Validity of Transcutaneous Electrical Nerve Stimulation Electrode Placement Technique in Acute Low Back Pain Management

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ABSTRACT

This work was conducted to determine the efficacy of transcutaneous electrical nerve stimulation (TENS) electrode placement technique compared with a control treatment in subjects with acute low back pain (LBP). Single-blind, randomized, controlled trial with a 1-month follow-up design was conducted. A random sample of 60 eligible patients with back pain participated in this study, their age varied between 18 and 65 years (27 men, 33 women; mean age ± standard deviation,35.3 ± 11.2yr), they were recruited from patients referred for physiotherapy treatment in the out-clinic of faculty of physical therapy, cairo university and randomly assigned to 1 of 3 groups: (Group I) "TENS painful area": TENS painful area electrode placement technique and an educational booklet of instructions called The Back Book (n = 20; 9 men, 11 women; mean age, 33.7 ± 11.8 yr); (Group II) "TENS spinal nerve": TENS spinal nerve root electrode placement technique and The Back Book (n = 20; 8 men, 12 women; mean age, 35.2 ± 12.1 yr); and, (GroupIII) "control": The Back Book only (n = 20; 10 men, 10 women; mean age, 34.9 ± 13.2 yr). Standardized TENS stimulation parameters were used: frequency 140Hz constant; pulse duration 130 μs; 30 minutes duration; 3 days per week for 1 month. The main outcome measures were: pain Rating Index (PRI), Roland-Morris Disability Questionnaire (RMDQ), and EuroQol (EQ-5D) were completed by subjects pretreatment and after 1 month follow-up. At the end of the study all patients in the three groups had a significant improvements in all outcomes. Subjects managed by TENS spinal nerve and The Back Book displayed both a statistically significant ($p<0.05$) and clinically meaningful reduction in pain severity (PRI) and functional disability (RMDQ), compared with management via TENS painful area and The Back Book combined or The Back Book alone. The highest level of improvement in generic health (EQ-5D) was found in the control group compared with the two other groups ($p<0.05$). The previuos findings showed that TENS electrode placement technique affects LBP-specific functional disability and pain severity providing preliminary implications for future clinical studies.

Key words: *Transcutaneous electrical nerve stimulation (TENS); Low back pain (LBP); pain measurement.*

INTRODUCTION

Low back pain is now greater than any other disease for which economic analysis has been conducted.[20] Despite numerous randomized controlled trials (RCTs), there is still no strong evidence for the most efficacious and cost-effective treatment for this disabling condition.[13] Current physiotherapy management encompasses both

evidence-based treatments advocated by clinical guidelines for low back pain (LBP), ie, manipulative therapy and general exercise therapy ,[2,37] and other treatments for which there is only limited evidence. One such treatment is transcutaneous electrical nerve stimulation (TENS) which is widely used for its proposed hypoalgesic effects.[28]

Factors related to the apparently high level of clinical usage are reported as its perceived effectiveness ease of application, and time efficiency.[19] Previous RCTs have reported significant improvements, but no significant differences in outcomes between subjects treated with TENS or alternative comparable treatments for LBP, TENS has been accepted as a standard modality in the management that control both acute and chronic pain.[16]

However, most parameters are at the direction of the individual therapist, eg, electrode placement technique. The following range of electrode placement methods exist: "painful area," "spinal nerve root," "dermatome," "myotome," "sclerotome," "trigger point," and "peripheral nerve."[39]

Survey work has determined that therapists most frequently select the "painful area" (86.4% of therapists) and "spinal nerve root" (53% of therapists) techniques in the treatment of patients with LBP, largely because of manufacturers' guidelines and advice from colleagues.[10] Less frequently used techniques were reported as "peripheral and central" (25.8%), "trigger points" (10.2%) and "acupuncture points" (5.3%) .

Marchand et al.,[21] reporting on the extensive literature on TENS for LBP conditions, have already shown that optimum electrode position must be established to achieve a good analgesic response. It is evident that studies of the efficacy of TENS parameters are required to establish protocols based on sound scientific results. The present study was conducted in preparation for a proposed RCT, which will compare the efficacy of TENS with current evidence-based treatments for LBP. The main purpose of this study was to investigate the efficacy of commonly used TENS electrode placement techniques for the management of subjects with LBP: "painful area" and "spinal nerve root" in combination with an evidence-based patient education booklet, *The Back Book*,[12] compared with a "control" treatment, *The Back Book* alone.

SUBJECTS, MATERIALS AND METHODS

Subjects

Sixty subjects (27 men, 33 women; mean age ± standard deviation [SD], 35.3 ± 11.2 yr) were recruited from patients referred for physiotherapy treatment in the out-patient clinic of faculty of physical therapy, Cairo University. No reimbursement or reward was offered to subjects for participation. Subjects aged 18 to 65 years, with LBP with or without pain radiation into one or both lower limbs for 1 to 3 months were eligible for inclusion. Acute LBP has been defined as a current episode of less than 3 months duration.[38] Because the median recurrence rate of LBP is 26 weeks,[34] only subjects who had no similar episodes in the previous 6 months were eligible for inclusion. Subjects were given a detailed information sheet, and after written informed consent, were screened for exclusion. Exclusions were pacemaker (or indwelling stimulator); breaks in the skin or lack of normal skin sensation under the area where the electrodes were to be placed; epilepsy; pregnancy; previous spinal surgery or fractures of the vertebrae; known medical, neurologic or musculoskeletal disorders; or

reflex and/or motor signs of nerve root compression.

Randomization was achieved using a predetermined list based on alpha numeric code. Thus, the trial coordinator was not involved in randomization. Consenting subjects were randomly assigned to 1 of 3 treatment groups by means of sealed envelopes: (1) "TENS painful area": TENS painful area electrode placement technique and *The Back Book* (n = 20; 9 men, 11 women; mean age, 33.7 ± 11.8 yr); (2) "TENS spinal nerve": TENS spinal nerve root electrode placement technique and *The Back Book* (n = 20; 8 men, 12 women; mean age, 35.2 ± 12.1 yr); and, (3) "control": *The Back Book* only (n = 20; 10 men, 10 women; mean age, 34.9 ± 13.2 yr).

Outcome Measures

Before commencing treatment and after a detailed verbal explanation, consenting subjects were requested to complete 3 self-administered valid and reliable questionnaires, to establish baseline LBP severity, LBP-specific functional disability, and generic health. Total completion time for all self-administered questionnaires was approximately 10 minutes. The physiotherapist involved in the treatment was blind to the scores achieved on the outcome measure questionnaires.

Pain severity was measured by the McGill pain Questionnaire (MPQ),[24,25] a valid and reliable measure of pain intensity; this yields the pain Rating Index (PRI), a composite score consisting of 4 subscales measuring the sensory, affective, evaluative, and miscellaneous components of pain, with a score range from 0 (no pain) to 78 (extreme pain severity). The MPQ has been recommended as the leading pain measurement scale available.[23]

LBP-specific functional disability was measured by the Roland-Morris Disability Questionnaire (RMDQ),[29] a short, simple, reliable, and sensitive measure of functional disability resulting from LBP, derived from the Sickness Index Profile. The RMDQ has shown good validity and responsiveness to small changes in health in people with LBP.[4] and is well supported by several critical reviews of LBP-specific self administered functional disability questionnairres.[3,10] Twenty four items related to subject's functional disability were checked on the day of completion, yielding a total score ranging from 0 (no complaint) to 24 (extreme disability).

The EuroQol (EQ-5D),[5,33] a valid and reliable questionnaire to measure the health of population and to detect differences in subgroups of the population,[17] was used a short, simple, self-administered measure of generic health. The descriptive profile from the EQ-5D consists of 5 items: mobility, self-care, usual activities, pain or discomfort, and anxiety or depression, which represent an individual's health, and related quality of life. Responses to these items have been weighted to produce a single index for describing and valuing health states, which ranges from 0.59 (extreme poor health) to 1 (full health).[11]

Materials

The Back Book. The Back Book is an evidence-based patient education booklet developed as an adjunct to the UK's Royal College of general practitioners guidelines for the management of acute LBP.[36] Early return to normal activities and participation in low-impact activities such as walking, swimming and cycling are emphasized. *The Back Book* has been shown to be readily accepted and understood by individuals with LBP and to create a positive shift in beliefs about LBP.[27,28]

However no significant difference was shown between it and a traditional educational booklet for reduction of pain or functional disablement.[7] Therefore, *The Back Book* served as the control treatment in this study, was given to subjects in all groups, and the message reinforced by the treating physiotherapist.

Transcutaneous electric nerve stimulation therapy. Sonopulse 992 device with dual channels stimulator was used to deliver the following TENS stimulation parameters, based on previous work,[22] ie, pulse shape is rectangular; frequency 140Hz constant; pulse duration 130μs; for 30 minutes. Before commencement of the study, the stimulation parameters were calibrated. Two metal well-padded electrodes were used to deliver the above treatment parameters. Individual subjects were always treated with the same TENS unit and electrodes.

Painful area electrode placement technique: Two electrodes were placed unilaterally or bilaterally at the peripheries of the LBP painful area. In subjects with unilateral pain, the cathode (-) electrode was positioned at the proximal extent and the anode (+) electrode at the distal extent of the painful area. Treatment of subjects with bilateral LBP involved paraspinal application of the cathode and anode electrodes at the lateral limits of the painful area, parallel to the vertebral column.

Spinal nerve root electrode placement technique: Which involved placement of the midpoint of the cathode and anode electrodes lateral to the intervertebral foramen of the target spinal nerve, parallel to the vertebral column. For unilateral symptoms, the proximal cathode was placed 2cm lateral to the intervertebral foramen and the distal anode electrode was placed 2cm further laterally. Treatment of subjects with bilateral LBP involved paraspinal application of the cathode and anode electrodes parallel to the vertebral column at the level of the intervertebral foramen of the paraspinal target spinal nerves.

Treatment Procedure

All treatments to an individual subject were conducted by the same physiotherapist. After routine physiotherapy assessment,[27] subjects were positioned on a treatment plinth in their preferred position of comfort, ie, prone lying or side lying. After a detailed explanation by the treating physiotherapist, the TENS unit was switched on, and the current amplitude gradually increased until the subject reported first a "mild tingling sensation" and then a "strong but comfortable sensation." To maintain a continuous level of intensity, the amplitude was increased by the physiotherapist when the subject reported a diminution of the current sensation. All TENS treatments were 30 minutes long. Subjects in all groups received treatment 3 times per week for about one month. A 1-month postal follow-up was conducted, whereby subjects were sent copies of the outcome measure questionnaires. Subjects who failed to attend for 2 successive appointments, or who requested it, were withdrawn from the study.

Data Analyses

Baseline data were coded and all outcome measure questionnaires scored by the trial coordinator. The mean and standard deviations were calculated for all subjects in each group for each measuring parameter. The student t test was used to compare the value among group before and after treatment. One-way ANOVA was used to compare the differences among the values between groups. A $P<0.05$ was considered statistically significant.

RESULTS

Subjects demographics and clinical characteristics. The sample was comprised predominately of women in this study, ie, slight female preponderance (54.9%). Age of participants ranged from (19 to 62yr), with mean age ± standard deviation [SD], 35.3 ± 11.2yr, varied work statistics (employed 64.8%, unemployed 19.6%, students15.5%), duration of current episode (mean, 6.1± 3.5wk), and analgesic medication consumption (71.6%). Fifteen subjects were removed from the study either for absence or the development of another unrelated medical condition, which prevented continuation of treatment. The remaining subjects (n = 45) received treatment until the relevant therapist considered maximal benefit had been achieved after one month and were discharged after completion of the outcome measure questionnaires (table 1).

Remaining subjects demographics and clinical characteristics: The 1-month follow up showed the following: TENS painful area group (n = 14; 5 men, 9 women; mean age, 34.1 ± 9.8 yr); TENS spinal nerve group (n = 16; 7 men, 9 women; mean age 35.4 ± 13.8 yr); and control (n = 15; 8 men, 7 women; mean age ,33.2 ± 12.6 yr). The remaining subjects were approximately similar in age, smoking status, employment status, duration of current episode and analgesic medication usage. The baseline median MPQ-PRI outcome measure scores were 12 for the painful area group; 14 for the spinal nerve group and 13 for the control group. The baseline median RMDQ outcome measure scores were 5.5 for the painful area group; 8 for the spinal nerve group and 7 for the control group. The baseline median EQ-5D outcome measure scores were 0.73 for the painful area group; 0.78 for the spinal nerve group; 0.69 for the control group (table 1).

Table (1): Demographics and clinical characteristics of treatment groups at start for all subjects and for the actual number who continued the study.

Baseline characteristics of subjects	At Start All Subjects (n = 60)			The Remaining Subjects (n = 45)		
	Pful Gr.I (n = 20)	Spn Gr.II (n = 20)	Con. Gr.III (n = 20)	Pful Gr.I (n = 14)	Spn Gr.II (n = 16)	Con.Gr.III (n = 15)
Men %	45	40	50	35.7	43.75	53.3
Mean age (yr)	33.7	35.2	34.9	34.1	35.4	34.6
Current smokers (%)	15	10	20	14.28	12.5	18.18
Aerobic exercise (%)	60	55	50	64.3	62.5	66.6
Employed (%)	65	60	70	71.4	62.5	73.3
Current episode (wk)	6	7	5	5	6	4
Analgesic usage (%)	70	75	70	71.4	75	73.3
Mean MPQ	13.5	15	14.5	12	14	13
Mean RMDQ	6.5	9.5	7	5.5	8	7
Mean EQ-SD	0.73	0.78	0.66	0.73	0.78	0.69

Abbreviations: Pful, painful area group; Spn, spinal nerve group; Con, control group.

Table 2 displays the mean (SD) values of the outcome measure scores at start and after 1 month for the 3 treatment groups showing the level of improvement for each measure in each group. Although significant differences were detected in all measures for all groups indicating significant improvement in all outcome measure scores after treatment for all groups ($p<0.05$), it is evident that the TENS spinal nerve group (Gr. 2) displayed the

highest level of improvement in PRI (12 ±2.61)and RMDQ (6.5±2.66) score values, then the TENS painful area group (Gr.1) PRI (9.5 ±1.61)and RMDQ (3.5±1.7), and the least improvement was shown in the control group PRI (7 ±3.43) and RMDQ (3±3.02). The highest level of improvement in EQ-5D was found in the control group (0.16±0.04) than the painful group (0.12±0.04) and the spinal group (0.06±0.019); (table 2).

Table (2): Mean (SD) values of the outcome measure scores at start and after 1 month showing the level of improvement In All Groups.

Painful Gr. I	At Start	After 1 m.	Improvement	t	p
MPQ-PRI	12 (1.41)	2.5 (0.94)	9.5 (1.61)	22.14	0.0001
RMDQ	5.5 (1.56)	2 (0.78)	3.5 (1.7)	7.7	0.0001
EQ-5D	0.73(0.04)	0.85 (0.03)	0.12 (0.04)	12.67	0.0001
Spinal nerve group (Gr.II)					
MPQ-PRI	14 (2.42)	2 (0.61)	12 (2.61)	18.36	0.0001
RMDQ	8 (2.66)	1.5 (0.63)	6.5 (2.66)	9.78	0.0001
EQ-5D	0.78 (0.03)	0.84 (0.03)	0.06 (0.019)	12.64	0.0001
Control group (Gr.III)					
MPQ-PRI	13 (2.51)	6 (2.24)	7 (3.43)	7.65	0.0001
RMDQ	7 (2.3)	4 (1.89)	3 (3.02)	3.84	0.002
EQ-5D	0.69 (0.03)	0.85 (0.03)	0.16 (0.04)	14.91	0.0001

Table 3 details the specific significant differences between groups for each outcome measure. There was a significant difference between the TENS painful group and the control group ($p<0.05$) in all outcome measure scores except the EQ-5D indicating the efficacy of TENS therapy over the painful area. Also, there was a high significant difference between the spinal nerve group and the control group ($p<0.05$) in all outcome measure scores except the EQ-5D indicating the greater efficacy of TENS therapy over the spinal nerves. The control group displayed a significant improvement in EQ-5D than the two other groups (Fig. 1,2,3).

Table (3): Comparison between improvements in all groups.

	Painful group (Gr.I)	Control group(Gr.III)	T	p
MPQ-PRI	9.5 (1.61)	7 (3.43)	2.6	0.02
RMDQ	3.5 (1.7)	3 (3.02)	0.82	0.43
EQ-5D	0.12 (0.04)	0.16 (0.04)	2.2	0.048
	Spinal group(Gr.II)	Control group(Gr.III)	T	p
MPQ-PRI	12 (2.61)	7 (3.43)	4.8	0.0001
RMDQ	6.5 (2.66)	3 (3.02)	3.85	0.002
EQ-5D	0.06 (0.019)	0.16 (0.04)	9.12	0.0001
	Painful group (Gr.I)	Spinal group(Gr.II)	T	p
MPQ-PRI	9.5 (1.61)	12 (2.61)	3.33	0.005
RMDQ	3.5 (1.7)	6.5 (2.66)	2.98	0.01
EQ-5D	0.12 (0.04)	0.06 (0.019)	5.95	0.0001

$p<0.05$ is considered to be significant.

Finally, as regards overall progress, all 3 groups showed significant improvements from pretreatment to follow-up in self-reported pain severity, LBP-specific functional disability and generic health levels, as shown in figures 3- 5 ($p< 0.05$; table 2). Analysis of between-group differences showed that the TENS spinal nerve group had significantly greater MPQ-PRI and RMDQ difference scores, which is considered clinically meaningful,[31] than either the TENS painful area or control groups ($p<0.05$; table 2). The control group showed a significant improvement in EQ-5D than the other two groups ($p<0.05$; table 3).

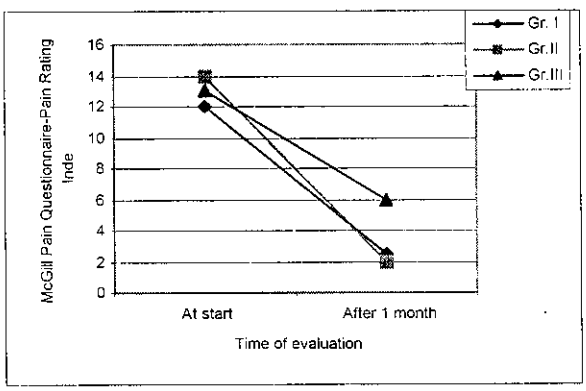

Fig. (1): Outcome measure scores of PRI at start and follow-up after 1 month. A decrease in raw score value indicates an improvement in PRI.

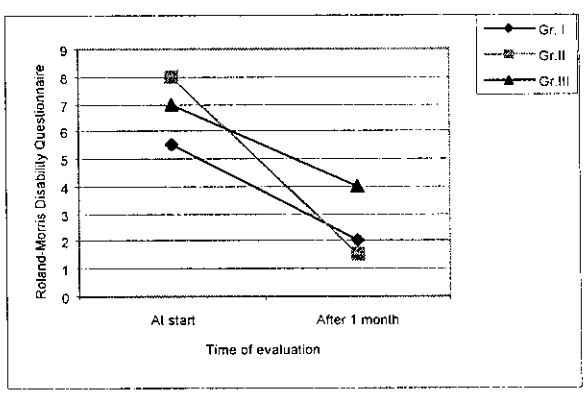

Fig. (2): Outcome measure scores of RMDQ at start and after 1 month. A decrease in raw score value indicates an improvement in RMDQ levels.

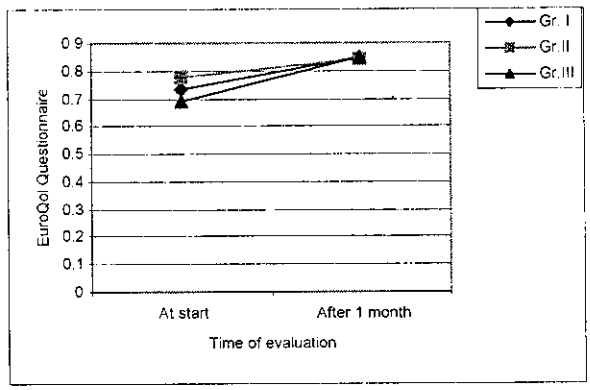

Fig. (3): Outcome measure scores of EuroQol at start and after 1 month. Decrease in raw value indicates a worsening in EQ-5D status and vice versa.

DISCUSSION

Previous studies[12,14] have established that TENS is one of the most widely used electrotherapeutic modality by physiotherapists in the clinical management of LBP. This is so despite the absence of scientific evidence for its superiority over other treatment strategies, lack of research of its various treatment parameters. This is the first report of the combined effect of *The Back Book* and TENS for subjects with acute LBP.

Subjects in all groups displayed significant improvements in pain, functional disability, and generic health levels when treated with TENS and *The Back Book* in combination or *The Back Book* alone. Comparing between groups, our reasons most notably indicate that subjects managed by *The Back Book* and TENS using the spinal nerve root technique displayed both a statistically significant and clinically meaningful reduction in functional disability,[31] compared with management via *The Back Book* alone or in combination with TENS by the painful area technique. These results are unlikely to be attributable to spontaneous recovery in acute

LBP, which is high in the first month of onset,[8] because subjects were required to have a current episode of at least 4 weeks to be eligible for inclusion. Thus, the results of the current study provide preliminary evidence that the TENS spinal nerve root electrode placement technique should be used instead of the TENS painful area technique in future RCTs for subjects with acute LBP.

Consistent with the limited number of previous RCTs, our results show the significant hypoalgesic effects of TENS. Thus, it remains to be proven scientifically that the hypoalgesic effects of TENS are superior to any other form of therapy, including an education booklet. The literature cites a range of hpoalgesic mechanisms attributable to TENS: stimulation of pain "gating" and opioid mechanisms,[9] stimulation of the reticular formation,[40] and removal of nociceptive substances[9]. The effect of TENS in relation to these hypotheses is largely speculative and requires detailed investigation in a placebo-controlled RCT.

Improvement in the level of functional disability is an important clinical outcome from the patient's perspective.[30] Despite the significantly greater reduction in RMDQ scores in the TENS spinal nerve group compared with the other groups, it should be acknowledged that this group displayed marginally higher baseline RMDQ values, reflecting greater functional disablement and thus more potential for change, which may in part explain the significant finding. This improvement in the spinal nerve group may be attributed to the direct placement of the electrodes over the original site of lesion and not the referred area of pain as in the painful group.

Conversely, the control group had higher level of improvement in EQ-5D score values, although it had the highest baseline percentage of current smokers, this may be attributed to its highest baseline percentage of aerobic exercise and employed subjects than the other two groups. Also, a recent systematic review concluded smoking should be considered a weak risk factor but not a cause of LBP.[18]

Finally, the TENS spinal nerve group reported the largest percentage of analgesic medication usage, and the control group had the highest number of subjects engaging in aerobic exercise. In categorizing pain coping strategies, Slade et al.,[30] considered analgesic medication usage a passive response and physical exercise participation an active coping strategy, which would suggest that the TENS spinal nerve group had the highest risk of LBP chronicity on entry to the study.[15]

In view of this and because of our powerfull calculations, it is evident that a larger sample size will be required for a future RCT to investigate the efficacy and cost-effectiveness of the TENS spinal nerve protocol compared with other evidence- based approaches for acute LBP. This RCT should definitively establish any proposed additional benefits from TENS on pain and generic health and explore the impact of risk factors for chronicity on outcomes.[15]

CONCLUSION AND RECOMMENDATIONS

These results concluded that TENS electrode placement technique may be an important parameter affecting LBP-specific functional disability at 1-month follow up. Specifically, treatment using *The Back Book* and TENS spinal nerve root electrode placement technique in combination resulted in a significantly greater and clinically meaningful reduction in RMDQ scores than management with *The Back Book* alone or in combination with the TENS painful area

electrode placement technique. The results emphasize the need for additional investigations of this widely used electrotherapeutic modality to justify its continued use, eg, appropriate selection of TENS parameters and a comparative study of the efficacy and cost-effectiveness of TENS with other physiotherapeutic modalities for subjects with LBP.

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الملخص العربي

صلاحية طريقة وضع الأقطاب الكهربية لجهاز تنبيه الأعصاب الكهربي عبر الجلد في علاج حالات آلام أسفل الظهر الحادة

الغرض من الدراسة: تحديد فاعلية وضع الأقطاب الكهربية لجهاز تنبيه الأعصاب الكهربي عبر الجلد مقارنة بالمجموعة الضابطة لدى الأشخاص المصابين بالام حادة بأسفل الظهر.

أفـــراد العيـــنة: ستون مريضا (27 رجل و33 امرأة) يتراوح أعمارهم بين 18 : 60 سنة ومتوسط العمر 35.3 ± 11.2 عاما و قد تم اختيارهم من العيادة الخارجية بكلية العلاج الطبيعي جامعة القاهرة. وقسموا إلى ثلاث مجموعات:

المجموعة الأولى: مجموعة العلاج بجهاز تنبيه الأعصاب الكهربي عبر الجلد عن طريق وضع أقطاب الجهاز على موضع الألم مع عمل برنامج إرشادي تعليمي لمرضى آلام أسفل الظهر.

المجموعة الثانية: مجموعة العلاج بجهاز تنبيه الأعصاب الكهربي عبر الجلد عن طريق وضع أقطاب الجهاز على الجذور العصبية على جانبي العمود الفقري مع عمل برنامج إرشادي تعليمي لمرضى آلام أسفل الظهر.

المجموعـــة الثالثة(الضابطة): مجموعة العلاج بدون إستخدام جهاز تنبيه الأعصاب الكهربي عبر الجلد مع عمل برنامج إرشادي تعليمي لمرضى آلام أسفل الظهر.

الطـــرق و الوســـائل المســـتخدمة: تم العلاج بواسطة جهاز تنبيه كهربي للأعصاب عبر الجلد ذو تردد قيمته 140 هرتز ، زمن النبضة الواحدة 130 ميكروثانية ، و زمن الجلسة 30 دقيقة و ذلك بمعدل ثلاث جلسات أسبوعيا لمدة شهر كامل.

طـــرق التقييم: نموذج أسئلة يجيب عنها المريض لتحديد حدة الألم و الإعاقة فى وظيفة الظهر و الحالة الصحية العامة للمريض قبل و بعد شهر من العلاج و التوجيه الإرشادى.

النـــتائج: أسفرت النتائج عن وجود تحسن ذو دلالة إحصائية في كل المجموعات (إلا أنه أظهر وجود فارق في التحسن ذو دلالة إحصائية فـــي كـــل مـــن وظيفة الظهر و حدة الألم بين المجموعات وكان في صالح المجموعة الثانية عنه في الأولى و الضابطة) ، أما عن الحالة الصحية العامة فقد تحسنت تحسناً ذا دلالة إحصائية في المجموعة الضابطة عنه في المجموعتين الأولى و الثانية.

المضمون و التوصيات: هذه النتائج توضح أن طريقة وضع الأقطاب الكهربية لجهاز التنبيه الكهربي للأعصاب عبر الجلد تؤثر في العلاج لمرضـــى آلام أسفل الظهر ويوصى بوضع الأقطاب على الجذور العصبية على جانبي العمود الفقري ، و تلقي هذه الدراسة الضوء على الدراسات المستقبلية في هذا المجال.