumption is no more required for them. (By Fig. 3)

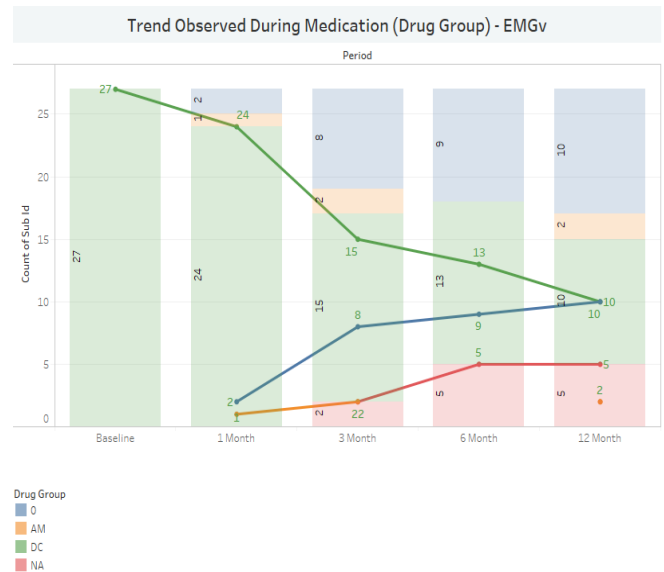
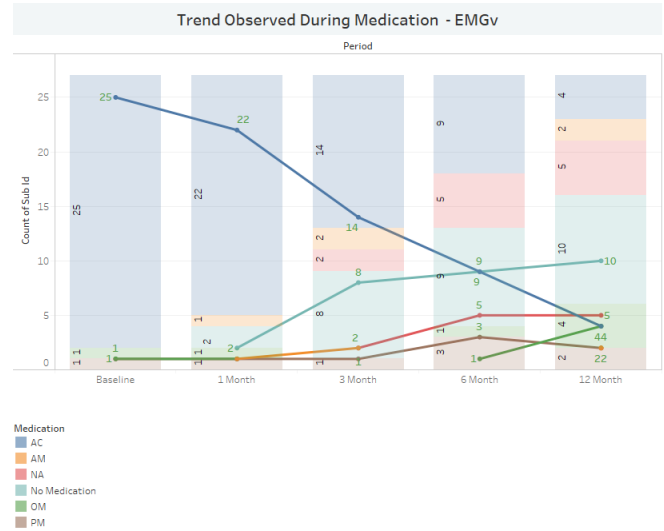
As the gap between the feedback duration increases the rate of improvement of subject of shifting from Analgesic to alternate or other or no medication has been reduced. Even the gap seems to be resulted in de motivation due to which for few types of medication negative rate has also been observed.

After 3 months and 6 months 33.33% improvements were recorded in no. of subjects shifting from AC zone to No Medication Zone.

The Movement from AC zone to drop Outs were counted as total in One Month were 0, in 3 months 3, in 6 months 3 and 12 months 6 were measured in the therapy.

Overall during EMGa therapy time 33.33% of subject has been either moved from AC to optional medication or stopped taking medicines.

#### b) EMGv Mode



**Fig. 4 Trend Observed During Medication in EMGv Mode (Separate and Combined)**

The trend observed during the study with the number of subjects moving from one medication bucket to other has been drawn to visualize the effectiveness of techniques.

In the EMGv subject group, during baseline period 100% of subject were on medication out of which all 100% were on Analgesic consumption. After the 1 month of therapy period 11.11% increase in count of subject has been observed

c) EMGav Mode

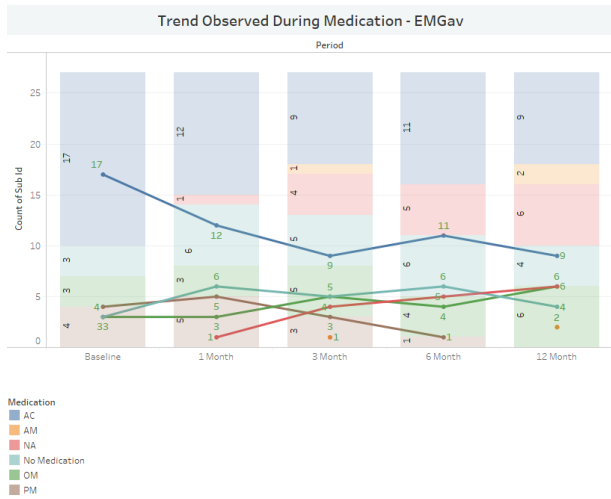


Fig. 5(a) Trend Observed During Medication in EMGav Mode(Separate)

who stopped taking the medicines. Also 7.4% drop has been observed in the analgesic consumption patient. With the passes of time it has been observed that alternative medicine (AM) consumptions has been started and increased but also the trends of decreasing the analgesic consumption continues during the therapy with some minor fluctuations. Few subjects left the therapy in between when they gain the health and analgesic consumption is no more required for them. (By Fig. 4)

As the gap between the feedback duration increases the rate of improvement of subject of shifting from Analgesic to alternate or other or no medication has been reduced. Even the gap seems to be resulted in de motivation due to which for few types of medication negative rate has also been observed.

After 3 months 32% and after 6 months 40.9% the improvements were recorded in no. of subjects shifting from AC zone to No Medication Zone.

The Movement from AC zone to drop Outs were counted as total in One Month were 2, in 3 months 8, in 6 months 9 and 12 months 10 were measured in the therapy.

Overall during EMGv therapy time 40% of subject has been either moved from AC to optional medication or stopped taking medicines.

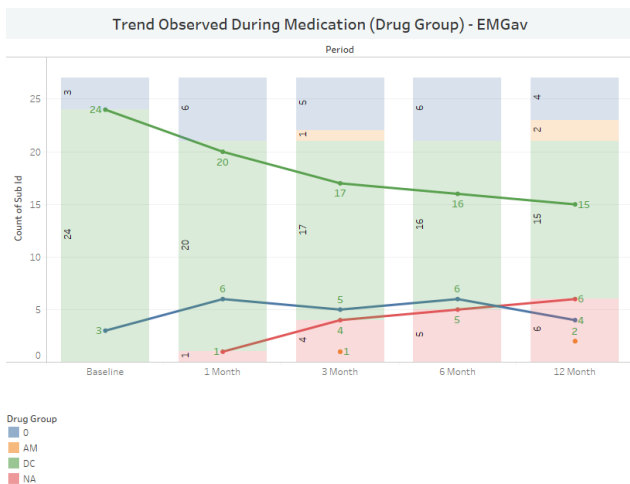


Fig. 5(b) Trend Observed During Medication in EMGav Mode(Combined)

The trend observed during the study with the number of subjects moving from one medication bucket to other has been drawn to visualize the effectiveness of techniques.

In the EMGav subject group, during baseline period 88.88% of subject were on medication out of which all these were on Analgesic consumption. After the 1 month of therapy period 23.07% increase in count of subject has been observed who stopped taking the medicines. Also 16.66% drop is observed in the analgesic consumption patient. With the passes of time it has been observed that alternative medicine (AM) consumptions has been started and increased but also the trends of decreasing the analgesic consumption continues during the therapy with some minor fluctuations. Few subjects left the therapy in between when they gain the health and analgesic consumption is no more required for them. (By Fig. 5)

As the gap between the feedback duration increases the rate of improvement of subject of shifting from Analgesic to alternate or other or no medication has been reduced. Even the gap seems to be resulted in de motivation due to which for few types of medication negative rate has also been observed.

After 3 months 21.73% and after 6 months 27.27% the improvements were recorded in no. of subjects shifting from AC zone to No Medication Zone.

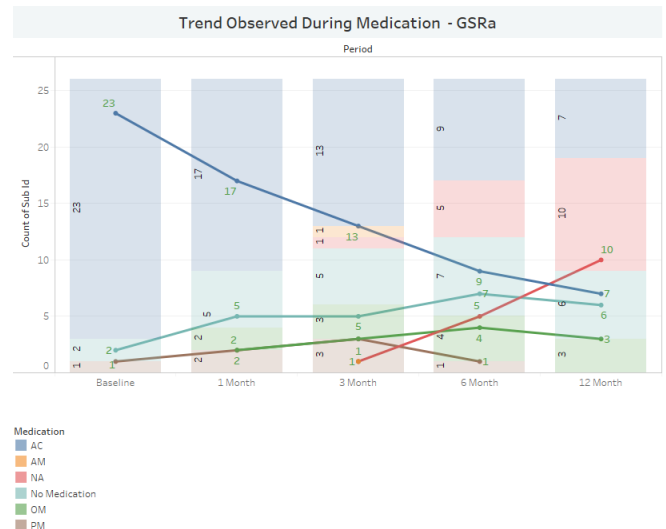
The Movement from AC zone to drop Outs were counted as total in One Month were 1, in 3 months 4, in 6 months 5 and 12 months 6 were measured in the therapy.

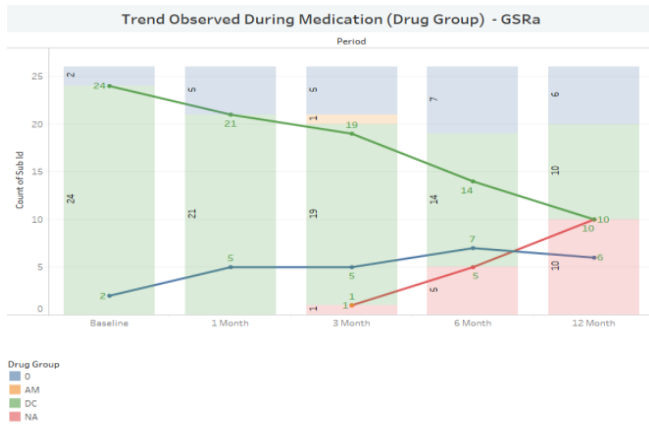
Overall during EMGav therapy time 28.57% of subject has been either moved from AC to optional medication or stopped taking medicines.

D. Trend Observed During Medication in different Modes of GSR Biofeedback Therapy

Trend Observed During Medications (all types of educations individually) and Then Observed (Drug Groups Combined and Alternative Medications, No Medications and Dropouts-NA)

a) GSRa Mode





**Fig. 6 Trend Observed During Medication in GSRa Mode( in seprate and combined mode)**

The trend observed during the study with the number of subjects moving from one medication bucket to other has been drawn to visualize the effectiveness of techniques.

In the GSRa subject group, during baseline period 92.3% of subject were on medication out of which 88.46% were on Analgesic consumption. After the 1 month of therapy period 19.23% increase in count of subject has been observed who stopped taking the medicines. Also 26.08% drop is observed in the analgesic consumption patient. With the passes of time it has been observed that alternative medicine (AM) consumptions has been started and increased but also the trends of decreasing the analgesic consumption continues during the therapy with some minor fluctuations. Few subjects left the therapy in between when they gain the health and analgesic consumption is no more required for them. (By Fig. 6)

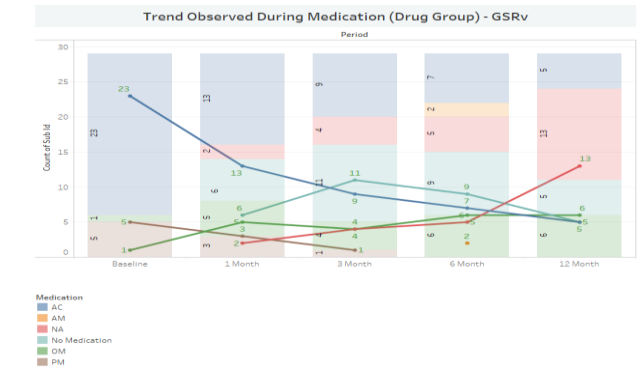
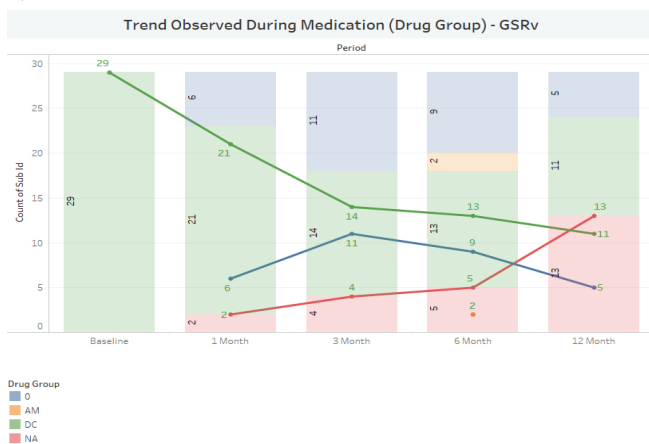
As the gap between the feedback duration increases the rate of improvement of subject of shifting from Analgesic to alternate or other or no medication has been reduced. Even the gap seems to be resulted in de motivation due to which for few types of medication negative rate has also been observed.

After 3 months 20% and after 6 months 36.84% the improvements were recorded in no. of subjects shifting from AC zone to No Medication Zone.

The Movement from AC zone to drop Outs were counted as total in One Month were 0, in 3 months 1, in 6 months 5 and 12 months 10 were measured in the therapy.

Overall during GSRa therapy time 37.5% of subject has been either moved from AC to optional medication or stopped taking medicines.

**b) GSRv Mode**



**Fig. 7 Trend Observed During Medication in GSRv Mode**

The trend observed during the study with the number of subjects moving from one medication bucket to other has been drawn to visualize the effectiveness of techniques.

In the GSRv subject group, during baseline period 100% of subject were on medication out of which 79.31% were on Analgesic consumption. After the 1 month of therapy period 22.22% increase in count of subject has been observed who stopped taking the medicines. Also 43.47% drop is observed in the analgesic consumption patient. With the passes of time it has been observed that alternative medicine (AM) consumptions has been started and increased but also the trends of decreasing the analgesic consumption continues during the therapy with some minor fluctuations. Few subjects left the therapy in between when they gain the health and analgesic consumption is no more required for them. (By Fig. 7)

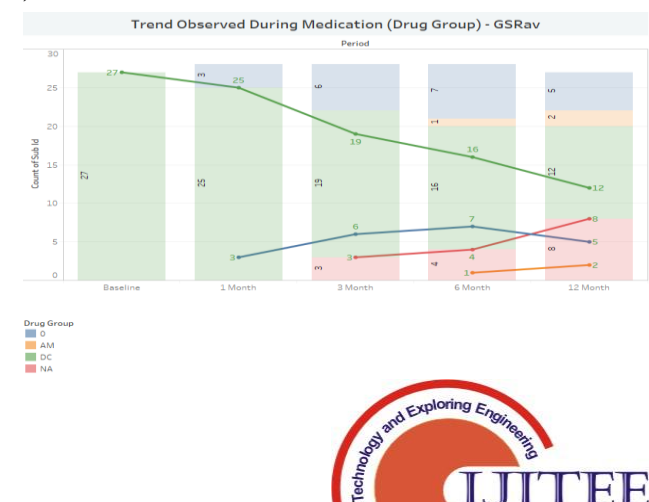
As the gap between the feedback duration increases the rate of improvement of subject of shifting from Analgesic to alternate or other or no medication has been reduced. Even the gap seems to be resulted in de motivation due to which for few types of medication negative rate has also been observed.

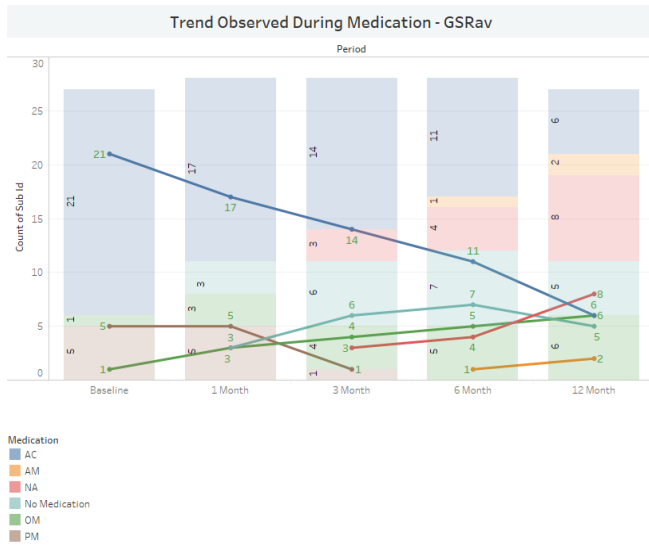
After 3 months 44% and after 6 months 37.5% the improvements were recorded in no. of subjects shifting from AC zone to No Medication Zone.

The Movement from AC zone to drop Outs were counted as total in One Month were 2, in 3 months 4, in 6 months 5 and 12 months 13 were measured in the therapy.

Overall during GSRv therapy time 31.25% of subject has been either moved from AC to optional medication or stopped taking medicines.

**c) GSRav Mode**





**Fig. 8 Trend Observed During Medication in GSRav Mode**

The trend observed during the study with the number of subjects moving from one medication bucket to other has been drawn to visualize the effectiveness of techniques.

In the GSRav subject group, during baseline period 100% of subject were on medication out of which all of them were on Analgesic consumption. After the 1 month of therapy period 11.11% increase in count of subject has been observed who stopped taking the medicines. Also 7.4% drop is observed in the analgesic consumption patient. With the passes of time it has been observed that alternative medicine (AM) consumptions has been started and increased but also the trends of decreasing the analgesic consumption continues during the therapy with some minor fluctuations. Few subjects left the therapy in between when they gain the health and analgesic consumption is no more required for them. (By Fig. 8)

As the gap between the feedback duration increases the rate of improvement of subject of shifting from Analgesic to alternate or other or no medication has been reduced. Even the gap seems to be resulted in de motivation due to which for few types of medication negative rate has also been observed.

After 3 months 25% and after 6 months 30.43% the improvements were recorded in no. of subjects shifting from AC zone to No Medication Zone.

The Movement from AC zone to drop Outs were counted as total in One Month were 0, in 3 months 3, in 6 months 4 and 12 months 8 were measured in the therapy.

Overall during GSRav therapy time 26.31% of subject has been either moved from AC to optional medication or stopped taking medicines.

### III. NOVELTY IN OUR WORK

In present scenario the problem of stress has emerged out to be as a big problem. Each person belonging to any class and society is now some and how affected by the problem of stress and thus face TTH.<sup>13,14</sup> Our research work is unique on its own which aim at reducing the headache level. based on results it was seen the transfer of people from one group to other. These type to research is really helpful for society seeing the increasing number of sufferings.<sup>15,16,17,18</sup>

### IV. FUTURE SCOPE, LIMITATIONS AND POSSIBLE APPLICATIONS

The study was conducted by our researcher on the limited number of people. The study in the future may be conducted on various type of people residing in various regions.

This TTH depends on various factors like age, gender, climate, region etc. The effect of biofeedback in future can be seen on people of different age, gender of various countries. The study is also affected by the various factors like education and mental status. The biofeedback therapy is very useful their effects can also be seen on various other health related problem. Although the biofeedback is very useful yet the cost to afford this therapy is still not in reach of common people. Efforts can be made in making this therapy accessible for every class of people whether high or low.<sup>19,20</sup>

Various healthcare devices can be made which once attached or worn by the patient can take the readings of various parameters, so the effect of biofeedback can easily be studied. These devices will not only help the researcher but will help the doctors in providing best healthcare facilities to the patient. Devices like these have been made and some better are yet to be launched in the market. The further research work may be conducted taking help of these devices.<sup>21,22,23,24</sup>

### V. CONCLUSIONS

It was seen that with the starting of the experiment the we had 96 people in AC group in the 1st month, which get reduced to 69 in the 3rd month, 57 in 6th month and 37 in the 12th month.

On seeing the results of Am group there was 1 single person in the 1st month, 4 in the 3rd month, 4 in 6th month and 7 in the 12th month. The number of persons kept on increasing in this group.

In no medication group there were 14 people in the 1st month, 17 in the 3rd month, 22 in the 6th month, 31 in the 12th month. Here the number of people increased with increase in time.

In PM group there were 22 people in the 1st month, 14 in the 3rd month, 8 in the 6th month, 4 in the 12th month. Here the people decreased with increased in time.

While in NA group there were 3 people in the 1st month, 17 in 3rd month, 27 in 6th month and 48 in the 12th month.<sup>25,26,27,28</sup>

The Overall Scenario shows a clear picture that EMGv has the best performance in terms of analgesic consumption dropouts and benefits to the subjects in biofeedback therapy in the period of stipulated time of 12 months in the cure of Chronic TTH.

Overall during EMGv therapy time 40% of subject has been either moved from AC to optional medication or stopped taking medicines.

Also, in overall scenario, EMG therapy is showing better performance over the GSR therapy.<sup>29,30,31</sup>



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REFERENCES

1. Rubin A. Biofeedback and binocular vision. Journal of behavioral optometry. 1992; Vol 3; 4, 9598.
2. Mullaly JW, Hall K, Goldstein R. Efficacy of BF in the Treatment of Migraine and Tension Type Headaches. Pain Physician: November/December 2009; 12: 1005-1011.
3. Fumal. A, Scohnen J. Tension-type headache: current research and clinical management. Lancet Neurology, 2008; 7: 70-83.
4. Millea JP, Brodie JJ. Tension type headache: American Family Physician. 2002, Vol. 66, No 5, Sept 1, 797-803.
5. Boureau F, Luu M, Doubrere JF. Study of experimental pain measures and nociceptive reflex in Chronic pain patients and normal subjects. Pain, 1991; 44, 131-138.
6. Scott DS, Lundeen TF. Myofascial pain involving the masticatory muscles: an experimental model. Pain, 1980; 8, 207-215.
7. Haynes SN, Griffin P, Mooney D and Parise M. Electromyographic BF and Relaxation Instructions in the Treatment of Muscle Contraction Headaches. Behavior therapy, 1975;6, 672-678.
8. Kropotov, J. D. (2009). Quantitative EMG, event-related potentials and neurotherapy. San Diego, CA: Academic Press.
9. Cassel, R. N. (1985). Biofeedback for developing self-control of tension and stress in one's hierarchy of psychological states. Psychology: A Journal of Human Behavior, 22(2), 50-57.
10. Turk, D. C., Swanson, K. S., & Tunks, E. R. (2008). Psychological approaches in the treatment of chronic pain patients- -When pills, scalpels, and needles are not enough. The Canadian Journal of Psychiatry, 53(4), 213-223.
11. Valdes, M. R. (1988). A program of stress management in a college setting. Psychotherapy in Private Practice, 6(2), 43-54.
12. Wenk-Sormaz, H. (2005). Meditation can reduce habitual responding. Advances in Mind-Body.
13. Carlson, Neil (2013). Physiology of Behavior. New Jersey: Pearson Education, Inc. ISBN 978-0-205-23939-9.
14. Haddock CK, Rowan AB, Andrasik F, Wilson PG, Talcott GW, Stein RJ. Home- based behavioural Treatments for chronic benign headache: a meta-analysis of controlled trials. Cephalalgia 1997; 17:113-8.
15. McCrory D, Penzien DB, Hasselblad V, Gray R. Behavioural and physical treatments for tension Type and cervicogenic headaches. Des Moines, IA: Foundation for Chiropractic Education and Research, 2001.
16. Rastogi R., Chaturvedi D.K., Arora N., Trivedi P., Mishra V., Swarm Intelligent Optimized Method of Development of Noble Life in the perspective of Indian Scientific Philosophy and Psychology, Proceedings of NSC-2017(National system conference) IEEE Sponsored conf. of Dayalbagh Educational Institute, Agra, Dec. 1-3, 2017.
17. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Singh P., Vyas P., Statistical Analysis for Effect of Positive Thinking on Stress Management and Creative Problem Solving for Adolescents, Proceedings of the 12th INDIACom; INDIACom-2018; IEEE Conference ID: 42835, Technically Sponsored by IEEE Delhi Section 2018, 5th International Conference on "Computing for Sustainable Global Development", 14th – 16 March, 2018 at Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA)) ISSN 0973-7529 and ISBN 978-93-80544-14-4, pp 245-251.
18. Rastogi R., Chaturvedi D.K., Arora N., Trivedi P., Singh P., Vyas P., Study on Efficacy of Electromyography and Electroencephalography Biofeedback with Mindful Meditation on Mental health of Youths, in

- Proceedings of the 12th INDIACom; INDIACom-2018; IEEE Conference ID: 42835, Technically Sponsored by IEEE Delhi Section 2018, 5th International Conference on "Computing for Sustainable Global Development", 14th – 16 March, 2018 at Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA)) ISSN 0973-7529 and ISBN 978-93-80544-14-4, pp 84-89.
19. Rastogi R., Chaturvedi D.K., Arora N., Trivedi P., Chauhan S., Framework for Use of Machine Intelligence on Clinical Psychology to study the effects of Spiritual tools on Human Behavior and Psychic Challenges, Proceedings of NSC-2017(National system conference) IEEE Sponsored conf. of Dayalbagh Educational Institute, Agra, Dec. 1-3, 2017.
20. Rastogi R., Chaturvedi D.K., Sharma S., Bansal A., Agrawal A., Audio Visual EMG & GSR Biofeedback Analysis for Effect of Spiritual Techniques on Human Behavior and Psychic Challenges, in Proceedings of the 12th INDIACom; INDIACom-2018; IEEE Conference ID: 42835, Technically Sponsored by IEEE Delhi Section 2018, 5th International Conference on "Computing for Sustainable Global Development", 14th – 16 March, 2018 At Bharati Vidyapeeth's Institute of Computer Applications and Management (BVICAM), New Delhi (INDIA)) ISSN 0973-7529 and ISBN 978-93-80544-14-4, pp 252-258.
21. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Yadav V., Yadav V., Sharma P., Chauhan S., Statistical Analysis of EMG & GSR Biofeedback Efficacy on Different Modes for Chronic TTH on Various Indicators, International Journal of Advanced Intelligence Paradigms, Inderscience Publishers Ltd., ISSN online 1755-0394, ISSN print 1755-0386, Indexed in Scopus (Elsevier), Academic OneFile (Gale), ACM Digital Library, Asian Digital Library, cnpLINKer (CNPIEC) and listed in Cabell's Directory of Publishing Opportunities and UGC.
22. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Gupta M., Yadav V., Chauhan S., Sharma P., Book chapter titled as Chronic TTH Analysis by EMG & GSR Biofeedback on Various Modes and Various Medical Symptoms Using IoT, Paperback ISBN: 9780128181461, Imprint: Academic Press, Published Date: 1st June 2019, volumes In series: Advances in ubiquitous sensing applications for healthcare, Book-Big Data Analytics for Intelligent Healthcare Management, Book link:https://www.elsevier.com/books/big-data-analytics-for-intelligent-healthcare-management/das/978-0-12-818146-1?fbclid=IwAR3eW09xDogil1zyYgCZlDdXnoMX718aldpCBUGUqVgKCVQJECs92iJ7Dc. Reference B978-0-12-818146-1.00005-2
23. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Singhal P., Gulati M, Statistical Resultant Analysis of Spiritual & Psychosomatic Stress Survey on Various Human Personality Indicators, in The International Conference proceedings of ICCI 2018, AISC Series Springer, (SCOPUS Indexed), at ICCI 2018: International Conference on Computational Intelligence at Birla Institute of Technology, Mesra Ranchi, Jharkhand.
24. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Sirohi H., Singh M., Verma P., Singh V., Which One is Best: Electromyography Biofeedback Efficacy Analysis on Audio, Visual and Audio-Visual Modes for Chronic TTH on Different Characteristics, in the proceedings of International Conference on Computational Intelligence & IoT (ICCIoT) 2018, 14-15 December 2018 at National Institute of Technology Agartala, Tripura, India, ELSEVIER- SSRN Digital Library (ISSN 1556-5068).
25. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Yadav V., Chauhan S., Sharma P., Analytical Comparison of Efficacy for Electromyography and Galvanic Skin Resistance Biofeedback on Audio-Visual Mode for Chronic TTH on Various Attributes, in the proceedings of the International Conference on Computational Intelligence and Data Analytics (ICCIDA-2018) on 27 and 28th October 2018 to be published in Communications in Computer and Information Science (CCIS) Series, Springer at Gandhi Institute for Technology, Khordha, Bhubaneswar, Odisha, India.
26. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Saini H., Verma H., Mehlyan K., Comparative Efficacy Analysis of Electromyography and Galvanic Skin Resistance Biofeedback on Audio Mode for Chronic TTH on Various Indicators, in the proceedings of International





- Conference on Computational Intelligence & IoT (CCIIoT) 2018, 14-15 December 2018 at National Institute of Technology Agartala, Tripura, India, ELSEVIER- SSRN Digital Library (ISSN 1556-5068).
27. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Trivedi P., Singh A., Sharma A., Singh A., Intelligent Analysis for Personality Detection on Various Indicators by Clinical Reliable Psychological TTH and Stress Surveys, in the proceedings of International Conference on Computational Intelligence in Pattern Recognition (CIPR 2019) at Indian Institute of Engineering Science and Technology, Shibpur on 19th-20th January 2019, Springer Advances in Intelligent Systems and Computing (AISC) Series.
  28. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Bansal I., Yadav V., Intelligent Analysis for Detection of Complex Human Personality by Clinical Reliable Psychological Surveys on Various Indicators, in the national Conference on 3rd Multi Disciplinary National Conference Pre-Doctoral Research [MDNCPDR-2018] at Dayalbagh Educational Institute, Dayalbagh, Agra On 06-07 September, 2018.
  29. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Yadav V., Chauhan S., Sharma P., SF-36 Scores Analysis for EMG and GSR Therapy on Audio, Visual and Audio Visual Modes for Chronic TTH, in the proceedings of the International Conference on Computational Intelligence and Data Analytics (ICCIDA-2018) on 27 and 28th October 2018 to be published in Communications in Computer and Information Science (CCIS) Series, Springer at Gandhi Institute for Technology, Khordha, Bhubaneswar, Odisha, India.
  30. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Saini H., Verma H., Mehlyan K., Varshney Y, Statistical Analysis of EMG and GSR Therapy on Visual Mode and SF-36 Scores for Chronic TTH, in the proceedings of international Conference on 5th IEEE Uttar Pradesh Section International Conference 2-4 Nov 2018 MMMUT Gorakhpur (IEEE Conference Record Number:43684X) at MMMUT Gorakhpur, UP Jointly organized by Madan Mohan Malaviya University of Technology, Gorakhpur (U.P) INDIA & University of the Ryukyus, Okinawa, Japan.
  31. Rastogi R., Chaturvedi D.K., Satya S., Arora N., Yadav V., Chauhan S., An Optimized Biofeedback Therapy for Chronic TTH between Electromyography and Galvanic Skin Resistance Biofeedback on Audio, Visual and Audio Visual Modes on Various Medical Symptoms, in the national Conference on 3rd Multi Disciplinary National Conference Pre-Doctoral Research [MDNCPDR-2018] at Dayalbagh Educational Institute, Dayalbagh, Agra On 06-07 September, 2018.