



Original Article

Comparison of The Therapeutic Effect Between SWD and TENS on Relieving Pain in Mechanical Low Back Pain Patients

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Abstract

Background : Low back pain (LBP) is the second cause of pain after headache and remains one of the most common symptoms for seeing a physician. About 90% of LBP is caused by mechanical factor. There are various physical modalities to relieve pain, such as, Short Wave Diathermy (SWD) and Transcutaneous Electrical Nerve Stimulation (TENS) which are proved to be useful to relieve pain. The aim of the study is to compare SWD and TENS on relieving pain in mechanical LBP patients.

Methods : A pre-posttest study in 36 outpatients, with subacute mechanical LBP, ranging from 30–55 years old, were randomly divided into two even groups, the SWD group and TENS group. The subjects received either SWD or TENS on lumbosacral area for 15 minutes, 3 times a week, with the interval of 2–3 days during 2 weeks. Visual Analogue Scale (VAS) was applied for pain assessments to all subjects before and 24 hours after the sixth therapy session.

Results : There was a reduction on VAS score in the SWD group from 4.56 ± 0.62 cm to 1.90 ± 0.51 cm ($p < 0.001$). There was a reduction on VAS score in the TENS group from 4.64 ± 0.59 cm to 2.03 ± 0.50 cm ($p < 0.001$). There was no significant difference on VAS score reduction between SWD and TENS group ($p = 0.643$).

Conclusion : TENS therapy relieves pain in subacute mechanical LBP patients as good as SWD Therapy.

Keywords : Mechanical low back pain, SWD, TENS.

Perbandingan Efek Terapi Metode SWD dan TENS dalam Mengurangi Rasa Sakit pada Pasien dengan Nyeri Punggung Bawah

Abstrak

Latar belakang : Nyeri Punggung Bawah (NPB) adalah penyebab nyeri terbanyak kedua setelah nyeri kepala dan merupakan salah satu keluhan yang paling sering membuat seseorang memeriksakan diri pada dokter. Selama hidupnya 50–80% orang dewasa pernah mengalami NPB, dan sekitar 90% NPB disebabkan karena faktor mekanik. Terdapat berbagai macam modalitas terapi fisik untuk mengurangi nyeri diantaranya *Short wave Diathermy* (SWD) dan *Transcutaneous Electrical Nerve Stimulation* (TENS) yang telah terbukti bermanfaat. Tujuan penelitian adalah membandingkan efek terapi SWD dengan TENS dalam mengurangi nyeri pada penderita NPB mekanik.

Metode : Penelitian intervensi *pre-post test design* dilakukan pada 36 pasien rawat jalan berusia 30–55 tahun dengan NPB mekanik sub akut. Subyek dibagi secara acak menjadi dua kelompok yaitu SWD dan TENS, tiap kelompok terdiri atas 18 orang. Kelompok SWD mendapat terapi SWD di daerah lumbosakral selama 15 menit, 3 kali seminggu, dengan interval 2-3 hari selama 2 minggu. Kelompok TENS mendapat terapi TENS pada titik nyeri di daerah lumbosakral selama 15 menit, 3 kali seminggu, dengan interval 2-3 hari, selama 2 minggu. Untuk penilaian nyeri pada semua subyek digunakan *Visual Analogue Scale* (VAS) yang dinilai sebelum terapi dan 24 jam setelah sesi terapi ke-6.

Hasil : Terdapat penurunan nilai VAS pada kelompok SWD dari $4,56 \pm 0,62$ cm menjadi $1,90 \pm 0,51$ cm ($p < 0,001$). Terdapat penurunan nilai VAS pada kelompok TENS dari $4,64 \pm 0,59$ cm menjadi $2,03 \pm 0,50$ cm ($p < 0,001$). Tidak terdapat perbedaan bermakna dalam penurunan nilai VAS antara kelompok SWD dan TENS ($p = 0,643$).

Simpulan : Terapi TENS dapat mengurangi nyeri pada penderita NPB mekanik subakut sama baiknya dengan terapi SWD.

Kata kunci : NPB mekanik, SWD, TENS.

INTRODUCTION

In the industrialized world, low back pain (LBP) is the second cause of pain after headache and remains one of the most common symptom related reason for seeing a physician. Fifty percent to 80 % of adults will have LBP at some time in their lives. The prevalence of LBP is between 10%–20% of the population, with the highest at the age of 35–55 years old. Men and women have similar risk of LBP up until age 60 years. About 90% of all LBP is caused by mechanical factor.^{1,2}

According to Sinaki and Mokri, mechanical LBP is a descriptive term commonly used for non-discogenic back pain that is provoked by physical activity and relieved by rest. It doesn't point to a single or particular cause. This type of pain is often due to stress or strain to the back muscles, tendons and ligaments and is usually attributed to strenuous daily activities, heavy lifting, prolonged standing or sitting. Mechanical LBP is often a chronic, dull, aching pain of varying intensity that affects the lower spine and might spread to the buttocks. The pain often progressively worsens because of bending, twisting, lifting, prolonged sitting or standing.¹ The pathophysiology of mechanical LBP remains complex and multifaceted. Multiple anatomic structures and elements of the lumbar spine (e.g. bones, ligament, tendons, disks, muscle) are all suspected to have a role. Many of these components of the lumbar spine have sensory innervation that can generate nociceptive signals representing responses to tissue-damaging stimuli.^{1,2,3}

In the field of medical rehabilitation, there are various physical modalities to relieve pain such as deep heating (e.g. short wave diathermy [SWD], micro wave diathermy [MWD], ultra sound diathermy [USD]), electrotherapy (TENS therapy, interferential therapy), manipulation or traction.^{4,5,6} Among those physical therapy modalities, SWD and TENS are proved to be useful to relieve pain and has been used in Dr. Kariadi General Hospital.

SWD is a physical therapy modality that produce deep heating through the conversion of electromagnetic energy from high frequency alternating current (27,12 MHz) to thermal energy. The thermal effects of SWD will increase blood flow and metabolic rate, improve the extensibility of the collagen tissue, and increase nerve conduction velocity. The therapeutic effects of SWD are relieving pain, reducing muscles spasm and resolution of the inflammatory process (subacute and chronic). Usually the power output of SWD used in relieving pain is only 50% from the maximum power (40 watt – 60 watt), the duration of therapy for subacute and chronic pain is 15–30 minutes per 1 session.^{4,5}

TENS is an electrical transmission that stimulate the nerve fibre to relieve pain. The types of TENS are : conventional TENS, acupuncture like TENS (ALTENS),

burst mode TENS, brief intense TENS and modulated TENS. Theoretically, the mechanism of TENS to relieve pain are Mellzack and Wall Gate Control Theory, endogenous opiate release theory and P substance release theory.⁴

One of the goal of LBP management is to relieve pain. In this study, we try to compare the therapeutic effects between SWD therapy and TENS therapy to relieve pain in mechanical LBP patients.

METHODS

Thirty six outpatient subjects with subacute mechanical LBP who came to Medical Rehabilitation Installation of Dr. Kariadi General Hospital were recruited. Age ranged between 30–55 years. This study used a pre and post test control group design. Inclusion criteria included a diagnosis of subacute mechanical LBP, age between 30 and 55 years, new case of mechanical LBP, willingness to participate. Exclusion criteria included radicular pain, neurologic deficits, spondilolisthesis (>25%), uncorrected leg length discrepancy, structural scoliosis, skin disorders at the site of therapy, sensibility disorder, malignancy, cognitive and communication disorders, metallic implant at the site of therapy, patient with pacemaker, taking NSAID in the last 24 hours/long acting NSAID, corticosteroid therapy in the last 3 days, pregnant or menstruating women, given any other physical modalities 10 days before. Drop out criteria included not completed the session of therapy, not come for therapy ≥ 2 times a week, LBP worsens, taking NSAID/corticosteroid during therapy.

The subjects were randomly divided into 2 groups (SWD group and TENS group). Visual Analogue Scale (VAS) pain assessments to all subjects were done twice, before therapy and 24 hours after the sixth therapy session. The SWD group (18 subjects) got SWD therapy on lumbosacral area for 15 minutes, 3 times a week, with the interval of 2–3 days during 2 weeks. The TENS group (18 subjects) got TENS therapy on the painful lumbosacral area for 15 minutes, 3 times a week, with the interval of 2–3 days during 2 weeks.

The paired *t* test was used to compare the VAS score before and after SWD and TENS therapy. The independent sample *t* test was used to compare the reduction of VAS score between SWD and TENS group. Statistical significance was set at $p < 0.05$. The SPSS version 15.0 for Windows was used in the data analysis.

RESULTS

During this study, we got 42 subjects who met with the inclusion criteria. Six subjects (4 subjects from SWD group and 2 subjects from TENS group) were excluded because they did not attend the therapy session as per the research protocol. Characteristic data on the study subjects of 36 men and women is shown in table 1.

TABEL 1
Characteristic of the subjects

Characteristics	SWD group	TENS group	t	p
Mean age (years)	42.06 ± 5.88	40.78 ± 4.41	0.738	0.466
Sex :				
Male	8 (44.4%)	9 (50%)	0.325	0.747
Female	10 (55.6%)	8 (44.4%)		
Educational level :				
Illiterate	0	0	0.329	0.744
Low	0	0		
Middle	10 (55.6%)	11 (61.1%)		
High	8 (44.4%)	7 (38.9%)		
Marital status :				
Single	0	1 (5.6%)		
Married	18 (100%)	17 (94.4%)		
Physical activity :				
Few physical activity	10 (55.6%)	11 (61.1%)	0.329	0.744
Much physical activity	8 (44.4%)	7 (38,9%)		
Pain duration (weeks)	3.78 ± 0.81	3.89 ± 0.76	-0.425	0.673
Pain relieve by taking rest	18 (100%)	18 (100%)		
Body Mass Index (kg/m ²)	23.11 ± 1.14	23.14 ± 1.15	-0.089	0.930
Mean lumbar lordotic angle	41.94 ± 1.80	42.06 ± 1.98	-0.176	0.861
Mean lumbosacral angle	31.83 ± 1.51	32.39 ± 1,33	-1.172	0.249
Mean VAS score before	4.56 ± 0.62	4.64 ± 0.59	-0.440	0.663

TABEL 2
Mean VAS score measurement pre and post SWD and TENS therapy

VAS score (cm)	SWD group	p	TENS Group	p
Mean VAS score (cm) pre	4.56 ± 0.62	<0.001	4.64 ± 0.59	<0.001
post	1.90 ± 0.51		2.03 ± 0.50	

Significant $p < 0.001$

The subjects were randomly divided into 2 groups, each group consisted of 18 subjects. From the statistical test we found that between the 2 groups, there were no significant differences on sex, mean of age, educational level, physical activity, mean of pain duration, mean of BMI, mean of lumbar lordotic angle, mean of lumbosacral angle, and mean of VAS score before therapy, therefore, the results of therapies between the 2 groups could be compared.

The therapy was given in 6 sessions (during 2 weeks), all subjects were given paracetamol orally if needed only in the 1st week. VAS score evaluations were

done twice (before therapy and 24 hours after the sixth therapy session). Mean of VAS score measurement pre and post SWD and TENS therapy are shown in table 2 and 3.

From statistical test (paired sample *t* test), SWD therapy and TENS therapy could reduce VAS score significantly ($p=0.000$). Comparison of mean VAS score reduction after therapy between SWD group and TENS group is shown in table 3.

From statistical test (independent sample *t* test), there was no significant difference on VAS score reduction between SWD and TENS group ($p=0.643$).

TABEL 3
Mean VAS score reduction after therapy

VAS score (cm)	SWD group	TENS Group	p
Mean VAS score reduction	2.66 ± 0.28	2.61 ± 0.27	0.64

Significant $p < 0.05$

DISCUSSION

In this study, subjects in SWD group showed significant reduction on VAS pain score. Mariani et al⁶ compared the effect of low level laser therapy and SWD on pain reduction and functional ability improvement in mechanical LBP patients. It was found that both low level laser therapy and SWD could reduce pain and improved functional ability in LBP, but there was no significant difference between low level laser therapy and SWD therapy on reducing pain and improving functional ability in LBP patients.

Kurniawan et al⁷ compared the effect of SWD therapy and SWD therapy combined with William Flexion Exercise (WFE) on pain reduction and functional ability improvement in mechanical LBP patients, found that SWD therapy combined with WFE was better than SWD therapy alone. Meanwhile Shakoor et al⁸ studied 97 patients of chronic LBP and found that there was significant improvement of symptoms after SWD therapy for six weeks compared to the placebo group.

SWD is a deep heating modality of physical therapy. It has significant effect on relief pain and increased temperature in the tissue due to heat causes increased arteriolar and capillary dilatation followed by increased blood flow to the area. SWD's therapeutic heating increases nerve conduction velocity, which may contribute to the reduced pain perception that occurs in response to increasing tissue temperature. Several studies also demonstrate that therapeutical heat can relieve pain likely as a result of gating by thermoreceptor activation and indirectly due to reduced ischemia as a result of vasodilatation.⁵

In this study, subjects in TENS group showed significant reduction on VAS pain score. Paliyama et al⁹ compared the therapeutical effect of interferential current and TENS on reducing pain in mechanical LBP and it was found that both interferential current and TENS could reduce pain in LBP, but with no significant difference.

Khadilkar et al¹⁰ reviewed the effects of TENS for chronic LBP, and it was concluded that there was limited and inconsistent evidence to support the use of TENS as an isolated intervention in the management of chronic LBP, although in one RCT, it was found that TENS produced significantly greater pain relief than the placebo control. Brosseau et al¹¹ reviewed the efficacy of

TENS versus placebo in patients with chronic LBP, and it was concluded that in general, patents treated with ALTENS responded similarly to those treated with conventional TENS, but the evidence from the small number of placebo-controlled trials does not support the use of TENS in the routine management of chronic LBP.

It has been proposed that electrical stimulation may control pain by stimulating the production and release of endorphins and enkephalins. These substances known as endogenous opiates, act in a manner similar to morphine and are known to modulate pain perception. Stimulation with pulsed currents with frequencies of less than 10 pulse per second (pps) used in ALTENS mode, have been found to most effectively increase endorphin and enkephalin levels. ALTENS will usually control pain for 4–5 hours after a 20–30 minutes of therapy.¹²

The result of this study showed that there was no statistically significant difference on VAS pain score reduction between SWD group and TENS group. It could be said that TENS therapy could reduce pain as well as SWD therapy in mechanical LBP patients. However there was a limitation of the study due to that the follow up to the patients were done only once (on 24 hours after the sixth therapy session).

CONCLUSION

TENS therapy could reduce pain in subacute mechanical low back pain patients as well as SWD therapy.

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