# EFFECTIVENESS OF KINESIO TAPING COMPARED WITH SHORT WAVE DIATHERMY ON PAIN PERCEPTION AND FUNCTIONAL STATUS IN KNEE OSTEOARTHRITIS PATIENTS

**Ratna D Haryadi, Imam Subadi, Nuryatien Husna**
Department of Physical Medicine and Rehabilitation,
Faculty of Medicine, Universitas Airlangga, Dr. Soetomo Hospital,
Surabaya, Indonesia.

## ABSTRAK

*Penelitian ini bertujuan mengkonfirmasi bahwa penurunan persepsi nyeri dan peningkatan status fungsional pada pasien osteoartritis lutut lebih efektif dengan Kinesio Taping (KT) dibandingkan dengan Short Wave Diathermy (SWD). Penelitian ini merupakan penelitian eksperimental yang dilakukan pada Klinik Rehabilitasi Medik, RSUD Dr. Soetomo, Surabaya. Sebanyak 20 pasien dengan osteoartritis lutut secara acak dimasukkan kelompok KT (n = 10) dan kelompok SWD (n = 10). Subjek dalam kelompok KT menjalani tiga aplikasi KT dalam waktu 2 minggu. Kelompok SWD menjalani empat sesi terapi SWD dalam waktu 2 minggu. Penurunan persepsi nyeri dievaluasi dengan Skala Visual Analog (VAS), dan peningkatan status fungsional dengan lutut Knee Injury and Osteoarthritis Outcome Score (KOOS) sebelum dan sesudah intervensi. Hasil penelitian menunjukkan bahwa tidak ada perbedaan yang signifikan dalam penurunan VAS pada kelompok KT dan SWD. Perbedaan signifikan peningkatan status fungsional terlihat pada kelompok KT dibandingkan dengan kelompok SWD. Simpulan, aplikasi KT lebih efektif daripada SWD dalam meningkatkan KOOS pada pasien osteoartritis lutut. Penerapan KT tidak lebih baik dari SWD dalam mengurangi persepsi nyeri.* ***(FMI 2014;50:239-244)***

***Kata Kunci:*** *kinesio taping, short wave diathermy, osteoartritis lutut*

## ABSTRACT

*This study aims to confirm that the reduction of pain perception and improvement of functional status in knee osteoarthritis patients is more effective with Kinesio Taping (KT) compared with Short Wave Diathermy (SWD). This study was an experimental study. It located at Physical Medicine and Rehabilitation Outpatient clinic Dr. Soetomo Hospital. A total of 20 patients with knee osteoarthritis were randomly assigned to KT group (n = 10) and SWD group (n = 10). Subjects in the KT group underwent three KT applications in a 2 week period. The SWD group received four SWD therapy sessions in a 2 week period. The reduction of pain perception was evaluated with a Visual Analog Scale (VAS), and the improvement of functional status with Knee Injury and Osteoarthritis Outcome Score (KOOS) before and after intervention. The results showed that no significant difference was observed in the reduction of VAS in the KT and SWD group. A significant difference in the improvement of functional status was observed in the KT group compared with SWD group. In conclusion, KT application is more effective than SWD in improving the KOOS in knee osteoarthritis patients. KT application is not better than SWD in reducing pain perception.* ***(FMI 2014;50:239-244)***

***Keywords:*** *kinesio taping, short wave diathermy, knee osteoarthritis.*

**Correnspondece:** Ratna D. Haryadi, Department of Physical Medicine and Rehabilitation, Dr. Soetomo Hospital, Universitas Airlangga, Jalan Prof. Dr. Moestopo 47, Surabaya 60131, Indonesia. Email: rdsoebadi@yahoo.com.

## INTRODUCTION

Kinesio Taping (KT) is a novel method that can be used to support rehabilitation programs and modulate physiological processes. According to the gate control theory, strain produced by KT may generate afferent stimuli that activate the inhibitory mechanism of pain. In addition, KT has an effect of reducing pain by increasing the cutaneous-muscular space that may improve circulation and reduce heat and chemicals in tissues. Several studies have attempted to determine the efficacy of KT in reducing pain (González-Iglesias et al 2009, Thelen et al 2008, Kaya et al 2010, Harnowo 2011). All those studies supported the efficacy of KT in reducing pain.

Osteoarthritis (OA) is a degenerative joint disease frequently leading to disabilities in the elderly. More frequently, knee OA causes disability than any other OA of the joints. The prevalence of OA is fairly high with substantial socio-economic impacts both in developed and developing countries (Schumacher et al 1993). Pain is a common complaint in patients with OA. In the more severe degrees of OA, pain can be perceived constantly that extremely disturbs patients' mobility (Kidd 2003). In OA, degenerative and inflammatory processes occur in the joint capsules that

suppress the nerve endings, causing pain. Pain in OA may also results from synovitis that leads to vasodilatation and an increased vascular permeability, causing the release of inflammatory mediators such as prostaglandins, cytokines, and mast cells that affects the nociceptors of free nerve endings. In addition, the presence of synovitis leads to spasms around the muscles that causes pain (Groncharov 2011).

Medical rehabilitation programs in patients with OA are aimed at achieving the most optimal level of functions by, among others, reducing pain (Santoso 2002). Short Wave Diathermy (SWD) is one of the standard therapies used to reduce pain in OA after passing through an acute period. Several studies have demonstrated the efficacy of SWD therapy in reducing pain in patients with osteoarthritis. The hypothesis of the present study was that Kinesio Taping was more effective than Short Wave Diathermy in reducing the perceived pain and improving functional status in patients with knee OA.

## MATERIALS AND METHODS

The present study was of experimental that began in November 2012 through March 2013 in the Department of Physical Medicine and Rehabilitation of Dr. Soetomo General Hospital, Surabaya. Samples were patients with knee OA who met the inclusion criteria. Sample consisted of 20 subjects, which was divided into 2 groups. Samples were taken by means of consecutive sampling. Treatment was assigned by simple randomization.

The inclusion criteria in the present study were patients with unilateral and bilateral knee OA who met the clinical and radiological criteria of the American College of Rheumatology; degrees II and III according to Kellgren and Lawrence; aged 50-70 years; 2 to 7 on Visual Analog Scale (VAS); anterior, medial and lateral knee pain; literacy; not using any modality for the last 72 hours; not using painkillers and/or anti-inflammatory medications for the last 72 hours; not willing to use other modalities or painkillers/anti-inflammatory medications during the study period; being cooperative; willing to participate in this study and comply with the study by signing an informed consent form.

The exclusion criteria in the present study were instability of the knee joints; atrophic quadriceps; deformed knee joints; difference in limb lengths; history of lower limbs fracture; pain in the lower limb joints other than the knee joints; lower back pain; acute inflammation of the pained knees; open injuries in the knee areas under study; disrupted sensibility of the pained knees; malignancy; implants in the body; presence of life-threatening diseases.

The drop-out criteria in the present study were hypersensitivity to KT; burns due to SWD administration; failure to fulfill the schedule for KT and SWD administration; increase in VAS score greater than or equal to 2; patients deciding to terminate participation.

Independent variables in the study were Kinesio Taping and Short Wave Diathermy. Dependent variables were perception of pain (VAS) and functional status of the knees (KOOS). Confounding variables were age, gender, genetics, daily physical activity, and body mass index.

## RESULTS

Total sample of the study was 20 subjects, randomly assigned to 2 treatment groups, each consisting of 10 subjects. Group 1 was treated with KT therapy and group 2 with SWD therapy. Group 1 was treated with KT therapy at a frequency of 3 times for 2 weeks, applied for 3 days and removed for one day. KT was applied by the researcher herself. Of the 10 subjects, none dropped out until the end of the treatment. Group 2 was treated with SWD therapy at a frequency of 4 times for 2 weeks with duration of 15 minutes for each therapy. SWD therapy was administered by an appointed physiotherapist. Of the 10 subjects, none dropped out until the end of the treatment.

Demographic characteristics of the subjects were shown in table 1. Group 1 had a mean age of 57.6 years, the youngest of 52 years, and the oldest of 65 years. Group 2 had a mean age of 59.5 years, the youngest of 52 years and the oldest of 65 years. With regard to gender distribution, group 1 consisted of one man and 9 women, whereas group 2 consisted of 10 women. With regard to body mass index (BMI), group 1 had a mean of 27.22, while group 2 had a mean of 27.69. Groups 1 and 2 shared the same degrees of OA, each consisting of 5 subjects with degree II and 5 subjects with degree III. Statistical analysis was performed by using SPSS 13, with a significance level of $p < 0.05$. Homogeneity tests of age, gender, BMI and OA degrees of subjects were carried out to determine the heterogeneity of the subjects' demographic characteristics in order to determine the effects on results.

Table 1 Demographic characteristic of the subjects

| Characteristic | Kinesio Taping, n=10 | SWD, n=10 | *P** |
|---|---|---|---|
| Age (year) | 57.6 ± 4.2 (52-65) | 59.5 ± 4.2(52-65) | 0.328† |
| Man | 1 | 0 | 1.000€ |
| Woman | 9 | 10 | |
| Body Mass Index kg/m $^2$ | 27.2±3.9 (20.8-32.9) | 27.69±4.7 (20-33.70) | 0.810† |
| Grade OA – II | 5 | 5 | 1.000€ |
| Grade OA –III | 5 | 5 | |

Table 1 shows homogeneity tests of age, gender, BMI and degrees of knee OA and there was no significant difference in both treatment groups.

Table 2. Assessments of VAS and the statistical analysis

| Data | KT | | SWD | |
|---|---|---|---|---|
| | VAS (pre) | VAS (post) | VAS (pre) | VAS (post) |
| Sample | 10 | 10 | 10 | 10 |
| Mean | 5.4 | 4.0 | 4.0 | 2.8 |
| SD | 1.4 | 1.3 | 1.1 | 1.2 |
| *Median* | 6.0 | 4.0 | 4.0 | 2.5 |
| *Wilcoxon Signed Ranks Test* | *p*= 0.048 | | *p*= 0.003 | |
| *Mann-Whitney Test* | *p*= 0.684 | | | |

Table 2 showed that KT-treated group had a significant decrease in VAS with a significance value of 0.048. SWD-treated group also showed a significant difference, with a significance value of 0.003 (< 0.05). Comparison of decrease in VAS between KT-treated and SWD-treated groups showed no significant difference with a significance value of 0.684 (< 0.05).

Table 3. Increase in the symptom scores of KOOS before and after treatment

| Data | KT | | SWD | |
|---|---|---|---|---|
| | Symptom (pre) | Symptom (post) | Symptom (pre) | Symptom (post) |
| Sample | 10 | 10 | 10 | 10 |
| Mean | 64.9 | 85.0 | 72.1 | 75.7 |
| SD | 9.5 | 4.1 | 6.9 | 7.3 |
| Delta | 20±7.3 | | 3.6±3.4 | |
| *T-test* | *p*< 0.0001 | | *p*= 0.008 | |
| *Independent Samples test* | *P*< 0.0001 | | | |

As shown in table 3, statistical tests of increase in mean symptom scores of KOOS indicated that KT-treated group showed a significant difference, with a significance value of p < 0.0001. SWD-treated group also had significant group differences, with a significance value of p = 0.008 (< 0.05). Comparison of increase in symptom scores of KOOS between KT-treated and SWD-treated groups showed a significant difference with a significance value of p < 0.0001 (< 0.05).

Table 4. Increase in pain scores of KOOS before and after treatment

| Data | KT | | SWD | |
|---|---|---|---|---|
| | Pain(pre) | Pain(post) | Pain(pre) | Pain(post) |
| Sample | 10 | 10 | 10 | 10 |
| Mean | 45.8 | 78.6 | 49.9 | 58.3 |
| SD | 7.3 | 13.7 | 6.0 | 11.0 |
| Delta | 32.8±15.4 | | 8.4±7.3 | |
| *T-test* | *p*< 0.0001 | | *p*= 0.006 | |
| *Independent Samples test* | *p* < 0.0001 | | | |

As shown in table 4, statistical tests of pre- and post-treatment increase in mean pain scores of KOOS indicated that KT-treated group had a significant difference, with a significance value of p < 0.0001. SWD-treated group also showed a significant difference, with a significant value of p = 0.006 (< 0.05). Comparison of increase in mean pain scores of KOOS between KT-treated and SWD-treated groups showed a significant difference with a significance value of p < 0.0001 (< 0.05). Statistical tests of pre- and post-treatment increase in mean Function in Activity of Daily Livings (ADLs) scores of KOOS were shown in table 5.

Table 5. Increase in mean Function in ADLs scores of KOOS before and after treatment

| Data | KT | | SWD | |
|---|---|---|---|---|
| | ADLs (pre) | ADLs (post) | ADLs (pre) | ADLs (post) |
| Sample | 10 | 10 | 10 | 10 |
| Mean | 55.3 | 77.6 | 53.8 | 58.1 |
| SD | 8.9 | 8.2 | 10.5 | 12.0 |
| Delta | 22.3±11.2 | | 4.3±4.2 | |
| *T-test* | *p* < 0.0001 | | *p*= 0.011 | |
| *Independent Samples test* | *p* < 0.0001 | | | |

As shown in table 5, statistical tests of pre- and post-treatment increase in mean Function ADLs scores of KOOS indicated that KT-treated group showed a significant difference, with a significance value of p < 0.0001. SWD-treated group also showed a significant difference, with a significance value of 0.011 (< 0.05). Comparison of increase in Function in ADLs scores of KOOS between KT-treated and SWD-treated groups showed a significant difference with a significance

value of p < 0.0001. Statistical tests of pre- and post-treatment increase in mean Sport and Recreational scores of KOOS were shown in table 6.

Table 6. Increase in mean Sport and Recreation scores of KOOS before and after treatment

| Data | KT | | SWD | |
|---|---|---|---|---|
| | Sport & recreational pre | Sport & recreational post | Sport & recreational pre | Sport & recreational post |
| Sample | 10 | 10 | 10 | 10 |
| Mean | 38.5 | 66.5 | 34.5 | 42.0 |
| SD | 9.7 | 10.5 | 16.9 | 12.9 |
| Delta | 28.0±10.0 | | 7.5±7.5 | |
| *T-test* | *p* < 0.0001 | | *p*= 0.012 | |
| *Independent Samples test* | *p* < 0.0001 | | | |

Table 7. Increase in QOLs scores of KOOS before and after treatment

| Data | KT | | SWD | |
|---|---|---|---|---|
| | QOLs pre | QOLs post | QOLs pre | QOLs post |
| Sample | 10 | 10 | 10 | 10 |
| Mean | 40.6 | 66.3 | 53.8 | 58.1 |
| SD | 8.4 | 13 | 10.5 | 12 |
| Delta | 25.6±13.1 | | 3.1±3.3 | |
| *T-test* | *p* < 0.0001 | | *p*= 0.011 | |
| *Independent Samples test* | *p*= 0.001 | | | |

As shown in table 6, statistical tests of pre- and post-treatment increase in mean Sport and Recreation scores of KOOS indicated that KT-treated group had a significant difference, with a significance value of p < 0.0001. SWD-treated group also showed a significant difference, with a significance value of p = 0.012 (< 0.05). Comparison of increase in Sport and Recreation scores of KOOS between KT-treated and SWD-treated groups showed a significant difference with a significance value of p < 0.0001.

As shown in table 7, statistical tests of pre- and post-treatment increase in mean QOLs scores of KOOS indicated that KT-treated group had a significant difference, with a significance value of p < 0.0001. SWD-treated group also showed a significant difference, with a significance value of p = 0.011 (< 0.05). Comparison of QOLs scores of KOOS between KT-treated and SWD-treated groups showed a significant difference with a significance value of 0.001 (<0.05).

As shown in table 8, results of statistical tests of pre- and post-treatment increase in mean scores of KOOS indicated that KT-treated group had a significant difference. SWD-treated group also showed a significant difference in pre- and post-treatment increase in mean scores of KOOS.

## DISCUSSION

Table 1 showed demographic characteristics of subjects and results of statistical analysis of age, gender, body mass index (BMI) and OA degrees. Homogeneity tests of age (p = 0.328), gender (p = 0.35), BMI (p = 0.810), and degrees of knee OA (p = 1.000) indicated that there was no significant difference in both treatment groups, meaning that the subjects in both groups were homogeneous.

Table 1 showed that results of statistical tests of decrease in VAS for KT-treated group was not significantly different compared with SWD-treated group (p = 0.684). This study rejected the hypothesis that there was a significant difference in pain reduction in KT-treated and SWD-treated groups. KT-treated group showed a significant difference in pre- and post-treatment decrease in VAS (p = 0.048). SWD-treated group also showed a significant difference in pre- and post-treatment decrease in VAS (p = 0.003).

The findings of this study supported previous research on the efficacy of KT in reducing pain. Harnowo (2011), who compared the efficacy of KT with SWD accompanied by exercises in reducing mechanical lower back pain, concluded that both KT and SWD were equally effective in reducing paralumbar muscular spasm and pain.

Table 8. Increases in scores of KOOS before and after treatment in KT-treated and SWD-treated groups

| KOOS | KT | | | SWD | | |
|---|---|---|---|---|---|---|
| | Pre | Post | *p (T-test)* | pre | Post | *p (T-test)* |
| Sample | 10 | 10 | | 10 | 10 | |
| Symptom | 64.9±9.5 | 85.0±4.1 | <0.0001 | 72.1±6.9 | 75.7±7.3 | 0.008 |
| Pain | 45.8±7.3 | 78.6±13.7 | <0.0001 | 49.9±6.0 | 58.3±11.0 | 0.006 |
| ADLs | 55.3±8.9 | 77.6±8.2 | <0.0001 | 53.8±10.5 | 58.1±12.0 | 0.011 |
| Sport and recreational | 38.5±9.7 | 66.5±10.5 | <0.0001 | 34.5±16.9 | 42.0±12.9 | 0.012 |
| QOLs | 40.6±8.4 | 66.3±13 | <0.0001 | 53.8±10.5 | 58.1±12 | 0.011 |

Kaya et al (2010), who compared the efficacy of KT with therapeutic modalities of ultrasound, transcutaneous electrical nerve stimulation (TENS), and warm compresses in reducing shoulder impingement syndrome, concluded that KT and therapeutic modalities were equally effective in reducing the pain scale (VAS) within two weeks.

González-Iglesias et al (2009) investigated effects of cervical KT on pain and range of motion of cervical joint in patients with acute whiplash injury. KT-treated group with strain showed an improvement in pain and range of motion of cervical joint immediately and 24 hours after application compared with KT-treated group without strain. Meanwhile, Thelen et al (2008) demonstrated an improvement in pain and range of motion of shoulder abduction immediately up to 3 days after the application of KT. The findings of this study were also consistent with the findings of Adegoke & Gbeminiyi (2004) that SWD was effective in reducing pain in patients with knee OA.

Tables 3 through 8 showed that the increase in KOOS for KT-treated group was different significantly in comparison with that of SWD-treated group in the subscales of Other Symptom ($p < 0.0001$), Pain ($p < 0.0001$), Function in Daily Living ($p < 0.0001$), Function in Sport and Recreation ($p < 0.0001$), and knee-related Quality of Life ($p = 0.001$). This study accepted the hypothesis that there was a significant difference in increase in KOOS for KT-treated and SWD-treated groups.

KT-treated group showed a significant difference relative to the improvement in functional status scores of KOOS for subscales of Other Symptoms ($p < 0.001$), Pain ($p < 0.0001$), Function in daily living ($p < 0.0001$), Function in Sport and Recreation ($p < 0.0001$), knee-related Quality of Life ($p < 0.0001$). SWD-treated group also showed a significant difference relative to the improvement in functional status scores of KOOS for subscales of Other Symptoms ($p = 0.008$), Pain ($p = 0.006$), Function in Daily Living ($p = 0.011$), Function in Sport and Recreation ($p = 0.012$), and knee-related Quality of Life ($p = 0.011$).

Kaya et al (2010) compared the efficacy of KT with therapeutic modalities of ultrasound, transcutaneous electrical nerve stimulation (TENS), and warm compresses in reducing shoulder impingement syndrome. They concluded that KT had the same effect as therapeutic modalities in reducing disability of arm, shoulder, and hand (DASH) within two weeks (Kaya et al 2010). The findings of this study were also consistent with those of Adegoke & Gbeminiyi (2004) that indicated that SWD was effective for improving the range of motion of joints and functional status in patients with knee OA.

In this study the application of KT for 2 weeks was equally effective as SWD in decreasing VAS, but KT was more effective than SWD in increasing the scores of KOOS for the subscale of Pain in patients with knee OA. This could be due to the fact that perception of pain was measured by VAS that measured pain generally perceived by subjects. Whereas the Pain subscale of KOOS measured several pain-related items such as the frequency of knee pain, knee pain during the last week after twisting the body by bearing the weight on the knee, straightening the knees fully, folding knees completely, walking on a flat surface, climbing and descending stairs, sleeping at night, sitting or lying down and standing upright.

The advantages of KT over SWD applications in patients with knee OA were that, among others, the former could be applied to less cooperative patients, acute inflammatory phase, and presence of metals (jewelry, pacemakers, intra-uterine devices, and implants), pregnancy and menstruation. In addition, KT was applied 3 times within 2 weeks, while SWD was applied 4 times within 2 weeks, the former being less expensive than the latter in terms of transportation costs. The advantages of SWD over KT in patients with knee OA were that, among others, the former could be applied to patients who were hypersensitive to adhesives, including KT. In fact, no subject in this study was hypersensitive to KT, despite the theory that KT had the side effect of hypersensitivity.

This study had several limitations. Firstly, there were several variables that could not be controlled by the researcher such as the use by the subjects of painkillers without informing the researcher, despite the instruction of not taking the medications in the beginning of the study; performance by the subjects of physical activities such as squatting, sitting in an excessively low chair, and climbing and descending stairs that could exacerbate knee pain, despite the instruction to perform knee joint conservation; the possibility of the shortened or lengthened use of KT due to the self-removable nature of KT, despite the recommendation of application for 3 days and removal for one day. Secondly, this study measured the perception of pain by using VAS and functional status by means of KOOS, both assessments of which were subjective.

## CONCLUSION

Two weeks of Kinesio Taping application for was not more effective than Short Wave Diathermy in reducing

perception of pain in patients with knee osteoarthritis. Two weeks of Kinesio Taping application was more effective than Short Wave Diathermy in improving functional status in patients with knee osteoarthritis. Application of Kinesio Taping 3 times for 2 weeks resulted in a decreased perception of pain and improved functional status in patients with knee osteoarthritis. A course of Short Wave Diathermy therapy, consisting of twice a week for 2 weeks (4 times), resulted in a decreased perception of pain and improved functional status in patients with knee osteoarthritis.

## REFFERENCES


Adegoke BOA and Gbeminiyi MO (2004). Efficacy of ice and shortwave diathermy in the management of osteoarthritis of the knee - a preliminary report. African Journal of Biomedical Research 7, 59-63

Goncharov N (2011). Osteoarthritis etiology: pain as a basis of local therapy. World Journal of Medical Sciences 6, 142-145

Harnowo S (2011). Perbandingan efektifitas Kinesio Taping dengan short wave diathermy terhadap penurunan spasme otot paralumbal dan nyeri pada nyeri punggung bawah mekanik. Thesis. Universitas Airlangga, Surabaya

González-Iglesias J, Fernández-de-Las-Peñas C, Cleland JA, Huijbregts P, Del Rosario Gutiérrez-Vega M (2009). Short-term effect of cervical kinesio taping on pain and cervical range of motion in patients with acute whiplash injury: a randomized clinical trial. Journal of Orthopaedic and Sports Physical Therapy 39, 515-520

Kaya EM, Zinnuroglu M, Tugcu I (2010). Kinesio tapping compared to physical therapy modalities for the treatment of shoulder impingement syndrome. Clinical Rheumatology 30, 201-207

Kidd B (2003). Pathogenesis of joint pain in osteoarthritis. Osteoarthritis, 2nd edn, New York, Oxford University Press, p 185-192

Santoso B (2002). Tatalaksana rehabilitasi medik penderita OA. SMF Rehabilitasi Medik RSU dr. Soetomo/FK-Universitas Airlangga, Surabaya

Schumacher RH., Klippel, JH, Koopman WJ (1993). Osteoarthritis: Primer on the Rheumatic Disease. 10th edn, Atlanta, p 184-185.

Thelen MD, Dauber JA, Stoneman PD (2008). The clinical efficacy of kinesio tape for shoulder pain: a randomized double-blinded clinical trial. Journal of Orthopaedic and Sports Physical Therapy 38, 389-395