

## The Influence of Combined Kinsiotaping and Proprioceptive Training in Knee Osteoarthritis

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### ABSTRACT

**Background:** One of the most frequent chronic joint illnesses is knee osteoarthritis (OA). Treatments for OA concentrate on reducing pain and other symptoms as well as improving function. Deficiency of proprioception has been demonstrated to result in abnormal pressure building up in the adjacent tissue, it might lead to an erroneous feeling of joint position and raise the risk of injury. Kinesiology taping (KT) has many different physiological mechanisms that can reduce pain in patient with knee OA.

**Objective:** This study aimed to investigate the influence of combined kinsiotaping and proprioceptive training on knee pain in patients with knee OA.

**Materials and Methods:** Thirty-six patients with knee joint osteoarthritis of both sexes were enrolled in this study. Their ages ranged from 45 to 65 years. Patients were divided into equal groups (18 patients each). Pain was assessed by VAS.

**Results:** The study findings revealed that there was great enhancement in the variable in both groups A and B after therapy compared to before treatment ( $p=0.001$ ). After therapy, there were obvious changes in VAS values among groups ( $P = 0.001$ ). Statistical analysis showed significant improvement in the study group regarding pain in comparison with the control group after treatment ( $p = 0.001$ ).

**Conclusion:** combined kinsiotaping and proprioception training proved to be more effective than proprioceptive training only in improving pain in knee OA

**Keywords:** Kinsiotaping, Proprioception training, OA, Pain.

### INTRODUCTION

Knee osteoarthritis (OA) is one of the most common chronic joint diseases. The primary tissue impacted by OA is cartilage, which results in subsequent symptoms including joint pain, stiffness, and swelling <sup>[1]</sup>. As a degenerative cartilage disease that affects the whole joint, including the cartilage, menisci, subchondral bone, synovium, capsule, ligaments, and muscles, osteoarthritis was previously characterised as this. It was proved that pain and functional disability were linked to decreased muscular strength, poor proprioception that all good predictor for knee instability <sup>[2]</sup>.

When it comes to the entire joint, including the cartilage, menisci, subchondral bone, synovium, capsule, ligaments, and muscles, osteoarthritis was formerly thought of as a degenerative cartilage disease. It was proved that pain and functional disability were linked to decreased muscular strength, poor proprioception that all good predictor for knee instability <sup>[3]</sup>.

Physical therapy is one of the cornerstones for the conservative treatment of OA and its clinical effect on pain and disability in knee OA is substantial while its associated costs are low. The physical therapy commonly used to alleviate knee OA discomfort, pain, inflammation, and stop disease development <sup>[4]</sup>.

Transcutaneous electrical nerve stimulation (TENS), therapeutic ultrasonography (US), and exercise are all examples of physical therapy methods

that are regularly employed. By activating the nerves, the electric currents produced by the TENS machine relieve pain. Some patients experienced pain relief after just one session, and this analgesic effect lasted for 24 hours in others. Additionally, US are the most often utilised deep tissue warmer in physical treatment. While reducing pain and muscular spasms, the thermal effects of US also increase metabolic rate, nerve transmission, circulation, and soft tissue flexibility. It is one of the safest treatments for knee OA and also has a chondroprotective impact on the OA cartilage. However, the mainstay of physical therapy, is exercise. Strengthening activities can lessen discomfort in those with early knee OA, while progressive resistance exercise has been found to increase overall levels of physical activity <sup>[5]</sup>.

The use of kinesiotaping (KT) has grown in popularity among the different knee OA treatment options. The KT innovation by Dr. Kenzo Kase was unique for its special thickness, great elasticity, and ability to stretch up to 130–140% of its static resting length, guaranteeing the unrestricted movement of the linked muscle or joint. The literature evaluations indicate that KT has a variety of physiological processes that can lessen pain by stimulating afferent input and activating cutaneous mechanoreceptors. Another goal of KT is to improve athletic performance and muscle performance <sup>[6]</sup>.

By expanding the cutaneous and subcutaneous interstitial region, KT is believed to

boost local blood circulation, decrease pain and inflammation, retrain the muscles, avoid injuries, and hasten the healing process the type of application determines the effect of KT. So it's critical to present a variety of application techniques to demonstrate the effect. Kinsiotaping has been shown to be useful in treating knee disease in the past, but there is still a need for more conclusive research, and its impact on knee OA is still debatable [7].

As a result of changed muscle activation patterns, altered proprioception, slower reaction times, and valgus and varus instability at the knee, people with OA experience neuromuscular abnormalities such as reduced strength and proprioceptive accuracy of the knee extensors. Proprioception deficiency has been shown to induce aberrant pressure to build up in the surrounding tissue, which may lead to an inaccurate perception of joint position and raise the risk of injury [8].

There may be a link between poor knee proprioception and pathologic changes in the early stages of knee OA, according to literature evaluations. According to the research, proprioceptive information may be a crucial mediator of timely and appropriate voluntary and involuntary movements. Proprioceptive exercises work the muscle groups simultaneously and cooperatively, resulting in dynamic stability. Proprioceptive training appeared to reduce pain and increase walking speed in individuals with knee OA, but many trials lacked reliable exercise regimens or long-term outcome information [9].

The aim of the study was to investigate the influence of combined kinsiotaping and proprioceptive training on knee pain in patients with knee OA.

## SUBJECTS AND METHODS

**Subjects:** Thirty-six patients suffering from OA participated in this study. The individuals were sent to our Outpatient Clinic at Damanhur Medical National Institute from Damanhur Orthopedic Center. They were diagnosed clinically by physician as patients with knee OA. Their ages ranged from 45 to 65 years old. Their pain was moderate to severe and VAS was more than 3. They were randomly separated into two groups of equal number (A) and (B). In this investigation, patients were divided into two equal groups at random (18 patients for each group). Group A, each patient in this group received proprioceptive exercises alone and applied sham taping on knee joint for placebo. Exercises for 30 to 45 minutes 2 times per week for 4 weeks. While, group B received kinsiotaping and proprioceptive exercises on knee joint for 30 to 45 minutes 2 times per week for 4 weeks. We measured pain using VAS. Patients were not aware. The study was carried out from May 2023 to September 2023.

**The inclusion criteria were as follow:** The patients were referred from Orthopedic surgeon according to

the following criteria: Age ranging between 45 and 65 years and both sexes males and females. Patients with grade II & III OA and duration of symptoms of knee pain is greater than 4 weeks. Body mass index (BMI) of the patients not under weight or extreme morbid obesity (BMI = 18.5 to 29.5). Patient with no major knee trauma and did not receive physical therapy treatment last 6 months. Knee pain was assessed by VAS more than 3. It was feasible to move independently and perform everyday tasks on your own.

**Exclusion criteria:** Patients who have undergone previous knee operations and who regularly take analgesic medications for pain alleviation systemic rheumatoid diseases, such as rheumatoid arthritis, fragile skin that is extremely sensitive, skin that has sores where the tapes were to be put, malignancy had been identified or there was a suspicion of cancer where the tape was to be put, not being able to carry out the functional tests called for by the research protocol, and 6 months following intra-articular injections.

## Materials:

- Visual analog scale.
- Universal Scale.
- Foaming step.
- Kinsiotaping.
- Balance board.

## Procedures:

### Group (A): Control group

- Every patient in group (A) was fully informed about the treatment protocol and the benefits of proprioception training and sham taping in order to achieve their cooperation and motivation throughout treatment.
- Group (A) received proprioceptive exercises alone and applied sham taping on knee joint for 30 to 45 minutes 2 times per week for 4 weeks.
- All proprioceptive exercises were performed by the patients inside two parallel bars to insure confidence and safety of the patients. The therapist was around the patients in all exercises.
- The exercise was subdivided to levels and the patient was transferred to next level according to his performance so at the end of each week we assessed every patient performance [8].

### Group (B): Study group

- Every patient in group (B) was fully informed about the treatment protocol and the benefits of proprioception training and kinsiotaping in order to acquire their cooperation and motivation throughout treatment.

- Group (B) received kinsiotaping and proprioceptive exercises on knee joint for 30 to 45 minutes 2 times per week for 4 weeks.
- Firstly therapist tested the sensitivity of the KT with the patients. The therapist applied the kinsiotaping in the first session then applied proprioceptive exercises and the patient was instructed to remove the taping at the night before the next session and to clean the skin well. At the next session, the therapist applied new tapping. Application of KT: Two I-shaped strips were placed over the patellar tendon and medial/lateral collateral ligaments, while two Y-shaped strips were placed over the anterior knee joint surface and thigh muscles. The exercises were applied twice per week for four weeks [10].

**Ethical approval: The Ethics Committee of Faculty of Physical Therapy, Cairo University granted the study approval. All participants signed informed consents after a thorough explanation of the goals of the study. The Helsinki Declaration was followed throughout the study's conduct.**

**Statistical analysis**

Data analysis was done using SPSS V. 20. Data were presented as mean ± SD. Data were checked for the existence of extreme scores, homogeneity of variance, and the assumption of normality. The measured variable was found to be regularly (normally) distributed using the Shapiro-Wilk and Kolmogorov-Smirnov tests. To compare between participants, an unpaired t-test was utilised to distinguish the two groups. MANOVA was used to examine the effects of the studied variable (pain as assessed by the VAS) within and between groups. P ≤ 0.05 was regarded as significant.

**RESULTS**

The mean ages of groups A and B were 52.56 ± 4.81 and 51.56 ± 5.14 years respectively and the mean values of BMI were 26.58 ± 1.66 and 26.59 ± 1.48 kg/m<sup>2</sup> respectively. The mean age and BMI of the two groups did not significantly differ from one another (p > 0.05) (Table 1).

**Table (1): Demographic data of subjects of both groups**

Demographic data	Group A	Group B	t-value	p-value
Age (years)	52.56±4.81	51.56±5.14	0.603	0.551
BMI (kg/m <sup>2</sup> )	26.58±1.66	26.59±1.48	-0.021	0.983

**Overall impact of therapy on the variable measured: MANOVA was used to examine how the**

treatment affected the variable being examined. There was a substantial main impact of time and treatment, as well as a significant interaction effect of treatment & time (p = 0.001) (Table 2).

**Table (2): The treatment's impact on the measured variable is shown in a MANOVA table.**

Interaction effect (treatment * time)	p- value	η <sup>2</sup>
F = 55.92	p = 0.001*	0.878
Effect of time		
F = 483.4	p = 0.001*	0.984
Effect of treatment		
F = 12.8	p = 0.001*	0.623

F value: Mixed MANOVA, F value, p value: Probability value, \*: Significant.

**I- The impact of treatment on pain:**

**-Within group comparison:** The mean of pain pre- and post-treatment of group A was 5.61 ± 1.24 and 2.39 ± 0.91 cm respectively. In group A, there was a statistically significant 57.4% reduction in pain after therapy compared to before treatment (p = 0.001). The mean of pain pre- and post-treatment of group B was 5.17 ± 1.24 and 0.94 ± 0.93 cm respectively. Pain was statistically significantly reduced in group B post-treatment by 81.8% compared to pre-treatment (p = 0.001) (Table 3).

**-Between groups comparison:** Pre-treatment mean values of pain, function, and joint position sensation did not differ statistically significantly between the two groups (p= 0.292), but post-treatment mean values did (p= 0.001) in favour of group B.

**Table (3): Mean of pain pre- and post-treatment of both groups**

Measured variables	Group A	Group B	f-value	P-value (between groups)
VAS (cm)				
Pre-treatment	5.61 ± 1.24	5.17 ± 1.24	1.14	0.292
Post-treatment	2.39 ± 0.91	0.94 ± 0.93	21.84	0.001*
% of change	57.4%	81.8%		
P-value (within group)	0.001*	0.001*		

Data was represented as Mean ±standard deviation, AS: Visual Analogue Scale \*: significant.

## DISCUSSION

The most prevalent form of arthritis, osteoarthritis (OA), which is a major contributor to disability, diminishes independence, and lowers quality of life in the elderly population. The knee is the joint most frequently affected by OA, particularly in older women. One of the main causes of impairment worldwide is knee OA (KOA), which is a degenerative, non-infectious knee joint condition <sup>[11]</sup>.

Proprioceptors in skeletal muscles, tendons, and the fibrous capsules in joints offer proprioception. Proprioceptive feeling may lessen in knee OA patients when their knee muscles, tendons, ligaments, and joint capsules deteriorate and suffer from injury. Additionally, individuals with knee OA may be more prone to discomfort or disability due to proprioceptive deficits. According to the majority of research, KT can lessen pain by activating cutaneous mechanoreceptors and boosting afferent input. Enhancing muscular performance and further enhancing athletic performance are two other KT objectives. Patients with functional disabilities and muscular weakness may benefit from these traits <sup>[8]</sup>. Lower extremity muscular weakness is a common symptom in OA of the knee patients. Muscular atrophy and a loss in muscular strength can result from pain, joint inflammation, and edoema, which can limit arthrogenic muscle growth. According to Dr. Kenzo Kase, KT administered from the muscle's origin to insertion can help with muscular contraction <sup>[12]</sup>.

We measured OA pain using VAS. Patients were not aware of group allocation and application of other groups to keep blindness. Pain was assessed by VAS scale before and after the intervention. The VAS score evaluations demonstrated considerable improvements, as the percentage of improvement was 81.8% in study group (B), and was 57.4% in control group (A). VAS scores showed statistical significant difference post-treatment ( $p= 0.001$ ) in favor of group B.

The study's findings are supported by **Prabhakar et al.** <sup>[8]</sup> who studied the effect of proprioceptive training on pain that was measured by VAS, function that was measured by KOOS and joint position sense, which was measured by digital goniometer on OA in comparison with conventional exercises only and found that the proprioception training improved pain, function and knee proprioception but mainly in early osteoarthritis. This study findings are in agreement with those of **Gurudut et al.** <sup>[13]</sup>, who investigated the effectiveness of combining traditional physical therapy with proprioceptive exercises in patients with OA. This study concluded that 3 months duration of combining proprioceptive exercises with conventional physiotherapy was more effective than conventional physiotherapy alone in knee OA.

The results of this study agree with **Donec and Kubilius** <sup>[14]</sup> who examined how well the kinesiotope approach helped OA patients to improve their mobility and functional abilities. For a month, the control group used non-specific knee taping, while the intervention group used specific kinesiotope. Both groups showed improvement in function, with the study group showing greater improvement than the control group because the non-specific taping application's smaller proprioceptive stimulation from the knee area was sufficient to slightly reduce pain, improve proprioception, and cause clinically significant improvements in function. Furthermore, **ÖĞÜT et al.** <sup>[15]</sup> investigated the impact of kinesiotope (KT) on isokinetic muscle function, walking speed, mobility limitation, and discomfort in female OA patients. Two groups of patients were randomly assigned. For three weeks (five days per week), both groups received therapeutic ultrasonography for 10 minutes each day, heated packs for 30 minutes, and transcutaneous electrical nerve stimulation for 30 minutes. Additionally, one group received KT treatment while the other received sham-KT treatment once each week for three weeks. All patients were advised to do a home workout regimen centred on strengthening their knees. Before treatment, at the end of treatment, and at one month and three months after treatment, all patients underwent evaluations with the VAS, WOMAC scores, goniometric measurements of active knee range of motion, 50-meter walking distance, and isokinetic knee extensor muscle peak torque measurements. The KT group showed a significant improvement in after treatment and first month VAS values compared to the sham-KT group ( $p<0.05$ ).

Recently trials done by **Dogan et al.** <sup>[16]</sup> that investigated the benefits of kinesiotope on pain, functional capacity, range of motion, and postural stability in patients with OA using a randomised double-blind controlled experiment in which patients were given kinesiotope or sham-kinesiotope on the rectus femoris muscle three times a week. At baseline, the first hour, the third week, and the seventh week, patients were assessed using the VAS, WOMAC, 50-meter walk time, ROM, and postural stability index. To investigate the impact of KT on outcome measures, a mixed model analysis of repeated measurements was utilised. The dynamic medio-lateral stability index showed a significant impact [ $p=0.015$ ], improvement in the study group was greater than in the control group, as a smaller proprioceptive stimulation from the knee region, delivered by a non-specific tape application, was sufficient to somewhat reduce pain, increase proprioception, and result in clinically significant improvements in function.

On contrast to this study, **Park et al.** <sup>[17]</sup> investigated the immediate impact of KT on older persons with knee OA's pain and gait function. The visual analogue scale was used to rate knee discomfort

while standing still and while moving around. A timed up and go test and a 10-m walking test were used to evaluate balance and walking. In this study, KT significantly reduced knee discomfort when walking compared to non-KT ( $P = .05$ ), while also improving gait and balance. This study showed that knee KT improves the walking and balance abilities of older persons with OA as well as pain reduction. As a result, this study suggested that KT could be used as an intervention to help older adults who are experiencing knee pain to walk more comfortably and to maintain their balance. However, when it came to measuring pain, the KT condition showed a significantly lower VAS score during gait as compared to the non-KT condition ( $P = .008$ ). On the other hand, when resting, there was no discernible difference between the 2 circumstances ( $P = .157$ ).

The systematic review of **Mao et al.** [6] also approved that among 11 included studies, in individuals with knee OA, KT or KT combined with conventional treatment significantly improves isokinetic muscular strength but not isometric muscle strength. KT is particularly helpful for promoting isokinetic muscle strength and can be an efficient treatment for knee OA discomfort.

## CONCLUSION

Considering the results of this study, combining proprioception training and kinesiotopeping had a positive effect on patients with knee OA, combining proprioception training and kinesiotopeping were considered a valuable treatment in physical therapy field and combining proprioception training and kinesiotopeping was more effective than proprioception training only in improvement pain in patients with OA.

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**Competing interests:** Nil.

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