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Original Research Article

A Comparative Study on the Transcutaneous Electrical Nerve Stimulation versus Intermittent Lumbar Traction in Chronic Non-Specific Low Back Pain Combined with the Extensor Endurance Exercise Regime

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Abstract: ***Background*:** The endeavor of this study was done to compare the effectiveness of transcutaneous electrical nerve stimulation (TENS) in subjects with chronic non-specific low back pain (LBP) as compared to intermittent lumbar traction (ILT) with simultaneous application of extensor endurance exercise with both the interventions. ***Methods***: Quasi-experimental approach was chosen for conducting the study with pre-intervention and post-intervention evaluation of the outcomes. Convenient sampling and random allocation to groups were used to select and assign the sample that comprised of 10 subjects each in the two experimental groups and 10 subjects in control group out of total sample size of 30. Standardized tools such as VAS for evaluating the pain, modified Oswestry LBP disability questionnaire for evaluating disability were utilized. Extensor endurance exercise with warm-up and cool down were administered to both the experimental groups in common and TENS and ILT were administered to subjects of first and second experimental group respectively. Control group subjects were only treated with hot packs. ***Results*:** The data were analyzed with help of Microsoft excel. Paired t-test was done for Intragroup analysis and un-paired t-test, ANOVA for intergroup analysis. The findings suggested that there was significant difference within group-A and group-B for pain and disability and for group-C; the significant difference was found only for pain. ***Conclusion*:** From this study we concluded that, with common intervention of extensor endurance exercise for both experimental groups; significant reductions were seen in disability of subjects with chronic non-specific low back pain after four weeks of intervention with intermittent lumbar traction than that of TENS but the reduction of pain was more significant in subjects intervened with TENS than that with intermittent lumbar traction.

Keywords: Oswestry LBP disability questionnaire, intermittent lumbar traction, TENS, chronic non-specific low back pain, extensor endurance exercise.

INTRODUCTION

LBP is a complex disorder that is associated with many unpleasant consequences such as physical disability, psychosocial disorder and increased use of health care resources [1]. Low Back pain is an extremely common human phenomenon; a price humankind has to pay for their upright bipedal posture. It accounts for more sick leave and disability than any other medical condition; most people suffer Incapacitating back pain at some stages in their lives.

Chronic Low back pain is the second most common ailment affecting a large percentage of population lasting for more than 3 months [2]. Although community surveys indicate that the incidence of low back pain is higher in females than males [3], industrial surveys demonstrate the reverse [4].

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Most subjects with chronic low back pain are treated with anti-inflammatory medications and exercises with or without other alternative therapeutic modalities include continuous/intermittent traction, shortwave diathermy, transcutaneous electrical nerve stimulation, interferential therapy, superficial heat, mobilization and manipulation [5].

Numerous studies have been done on the effects of intermittent lumbar traction. Its mechanical effects result in joint distraction, reduction of disc protrusion, Soft tissue stretching, muscle relaxation, joint mobilization [6, 7].

Effects of TENS are primarily to either modulate the pain irrespective of the causative factor, whereas effects of traction could partly or completely modify the etiological factors.

Many research studies, meta-analyses as well as systematic reviews are in favour or in contradiction regarding the use of the above two therapeutic modalities in comparison to the conventional exercises [8, 9], but there is no experimental work comparing these two with each other simultaneously along with conventional exercises.

Hence In this study an attempt was made to compare the effectiveness of intermittent lumbar traction with transcutaneous electrical nerve stimulation in relieving pain and improve functional level along with simultaneous use of conventional exercises.

MATERIALS AND METHODOLOGY

Thirty subjects were selected for the study from the outpatient department of physiotherapy.

Convenient sampling method was adopted for the study and then subjects were allocated randomly into any one of the study groups [group-A: TENS & exercise, group-B: intermittent lumbar traction & exercise, group-C hot packs & back care advice]. Quasi-experimental study design was adopted.

Inclusion Criteria:

Both male and female Subjects aged between 40 to 50 years with primary finding of non-specific Low back pain (neither clinical examination nor imaging investigations confirming any specific pathology) of more than 3 months duration (chronic) with or without associated leg pain were selected for the study.

Instrumentation and Tools Used:

- Motorized Traction unit fitted with split bed
- TENS unit
- Treatment couch
- Aqua-sonic gel
- Visual analog Scale
- Modified OSWESTRY low back pain disability questionnaire
- Moist heat pack

Intervention Protocol:

Out of 30 subjects, 10 subjects in group A [Experimental Group] were given TENS, exercise and 10 subjects in group B [Experimental Group] were given intermittent lumbar traction and exercise. In addition, 10 subjects in group C [control group] received moist heat pack. All group of subjects received back care advice at initial session. The subjects in all groups were treated three times a week once daily with a total duration of four weeks.

For Group-A:

The first experimental group [n=10] received high rate surged TENS with electrodes close to the painful area or in same dermatome [10], [frequency= 100Hz, surge duration=0.5 sec, pulse width=0.2m sec, duration: 30 minutes].

- Extensor endurance exercise regimen consisting of two levels. Level 1: bilateral shoulder lifts in a prone position; Level 2: contra-lateral arm and leg lifts in a prone position [11].
- Each exercise was repeated for 10 times with 10 seconds hold and 30 seconds rest was allowed between the exercises. If pain aggravates during exercise, subjects will stop and will start after 5 minutes after pain diminishes then asked to continue exercise position only for 5seconds.
- Cycle ergometer for 7 minutes and 10 repetitions of back extensor stretch were performed before and after extensor endurance exercise.

For Group-B:

Second experimental group [n=10] received intermittent lumbar traction on a split bed for a duration of 20minutes in fowler position, with a hold time of 40 seconds and relaxation time for 5 seconds, at a force (load) of 1/3rd of subject's body weight [6], and the same extensor endurance exercise regimen as first experimental group.

For Group C: The control group [n=10] received only moist heat pack for 20 minutes at each session.

All three group of subjects received back care advice at initial session with help of a leaflet illustration by which they got an idea about proper body postures during lying, sitting, standing and lifting objects to avoid extra stress on back.

METHOD OF DATA COLLECTION

To find out the difference in outcomes visual analog scale and Modified Oswestry low back pain disability questionnaire were employed.

Tools Used:

VAS, Modified Oswestry low back pain disability questionnaire are internationally standardized

and highly reliable tool for quantifying pain and disability respectively.

Visual Analogue Scale (VAS) is a measurement instrument that tries to measure a characteristic or attitude that is believed to range across a continuum of values and cannot easily be directly measured. For example, the amount of pain that a patient feels ranges across a continuum from none to an extreme amount of pain. From the patient's perspective this spectrum appears continuous; their pain does not take discrete jumps, as a categorization of none, mild, moderate and severe would suggest. It was to capture this idea of an underlying continuum that the VAS was devised.

Oswestry low back pain disability questionnaire is designed to give examiner information as to how the back pain has affected patient's ability to manage in everyday life. Ten sections or items assess pain, personal care, lifting, walking, sitting, standing, sleeping, social life, travelling and employment.

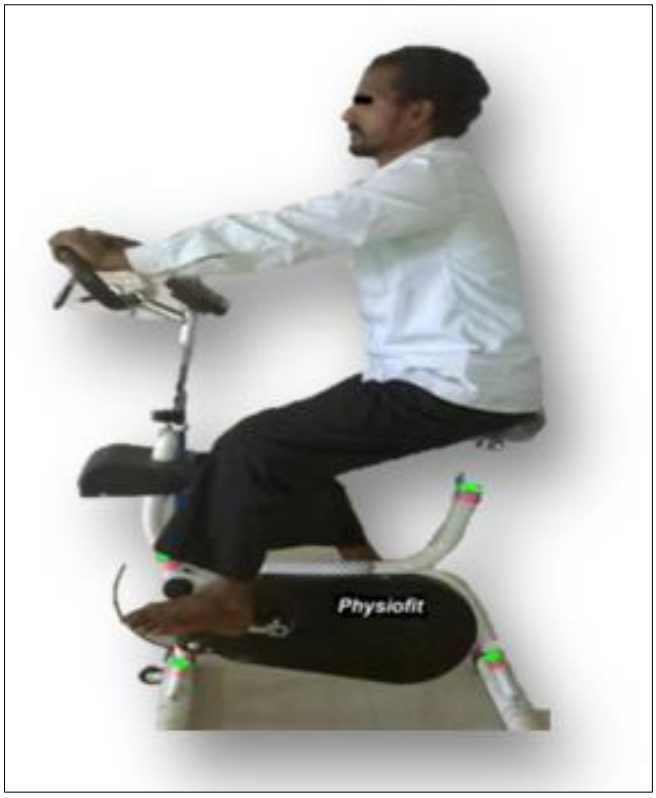


Figure 1: Warm-up exercise with cycle ergometer

Figure 2: Back extensor stretching as warm-up exercise

Figure 3: Extensor exercise [level-1] bilateral shoulder lifts in prone position

Figure 4: Extensor exercise [level-2] contra lateral arm and leg lifts in prone position

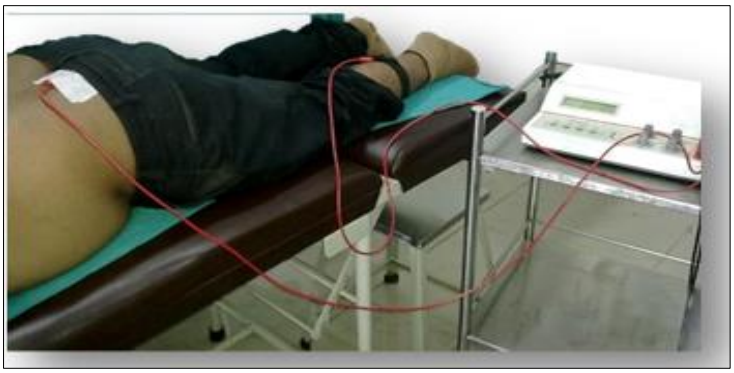
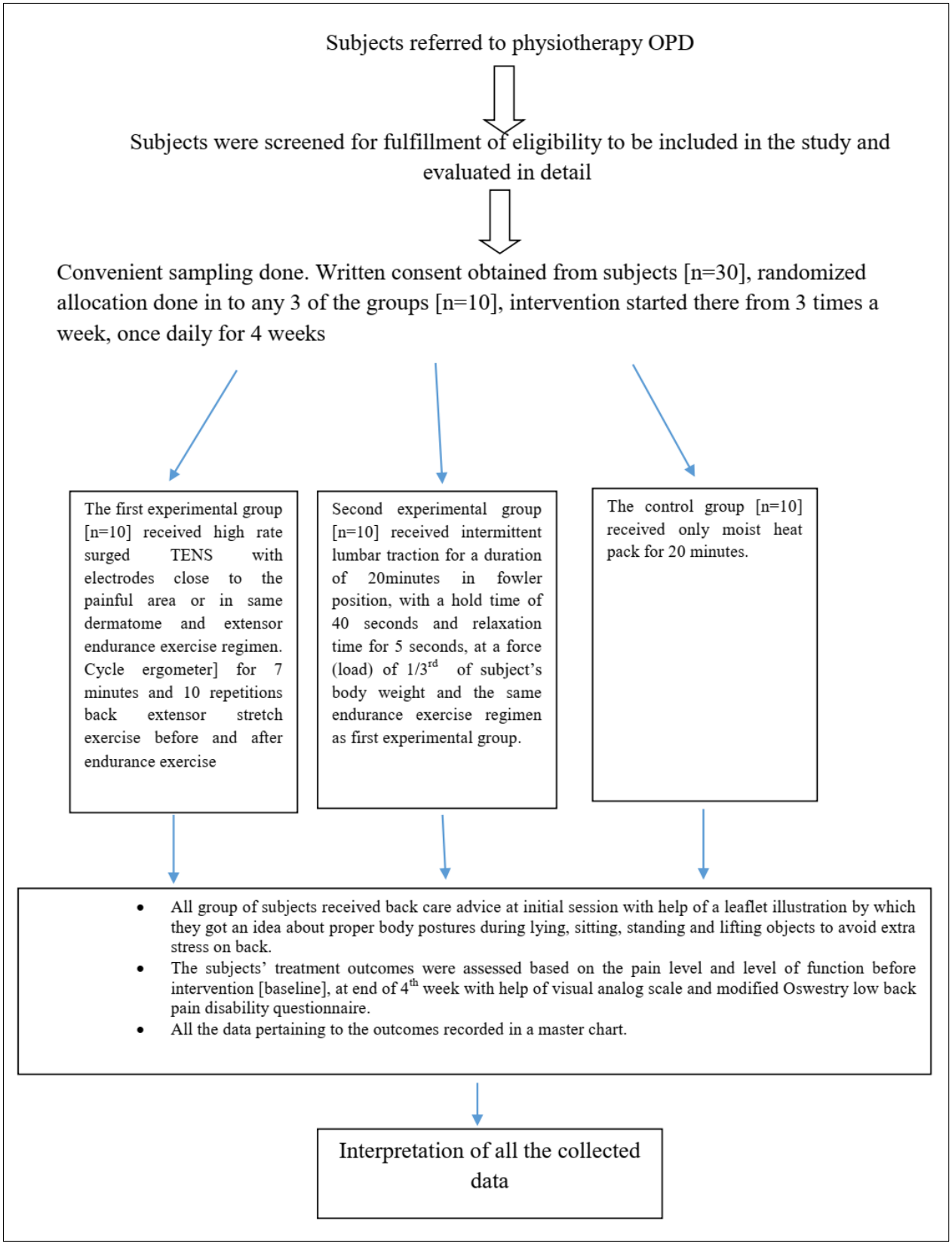


Figure 5: TENS application

Figure 6: Intermittent lumbar traction on a split bed with subject in fowler position

FLOW-CHART OF STEPWISE PROCEDURES



RESULTS

Statistical analyses were performed by using the Microsoft excel. Results are calculated by using *p=0.05* levels of significance [α].

Intragroup Analysis:

Table 1: mean, standard deviation of age for the subjects of group-A, group-B and group-C

Demographic data	Group-A		Group-B		Group-C	
	mean	S.D	mean	S.D	mean	S.D
Age	44	3.829	44.1	2.806	45	2.828

Table 2: mean, standard deviation of pain for the subjects of group-A, group-B and group-C

Pain	Group-A		Group-B		Group-C	
	mean	S.D	MEAN	S.D	MEAN	S.D
Pre-Intervention	5.85	0.611	6.02	0.891	5.79	0.593
Post-Intervention	3.97	0.400	2.45	1.093	4.87	0.588

Table 3: Comparison of mean values for pain at pre and post-intervention within subjects of group-A, group-B and group-C

pain	Group-A		Group-B		Group-C	
	t-value	p-value	t-value	p-value	t-value	p-value
Pre vs post	15.547	p≤0.001	12.300	p≤0.001	11.075	p≤0.001

Table 4: mean, standard deviation of disability index for the subjects of group-A, group-B and group-C

Disability index	Group-A		Group-B		Group-C	
	MEAN	SD	MEAN	SD	MEAN	SD
PRE-INTERVENTION	48.2	4.049	48.8	5.094	48.4	3.502
POST-INTERVENTION	43.8	3.823	39.2	5.006	48.4	4.195

Table 5: Comparison of mean values for disability index at pre and post-intervention within subjects of group-A, group-B and group-C

Disability index	Group-A		Group-B		Group-C	
	t-value	p-value	t-value	p-value	t-value	p-value
Pre vs post	11	p≤0.001	19.242	p≤0.001	0	

Intergroup Analysis:

Table 6: comparison of mean values of differences in pain between group-A&B, group-B&C and group-A&C

Mean values of difference between groups	Group-A& B		Group-B& C		Group-A& C	
	t-value	p-value	t-value	p-value	t-value	p-value
pain	5.375	p≤0.001	8.813	p≤0.001	6.656	p≤0.001

Table 7: comparison of mean values of differences in disability index between group-A&B, group-B&C and group-A&C

Mean values of difference between groups	Group-A& B		Group-B& C		Group-A& C	
	t-value	p-value	t-value	p-value	t-value	p-value
Disability index	8.132	p≤0.001	12.347	p≤0.001	6.127	p≤0.001

Table 8: comparison of mean value of pain and disability index at pre-intervention levels between group-A, group-B and group-C

Pre-intervention	f-value	p-value
Pain	0.280	p≤0.05
Disability index	0.051	p≤0.05

Table 9: comparison of mean of differences (pre vs post) of pain, disability index between group-A, group-B and group-C

Mean difference	f-value	p-value
Pain	26.355	p≤0.05
Disability index	11.080	p≤0.05

DISCUSSION

The Intragroup analysis was performed with paired t-test for comparing the values of pain and disability index at pre and post-intervention levels for all groups which implied that; there is a significant difference between pre and post-intervention levels of

pain in group-A, group-B with respective t-values of 15.547($p \leq 0.001$) and 12.300($p \leq 0.001$). There is a significant difference between pre and post-intervention levels of disability index in group-A, group-B with respective t-values of 11($p \leq 0.001$) and 19.242($p \leq 0.001$).

There is a significant difference between pre and post-intervention levels of pain in group-C with a t-value of 11.705($p \leq 0.001$) but there is no difference between pre and post-intervention levels of disability index.

The intergroup analysis was performed with unpaired t-test and ANOVA for pain and disability between all the groups. The un-paired t-test showed significant difference in mean values of difference in pain between group-A&B, group-B&C and group-A&C with t-values of 5.375($p \leq 0.001$), 8.813($p \leq 0.001$) and 6.656($p \leq 0.001$) respectively. The un-paired t-test showed significant difference in mean values of difference in disability index between group-A&B, group-B&C and group-A&C with t-values of 5.375($p \leq 0.001$), 8.813($p \leq 0.001$) and 6.656($p \leq 0.001$) respectively.

The ANOVA showed significant difference of pain and disability index between all the 3 groups with f-values of 26.355($p \leq 0.05$), 11.080($p \leq 0.05$) respectively.

Disability is a multidimensional factor and reliable predictor of prognosis of low back pain; which depends on other variables such as pain, quality of performing daily activities, ease or difficulty in performing work place activities and psychological status of a person. Therefore, reduction of pain alone could not result in improvement of disability.

Effects of TENS are primarily to modulate only the pain irrespective of the etiological factors whereas mechanical effects of intermittent lumbar traction (joint distraction, reduction of disc protrusion, Soft tissue stretching, muscle relaxation, joint mobilization) could have resulted in improvement due to modification of the etiological factors partly or completely. That is why the reduction of pain is more significant in subjects of group-A than that of group-B but the disability is more significantly reduced in subjects of group-B. While the reduction of pain in control group subjects could be partly due to placebo effect and partly due to thermal effect.

The findings of this study are similar to the results of the research studies undertaken by the previous studies. One study compared the effects of TENS and massage in 41 subjects with chronic low back pain and concluded that TENS is effective than massage for pain and range of motion [12]. Another study compared the efficacy of vertebral axial decompression [VAX-D] therapy and TENS in 44 subjects with low back pain and concluded that VAX-D is more effective than TENS in improving pain and functional outcome [13]. Researchers also studied the effects of continuous lumbar traction on the size of the herniated disc material in 46 subjects and concluded that lumbar traction is both effective in improving symptoms and clinical findings in subjects with lumbar disc herniation and also in decreasing the size of the herniated disc material as measured by CT scan [14]. Another study performed a subgroup analysis to compare flexion-distraction with active exercise in 235 subjects with chronic low back pain and concluded that Subjects allocated to flexion distraction [FD] had significantly greater relief from perceived pain than those in active trunk exercise protocol [ATEP] [15]. Other researchers in a study investigated the long term outcomes following the treatment with prone traction delivered with vertebral axial decompression [VAX-D] in 118 subjects with chronic activity limiting low back pain and concluded that there was significant improvements in pain intensity in both short- and long-term follow-up, in those subjects who had previously failed two non-operative interventions for their current symptoms [16].

CONCLUSION

The study showed that with common intervention of extensor endurance exercise for both experimental groups; significant reductions were seen in disability of subjects with chronic non-specific low back pain after four weeks of intervention with intermittent lumbar traction than that of TENS but the reduction of pain was more significant in subjects intervened with TENS than that with intermittent lumbar traction.

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Conflict of Interest: The authors declare no conflicts of interest.

Ethical Approval: The Institutional Ethical Committee approved the study

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