

EFFECTS OF BRIEF-INTENSE MODE AND ACUPUNCTURE-LIKE TENS IN THE RELIEF OF CHRONIC LOW BACK PAIN

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Abstract

Background: Transcutaneous electrical nerve stimulation (TENS) is a physical modality used in the management of pain using various treatment modes. However, the optimal mode of application for the treatment of chronic low back pain appeared not to be well studied.

Aim: The study aimed to determine and compare the effects of Brief-intense mode and Acupuncture-like TENS in the relief of chronic low back pain.

Materials and Methods: Twenty-seven (27) participants were recruited using a consecutive sampling technique. Participants were randomly allocated into three groups (Brief-intense, Acupuncture-like TENS and Control group) using simple balloting. Participants in brief-intense group and acupuncture-like TENS group received TENS treatment using different current intensities, pulse duration and frequency in addition to conventional physiotherapy treatment for low back pain. However, participants in control group received only conventional physiotherapy treatment for low back pain. Each group received treatment two times a week for six weeks. Outcome measures assessed were pain intensity and functional disability using Numerical Pain Rating Scale (NPRS) and Roland Morris Questionnaire (RMQ) respectively. Data collected at baseline, week three and six were analyzed using one-way ANOVA and independent T test. Alpha level was set at < 0.05 .

Results: There was a significant reduction in pain intensity and functional disability in the three groups across the three time frame for measurement ($p < 0.05$). However, there was no significant difference between the effects of Brief-intense mode and Acupuncture-like TENS on pain intensity and functional disability ($p > 0.05$).

Conclusion: Both modes of TENS (brief-intense group, acupuncture-like TENS) produced a significant effect in the reduction of pain as well in the improvement of functional disability in all participants with chronic low back pain. However, no one seems to be more effective than the other in the treatment of chronic low back pain.

Keywords: *low back pain, Transcutaneous electrical nerve stimulation, Brief-intense TENS*

Introduction

The low back with regards to anatomy of the human body is defined as extending from the 12th rib to the iliac crest¹. Krismer & van Tulder² also referred to Low back pain as pain located between the 12th rib and the inferior gluteal folds, with or without leg pain. Back pain will affect 75–85% of persons at some point in their lives³. Low Back Pain (LBP) can be caused by a several factors such as: trauma, degenerative conditions, body anthropometrics, work conditions, disease conditions, posture as well as lifestyle and psychological factors. Typically, mechanical and nonspecific causes of low back pain exist. Intrinsically, the intervertebral disks, spine, or the nearby soft tissues might cause mechanical low back pain. Clinical signs which are usually referred to as red flags, can be used to spot cases of non-mechanical LBP and recommend additional testing or imaging. LBP is divided into three broad categories according to how long the symptoms last. A back pain can be referred to as acute when it has been present for not more than six weeks while sub-acute back pain usually lasts between six to twelve weeks⁴. Chronic LBP is defined as that which lasts for 12 weeks or longer⁵.

LBP is an extremely common issue that most people encounter at some point in their life⁶. The burden of low back pain is increasing along with the aging and expanding populations since it is the main cause of years lost to disability worldwide⁷. LBP, which is rated as the number one cause of disability worldwide, is thought to affect adults of working age more than any other group⁶. Epidemiological data reveals that improving social and economic conditions in low and middle income countries could decrease the prevalence of LBP, as the practice of seeking for low-value healthcare among people living with LBP can lead to

increase in the risk of long-term back-related disability⁸. LBP is the number one contributor to the overall burden of musculoskeletal conditions with 570 million prevalent cases worldwide, responsible for 7.4% of global years of healthy life lost to disability⁹. Some risk factors for developing low back pain include; lifting at work, Obesity, depressive symptoms and lifestyle factors such as smoking¹⁰. In a global review by Hoy *et al.*,¹¹ after accounting for methodological variability, it revealed a point prevalence of 11.9% \pm 2.0%, its one month prevalence was 23.2% \pm 2.9%, the annual prevalence was 38.0%, its overall lifetime prevalence revealed 39.9% and the mean prevalence was 31.0% \pm 0.6% overall. According to studies, it has been established that Africa has a 47% lifetime prevalence of LBP, a 57% one-month prevalence, and a 39%-point prevalence¹². LBP is thought to affect between 32.5% and 73.5% of Nigerians on a yearly basis with a mean prevalence of 55.39%¹³. The occurrence of neuropathic pain in LBP is commonly estimated to be around 5%, however some research indicates that up to 16–55% of patients with chronic LBP may have potential neuropathic pain components¹⁴.

Transcutaneous electrical nerve stimulation (TENS) is a low-cost non-pharmacological method used to treat disorders including both acute and chronic pain¹⁵. Pain is an unpleasant sensory and emotional experience associated with, or resembling that associated with, actual or potential tissue damage¹⁶. To trigger mechanisms that relieve pain, several TENS approaches are employed to selectively activate populations of nerve fibers. Conventional TENS with stimulation parameters such as low intensity and high frequency, Acupuncture-like TENS with stimulation parameters such as high intensity and low frequency, and Brief-intense TENS with stimulation parameters

such as high intensity and high frequency are some of the common modes TENS deliveries¹⁷. In a study by Melzack *et al.*,¹⁸ it was found that Transcutaneous electrical stimulation was efficient in relieving LBP when compared to therapeutic massage. According to a randomized study by Yannick *et al.*,¹⁹ the application of acupuncture-like TENS induced a clinically significant analgesia in all participants with chronic LBP. In another randomized study by Ilhanli,²⁰ the application of acupuncture-like TENS induced analgesia in all participants with chronic LBP following lumbar disc herniation. However, analgesia was found to be starting earlier in treatment regimen. In a review by Flowerdew & Gadsby,²¹ it was reported that there was limited statistical evidence that acupuncture-like TENS was effective in inducing analgesia in participants with chronic LBP. In a randomized trial by Ilhanli,²⁰ the application of brief-intense TENS mode induced analgesia in all participants with chronic LBP and lumbar disc herniation.

LBP is a widespread problem that affects millions of people worldwide. TENS is a popular non-invasive therapy for the management of chronic LBP. However, there is a lack of consensus on the most effective mode of TENS for pain relief. Specifically, there is a need to compare the effects of brief-intense TENS mode and acupuncture-like TENS mode in the relief of low back pain. This study therefore aims to address this gap in the literature by investigating and comparing the effects of Brief-intense mode of TENS and Acupuncture-like mode of TENS in the relief of low back pain. The specific objective of the study was to identify the TENS mode that would result in a more significant reduction in pain intensity and functional disability among patients with chronic low back pain.

Materials and methods

Ethical approval for this experimental study was obtained from ethical review committee of the University of Benin Teaching Hospital (UBTH) (protocol number ADM/E 22/A/VOL.VII/148301176). Participants in this study included male and female patients with a history of Low back pain who are currently being managed at the physiotherapy clinic in the University of Benin Teaching Hospital (UBTH). Participation in this study was voluntary and decision not to participate in this study had no repercussion however, the following categories of patients were excluded: patients with major mental health condition (i.e. schizophrenia), patients with skin sensation impairment and other contraindications to TENS therapy.

A simple randomization technique using simple balloting technique was used to assign participants into group A (brief-intense group), group B (Acupuncture-like TENS) and group C (control/no TENS). The sample size was determined by Cohen's table of sample size determination using power of 80% (0.80) with the effects size of 1 (d=1) while setting the alpha level at 0.05. The sample size therefore was 17 per group, while the total sample size for the 3 groups was 51. Taking 10% attrition rate into consideration, the overall total estimated sample size was 56. However, a total of 33 participants who were available and met inclusion criteria were randomly assigned into the three groups i.e (Acupuncture-like TENS group n=12, Brief intense group n=9 and the Control group n=12). 6 participants did not complete the six weeks' treatment sessions and their data were therefore excluded in the final data analysis while only 27 participants completed the six weeks' treatment sessions (Acupuncture-like

TENS n=8, Brief-intense n=9 and Control n=10).

The Numerical Pain Rating Scale (NPRS) was used to grade the pain intensity of participants while Roland Morris Questionnaire was used to evaluate their level of physical disability as a result of low back pain at baseline, week 3 and week 6 of the study.

Interventions:

Group A (Brief-intense mode): The participants were given a proper explanation on the procedure followed by proper assessment to check for contraindications to the application of TENS. Participants in this group were positioned in prone lying on a treatment couch and were treated with brief-intense mode of TENS with a pulse duration of 155 μ s and a frequency of 85Hz for 10 minutes, twice a week for 6 weeks as well as their conventional treatment for Low back pain which includes; manual therapy such as soft tissue mobilization, mobilization and/or manipulation of the lumbar spine, specific trunk muscle training; Infrared radiation to the low back and patient education. Data were collected using the NPRS at baseline, 3 weeks and at 6 weeks of intervention. Similarly, Roland Morris Questionnaire was used to assess level of functional disability at baseline, 3 weeks and at 6 weeks of intervention.

Group B (Acupuncture-like TENS): Similar procedure was followed as for participants in group A. However, participants in this group were treated with Acupuncture-like TENS mode with a pulse duration of 155 μ s, frequency of 5Hz and a tolerable level of intensity for 10 minutes, twice a week for 6 weeks as well as their conventional treatment for Low back pain which includes; manual therapy modalities such as soft tissue mobilization, mobilization and/or manipulation of the lumbar spine, specific trunk muscle training;

Infrared radiation to the low back and patient education. Data were collected using the NPRS and Roland Morris Questionnaire at baseline, 3 weeks and at 6 weeks of intervention.

Group C (Control/no TENS): Participants in this group did not receive any TENS treatment, however, they were only treated with the conventional treatment for Low back pain which includes; manual therapy modalities such as soft tissue mobilization, mobilization and/or manipulation of the lumbar spine, specific trunk muscle training; Infrared radiation to the low back and patient education. Data were collected using the NPRS at baseline, 3 weeks of intervention and at 6 weeks of intervention. Using the Roland Morris Questionnaire, data were collected at baseline, 3 weeks and at 6 weeks of intervention.

Data was compared within the groups at baseline, at three weeks and at six weeks using one-way ANOVA, and compared between group using independent T test. Alpha level was set at 0.05.

Results

The main purpose of this study was to compare the effects of Acupuncture-like and brief intense TENS mode in the management of patients with Low Back Pain in the University of Benin Teaching Hospital. A total of 27 participants were recruited from the out-patient clinic of physiotherapy Department, University of Benin Teaching Hospital (UBTH).

Shown in figure 1 is the participant flow chart. 33 participants who met inclusion criteria were randomized into Acupuncture-like TENS group (12), Brief-intense TENS group (9) and Control group (12). 4 patients dropped out of Acupuncture-like group, while 2 dropped from the Brief-intense

group. A total of 27 patients with LBP completed the study.

Presented in table 1 is the sociodemographic characteristics of the participants. A total of twenty-seven (100%) patients with low back pain participated in this study. 8 (29.6%) in acupuncture like TENS group, 9 (33.33%) in brief intense TENS group and 10 (37.0%) in control group. 14 (51.90%) were males while 13 (48.10%) were female. Majority of the participants 26 (96.30%) were Christians. The most represented ethnic group in this study were Benin (22.20%). Majority of the participants 12 (44.4%) had a low back pain diagnosis of about 1 year duration.

Table 2 shows the clinical characteristics of the participants: In the acupuncture-like TENS group, the age of the participants ranged from 40 to 60 with a mean age of 51.38 ± 8.63 . The mean duration of low back pain was 2.63 ± 1.59 . The mean pain score of the participants at baseline, week 3 and week 6 were 6.00 ± 2.83 , 5.13 ± 2.85 and 3.75 ± 2.12 respectively. The mean Roland Morris Questionnaire score of the participants at baseline, week 3 and week 6 were 9.38 ± 5.99 , 6.38 ± 5.15 and 7.75 ± 4.77 respectively.

In brief intense group, the age of the participants ranged from 42 to 72 with a mean age of 57.33 ± 8.88 . The mean duration of low back pain was 2.33 ± 1.32 . The mean pain score of the participants at baseline, week 3 and week 6 were 6.44 ± 1.81 , 5.22 ± 1.85 and 4.22 ± 1.64 respectively. The mean RMQ score of the participants at baseline, week 3 and week 6 were 11.33 ± 4.69 , 9.77 ± 4.09 and 8.00 ± 4.00 respectively.

In the control group, the age of the participants ranged from 37 to 75 with a mean age of 50.88 ± 13.18 . The mean duration of low back pain was 2.00 ± 1.33 .

The mean pain score of the participants at baseline, week 3 and week 6 were 4.90 ± 1.59 , 4.00 ± 1.41 and 2.70 ± 1.25 respectively. The mean RMQ score of the participants at baseline, week 3 and week 6 were 8.30 ± 6.52 , 7.30 ± 6.25 and 6.30 ± 5.91 respectively.

Presented in table 3 is the result of One way ANOVA showing comparison between age, duration of LBP, pain rating and functional disability at baseline. The result shows, there was no significant difference in age, duration of low back pain, pain intensity and functional disability at baseline ($p=0.365$, $p=0.649$, $p=0.272$, and $p=0.528$ respectively (see Table 3).

The result of a paired t test for significance difference in pain rating scores and RMQ scores within the three groups at baseline, week 3 and week 6 of the study is as shown in table 4.

In the Acupuncture like treatment group, the results revealed a statistically significant decrease in pain scores from baseline (6.00 ± 2.83) to week 3 (5.13 ± 2.85) $p=0.006$. There was also a statistically significant decrease in RMQ scores from baseline (9.38 ± 5.99) to week 3 (8.37 ± 5.15) $p=0.018$. Similarly, between, there was a statistically significant decrease in pain scores from baseline (6.00 ± 2.83) to week 6 (3.75 ± 2.12) $p<0.001$ and a statistically significant decrease in RMQ scores from baseline (9.38 ± 5.99) to week 6 (7.75 ± 4.77) $p=0.014$.

In the brief intense treatment group, there was a statistically significant decrease in pain scores from baseline (6.44 ± 1.81) to week 3 (5.22 ± 1.85) $p=0.002$. There was also a statistically significant decrease in RMQ scores from baseline (11.33 ± 4.69) to week 3 (9.77 ± 4.09) $p=0.001$. Similarly, there was a statistically significant decrease in pain scores from baseline (6.44 ± 1.81) to week 6 (4.22 ± 1.64) $p<0.001$. There was

also a statistically significant decrease in RMQ scores from baseline (11.33 ± 4.69) to week 6 (8.00 ± 4.00) $p < 0.001$.

In the control group, the result showed that there was a statistically significant decrease in pain scores from baseline (4.90 ± 1.59) to week 3 (4.00 ± 1.41) $p = 0.001$. There was also a statistically significant decrease in RMQ scores from baseline (8.30 ± 6.52) to week 3 (7.30 ± 6.25) $p = 0.001$. Between baseline and 6 weeks, there was a statistically significant decrease in pain ($t=6.000$, $p < 0.001$) and a statistically significant decrease in RMQ scores ($t=11.000$, $p < 0.001$).

Table 5 shows the result of One way ANOVA comparison of pain rating and functional disability across the three groups (acupuncture-like TENS, brief intense and control) at baseline, week 3 and 6 of the study. A one way ANOVA across group tests was conducted to explore the effect of acupuncture like TENS, Brief intense TENS and the control group on pain intensity and functional disability at baseline, week 3 and week 6. The result revealed that, there was no statistically significant difference in pain intensity scores across all the three groups at baseline, week 3 and week 6 of the treatment period ($p=0.272$; $p=0.374$; $p=0.148$ respectively). Furthermore, the result also revealed no statistically significant difference in functional disability scores across all three groups at baseline, week 3 and week 6 ($p=0.528$; $p=0.601$; $p=0.729$).

Table 6 shows result of One-way ANOVA comparing the pain and disability scores across baseline, week 3 and week 6 within the three groups. The result shows a statistically significant difference across baseline, week 3 and week 6 within the brief intense group ($p=0.045$) and in the control group (0.026) while there was no significant difference within the Acupuncture like treatment group across the three-time frame

($p= 0.247$). The result also revealed no significant statistically difference in the functional disability scores across baseline, week 3 and week 6 within the three groups. A post hoc analysis using Bonferroni analysis showed that there was a statistically significant decrease in pain rating scores between baseline and week 6 in the control group ($p=0.022$) and brief intense group (0.041) as shown in table 7.

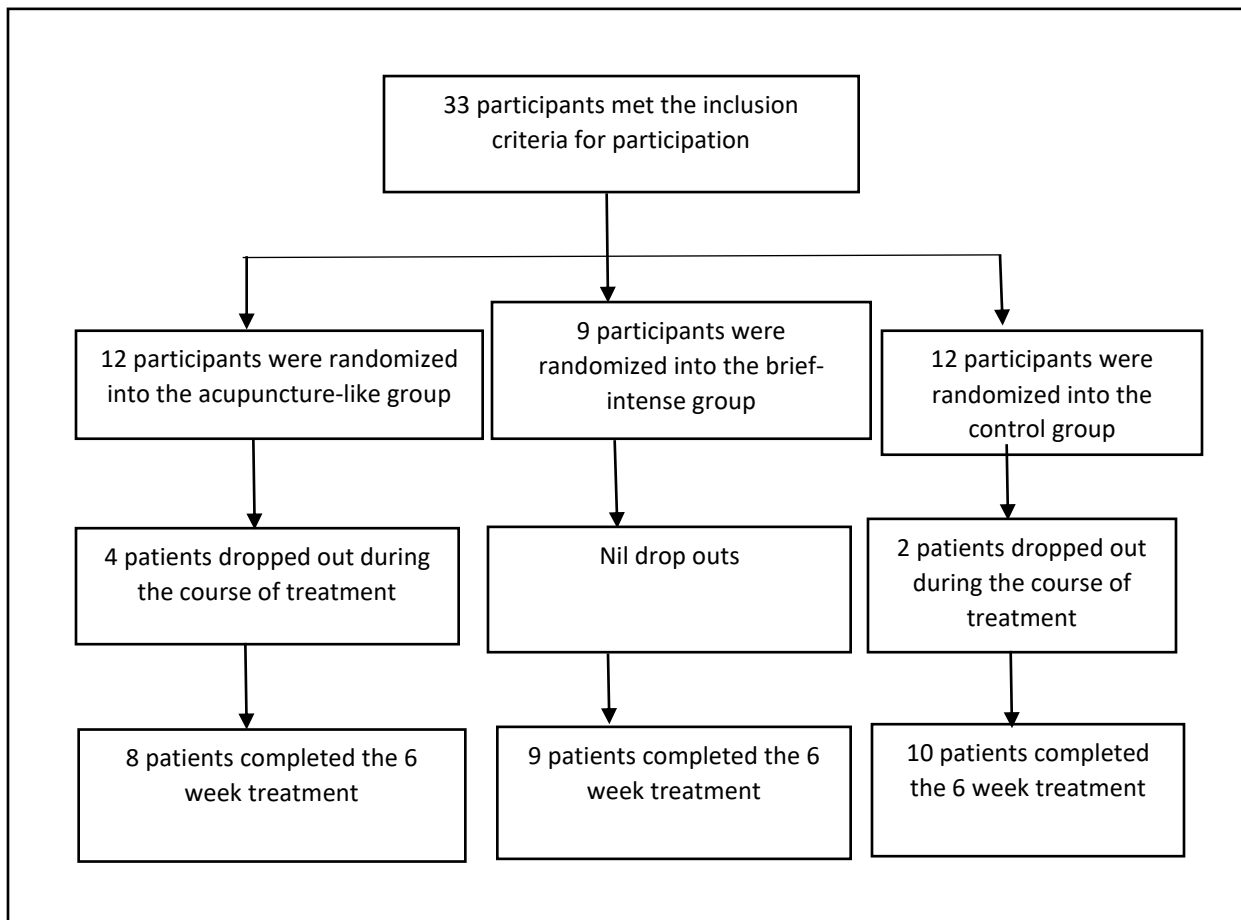


Figure 1: Participants flow chart

Table 1: Sociodemographic Data of the Participants (n=27)

Variable	Acupuncture-like TENS N (%)	Brief intense TENS N (%)	Control N(%)	Total N(%)
Gender				
Male	4(14.81)	3(11.11)	6(22.22)	14 (51.90)
Female	6(22.22)	5(18.51)	4(14.81)	13 (48.10)
Marital Status				
Single	0(0.00)	0(0.00)	3(11.11)	3 (11.10)
Married	8(29.63)	9(33.33)	7(25.93)	24 (88.90)
Religion				
Christianity	8(29.63)	8(29.63)	10(37.04)	26 (96.30)
Islam	0(0.00)	1(3.70)	0(0.00)	1 (3.70)
Ethnicity				
Benin	1(3.70)	1(3.70)	4(14.81)	6 (22.20)
Ibo	4(14.81)	4(14.81)	0(0.00)	8 (29.60)
Yoruba	1(3.70)	2(7.41)	1(3.70)	5 (18.5)
Others	2(7.41)	2(7.41)	4(14.81)	8 (29.60)
Occupation				
Civil Servant	3(11.11)	0(0.00)	1(3.70)	4 (14.81)
Business	1(3.70)	2(7.41)	2(7.41)	5 (18.52)
Retired	1(3.70)	2(7.41)	2(7.41)	5 (18.52)
Others	4(14.81)	5(18.51)	5(18.51)	14 (51.85)
Level of Education				
Primary	1(3.70)	0(0.00)	0(0.00)	1 (3.70)
Secondary	4(14.81)	3(11.11)	1(3.70)	8 (29.6)
Tertiary	5(18.51)	5(18.51)	8(29.63)	18 (66.7)
Duration of low back pain (years)				
1	3(11.11)	3(11.11)	6(22.22)	12 (44.4)
2	1(3.70)	2(7.41)	0(0.00)	3 (11.1)
3	1(3.70)	3(11.11)	2(7.41)	6 (22.2)
4	2(7.41)	0(0.00)	2(7.41)	4 (14.8)
5	1(3.70)	1(3.70)	0(0.00)	2 (7.4)

Table 2: Clinical characteristics of the Participants (n=27)

Group		Minimum	Maximum	Mean ± S.D
Acupuncture-like (n=8)	Age	40.00	63.00	51.38 ± 8.63
	Duration of LBP (years)	1.00	5.00	2.63 ± 1.59
	NPRS Baseline	2.00	10.00	6.00 ± 2.83
	NPRS Week 3	1.00	9.00	5.13 ± 2.85
	NPRS Week 6	1.00	7.00	3.75 ± 2.12
	RMQ Baseline	2.00	18.00	9.38 ± 5.99
	RMQ Week 3	2.00	16.00	6.38 ± 5.15
	RMQ Week 6	2.00	15.00	7.75 ± 4.77
Brief Intense (n=9)	Age	42.00	70.00	57.33 ± 8.88
	Duration of LBP (years)	1.00	5.00	2.33 ± 1.32
	NPRS Baseline	3	9	6.44 ± 1.81
	NPRS Week 3	2	8	5.22 ± 1.85
	NPRS Week 6	1	7	4.22 ± 1.64
	RMQ Baseline	6	20	11.33 ± 4.69
	RMQ Week 3	6	17	9.77 ± 4.09
	RMQ Week 6	4	15	8.00 ± 4.00
Control (n=10)	Age	37.00	75.00	50.80 ± 13.18
	Duration of LBP (years)	1.00	4.00	2.00 ± 1.33
	NPRS Baseline	3.00	9.00	4.90 ± 1.59
	NPRS Week 3	2.00	7.00	4.00 ± 1.41
	NPRS Week 6	2.00	6.00	2.70 ± 1.25
	RMQ Baseline	3.00	22.00	8.30 ± 6.52
	RMQ Week 3	2.00	21.00	7.30 ± 6.25
	RMQ Week 6	2.00	20.00	6.30 ± 5.91

Table 3: One way ANOVA showing comparison between age, duration of LBP, pain rating at baseline and functional disability at baseline (n=27)

	Acupuncture Like	Brief Intense	Control	F	P value
Age	51.38 ± 8.63	57.33 ± 8.88	50.80 ± 13.18	1.051	0.365
Duration of LBP (years)	2.63 ± 1.59	2.33 ± 1.32	2.00 ± 1.33	0.440	0.649
NPRS Baseline	6.00 ± 2.83	6.44 ± 1.81	4.90 ± 1.59	1.377	0.272
RMQ Baseline	9.38 ± 5.99	11.33 ± 4.69	8.30 ± 6.52	0.657	0.528

Table 4: Paired t test showing the difference in pain rating scores and RMQ scores within the three groups at baseline, week 3 and week 6 of the study. (n=27)

	Baseline – Week 3 Baseline – Week 6	Mean ± S.D	T value	p-value
Acupuncture like (n=8)	NPRS Baseline – Week 3	0.875± 0.641	3.862	0.006*
	NPRS Baseline – Week 6	2.25 ± 0.87	7.180	<0.001*
	RMQ Baseline – Week 3	1.00 ± 0.926	3.055	0.018*
	RMQ Baseline – Week 6	1.63 ± 1.41	3.27	0.014*
Brief Intense (n=9)	NPRS Baseline – Week 3	1.22 ± 0.833	4.400	0.002*
	NPRS Baseline – Week 6	2.22 ± 0.67	10.00	<0.001*
	RMQ Baseline – Week 3	1.56 ± 0.88	5.29	0.001*
	RMQ Baseline – Week 6	3.33 ± 1.12	8.944	<0.001*
Control (n=10)	NPRS Baseline – Week 3	0.900 ± 0,57	5.014	0.001*
	NPRS Baseline – Week 6	2.00 ± 0.632	6.000	<0.001*
	RMQ Baseline – Week 3	1.00 ± 0.667	4.8743	0.001*
	RMQ Baseline – Week 6	2.00 ± 1.05	11.000	<0.001*

Table 5: One way ANOVA comparing pain rating and functional disability across the three groups (acupuncture-like TENS, brief intense and control) at baseline, week 3 and 6 of the study (N=27)

	Time frame	Acupuncture like (Mean ± S.D)	Brief Intense (Mean ± S.D)	Control (Mean ± S.D)	F	p-value
NPRS	Baseline	6.00 ± 2.83	6.44 ± 1.81	4.90 ± 1.59	1.377	0.272
	Week 3	5.13 ± 2.85	5.22 ± 1.85	4.00 ± 1.41	1.026	0.374
	Week 6	3.75 ± 2.12	4.22 ± 1.64	2.70 ± 1.25	2.070	0.148
RMQ	Baseline	9.38 ± 5.99	11.33 ± 4.69	8.30 ± 6.52	0.657	0.528
	Week 3	6.38 ± 5.15	9.77 ± 4.09	7.30 ± 6.25	0.521	0.601
	Week 6	7.75 ± 4.77	8.00 ± 4.00	6.30 ± 5.91	0.320	0.729

Table 6: One way ANOVA comparing pain rating and functional disability at baseline, week 3 and week 6 within acupuncture-like TENS, brief intense and control group. (N=27)

	Time frame	Acupuncture like	Brief intense	Control
NPRS	Baseline	6.00 ± 2.83	6.44 ± 1.81	5.74 ± 2.12
	Week 3	5.13 ± 2.85	5.22 ± 1.85	4.74 ± 2.07
	Week 6	3.75 ± 2.12	4.22 ± 1.64	3.52 ± 1.74
	P value	0.247	0.045*	0.026*
RMQ	Baseline	9.38 ± 5.99	11.33 ± 4.69	9.63 ± 5.73
	Week 3	6.38 ± 5.15	9.77 ± 4.09	8.44 ± 5.19
	Week 6	7.75 ± 4.77	8.00 ± 4.00	7.30 ± 4.87
	P value	0.829	0.272	0.578

Table 7: Post hoc analysis using Bonferroni post hoc test showing difference in pain rating scores across baseline, week 3 and week 6 in control and brief-intense group (N=27)

		Mean Difference	Std. Error	p	95% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Control (NPRS)						
Baseline	Week 3	0.8272	0.654	0.652	-0.844	2.498
	Week 6	1.949*	0.673	0.022*	0.230	3.658
Week 3	Baseline	-.8272	0.654	0.652	-2.498	0.844
	Week 6	1.122	0.688	0.344	-0.635	2.879
Week 6	Baseline	-1.949*	0.673	0.022*	-3.668	-0.230
	Week 6	-1.122	0.688	0.344	-2.879	0.6353
Brief Intense (NPRS)						
Baseline	Week 3	1.222	0.835	0.469	-0.927	3.371
	Week 6	2.222*	0.835	0.041*	0.072	4.372
Week 3	Baseline	-1.222	0.835	0.469	-3.371	0.927
	Week 6	1.000	0.851	0.729	-1.149	3.149
Week 6	Baseline	-2.222*	0.835	0.041*	-4.371	-0.007
	Week 6	1.000	0.851	0.729	-3.141	1.114

Discussion

The results of this study showed that the Brief intense mode had a significant effect in reduction of pain and functional disability in individuals with chronic LBP, similarly, the Acupuncture-like TENS mode was also found to produce a significant reduction in pain and functional disability in individuals with chronic LBP. The finding is similar to a study carried out by Rajfur *et al.*,²² that compared the efficacy of different selected electrical therapies including TENS on chronic LBP. It reported that TENS was effective in elimination of pain and improvement of functional abilities of patients suffering from LBP, although findings of Rajfur *et al.*,²² and the finding in this study should be compared with caution as two different TENS modes including; conventional mode and acupuncture-like TENS mode were both used concurrently in the study by Rajfur *et al.*,²² without any distinction on which exact mode had the most effect on the participants with chronic LBP. Further, the results of a systematic review by Khadilkar *et al.*,²³ where the standard modes of TENS including; conventional, acupuncture-like, brief intense, burst mode and modulation mode were compared to placebo TENS, showed that there was conflicting evidence on the benefits of TENS in reducing LBP intensity. Again, caution should be observed when comparing the findings from the review by Khadilkar *et al.*,²³ and the finding in this study as several other standard modes of TENS were included in the study of Khadilkar *et al.*²³.

It was observed from this study, that there was statistically significant improvement in pain rating score as well as on functional disability in all participants in the brief intense, acupuncture-like TENS and the control treatment groups. This finding is in tandem with a study carried out by

Moseley²⁴ on the efficacy of combined physiotherapy i.e. manual therapy, specific exercise training and education in chronic LBP patients on dependent variables such as pain and functional disability as majority of the components making up the combined physiotherapy and education treatment approach were part of the treatment given to all the participants in the three different treatment groups i.e. brief-intense group, acupuncture-like TENS group and the control group. The result of the study carried out by Moseley²⁴ revealed that after four weeks of treatment and at follow up, there was significant improvement in pain rating scores as well as on functional disability in all participants randomized into the combined physiotherapy and education treatment group when compared to the control group.

Although, both modes of TENS were seen to be effective in the reduction of pain on the low back among participants in this study, there was no significant difference in the effect between the brief intense mode, acupuncture-like TENS mode and in the control group. This finding is in tandem with a study carried out by Ilhanli²⁰ that revealed no significant difference at the end of the treatment regimen in the effects of three modes of TENS including conventional, acupuncture-like and brief-intense modes of TENS in participants with chronic LBP following lumbar disc herniation. However, the findings of the study carried out by Ilhanli,²⁰ may not be suitable for direct comparison with the finding in this study as that of Ilhanli,²⁰ was delimited to patients diagnosed of chronic LBP following lumbar disc herniation, hence caution should be observed when comparison are being made with respect to this project. This observed insignificant difference between the effects of brief-intense mode, acupuncture-like TENS and in the control group could be

attributed to the short duration of treatment sessions adopted for treating participants in the three treatment groups i.e. brief-intense group, acupuncture-like TENS group and the control group throughout the course of the study as well as the inability to stimulate to the point of visible muscle twitching in the participants within the acupuncture-like TENS group.

Conclusion

From this study, both modes of TENS (brief-intense group, acupuncture-like TENS) proved to have statistically significant effect in the reduction of pain as well in the improvement of functional disability in all participants with chronic LBP. However, no one seems to be more effective than the other in the treatment of chronic LBP.

Recommendations

Further studies on the effect of TENS on chronic LBP should be researched into. Similar studies should also be carried out with a larger population, a longer duration, more importantly, each treatment session using the acupuncture-like TENS mode should be long enough to produce visible muscle twitching. Other standard modes of TENS should be explored in the treatment of chronic low back pain.

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Conflict of interest

The authors declare no conflict of Interest in this study.

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