

Effectiveness Of Rhythmically Synchronized Tens On Chronic Musculoskeletal Pain.

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ABSTRACT:

Background: TENS and music therapy have long been used as a non-pharmacological mode of pain treatment. Variety of articles has been found on TENS and music therapy regarding the claims on chronic pain reduction and both of them has been proved as an effective mode of pain treatment and associated symptoms of anxiety and insomnia. Although both treatment effective in reduction of perceived pain but none of the modes has been completely effective in targeting all associated factors and symptoms. We proposed that combining music therapy with TENS therapy can work effectively in targeting pain, anxiety, insomnia and depression and can also reduce the health risk caused by drugs like analgesics, antidepressants, and sedatives. Musically synchronized TENS is a proposed machine that is based on the same principle as of conventional TENS but the stimulation time period and intensity is determined by the intensity of the music used and an audio cuing is also provided via headphones which is connected via the same audio source.

Methods: This study was an experimental study in which patient were given to fill data form and were selected on the basis of inclusion criteria. A total of 60 patients was taken into the study base doninclusionex clusion criteriaanddividedintotwogroupsof30patientseach.30 patients were taken into group A who have undergone conventional TENS therapy and other 30(group B) were subjected to Musically Synchronized TENS therapy for 15 consecutive days.

Results: A significant reduction in VAS scores and chronic pain was seen in the patients of musically synchronized TENS compared to the patients who were given conventional TENS therapy specially in second half sessions of the study.

Conclusion: Musically synchronized TENS proved to be an effective treatment method in chronic pain reduction when used in long run.

Keywords: Chronic Musculoskeletal Pain, TENS, Music therapy, Musically Synchronized TENS

INTRODUCTION

Music is said to have emerged from the sound of Shiva's drum, known as Damru. Shiva also played his Damru as the universe was created. These sounds can create, maintain, regulate, transform, and destroy. Shiva played on His Damaru (drum) fourteen times from which emerged the following fourteen Sutras popularly known as "Shiva Sutra" or "Maaheswar Sutra"⁽¹⁾. Music has been known to be one of the most effective modes of healing in the world, take it from the Hymns of OM or the Ragas of Classical Music; each of them has proved to be an effective medicine for psychological wellbeing and since it works in perfect synchrony with physical health so cannot be differentiated from physical wellbeing. Researches have shown that music therapy helps the patient to subdue their pain by activating the Endorphin system.

⁽²⁾TENS machine has become an integral part of Physiotherapy protocols and treatment of pain, spasms and dema and sometimes also helps in low level muscle strengthening. Low frequency TENS therapy has already been known to work on pain gait and on releasing endorphin in the body.⁽³⁾ Chronic pain has more psychological aspect to it rather than just a physiological aspect and to what extent it is rooted into the body system.⁽⁴⁾ In this article we are moving in the direction to make TENS more effective in its domain by combining it with a more reliable and psycho modulatory effect of music therapy and thus increase its efficacy over chronic pain.⁽⁵⁾ The effect can be long lasting thus can increase the efficacy of TENS when used in synchronized way. However, the variation in etiology behind the pain can make it more challenging as to what extent the Musically Synchronized TENS is able to manage the pain variations. Although the debate on the boundaries of music therapy is still going on, different approaches of musical intervention are available, referring to three principal domains: relational approaches, rehabilitative approaches and music listening. Relational approaches refer to psychological models and involve both active and receptive techniques. The former consists of different musical activities such as free or structured musical improvisation utilizing simple musical instruments, singing, song writing etc. that allow patient and therapist to directly interact building a musical relationship. In receptive approaches, music imagery and music listening are used to induce psychological beneficial effects and even to evoke and process motions and thoughts. Rehabilitative approaches, such as Neurologic Music Therapy (NMT,) refer to neuroscientific models and use primarily

the potential of musical stimuli to activate perception and production areas in the human brain, providing a series of therapeutic applications to sensory, cognitive, and motor dysfunctions resulting from neurological disorders. Using adirective approach based on a series of exercises, neurologic music therapy may be used, for example, to improve gait and movements in post-stroke and PD patients and language in persons with aphasia. ⁽⁴⁾

METHODOLOGY

Materials Used: TENS, Musically Synchronized TENS, Headphones Music Source (laptop, mp3 player etc.)

Musically Synchronized TENS: Musically Synchronized TENS is machine that is based on the conventional TENS but there is a change in the circuitry with the introduction of voltage switch. The Musical TENS consists of three major components MP3 player or any source of music that has at least 2 channels, 12volt amplifier for boosting the audio signal, a rectifier for converting alternating current to direct current from audio source, voltages witch to control the TENS voltage based on audio signal feed and finally the TENS circuitry. The Musically Synchronized TENS is based on the same concept of Burst TENS but the intensity fluctuations are nonuniform and nonperiodic and the intensity is fully synchronized with the music volume/intensity i.e., when ever the intensity on music goes up the intensity of TENS also goes up and visa-versa. Also, the patient gets real time feedback of the music intensity fluctuations through headphones while the nerve gets stimulated via electrodes in the very same pattern.

Working and music selection: The Musically Synchronized TENS is based on the conventional TENS machine while being amplitude/Intensity modulated via the music source. The machine works best when there is deep variation in music intensity or volume and doesn't work good with lyrical songs. The best results are seen with monophonic music as there is a distinct intensity variation in the music. The machine works best with the monophonic instrumentals with high intensity variations rather than any lyrical music or flat music and the music mostly included instrumentals of Piano, Flute and Harps and OM mantra sound.

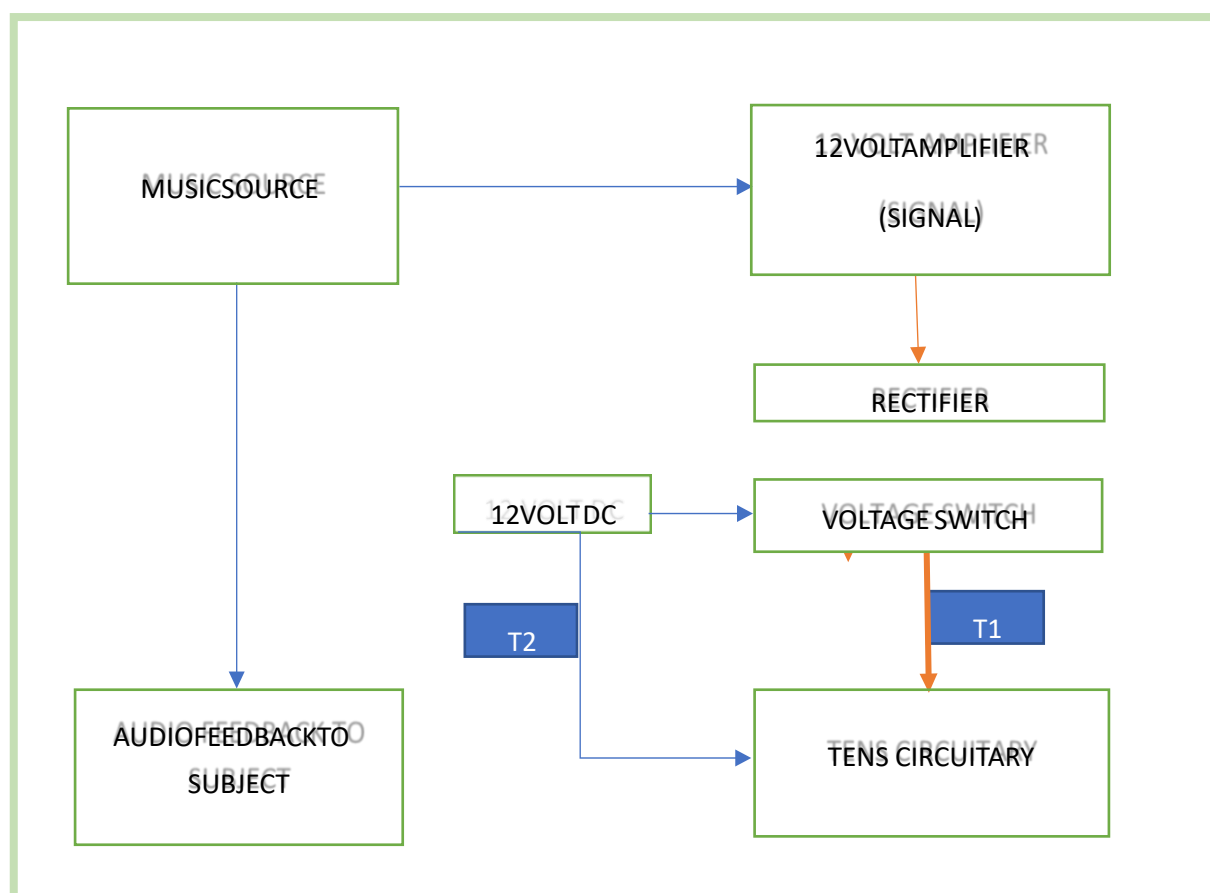


Figure 1 Block diagram of musically synchronized TENS

Participants Selection: A total of 60 patients were made to participate in to the study based on inclusion exclusion criteria and divided into two groups of 30 patients each. 30 patients were taken into group A who have undergone conventional TENS therapy and other 30 (group B) were subjected to Musically Synchronized TENS therapy for 15 consecutive days.

Inclusion Criteria

- Chronic neuromuscular pain(>3 months)
- Age group 18-60

Exclusion Criteria

- Patients who are involved in music listening involving other sound - based interventions, e.g., Rhythmic Auditory Stimulation or auditory cueing
- Using muscle relaxant or pain reliever
- pacemakers
- epilepsy
- pregnancy
- tinnitus any other auditory problems

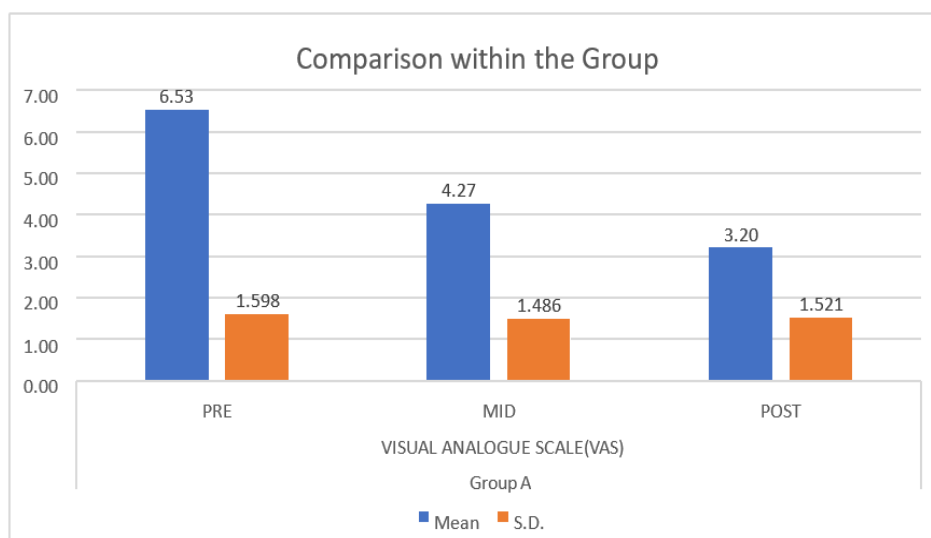
Treatment duration: The patients of both the group (control and experimental group) were subjected to a single treatment session of 10 mins per day for 15 consecutive days. Intensity of TENS and Music was calibrated according to the patient's comfort.

RESULT

The musically synchronized TENS machine was tested on over 30 subjects and the correlation coefficient as always greater than 0.8 hence the machine was proved to be reliable in every situation applicable under defined conditions. A coefficient of correlation of +0.8 or -0.8 indicates a strong correlation between the independent variable and the dependent variable.

Repeated ANOVA	Group A		
	VISUAL ANALOGUE SCALE (VAS)		
	PRE	MID	POST
Mean	6.53	4.27	3.20
S.D.	1.598	1.486	1.521
Median	6	4	4
Number	15	15	15
DF1	2		
DF2	28		
F Test	27.01		
/			
Table Value	3.340		
P value	<0.001		
Result	Significant		
Tukey’s method for Pairwise comparison			
Mean Difference & Result>	PRE		
	MID	2.27Sig	MID
	POST	3.34Sig	1.07NSig

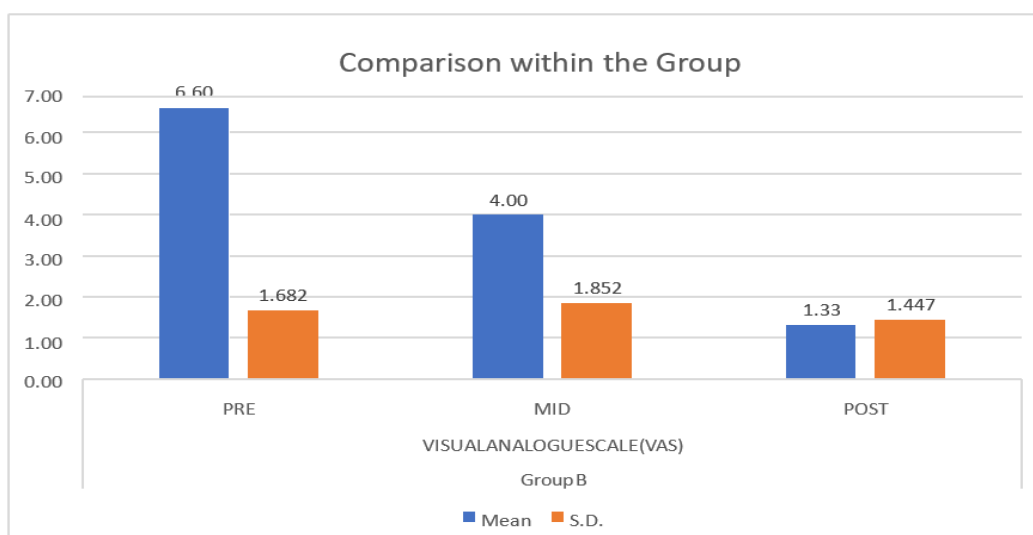
Table 1 Within Group Analysis is Group A (Repeated ANOVA)



Graph 1 Comparison within the Group A

	Group B		
Repeated ANOVA	VISUAL ANALOGUE SCALE(VAS)		
	PRE	MID	POST
Mean	6.60	4.00	1.33
S.D.	1.682	1.852	1.447
Median	6	4	1
Number	15	15	15
DF1	2		
DF2	28		
F Test	112.22		
Table Value	3.340		
P value	<0.001		
Result	Significant		
Tukey’s method for Pairwise comparison			
Mean Difference & Result>			
	PRE		
	MID	2.6Sig	MID
	POST	5.27Sig	2.67Sig

Table 2 Within Group Analysis Group B (Repeated ANOVA)



Graph 2 Comparison within the Group B

After doing repeated anova test with in the groups both group A and group B showed significant results i.e., both the machine and treatment protocol are effective in themselves but the individual average of each session in Group B showed reduction in pain compared to Group A and significantly when comparison is done between mid-session and post session i.e., day 7 and day 14. While musically synchronized TENS performed slightly better while compared to conventional TENS, the result musically synchronized TENS was significantly better when the machine was tested at different time slots of Day 0, Day 7, and Day 14, as the p value out to be <0.001 . In Group A difference in the pain score between pre and mid-session was 2.26 while between mid and post session came to be 1.07 only, which shows that initial 7 days of treatment was more effective in comparison to last 7 days. Within Group B difference in the pain score between pre and mid session was 2.6 and between mid and post session so came to be around 2.6 which shows that the effect of musical TENS in pain reduction is uniform throughout the given time period. The results showed that the proposed machine is effective and reliable as results are consistent with time and the p value came out to be <0.001 . While comparing the pain measurement value of both groups the difference between pre and post came to be 3.34 in Group A while 5.27 in Group B, which is significant difference when comparing the effectiveness of Musically Synchronized TENS with Conventional TENS.

DISCUSSION

The results of the VAS scores of both the group suggest that musically synchronized TENS is a very effective means of treatment as there is a major decrement in pain and the patients were satisfied with the effect of Musical TENS. There was a significant reduction in the VAS scores of experimental groups specially in the patients with posture related pain, pain associated with muscle fatigue due to similar strenuous work in daily routine. Effect of the musical TENS increased when the patient was treated in peaceful environment and the same increases sedation level in few of patients due to calming effect of the music. Also, music with synchronized TENS therapy might have provided a good distraction to the patients as the patient gets diverted from pain while focusing on music and TENS fluctuations working in sync and pleasure induced by music. The feeling of pleasantness and relaxation and in some patient's induction of sleep was also noticed as accompanied benefits of machine.

Limitation: We have already discussed the clinical relevance and future scope of the musical TENS but as the machine is new, there are some limitations that can be addressed in future research.

- Lack of peaceful and accumulative environment
- Low sample size
- The machine was only operated on high frequency (>100)

CONCLUSION

The result showed an outcome that favored the use of Musically Synchronized TENS as an effective mode of treatment and in future it can prove to be a better alternative to conventional TENS while curing chronic pain.

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