

# Physiotherapy Effects in Gait Speed in Patients with Knee Osteoarthritis

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## Abstract

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**BACKGROUND:** Knee osteoarthritis is a chronic degenerative disease, known as the most common cause of difficulty walking in older adults and subsequently is associated with slow walking. Also one of the main symptoms is a degenerative and mechanics type of pain. Pain is very noticeable while walking in rugged terrain, during ascent and descent of stairs, when changing from sitting to standing position as well as staying in one position for a long time. Many studies have shown that the strength of the quadriceps femoris muscle can affect gait, by improving or weakening it. Kinesio Tape is a physiotherapeutic technique, which reduces pain and increases muscular strength by irritating the skin receptors.

**AIM:** The aims of this study was first to verify if the application of Kinesio Tape on quadriceps femoris muscle increases gait speed in patients with knee osteoarthritis and secondly if applying Kinesio Tape on quadriceps femoris muscle reduces pain while walking.

**METHOD:** Seventy-four patients with primary knee osteoarthritis, aged 50 - 73 years, participated in this study. Firstly we observed the change of gait speed, while walking for 10 meters at normal speed for each patient, before, one day and three days after the application of Kinesio Tape on quadriceps femoris muscle, with the help of the 10 - meter walk test. Secondly, we observed the change of pain, while walking for 10 meters at normal speed for each patient, before, one day and three days after the application, with the help of Numerical Pain Rating Scale - NRS.

**RESULTS:** Our results indicated that there was a significant increase in gait speed while walking for 10 meters one day and also three days after application of Kinesio Tape on quadriceps femoris muscle. Also, there was a significant reduction of pain level 1 and 3 days after application of Kinesio Tape, compared to the level of pain before its application.

**CONCLUSIONS:** Our results indicated that there was a significant decrease in pain and increase of gait speed while walking for 10 meters. Kinesio Tape can be used in patients with knee osteoarthritis, especially when changing walking stereotypes is a long-term goal of the treatment.

## Introduction

Osteoarthritis is a widespread, slowly developing disease, with a high prevalence increasing with age. The most common large joints involved in the disease are the knees, where the disease is particularly disabling because of difficulty in rising from a chair, climbing stairs, kneeling, standing and most important walking. These limitations are partly due to muscle weakness, especially quadriceps femoris muscle [1] [2] [3] [4]. It has been suggested that functional ability is also affected by poor proprioception [5] [6] [7] [8] [9] [10] [11].

Patients with knee osteoarthritis have a problem walking and tend to walk slower than controls. It is shown that knee osteoarthritis is the

most common cause of difficulty walking in older adults [12] [13] and subsequently is associated with slow walking [14] [15]. Previous cross-sectional studies report that people with both radiographic knee osteoarthritis and knee pain have slower walking speed than healthy age-matched controls [15] [16] [17].

In knee osteoarthritis, decreased walking speed is associated with joint space narrowing [18], increased concentrations of inflammation mediators [19], pain [20] and also and quadriceps muscle weakness [21] [22]. Increased joint stresses occur with faster-walking speeds [23] [24], and repetitive high-level dynamic joint loading has been shown to contribute to chondrocyte death [25] and the development of osteoarthritis in animal models [26]. As with healthy individuals, the increase of walking speed can mean an additional joint overload in elderly

patients with osteoarthritis, which was also shown for elderly persons without osteoarthritis [28] [29]. Faster walking speed in combination with abnormal joint biomechanics may further amplify dynamic joint loading [23] and may accelerate joint degeneration. Decreasing walking speed has been suggested as a mechanism used by individuals with knee pathologies to reduce loading and pain in the medial compartment of the knee [27].

Lay et al. [30] reported that when walking at the same speed, hip, knee, and ankle (plantar flexor) extensor muscle activations increased during uphill walking, but only the knee extensor muscle (quadriceps muscle) activations increased during downhill walking. Main contributors to progression and support during gait are the quadriceps femoris, gluteus maximus and plantar flexors. Quadriceps femoris weakness, in particular, has been linked to functional impairment such as increased fall risk and slower walking speed, also is one of the earliest and most common symptoms of osteoarthritis [31] [32] [33].

The aim of this study was verify if the application of Kinesio Tape on quadriceps muscle changes walking speed and pain while walking for 10 meters at normal speed, in patients with knee osteoarthritis before the application of Kinesio Tape, a day after the application of Kinesio Tape and three days after the application of Kinesio Tape on quadriceps femoris muscle.

## Patients and Methods

The subjects ( $n = 74$ ), aged 50 – 73 years (mean age 61.5), 67% of whom were female, were consecutive outpatients with a clinical diagnosis of primary unilateral knee osteoarthritis made by a rheumatologist. The main criterion for the selection of the subjects in this study was the diagnosis of knee osteoarthritis by X-ray. Criteria for excluding subjects in the study were other musculoskeletal diseases, total knee replacement, significant hip or spinal arthritis, neurological diseases and diseases that affect balance and coordination. The subjects were not in medical treatment. All of the subjects signed a written consent to participate in the study voluntarily.

Kinesio Tape (KT) was applied with a tonus regulation technique also called muscle technique on quadriceps femoris muscle. We measured the tape length in the maximal stretched position of the tissue. The application was made with the patient in this maximal stretched position. The tape was applied without stretch following the course of the muscle borders from one insertion to the opposite one.

We observed the change of walking speed,

while walking for 10 meters at normal speed for each patient, before, a day after the application and three days after the application of KT on quadriceps femoris muscle, with the help of a 10 meter walk test, where we measured and marked a 10 - metre walkway adding a mark at 2 - metres and at 8 - metres. The patient performed three trials, and we calculate the average of three trials [35]. Also we observed the change of pain, while walking for 10 meters at normal speed for each patient, before, a day after the application and three days after the application of KT on quadriceps femoris muscle, with the help of numerical pain rating scale - NRS. The worse knee, as assessed by X - ray was the "index" knee. Pain was assessed by numerical pain rating scale (NRS), by instructing the patient to choose a number from 0 to 10 that best describes their current pain. 0 would mean "no pain" and 10 would mean "worst possible pain" [34].

## Statistical Analysis

Continuous variables were presented as mean and standard deviation: mean  $\pm$  SD (standard deviation). Categorical variables are presented as actual numbers ( $n$ ) and percentages (%). Chi-square analysis was used to compare frequencies between groups and Student t-test, one - way ANOVA or non - parametric tests were used when necessary for quantitative analysis of the variables. The analysis was conducted using the SPSS (statistical software statistics package for social scientists) version 15.0. Statistical significance was considered to be the value of  $P \leq 0.05$ .

## Results

Seventy-four out-patients with a clinical diagnosis of primary knee osteoarthritis participated in this study, mean age of the participants was 61.5 (range: 50 - 73). The worse knee as assessed by X-ray was the "index" knee.

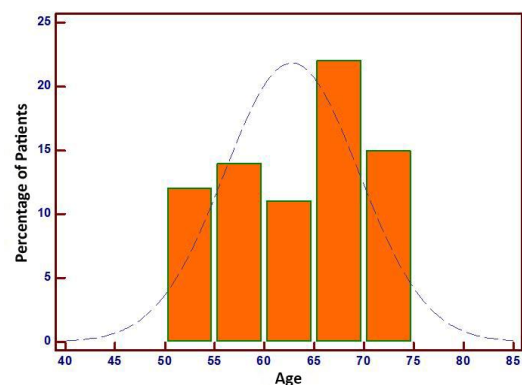
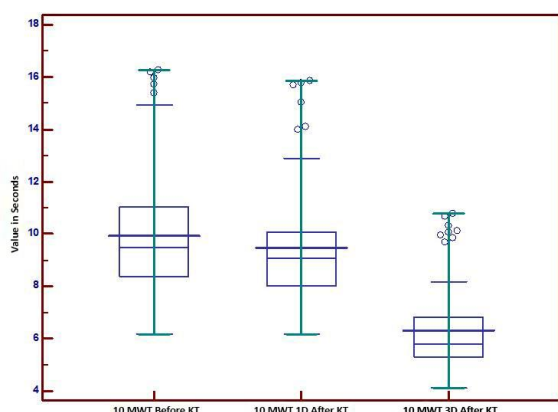


Figure 1: Age distribution histogram of patients

**Table 1: Data results on gait speed in seconds before the application of KT (10MWT Before KT), one day after the application of KT (10 MWT 1 Day after KT) and three days after the application of KT (10 MWT 3 Days after KT) on quadriceps femoris muscle**

	Nr.	Mean	SD	Minimum Value	Maximum Value
10 MWT Before KT	74	9.917	2.3458	6.173	16.277
10 MWT 1 day after KT	74	9.462	2.2734	6.160	15.847
10 MWT 3 days after KT	74	6.319	1.6274	4.123	10.787

The results show that there is a significant increase in gait speed as patients complete the route along 10 meters in less time 1 day and 3 days after KT application. 10 MWT before KT application compared to 10MWT 1 day after KT application has no significant change,  $P = 0.23$ . 10 MWT before KT application compared to 10MWT 3 days after application of KT has a significant change,  $P < 0.0001$ . Also, 10MWT 1 day after KT application compared to 10MWT 3 days after KT application has significant change,  $P < 0.0001$ .



**Figure 2: Comparison of gait speed in seconds before the application of KT (10MWT Before KT), one day after the application of KT (10 MWT 1 D After KT) and three days after the application of KT (10 MWT 3 D After KT) on quadriceps femoris muscle**

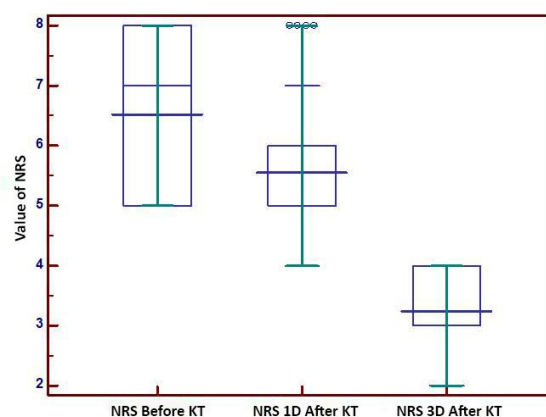
The results show that there is a significant reduction in pain level 1 and 3 days after KT application, compared with the level of pain before its application. The degree of pain reported before KT application compared to the reported pain level 1 day after KT application has a significant change,  $P < 0.0001$ .

**Table 2: Data results on pain level according to NRS before KT application, one day after KT application and three days after KT application on quadriceps femoris muscle**

	Nr.	Mean	SD	Minimum Value	Maximum Value
NRS before KT	74	6.514	1.1849	5.000	8.000
NRS 1 day after KT	74	5.554	0.9951	4.000	8.000
NRS 3 days after KT	74	3.243	0.7730	2.000	4.000

The pain level reported before KT application compared to the reported pain level 3 days after the application of KT has a significant change,  $P < 0.0001$ . Also, the level of pain reported 1 day after KT

application compared to the reported pain level 3 days after KT application has significant change,  $P < 0.0001$ .



**Figure 3: Comparison of pain level results according to NRS before KT (NRS before KT), one day after KT (NRS 1D after KT) and three days after KT (NRS 3D After KT) application on quadriceps femoris muscle**

## Discussion

Lack of information about the impact of elastic therapeutic tape in gait speed in this diagnosis led us to carry out this research. Our objective was to determine whether the application of Kinesio Tape on quadriceps muscle in patients with knee osteoarthritis will lead to increasing gait speed while walking a 10-meter distance at a normal speed.

The results of this study showed a significant increase in gait speed during walking one day and three days after applying Kinesio Tape on quadriceps femoris muscle. In graphic1 is shown that most of the patients finish the 10-meter walk test in a shorter time after applying Kinesio tape on quadriceps muscle a day and also three days after the application. However, a significant decrease in pain intensity was shown, during walking, three days after applying the Kinesio Tape. Similar findings have been reported elsewhere. Kaya et al. [47] studied 55 patients with shoulder impingement syndrome treated by Kinesio Tape or local modalities and found that although the immediate effect of Kinesio Tape is greater than the local modalities, Kinesio Tape was similarly effective at the second week of the treatment.

Based on these results, it can be inferred that applying Kinesio tape facilitated muscle activation in the indexed knee on patient increased gait speed and decreased the time needed to perform the 10-meter walk test. This suggests that applying Kinesio Tape leads to improvement in walking speed through muscle facilitation in the indexed knee [36]. This is because Kinesio Tape effectively stimulated the proprioceptive sense, muscle spindles, Golgi tendons,

etc., and strengthened muscles in the affected parts [37]. These results were in agreement with the results of previous studies, which reported that Kinesio Tape increases muscle activity, restricts excessive movement of the joint and increases gait speed [38] [39].

However other studies did not find significant differences immediately after Kinesio tape application [40] [41]. Chang et al. [42] found no change in grip strength immediately after applying Kinesio tape in healthy people. Lins et al. [43] evaluated the effects of Kinesio tape application on the activity of the vastus lateralis, rectus femoris, and vastus medialis muscles of healthy women who exercised and found no significant effects.

Stupik et al. [44] evaluated the effects of applying KT over the vastus medialis and found no change in muscle activity 10 minutes post-taping but, similar to us; they found increased muscle activity 24 hours after Kinesio tape application. The difference between these results may be due to different forms and tensions of Kinesio tape application. Different Kinesio tape techniques can provide different tactile stimulation intensities [37].

Kase et al. [45] and Thelen et al. [46] however, recommend at least three daily actions of elastic therapeutic tape. Kase et al. mention that three days after the application of Kinesio Tape can occur soft tissue changes, improvement of muscle function, increase of blood circulation and lymphatic drainage. Thelen et al. found that after three days of Kinesio Tape application was shown a significant decrease in the functional shoulder joint pain and increase of movement.

Limitations in this study were the sample size, with a greater sample size we could get better results. In this study, the effect of Kinesio Tape in increasing gait speed in knee osteoarthritis was statistically significant. Further studies are needed to investigate the effect of Kinesio Tape in gait speed on knee osteoarthritis.

In conclusion, there seems to be a significant increase of gaits Speed and a decrease of time needed to accomplish the 10-meter walk test one day and also three days after applying Kinesio Tape on quadriceps femoris muscle. Also, there was a significant decrease in pain one day and three days after applying Kinesio Tape on quadriceps femoris muscle.

Kinesio Tape can be used in patients with knee osteoarthritis, especially when changing walking stereotypes is a long-term goal of the treatment. More clinical research is needed to investigate the effect of Kinesio Tape in gait speed on knee osteoarthritis.

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