Original Article Journal of Evidence-Based Physiotherapy and Research 2016 March - June;1(1):27-30

Short term effects of kinesio taping on Vastus Medialis in Patients with Osteoarthritis Knee for gait and joint function enhancement

Akanksha A Saswadkar[1], Apurv P Shimpi[1], Ashok Shyam[2], Parag K Sancheti[2]

Abstract

Purpose: Background: Osteoarthritis is a disabling degenerative condition causing restricted movements and functional disability. Lateral patellar tracking, because of weak Vastus medialis (VM) muscle, may contribute to gait and functional alterations. Kinesio taping may help to facilitate the VM and help the patient gain movement and functional losses.

Methodology: The aim of the study was to assess the beneficial effects of kinesio taping on VM on spatiotemporal gait parameters, quadriceps strength and functional outcomes in these patients. A randomized control single blinded parallel group trial was done on 72 patients between 40-70 years age having grade 1-2 patello-femoral and medial compartmental knee osteoarthritis by computerised simple random sampling post written informed consent by applying kinesio tape by facilitatory technique on VM for 3 days. Intra group analysis was done by paired t-test for gait and strength and Wilcoxon sign rank test for functions. Inter group analysis was by unpaired t-test and Mann Whitney U test for the same with alpha set at $p<0.05$ at 95% CI.

Results: A marked improvement was found in the gait parameters, Strength and functional outcomes in both the groups while between group analysis showed significant improvement in gait parameters in the kinesio taping group ($p<0.05$) but not on the strength ($p=0.1$) and functional outcomes of pain ($p=0.8$), stiffness ($p=0.6$) and ADL's ($p=0.4$) as compared to control group.

Conclusion: Facilitatory kinesio taping done on Vastus Medialis does enhance spatio-temporal gait parameters but has no additive effects on strength and functional enhancement in patients with OA knee.

Keywords: Kinesio taping, osteoarthritis Knee, Vastus Medialis, Temporo-spatial parameters of gait

Introduction

Osteoarthritis (OA) is a degenerative condition of a joint which involves mainly the articular cartilage and subchondral bone. This is a condition in which there is a loss of natural cushioning between the bone and the cartilage. The disease process of OA confines itself to affected joint. There is a loss of proteoglycans in joint cartilage resulting in compressive stiffness and elasticity and transmission of compressive forces to the underlying bones. Clinical symptoms show pain, crepitus, restricted ROM and disability and their increased severity is graded by Lawren and Kellegren scale [1].

The knee joint is a weight bearing joint. OA knee can result in knee pain and functional limitation resulting from that. Patients with OA knee walk with antalgic gait and therefore there are changes in the gait parameters associated with patients with OA knee [2]. Majority of OA knee cases show lateral mal-tracking of patella because of weakness of Vastus medialis muscle [3]. It is the weakest muscle in OA knee, thereby affecting the pulley mechanism and biomechanics of knee joint ultimately affecting the gait in OA knee patients [2]. Osteoarthritis of knee is associated with pain and restricted ROM which ultimately impacts on functional abilities. So there is difficulty experienced by the patients in day to day activities [4]. Kinesio taping was invented by Dr. Kenzo Kase, basically for use in sport for athletic injuries. It was invented to overcome the drawbacks of rigid taping. This technique is now being used world-wide to treat different conditions [5]. It is used to reduce pain and correct positional defects in the joint as a part of preventive and curative protocol. Kinesio taping is used to facilitate muscle action and improve proprioception. It also supports the joint, ligaments or tendons, prevents unwanted joint movement and allows healing with minimum stress on injured tissue [6].

Methods

A randomized control, single blinded, parallel group trial was done on 72 patients between 40-70 years age having grade 1-2 of patello-femoral and medial compartmental knee osteoarthritis by simple random sampling post written informed consent. The diagnosis of knee OA was done by 2 different

[1]Sancheti College of Physiotherapy, Pune.
[2]Sancheti Institute for Orthopaedics and Rehabilitation, Pune.

Address of Correspondence
Dr. Apurv P Shimpi
Associate Professor and Head, Dept of Community Physiotherapy, Sancheti College of Physiotherapy, Shivaji nagar, Pune, India.
Email: apurvshimpi@sha.edu.in


Dr. Akanksha A Saswadkar (PT)


Dr. Apurv Shimpi (PT)


Dr. Ashok Shyam

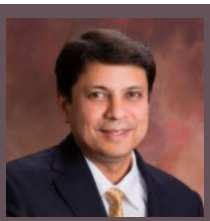

Dr. Parag Sancheti

Table 1: Demographic details and baseline comparison between both the groups

Study Parameters	Experimental	Control	p value
Age (SD) years	**52.9 (5.6)**	**51.8 (5.8)**	**0.445**
Female: Male	24:12	22:14	
Height (SD) (cms)	**160.1 (4.9)**	**159.6 (5.0)**	**0.696**
Weight (SD) (kgs)	70.8 (6.4)	70.6 (6.1)	0.904
Body Mass Index (SD)	**27.7 (1.7)**	**27.7 (1.7)**	**0.974**

Orthopedicians with more than 8 years of clinical experience. The samples were distributed in 2 groups, experimental group (n=36) and control group (n=36) by computer generated simple randomisation. Subjects in the experimental group were given conventional physiotherapy treatment and kinesio taping while subjects in the control group were given only conventional physiotherapy treatment. The intervention period for both the groups was 3 days. Taping was done by author 2 and the pre-post assessments for both the groups for gait parameters, strength and functional outcomes were done by author 1 who was blinded to the treatment protocols. Kinesio taping for facilitation of VM was done on the affected side on subjects in experimental group by author 2. The subjects were in supine lying with affected side hip extended and knee flexed. Y strip of kinesio tape was used to tape the lower 2/3rdof VM with 25-30% tension in the base (figure 1). Physiotherapy treatment for both the groups included isometric quadriceps exercises [7], isometric hamstring exercises, Straight leg raise in all the 3 planes[8], open chain VMO exercises,

Table 2: Comparison between pre and post readings for spatio-temporal parameters of gait, strength and Functional outcomes (pain, stiffness and ADL's) in experimental group

EXP	R step length (cm)		L step length (cm)		Stride length (cm)		Cadence (steps/min)		Strength (kg)		Pain		Stiffness		ADL's	
	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t
Mean (SD)	33.8 (4.0)	41.2 (4.7)	34.6 (5.4)	40.6 (5.1)	68.3 (8.3)	81.8 (4.5)	51.2 (9.4)	57.9 (8.9)	9.3 (2.7)	9.6 2(.7)	10.9 (2.1)	8.7 (2.7)	5.5 (1.0)	4.2 (1.4)	33.3 (3.6)	30.3 (3.7)
P value	**<0.05**		**<0.05**		**<0.05**		**<0.05**		**<0.05**		**<0.05**		**<0.05**		**<0.05**	

EXP-Experimental, cm- centimeter, Steps/min- Steps per minute, R-Right, L-Left, Kg- kilogram, ADL's- Activities of daily living, SD- Standard deviation expressed as ± mean

Table 3: Comparison between pre and post readings for spatio-temporal parameters of gait, strength and Functional outcomes (pain, stiffness and ADL's) in control group.

CONT	R step length (cm)		L step length (cm)		Stride length (cm)		Cadence (steps/min)		Strength (kg)		Pain		Stiffness		ADL's	
	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t	p r e t	p o s t
Mean (SD)	36 (6.3)	38 (6.5)	37 (6.4)	38 (6.3)	73 ± (12.5)	76 ± (12.4)	57 ± (7.5)	60 ± 8.1	11 ± 3.4	11 ± 3.3	11 ± 2.04	9 ± 2.9	5.6 ± 1.08	4.2 ± 1.20	34.5 ± 3.05	31 ± 3.5
P value	<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05		<0.05	

CONT- Control, cm- centimeter, Steps/min- Steps per minute, R-Right, L-Left, Kg- kilogram, ADL's- Activities of daily living, SD- Standard deviation expressed as ± mean

Table 4: Comparison of spatio-temporal parameters of gait, strength and Functional outcomes (pain, stiffness, ADL's) between Experimental and Control group

INTER GROUP	R step length (cm)		L step length (cm)		Stride length (cm)		Cadence (Steps/ min)		Strength (kg)		Pain		Stiffness		ADL's	
	e x p	c o n	e x p	c o n	e x p	c o n	e x p	c o n	e x p	c o n	e x p	c o n	e x p	c o n	e x p	c o n
Mean (SD)	7.4 (2.7)	1.8 (1.4)	5.9 (3.6)	1.3 (1.5)	13.4 (4.5)	3.03 (2.5)	6.7 (3.1)	3.3 (3.9)	0.28 (0.36)	0.46 (0.28)	2.2 (1.5)	2.1 (1.8)	1.3	1.4	3	3.5
													-0.9	-0.8	-1.8	-1.7
P value	**<0.05**		**<0.05**		**<0.05**		**<0.05**		**0.1**		**0.6**		**0.8**		**0.4**	

EXP- Experimental, CONT- Control, cm- centimeter, Steps/min- Steps per minute, R-Right, L-Left, Kg- kilogram, ADL's- Activities of daily living, SD- Standard deviation expressed as ± mean

Fig 1: Kinesio tape application

Fig 2: Strength testing of quadriceps by FET 3

dynamic quadriceps exercises in sitting[7,8]. Pre readings for temporo-spatial parameters of gait were taken for both the groups by footprint method. Subjects were made to walk on a 3 meter paper-spread and then gait analysis was done for step length (cm), stride length (cm) and cadence (steps/min) by author 1 who was blinded towards intervention by asking the subjects to be dressed till below the knee during analysis. Pre and post readings for quadriceps strength were taken by Micro FET-3 dynamometer. Subjects were in sitting position and were asked to perform knee extension against resistance applied by author 1 with FET-3 placed distally on the lower extremity (figure 2, knee exposed by author 2 for photo purpose only). The FET-3 was set at 'H' group of muscles and kilogram as a unit.

Functional outcomes were assessed for pain, stiffness and activities of daily living by WOMAC questionnaire for pre and post score in both the groups by author 1.

Statistical Analysis: Data was analyzed using paired and unpaired t-test for intra and inter gait parameters and strength respectively while Wilcoxon's signed rank test and Mann Whitney's U test for intra and inter functional outcome analysis for both the groups with SPSS software with alpha set at <0.05 at 95% CI.

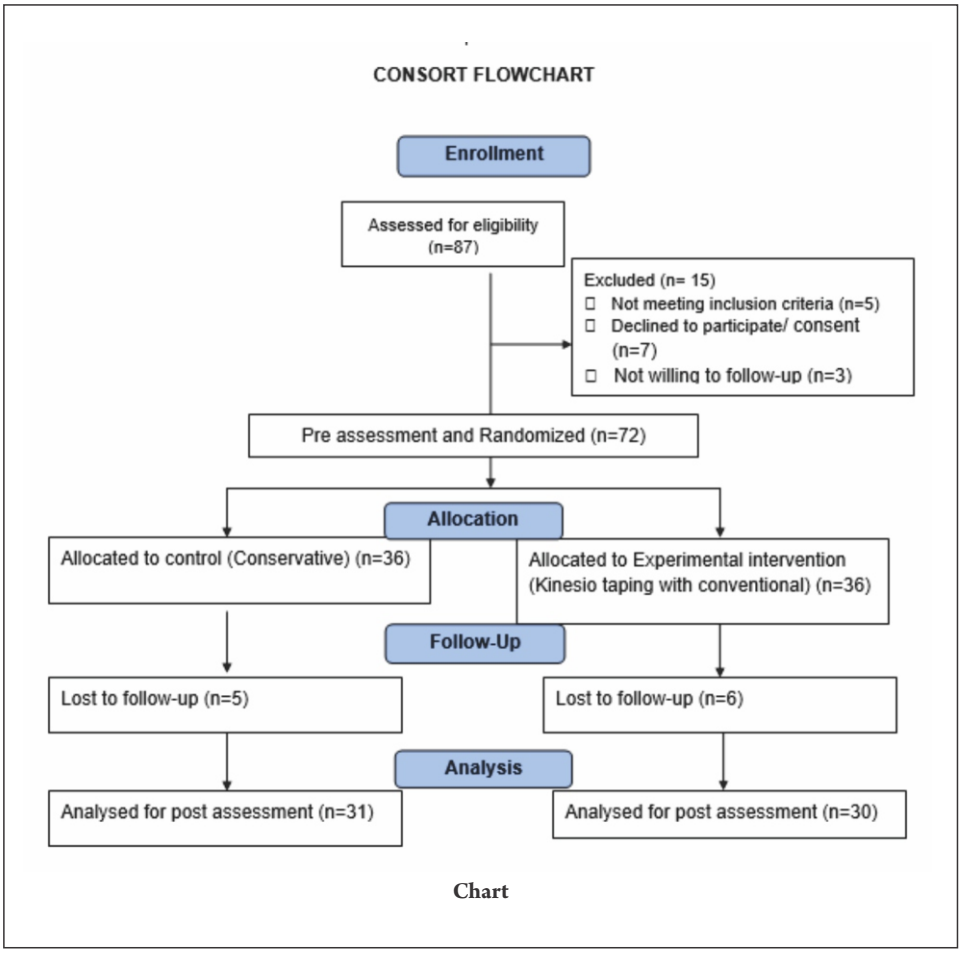
Results

On comparison of both the groups with independent value t test, both the groups were found to be comparable. (Table 1) Out of 72 subjects, 11 subjects were excluded due to non-compliance (Dropped outs, 6 from experimental group and 5 from control group). (Fig 3) There was a statistically significant improvement found in the gait parameters in the experimental group as compared to the control group as seen in Tables 2-4.

Discussion

It has been found out that quadriceps are often weak in OA knee and amongst them, Vastus Medialis (VM) is the most inhibited muscle [2]. Weak VM causes the lateral tracking of the patella. This alters the normal pulley mechanism which reflects on the gait parameters. Along with the weak VM, if the illiotibial band is also tight then the tibia remains in the externally rotated position thereby disturbing the unlocking of the knee joint during different phases of gait cycle. The patellar pull of the proximal and distal fibres of VM is approximately 15-18 and 55 degrees medial to the femoral shaft respectively. The VM inserts along the supero-medial portion of the patella and around the lower border. In OA knee, due to varus mal-alignment, VM insertion shifts more at the lower medial border, as a result the VM cannot resist the lateral tracking of the patella [9].

Although kinesio taping facilitates the muscle action when applied with specific tension and direction, electro-myographic studies have shown that kinesio taping does not produce any changes in the muscle activity. Kinesio



Chart

tape acts as a tactile feedback to the muscle and the efferent activity is increased by change in the excitability of central nervous system [10]. It also interferes with the mechanical and painful stimulus. This explains the facilitation of VM when taped in proximal to distal direction in subjects with OA knee. With all the above effects of K tape on VM, there is improved mechanical control on the patella or the patellar stability thereby improving the biomechanics of patella-femoral and tibio-femoral joint [11].

Kinesio tape puts an analgesic stimulus on the skin and activates the pain-gate mechanism and thus helps in reduction of pain. There are ongoing studies also on the role of kinesio tape on the non-neuronal cells as messengers for sensory inputs by triggering adjacent neuronal structures [12]. This probably can explain the pain reduction mechanism of kinesio tape when applied to the skin. Kinesio tape puts the lifting effect on the skin to increase the space between skin and muscle reducing the localized pressure encouraging the blood circulation and lymphatic drainage. This helps in reduction of pain, swelling and muscle spasm which reduces the stiffness [13].

A Study by Masatsugu et al suggests that whenever there is a biomechanical signal given to the synovium in the form of exercises or any muscular activity, the changes occur in the physiological condition of synovial cells resulting in the change of molecular weight of hyaluron which influences joint lubrication and cartilage metabolism which causes pain relief [10]. Collectively all these reasons contribute to improvement in temporo-spatial parameters of gait by improved mechanical advantage over the biomechanics of knee joint and reduced pain.

Proposed mechanism for increased strength is that taping can stimulate mechanoceptors. The increase in strength can be because of the neuro-physiological effect exerted by the kinesio tape[14]. The sensory cutaneous stimulus activates number of motor functional units. But, afferent stimulation from taping may not have met threshold to activate muscle [15]. Also, the reduction in the pain increases the muscle activity which can be reflected in the form of increased muscle activity. Studies have revealed that application of kinesio taping helps in increased muscle torque in concentric and eccentric contraction of the muscle due to increased muscle spindle activation [12]. This explains the increase in the strength in experimental group.

Significant reduction in pain can increase the range of motion of the joint and the ease to carry out the movement. Therefore, there was improvement in the Functional outcomes-pain, stiffness and Activities of daily living.

Although much of the protocols were followed, in conducting the present study, the medications prescribed to the patients for their pain management could not be standardized in between the groups and could have let to no variation in the pain levels between the groups. Also, the first and third session of exercises was under the supervision of the second author, the second session was at home and optimal exercise performance for this cannot be confirmed.

Thus it can be concluded from the present study that facilitatory kinesio taping on Vastus Medialis enhances the spatio-temporal gait parameters of step length, stride length and cadence but has no additive beneficial effects on enhancement of strength and on functional components of pain, stiffness, and activities of daily living in patients with OA knee.

References

1. Andrew A. Arthritis In: Physical Rehabilitation, 5th edition, New delhi: Jaypee Brothers Medical Publishers(P) Ltd,2006, p.1067.
2. Fink B, Egl M, Singer J, Fuerst M, Bubenheim M, Neuen-Jacob E. Morphologic changes in the vastus medialis muscle in patients with osteoarthritis of the knee. Arthritis & Rheum. 2007 ;56(11):3626-33.
3. Berger MJ, Chess DG, Doherty TJ. Vastus medialis motor unit properties in knee osteoarthritis. BMC musculoskeletal disord. 2011;12(1):199.
4. Guccione AA, Felson DT, Anderson JJ, Anthony JM, Zhang Y, Wilson PW, Kelly-Hayes M, Wolf PA, Kreger BE, Kannel WB. The effects of specific medical conditions on the functional limitations of elders in the Framingham Study Am J Public Health . 1994;84(3):351-8.
5. Kenzo K., A brief history of kinesio Tex Taping, http://www.kinesiotaping.co.uk/history.jsp [Viewed on Feb 11, 2015]
6. Macdonald R, introduction, in: Rose Macdonalds, Taping techniques-Principals and practice, 2nd edition, Edinburgh, Butterworth-Heinemann; Elsevier Ltd 2004, p.3-4.
7. Anwer S, Alghadir A. Effect of isometric quadriceps exercise on muscle strength, pain, and function in patients with knee osteoarthritis: a randomized controlled study. J Phys Ther Sci. 2014;26(5):745-8.
8. Carvalho NA, Bittar ST, Pinto FR, Ferreira M, Sitta RR. Manual for guided home exercises for osteoarthritis of the knee Clinics (Sao Paulo)2010;65(8):775-7¬¬80.
9. Snyder L. The Knee In: Joint structure and function: a comprehensive analysis, 4th edition, New Delhi, Jaypee Brothers Medical Publishers (P) Ltd. 2006, p.426.
10. Miyaguchi M, Kobayashi A, Kadoya Y, Ohashi H, Yamano Y, Takaoka K. Biochemical change in joint fluid after isometric quadriceps exercise for patients with osteoarthritis of the knee. Osteoarthr. Cartil.. 2003;11(4):252
11. Chen PL, Hong WH, Lin CH, Chen W. Biomechanics effects of kinesio taping for persons with patellofemoral pain syndrome during stair climbing. In4th Kuala Lumpur International Conference on Biomedical Engineering 2008 (pp. 395-397). Springer Berlin Heidelberg.
12. Fratocchi G, Di Mattia F, Rossi R, Mangone M, Santilli V, Paoloni M. Influence of Kinesio Taping applied over biceps brachii on isokinetic elbow peak torque. A placebo controlled study in a population of young healthy subjects. J Sci Med Sport. 2013;16(3):245-9.
13. Mostamand J, Bader DL, Hudson Z. The effect of patellar taping on EMG activity of vasti muscles during squatting in individuals with patellofemoral pain syndrome. J Sports Sci2011;29(2):197-205.
14. Sled EA, Khoja L, Deluzio KJ, Olney SJ, Culham EG. Effect of a home program of hip abductor exercises on knee joint loading, strength, function, and pain in people with knee osteoarthritis: a clinical trial. Phys Ther. 2010;90(6):895.
15. Fu TC, Wong AM, Pei YC, Wu KP, Chou SW, Lin YC. Effect of Kinesio taping on muscle strength in athletes—a pilot study. Journal of science and medicine in sport. 2008;11(2):198-201.

Conflict of Interest: NIL
Source of Support: NIL

How to Cite this Article

Saswadkar A A, Shimpi A P, Shyam A, Sancheti P K. Short term effects of kinesio taping on Vastus Medialis in Patients with Osteoarthritis Knee for gait and joint function enhancement. J Evidence-Based Physio Research March -June 2017; 1(1): 27-30.