

Effectiveness of Kinesio Taping on Pain and Functional Disability in Grade I and Grade II Knee Osteoarthritis: A Randomized Controlled Trial

Apurva Tankhiwale¹, Shilpa Chourasia², Arti Kumkumwar³, Ishita Kulkarni⁴

^{1,3,4}M.P.T in Musculoskeletal Physiotherapy

²M.P.Th in Musculoskeletal Physiotherapy, Professor in Musculoskeletal Sciences, VSPM's College of Physiotherapy-Nagpur

Abstract: *To investigate effect of kinesio taping on pain intensity and functional disability in grade I and grade II knee osteoarthritis. 52 individuals, radiographically diagnosed as grade I or grade II unilateral knee osteoarthritis were selected and divided into two groups- group A (Kinesio taping along with conventional exercise therapy) and group B (Conventional exercise therapy alone) using randomized block design. Individuals were assessed for outcome measures using numeric pain rating scale for pain intensity, Modified WOMAC scale – CRD Pune version for functional disability. Kinesio taping was given to facilitate quadriceps muscle for 2 days and conventional exercise therapy was common to both groups. Data was documented pre and post treatment and analyzed using paired and unpaired t test. Both the groups were statistically significant on reducing pain intensity, improving functional disability score but kinesio taping along with conventional exercise therapy was found to be more effective. Kinesio taping when given along with conventional exercise program is significantly better to relieve pain and improve functional disability.*

Keywords: Knee Osteoarthritis, Kinesio taping, numeric pain rating scale, Modified WOMAC, Conventional exercise therapy

1. Introduction

Osteoarthritis (OA), the most prevalent form of arthritis is a leading cause of chronic disability between fourth and fifth decade of life¹. OA was estimated to be the 10th leading cause of nonfatal burden². It is most frequent joint disease in India with a prevalence of 22% to 39%^{3,4,5}.

Articular cartilage is believed to be an important factor in pathogenesis of disease. Kelley Fitzgerald, in 2004 revealed that maximum number of individuals with knee OA report episodes of knee instability during activities of daily living, and instability affects physical function beyond that which can be explained by contributions from other impairments such as knee pain, range of motion, and quadriceps strength⁶. Articular damage may stimulate articular mechanoreceptors evoking abnormal sensory information which in turn decreases excitability of alpha-motor neurons; this would reduce the voluntary activation of quadriceps^{7,8,9}.

Knee osteoarthritis is commonly associated with 50–60% reduction in maximum quadriceps torque which usually results from disuse atrophy and arthrogenic inhibition¹⁰. Subjects with knee osteoarthritis are functionally limited when compared with age and sex matched controls¹¹.

Among symptoms commonly present, pain is considered to be of greatest concern and motor disabilities such as immobility are second most common cause of concern. Ali Ahnandi in 2012 reported that pain and significant physical function decline have been associated with reduced muscle strength, poor proprioception, and impaired self-reported knee status¹². Knee osteoarthritis leads to difficulty with activities of daily living such as walking, stair climbing, stooping and getting up from a seated position due to knee pain, weakness or instability¹³. It is important to manage

knee osteoarthritis in early phases of life as, physical disability arising from knee OA prevents performance of daily life activities and negatively affects life quality.

It is important to manage knee osteoarthritis in early phases of life as, physical disability arising from knee OA prevents performance of daily life activities and negatively affects life quality.

Among conservative treatment available, use of various kinds of taping approaches in clinics for management of degenerative disorders of knee joint is increasing. The American College of Rheumatology has recommended use of kinesio taping on osteoarthritis recently (2012)¹⁴.

Kinesio taping is a recent therapeutic modality that aims on correction and treatment of many musculoskeletal disorders which is based on natural healing process⁴¹. Kinesio tape was designed to mimic qualities of human skin. It can be stretched between 30% - 40% of its resting length longitudinally as it has roughly the same thickness as of epidermis¹⁵.

As 15% to 40% of people above 40 years of age are diagnosed with knee osteoarthritis, it is important to measure efficacy of kinesio taping technique in this age group. In order to consider kinesio taping as an adjunct, short term effects must be evaluated to gain suitability to tape.

Physiological effects of kinesio taping on muscle activity create a need to study its application on knee osteoarthritis. Thereby, forming a rationale for treatment protocol, and an evidence for practice of this technique in treatment of knee osteoarthritis.

2. Methods and Procedure

It was a randomized controlled trial on 52 individuals who were radiologically diagnosed cases of grade I and grade II knee osteoarthritis according to Kellgren and Lawrence scale aged between 40-60 years. These individuals were divided into two groups based on computer generated random allocation plan; Group A: Kinesio taping technique along with conventional exercise therapy, Group B: Conventional exercise therapy alone.

1) Inclusion Criteria:

- Case of unilateral knee osteoarthritis.
- Radiographically diagnosed grade I or grade II osteoarthritis according to Kellgren and Lawrence scale.
- Age: 40-60 years.
- Both genders.

2) Exclusion Criteria:

- Bilateral knee osteoarthritis.
- Radiographically diagnosed grade III or grade IV knee osteoarthritis according to Kellgren and Lawrence scale.
- History of lower limb surgery or trauma.
- Presence of lower limb dysfunction.
- Use of walking aids

2.1 Procedure

Permission from head of institution and approval from institutional ethical committee was obtained. Patients pre-diagnosed with Grade I and Grade II OA (Kellgren and Lawrence classification) were selected for this study. Consent was taken from patients after confirming the diagnosis of Grade I and Grade II OA by orthopedician. Study was explained to them in detail.

Experimental group: Individuals in this group received kinesio taping to facilitate quadriceps muscle along with exercises. They were instructed to keep tape for 2 days and perform all exercises with presence of tape.

Control group: Subjects divided in this group performed exercises such as isometric quadriceps, isometric hamstring, straight leg raise, open chain VMO exercises and dynamic quadriceps.

All exercises were repeated 10 times with hold of 5 seconds. Two sets of exercises were performed per day for 2 days.

KINESIO TAPING: Individuals were asked to shave anterior thigh up to knee. Two Kinesio tape were applied.

Taping Procedure

1) First Tape

K tape was applied for facilitation of quadriceps muscle. Patient position: Subjects were asked to be in high sitting position. Subjects were seated with affected leg out of the bed and thigh in flexed position. Superior "Y" technique was done. The application of tape began with the kinesio "Y" strip approximately from mid thigh. It was applied with (25% of available) tension until "Y" in kinesio strip reaches the superior pole of patella. The subjects were instructed to

flex the knee in maximum flexion. The tails of kinesio strip were applied with light tension. The tip of the tail ended with no tension on the tibial tuberosity.

2) Second Tape

It consists of application of mechanical correction with tension on tail of "I" strip. Base of "I" strip was applied on medial joint line when knee will be in relaxed position. With one hand, base was held to ensure no tension were added during application. Tail of "I" strip was applied with moderate (50% of available) and inward pressure along the inferior pole of patella. Last one inch of tail was applied with no tension on lateral joint line. All subjects were instructed to keep the tape for 2 days and return for review on 3rd day¹⁶.



Kinesio Taping Method

3. Data Analysis

Statistical software STATA version 10.0 was used for data analysis.

Tests used for statistical analysis are:

- Chi squared test
- Paired 't' test
- Unpaired 't' test

4. Results

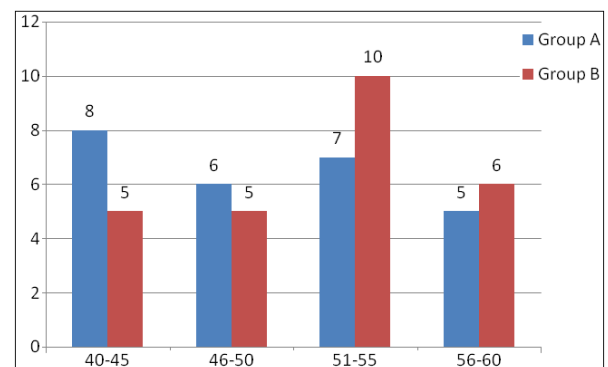


Figure 1: Distribution of sample population in both groups according to its age

Chi Squared value obtained for age distribution is 15.142 with $p=0.713$.

In both the groups, age is comparable.

Table 1: Distribution of sample population in both groups according to grade of knee osteoarthritis.

Grade	Group A	Group B	Total
Grade I	4	3	7
Grade II	22	23	45
TOTAL	26	26	52

Chi squared value of 0.1651 with p value= 0.685 suggest that grades of is not going to affect the outcome parameters assessed.

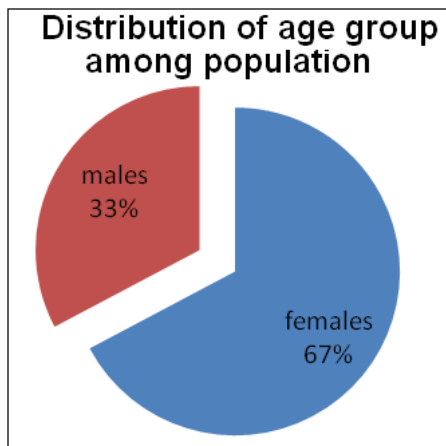


Figure 2: Distribution of sample population in both groups according to gender involved:

Gender does not affect outcome measures as Chi square is 0.0874, p = 0.768 .

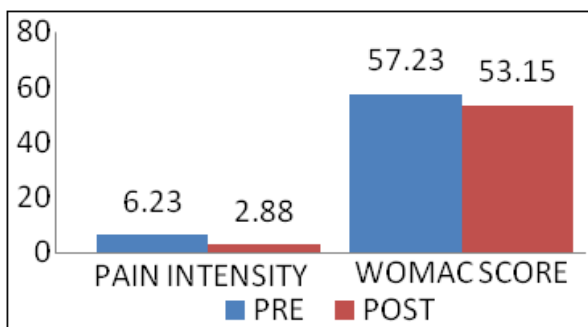


Figure 3: Graphical representation of effect of kinesio taping on pain intensity and Modified WOMAC score in Group A:

Statistical improvement in mean pain intensity was noted with decrease in mean score value from 6.23 to 2.88 and Modified WOMAC score of 57.23 was reduced to 53.15 with p value <0.00001.

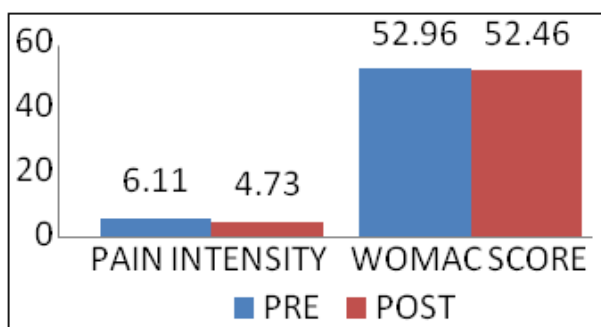


Figure 4: Graphical representation of effect of conventional exercisetherapy on pain intensity and Modified WOMAC score in Group B:

Statistical improvement in mean pain intensity from 6.11 to 4.73 and reduced in WOMAC score from 52.96 tp 52.46.

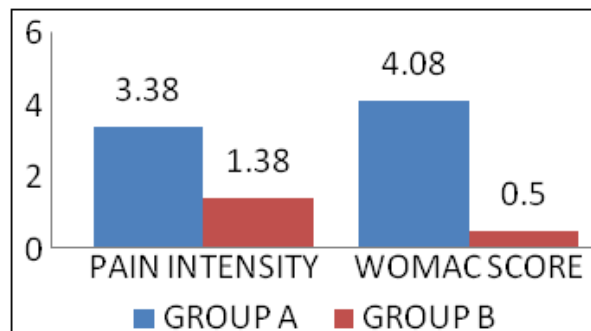


Figure 5: Comparison of pain intensity and Modified WOMAC score in Group A and Group B.

On comparing mean differences of two groups, Group A was considered to be more effctive than Group B.

5. Discussion

A randomized control trial in radiographically diagnosed cases of Grade I and Grade II knee osteoarthritis, between age group of 40-60 years was carried out to find effect of kinesio tape on pain intensity, functional disability and functional mobility Results showed significant improvement on these parameters in both groups .However when intergroup comparison was done, Group A was found to be more effective than Group B in improving the parameters.

Knee osteoarthritis presents with reduced force generating ability in quadriceps which is inability to fully and volitionally activate muscle^{17,18}. Kinesio taping technique used in this study, results tension on tape to use, “recoil effect”, of elastic quality of kinesio tape to create proprioceptive tension¹⁹. KT for facilitation of quadriceps alters muscle recruitment by facilitating motor units. It provides gentle sensory stimulation to various types of sensory receptors in skin during performing various movements when tape is kept for longer period of time i.e. more than 24 hrs. Kase K (2003) and Konishi Y (2014) reported that kinesio taping has been described to generate tactile stimuli that alters excitability of motor neurons and reduces the time to reach peak torque of muscle²⁰. Stimulation of sensory receptors activates spinal inhibitory and descending inhibitory system to decrease pain.²¹

More pronounced reduction in pain intensity was observed in Group A, due to modulation of pain via pain gate theory. Kinesio tape stimulates neuromuscular pathway via increases afferent feedback. Under gate control theory, an increase in afferent stimulus through large diameter nerve fibres can serve to mitigate inputs received from small diameter nerve fibres through nociception.

It is proposed that kinesio tape lifts the skin and increases space between skin and muscle. This causes reduction in localized pressure which helps to promote circulation, resulting in unloading of infrapatellar fat pad. Kinesio tape application and positioning of tape aligns the knee in more stable position and reduces stress and strain on soft tissues that surrounds the knee. As pain is relieved, disability score is also improved. Kinesio tape provides a sense of support

which improves confidence, resulting in taking more steps which in turn improves mobility. Powers et al, investigated short term effect of patellar taping on stride characteristics and joint motion with patellofemoral pain syndrome and showed statistically significant increase in loading response²².

Isometric exercise is a static form of exercise in which muscle contracts without any noted change in length of muscle or without visible joint motion. Carrie M.Hall, Lori Thein Brody says that isometric exercise is commonly used to increase muscle performance²³. Vastus medialis oblique exercises are commonly prescribed for knee affected individuals and have shown considerable symptomatic benefit²⁴.

According to this study, one time application of kinesio taping causes statistically significant improvement on pain intensity, functional disability score and functional mobility score in grade I and grade II knee O.A individuals. significantly better to relieve pain and improve functional disability which can also be effectively used as an adjunct rehabilitation technique in grade I and grade II knee osteoarthritis individuals. Thus, kinesio taping can be effectively used as an adjunct to rehabilitation protocol of knee O.A to gain better results.

6. Conclusion and Clinical Implications

The study concludes that kinesio taping when given along with exercise program may be Further research could be carried out to study long term effect of kinesio taping on pain intensity, functional disability in grade I and grade II knee osteoarthritis. Considering prevalence of knee osteoarthritis in India, sample size calculated was small, thus future research can be carried out with a larger sample size. Strength of this study is that Modified WOMAC Indian Version was used to access functional disability. Age group restricted to 40-60 years is a limitation.

References

- [1] Bennell. K. L, Hinman. R. S, Metcalf. B. R, Crossley. K. M, Buchbinder. R, Smith. M, McColl. G. Relationship of knee joint proprioception to pain and disability in individuals with knee osteoarthritis. *Journal of Orthopaedic Research*. 2003; 21: 792-797.
- [2] Anthony D. Woolf & Bruce Pflieger. Burden of major musculoskeletal conditions Bone and Joint Decade 2000 –2010. *Bulletin of the World Health Organization*. 2003;81:646-656.
- [3] Chopra A, Patil J, Billempally V, Relwani J, Tandale HS. Methodology and first information report:J of Rheumatology. Bhigwan India: 1997;1:145-54.
- [4] Chopra A, Patil J, Billempally V, Relwani J, Tandale HS. Prevalance of rheumatic disease in rural population in Western India WHO-ILAR COPCARD study:J Assoc Physicians India. Feb 2001;49 :240-6.
- [5] Symmons D, Mathers C, Pflieger B. Global Burden of Osteoarthritis in year 2000.. *World health report*:. 2002;5 Version 2.
- [6] Kelley fitzgerald, Sara R. Piva, James J. Report of Joint Instability in Knee Osteoarthritis: Its Prevalence and Relationship to Physical Function. *Arthritis & Rheumatism (Arthritis Care & Research)*. December 15, 2004;51(6): 941–946.
- [7] Michael V Hurleya, David L Scottb, Joanne Reesa, Di J Newhama. Sensorimotor changes and functional performance in patients with knee osteoarthritis.:*Annals of the rheumatic disease*.1997;56(11):641-648.
- [8] R. Marks. Peripheral articular mechanisms in pain production in osteoarthritis. *Australian physiotherapy*.1992; 38(4):289-297.
- [9] Schaible HG, Neugebauer V and Schmidt RF.Osteoarthritis and Pain. *Seminars in Arthritis and Rheumatism*.1989;2(18):30-34.
- [10]Fitzgerald GK, Piva SR, Irrgang JJ, Bouzubar F, Starz TW. Quadriceps activation failure as a moderator of the relationship between quadriceps strength and physical function in individuals with kneeosteoarthritis. *Arthritis Rheum*. 2004;51(1):40-48.
- [11]Hurley MV, Scott DL, Rees J, Newham DJ. Sensorimotor changes and functional performance in patients with knee osteoarthritis.*Ann Rheum Dis*. 1997 Nov; 56(11):641-8.
- [12]Ali H. Alnahdi, Joseph A. Zeni, Lynn Snyder-Mackler. Muscle Impairments in Patients With Knee Osteoarthritis. *Sports Health*. 2012 Jul; 4(4): 284–292.
- [13]Dillon CF, Rasch EK, Gu Q, Hirsch R. Prevalence of knee osteoarthritis in the United States: arthritis data from the Third National and Nutrition Examination Survey.*J Rheumatol*. 2006 Nov; 33(11):2271-9.
- [14]Hochberg MC et al. American College of Rheumatology 2012 recommendations for the use of nonpharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee.*American College of Rheumatology*.2012 Apr;64(4):465-74.
- [15]JitenderMunjhal, AshimaChachra. Immediate effect of Kinesio taping on shoulder muscle strength and range of motion in healthy individuals: A randomised trial. *Hong Kong Physiotherapy Journal*. December 2015;33(2):80-88.
- [16]Priyesh Malgaonkar,Sai Kumar,Vinod Babu,Syed Rais Rizvi.Short Term Effect Of Mulligan’s Mobilization Versus Kinesio Taping on Knee Pain and Disability For Osteoarthritis of Knee:*Int J Physiother*.2014 October;1(4):233-240.
- [17]Diraçoğlu D, Baskent A, Yagci I, Özçakar L, Aydın R. Isokinetic strength measurements in early knee osteoarthritis. *Acta Reumatol Port*. 2009 Jan-Mar; 34(1):72-7.
- [18]Ikeda S, Tsumura H, Torisu T.Age-related quadriceps-dominant muscle atrophy and incident radiographic knee osteoarthritis.*J Orthop Sci*. 2005; 10(2):121-6.
- [19]Arora Pooja, Arya Shilpa,Yardi Sujata.A Study of Immediate Effects Of Taping in Patients with Knee Osteoarthritis.*Ind J of Physiother and Occu Ther*.2012 Sept;6(3):196.
- [20]Kase K,Tatsuyuki H,Tomokio O.Development of Kinesio tape:Kinesio taping perfect manual.Kinesio taping Association.1996;6(10):117-118.
- [21]Kase K, Wallis J, Kase T. *Clinical Therapeutic Application of the Kinesio Taping Method*.2nd edition.

Eugene U.S.A.: Kinesio taping association; 30th sep ,2003.45-46.

[22] Powers CM et al. The effects of patellar taping on stride characteristics and joint motion in subjects with patellofemoral pain. J Orthop Sports Phys Ther.1997 Dec;26(6):286-91.

[23] Lori Thein Brody, Carrie M Hall. Therapeutic Exercise: Moving Toward Function, 3rd edition. pg 15

[24] M Khoshkoo, A Killingback, C J Robertson, Phillip Adds. The effect of exercise on vastus medialis oblique muscle architecture: An ultrasound investigation. Clinical Anatomy. March 29;4(6) 75-79

Author Profile



Apurva Tankhiwale: M.P.T in Musculoskeletal Physiotherapy, VSPM's College of Physiotherapy, Nagpur



Shilpa Chourasia, M.P.Th in musculoskeletal physiotherapy, Professor in musculoskeletal sciences, VSPM's College of Physiotherapy, Nagpur.



Arti Kumkumwar: M.P.T in Musculoskeletal Physiotherapy, VSPM's College of Physiotherapy, Nagpur.



Ishita Kulkarni, M.P.T in Musculoskeletal Physiotherapy, VSPM's College of Physiotherapy, Nagpur