

Original Research Article

## A Study to Find the Combined Effect of Knee Tape with Ultrasound and Ultrasound Alone In Patients with Knee Osteoarthritis

Neha Inamdar<sup>1</sup>, Ravi Savadatti<sup>2</sup>

<sup>1</sup>Assistant Professor, Dept of Physiotherapy, Dr. D.Y. Patil College of Physiotherapy, Pune, Maharashtra, India.

<sup>2</sup>Professor and Principal, SDM College of Physiotherapy, Dharwad, Karnataka, India.

Corresponding Author: Neha Inamdar

Received: 06/09/2016

Revised: 27/09/2016

Accepted: 01/10/2016

### ABSTRACT

**Background and objective:** Knee osteoarthritis is a leading cause of pain and disability in elderly population. Conservative treatment aims to reduce pain and limit functional impairment. Inexpensive interventions with minimal side effects are desirable. This study was done to find out the combined effect of knee taping and ultrasound versus ultrasound alone in knee osteoarthritis patients.

**Methods:** Sixty subjects with a mean age of  $58.12 \pm 4.33$  years were randomly allocated into two groups: Study group (group A) of 30 subjects receiving medial patella taping and ultrasound while Control group (group B) of 30 subjects receiving ultrasound alone. Treatment was given for 4 weeks, 3 times per week. Outcome measures were Visual Analogue Scale and Lequesne Knee Score, measured at 1<sup>st</sup> day and 4<sup>th</sup> week.

**Results:** Group A showed a statistical significant difference with mean of  $3.50 \pm 1.20$  between pre and post treatment while group B showed difference with mean of  $1.50 \pm 1.04$  on VAS scores. For the Lequesne Knee Score, the mean difference for group A was  $5.17 \pm 1.66$  and for group B was  $1.03 \pm 0.80$  between pre and post treatment. Both the groups showed significant results but the study group improved much better than the control group.

**Conclusion:** Subjects in the study group showed better change than the control group in VAS and Lequesne Knee Score. Hence, combination of ultrasound and taping gives a better result than ultrasound in knee osteoarthritis patients.

**Keywords:** Knee osteoarthritis, medial glide taping, ultrasound, Lequesne Knee score.

### INTRODUCTION

According to the American Rheumatism Association (ARA), Osteoarthritis (OA) is defined as a heterogeneous group of conditions that leads to joint symptoms and signs which are associated with defective integrity of cartilage, in addition to the related changes in underlying bone and at the joint margin. [1,2]

In Asia, prevalence rates of osteoarthritis knee were found to be high in elderly people, especially women. In India, the prevalence of osteoarthritis ranges from 22%-39%. About 13% of women and 10%

of men aged 50 years and older have symptomatic knee OA. [3-5]

The ARA has classified OA as primary and secondary. Primary knee OA is the one which develops without a known cause and is further classified into: medial, lateral and patellofemoral compartment. Secondary knee OA can be due to trauma, congenital disorders, developmental disorders, calcium deposition disease and other bone and joint diseases. [6] The exact etiology of OA is unknown, but there are several risk factors as follows:

### 1. Systemic factors:

- a. Age
- b. Ethnicity
- c. Genetic predisposition
- d. Gender
- e. Overweight
- f. Malalignment.

### 2. Biomechanical factors:

#### A. Intrinsic factors:

- a. Previous trauma
- b. Joint disorders and Congenital factors)
- c. Surgery (e.g. Meniscectomy)
- d. Muscular weakness

#### B. Extrinsic factors:

- a. Strenuous profession (much lifting, squatting and kneeling)
- b. Sports (esp. top level sports like soccer or ballet)
- c. Prolonged squatting. [7]

The criteria for diagnosing idiopathic OA knee are as follows:

Knee pain plus osteophytes on radiographs and at least one of the following:

1. Age more than 50 years.
2. Morning stiffness lasting 30 minutes or less.
3. Crepitus on motion. [5,8]

Clinically, painful creaking and grating on active motion, particularly about the patella, is an early finding. Pain, stiffness and altered functions are the chief complaints which tend to worsen with weight bearing and ambulation. This can progress to pain during day and night once cartilage loss leads to bone-on-bone contact. Pain is worsened as the day progresses with activities like ascending or descending stairs, arising from a sitting position. Stiffness in osteoarthritis is termed as “inactivity stiffness” that lasts about 5-10 minutes and occurs when patient gets up and bears weight after prolonged immobility. On examination, there may be a crackling feeling on palpation of knee with motion. Loss of knee articular cartilage leads to malalignment of leg. According to McConnell, there are four malalignments of the patella seen in knee OA: excessive lateral glide, excessive lateral tilt, excessive

posterior tilt of the inferior pole and excessive rotation. Malalignment of patella from altered mechanics will predispose the patient to patellofemoral pain that increases with knee flexion and when ascending and descending stairs. [9-11]

Physiotherapy for knee OA includes various therapeutic interventions. [12-16]

Medially directed patella taping is one of the commonly used treatment technique in reducing pain in knee OA. The aim of patellar taping is to create a mechanical medial realignment of the patella, thus centralizing it within the trochlea groove and improving patellar tracking. According to McConnell, patellar taping is designed to correct the malalignments and has four basic components: medial glide, medial tilt, anterior tilt and rotation. [17] If these deviations are seen in the observation phase they are considered static problems. The patellar movement should also be checked during active movement to rule out any dynamic problem. Normally, the patella moves medially in early flexion and then laterally. Passive medial and lateral movement of the patella is also carried out to determine its mobility in the static position. Normally, when carried out passively, the patella should move up to half its width medially and laterally with knee in extension. Decreased patella mobility is manifested by less than one quadrant of medial and lateral glide of patella; movement of more than 2 quadrants is considered hyper mobile. [18] In a randomized, single blind, crossover trial of three different forms of taping, medial taping of the patella showed significant reduction in pain as compared to neutral and lateral taping in knee osteoarthritis patients. [19] Therapeutic ultrasound is commonly recommended for the treatment of knee osteoarthritis. Its physiological effects include increase in tissue extensibility and scar tissue, increased fibroblast recruitment, accelerated fibrinolysis, increased protein synthesis, and increased blood flow and tissue regeneration leading to early resolution of inflammation and tissue

healing. [20] A Cochrane review on therapeutic ultrasound for osteoarthritis of the knee or hip reported that therapeutic ultrasound is beneficial for patients with osteoarthritis of the knee. [21]

The Visual Analogue Scale (VAS) is a measurement instrument consisting of a 10 cm line with zero on one end representing no pain and 10 on the other end representing worst pain ever experienced. The patient marks on this scale to indicate the severity of his or her pain. A study was done to assess the reliability of VAS in patients with musculoskeletal pain. Results showed an intraclass correlation co-efficient (ICC) of 0.97 (CI= 0.96-0.98) based on which they concluded that reliability of VAS for musculoskeletal pain appears to be high. [22]

The Lequesne Algofunctional index includes the measurement of pain (5 questions), walking distance (1 question) and activities of daily living (4 questions). Scores for each question are added together to provide a combined disease severity score. Scores of 1-4 indicate mild OA, 5-7 as moderate OA, 8-10 as severe, 11-13 as very severe and more than 14 as extremely severe. A study was done for assessment of test-retest reliability using intra-class coefficient (ICC) and construct validity using factor analysis of the Lequesne algofunctional index in patients with knee OA. Results showed an ICC of 0.95 with 48.7% of variance. Thus they concluded that the Lequesne algofunctional index is a reliable and valid score for measuring severity of knee osteoarthritis. [23]

Knee O.A is a leading cause of pain and disability in elderly population worldwide. Inexpensive interventions with minimal side effects are desirable. Knee taping and ultrasound are such strategies. [16] Knee tape is believed to reduce pain by improving alignment of patellofemoral joint and/or unloading inflamed soft tissues; however there is weak evidence to provide justification of its use. [12] Ultrasound has demonstrated a positive physiological effect by reducing inflammation and thereby accelerating tissue healing in knee

osteoarthritis. [20] Taking into consideration the correction of mal tracking of the patellofemoral joint by knee taping and the beneficial physiological effects of ultrasound in controlling the inflammation of soft tissues in patients with knee joint OA, it is legitimate to question whether the combination of knee taping & ultrasound has any beneficial effect in these patients. Hence, the purpose of this study is to combine these therapies to see their results on pain and severity in patients of knee osteoarthritis.

## MATERIALS AND METHODOLOGY

The study was conducted at the physiotherapy department of the SDM hospital, Dharwad, Karnataka, India. The ethical clearance was obtained and written informed consent was taken from the selected subjects. Sixty subjects of either gender diagnosed with knee osteoarthritis and aged 50 years and above with unilateral involvement were included for the study. Subjects with contraindications for taping and ultrasound, those who had taken physiotherapy treatment since 6 months, those taking steroids and any other cause of knee pain apart from knee osteoarthritis were excluded. The study was done for 4 weeks; knee taping and ultrasound were applied for 3 sessions per week, with a total of 12 sessions.

Screening was done based on the inclusion and exclusion criteria. Participants were allocated to their respective treatment groups using sealed, opaque envelopes. Sixty opaque envelopes were taken by principal investigator, where 30 envelopes contained a sticker mentioning "Study group" and other 30 mentioning "Control group". These 60 envelopes were shuffled and kept together. The subjects were asked to pick any one envelope from the bundle. According to the group mentioned in the sticker, the subjects were allocated. The study group (Group A) was given knee tape and ultrasound while control group (Group B) was given ultrasound alone. Following allocation, demographic data, chief

complaint and history were collected. Duration of the symptoms, signs and the side affected was noted and initial evaluation of patella malt racking, pain profile using the outcome measure VAS while the knee scoring was based on the Lequesne Knee Score was done. These outcome measures were assessed at baseline before treatment on day one of the intervention and at the end of 4th week of intervention.

### **Procedure**

The subject was explained about the treatment method prior to the application. Ultrasound was given before the application of the therapeutic tape. The subject was in supine position, with knee in either flexion or extension depending upon the end range that presented the most functional loss to the patient. The treatment area was exposed and an acoustic gel that did not contain any pharmacologically active substance was applied. A continuous ultrasound of 1.5 W/cm<sup>2</sup> or a pulsed ultrasound of 25% duty cycle with frequency 1MHz (Techno med Electronics) was applied over the medial and lateral aspects of the knee joint in a circular pattern with the probe held at right angles to the affected area to ensure maximum absorption of energy. Each session lasted for 12 minutes and was applied for 3 times for 4 weeks. [19, 24-28]

The therapeutic tape was applied for the study group alone after the application of ultrasound. All the subjects were instructed to shave off the affected knee joint area. Each subject was informed about the side effects of the tape which they had to observe for. The affected area was exposed, cleaned and the subject was made to lie in a supine position. The knee was placed in extension and the subject was instructed to relax the quadriceps completely. A hypoallergenic under tape (VPK enterprises Ltd.) was first applied to prevent any irritation of skin. A medial glide was given to the patella and then the Leukotape (VPK enterprises Ltd.) was applied maintaining the glide. Starting from the lateral border, the patella was pulled in a medial direction

with the help of the thumb, pushing the soft tissue on the medial aspect of knee towards the patella and anchoring over the medial femoral condyle, with enough medial force applied to shift the patella medially. To standardize the amount of medialization, the tape was pulled until a skin crease of greater than 2 cm wide was visible at the medial side of the knee. As inflamed soft tissue is aggravated by stretch, tape was also applied to unload the infrapatellar fat pad. Subjects were asked to check the skin for damage and keep the tape at least for 24 hours. [17,29-33]

The control group received only ultrasound as per the same procedure that was used in the study group. However, no tape was applied for this group.

### **Statistical analysis**

Statistical analysis was done using SPSS software, version 16. The investigator initially evaluated the descriptive statistics using Mean and Standard deviation for the baseline characteristics.

- The difference in pain scores between 2 groups (study group and control group) at 1st day pre treatment and after 4th week post treatment was studied using Mann-Whitney U test.
- The difference in Lequesne Knee Score between 2 groups (study and control group) at 1<sup>st</sup> day and after 4th week was studied using unpaired t test.
- Wilcox on matched paired test by rank was used to analyze the difference in pain scores from 1st day to 4th week for both study and control group.
- Students paired t test was performed to assess significant changes between pre and post treatment with respect to LKS in study group and control group separately.

### **RESULTS**

Sixty subjects of knee osteoarthritis were selected for the study. The study group (Group A) received ultrasound and knee taping while the control group (Group B) received only ultrasound.

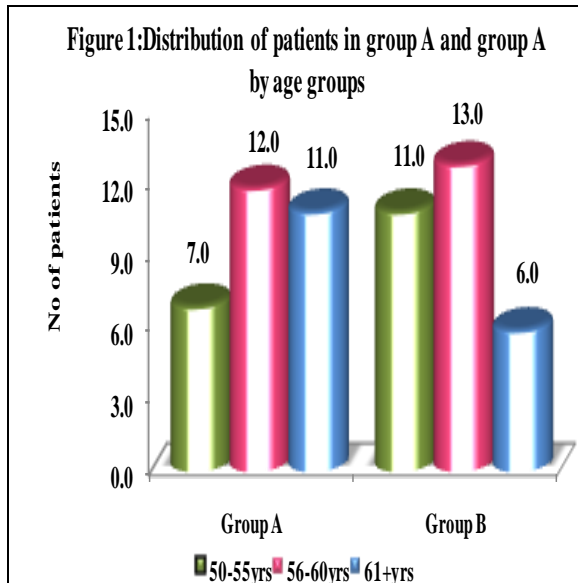
The distribution of subjects by age groups in group A and group B is depicted

in Table 1. The mean age of subjects in Group A is  $59 \pm 4.65$  while for Group B is  $57.23 \pm 3.87$ . The commonly affected age

group in this study is 56-60 years. Both the groups had equal number of participants i.e. 15.

**Table 1: Distribution of patients by age groups in group A and group B**

Age groups	Group A	%	Group B	%	Total	%
50-55yrs	7	23.33	11	36.67	18	30.00
56-60yrs	12	40.00	13	43.33	25	41.67
61+yrs	11	36.67	6	20.00	17	28.33
Total	30	100.00	30	100.00	60	100.00
Mean age	59.00		57.23		58.12	
SD age	4.65		3.87		4.33	



1.01 and of group B is  $7.20 \pm 0.89$  while at 4th week for group A is  $3.57 \pm 1.17$  and group B is  $5.70 \pm 1.15$ .

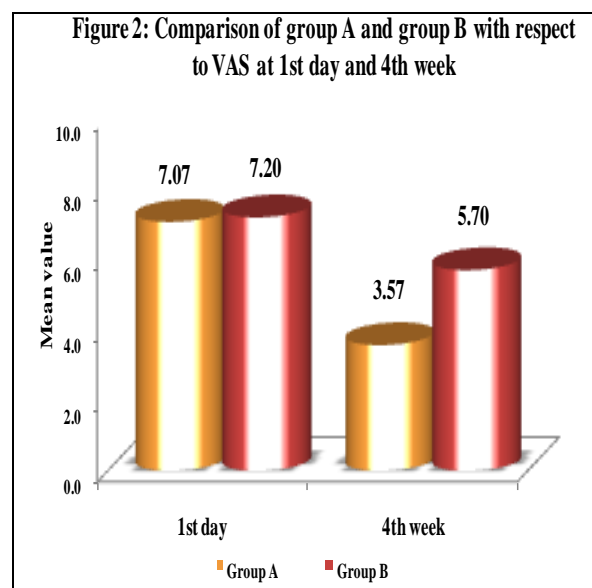


Table 2 and Figure 2 depict the comparison and difference of group A and group B with respect to VAS at 1st day and 4th week. The baseline scores of VAS on day 1 in both the groups showed no significant difference ( $p=0.63$ ). The mean pain scores at 1st day of group A is  $7.07 \pm$

**Table 2: Comparison of group A and group B with respect to VAS at 1<sup>st</sup> day, 4<sup>th</sup> week and their difference by Mann-Whitney U test**

Variable	Groups	Mean	SD	Sum of ranks	U-value	Z-value	P-value
1 <sup>st</sup> day	Group A	7.07	1.01	883.00			
	Group B	7.20	0.89	947.00	418.00	-0.4731	0.6361
4 <sup>th</sup> week	Group A	3.57	1.17	559.50			
	Group B	5.70	1.15	1270.50	94.50	-5.2559	0.0000*
Difference	Group A	3.50	1.20	1288.50			
	Group B	1.50	1.04	541.50	76.50	-5.5220	0.0000*

\* $p < 0.05$

Table 3 and Figure 3 represent the comparison and difference of group A and group B with respect to Lequesne Knee Score at 1st day and 4th week. Baseline scores at day 1 show no statistical significant difference between both the groups. The mean value of LKS at 1st day for group A is  $9.65 \pm 2.31$  and for group B is  $9.53 \pm 1.61$  while at the 4th week for

group A is  $4.48 \pm 1.15$  and for group B is  $8.50 \pm 1.72$ .

**Table 3: Comparison of group A and group B with respect to Lequesne knee scores at 1<sup>st</sup> day, 4<sup>th</sup> week and their difference by t test**

Variable	Groups	Mean	SD	t value	P-value
1 <sup>st</sup> day	Group A	9.65	2.31		
	Group B	9.53	1.61	0.2271	0.8211
4 <sup>th</sup> week	Group A	4.48	1.15		
	Group B	8.50	1.72	-10.6290	0.0000*
Difference	Group A	5.17	1.66		
	Group B	1.03	0.80	12.3070	0.0000*

\* $p < 0.05$

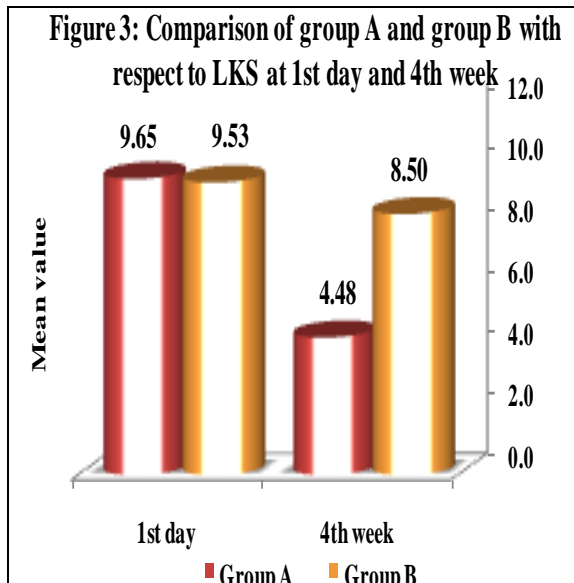


Table 4 and Figure 4 depict the comparison of percentage of changes found in the pain scores in group A and group B. Group A shows 49.53% reduction in pain and group B shows 20.83%. Both the groups show significant reduction in pain ( $p < 0.05$ ) but the percentage reduction in pain of group A is more as compared to group B.

Table 5 and Figure 5 depict the comparison of percentage changes in Lequesne Knee Score found in group A and group B. Group A showed 53.54% of improvement in LKS as compared to group B which is 10.84%. Both the groups show significant improvement ( $p < 0.05$ ) however percentage improvement in group A is more than in group B.

Table 4: Comparison of different time points i.e. 1<sup>st</sup> day and 4<sup>th</sup> week with respect to VAS in group A and group B by Wilcoxon matched pairs test

Groups	Time	Mean	SD	Mean Diff.	SD Diff.	% of change	Z-value	P-value
Group A	1 <sup>st</sup> day	7.07	1.01					
	4 <sup>th</sup> week	3.57	1.17	3.50	1.20	49.53	4.7616	0.0000*
Group B	1 <sup>st</sup> day	7.20	0.89					
	4 <sup>th</sup> week	5.70	1.15	1.50	1.04	20.83	4.3493	0.0000*

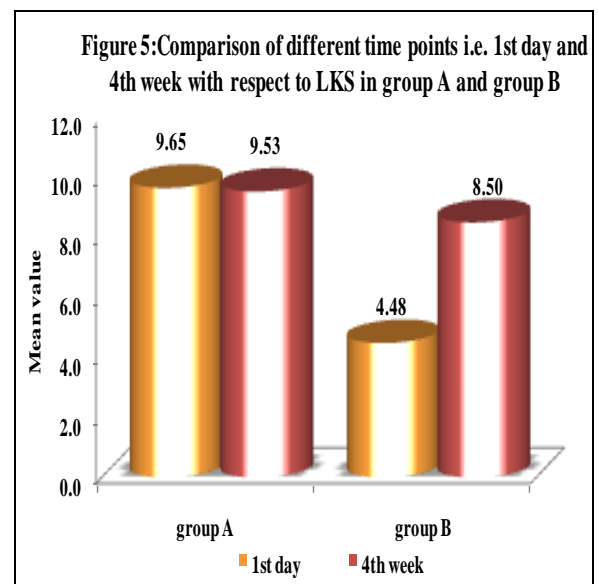
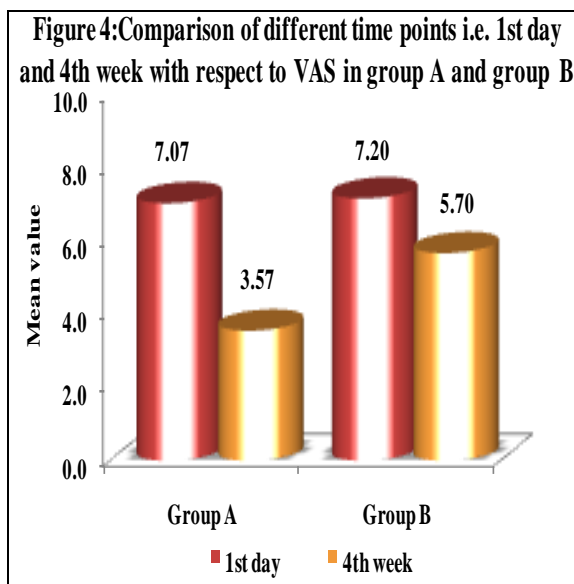


Table 5: Comparison of different time points i.e. 1<sup>st</sup> day and 4 week with respect to Lequesne knee scores in group A and group B by paired t test

Groups	Time	Mean	Std. Dv.	Mean Diff.	SD Diff.	% of change	Paired t	P-value
Group A	1 <sup>st</sup> day	9.65	2.31					
	4 <sup>th</sup> week	4.48	1.15	5.17	1.66	53.54	17.0739	0.0000*
Group B	1 <sup>st</sup> day	9.53	1.61					
	4 <sup>th</sup> week	8.50	1.72	1.03	0.80	10.84	7.0926	0.0000*

\* $p < 0.05$

## DISCUSSION

The purpose of this study was to find the effect of taping and ultrasound on knee

osteoarthritis patients as compared to only ultrasound. The study group i.e. group A was given ultrasound and medial glide

patella taping while the control group i.e. group B was given ultrasound alone. The tape was applied for 4 weeks; 3 times per week (i.e. 12 sessions) and was worn continuously. Outcome measures used were VAS and Lequesne Knee Score. The results were analyzed using unpaired and paired t test, Mann Whitney U test and Wilcoxon matched paired test. The experimental study showed a positive impact in VAS scores and Lequesne Knee Scores in Group A than the group B. Also the Lequesne Knee score showed better improvement in the group A than the group B. Table 1 and figure 1 show the mean age and standard deviation of study subjects. A study shows that the commonly affected age group in knee OA is over 45 years of age. [34] Similarly, in this study, OA was seen in the age group above 50 years, the mean age of affection being 59 years. Population studies of OA showed that its frequency, as expected, increases steadily with age, especially as observed in the Roentgenographic surveys in which articular alterations are found in many asymptomatic individuals. Prevalence varies from 40% among those aged 18-24 years to 85% among those aged 75- 79 years, with average of 37% overall. [35]

Table 2 and figure 2 represent the comparison of difference between the study group and control group for VAS scores at 1st day pre treatment and 4<sup>th</sup> week post treatment. The mean pain scores at 1st day of group A is  $7.07 \pm 1.01$  and of group B is  $7.20 \pm 0.89$ . Following post treatment at 4th week, there was a significant reduction in pain with mean scores for group A being  $3.57 \pm 1.17$  and for group B being  $5.70 \pm 1.15$ . However there was more significant reduction of pain in Group A as compared to Group B ( $p < 0.01$ ). Table 4 and figure 4 depict the comparison of percentage change at different points of time within both groups with respect to VAS scores. The percentage reduction of pain in group A was 49.53% with mean difference  $3.50 \pm 1.20$  while the Group B showed a pain reduction of 20.83% with mean difference  $1.50 \pm 1.04$ . Both the groups show a significant

reduction in pain; however the percentage reduction of pain in group A was higher than the group B. Therapeutic knee tape is a simple, inexpensive strategy that increases the treatment options for therapists and patients in the management of knee OA. [29,30] Various studies show that medial patella taping has a significant reduction in pain in knee OA. In a study by Hinman et al where the efficacy of knee taping in the management of osteoarthritis of knee was evaluated, the same treatment technique of taping the patella medially in knee osteoarthritis patients was used with the addition of tape to unload the infrapatellar fat pad. The results in this study showed a statistically significant improvement in the taping group ( $p = 0.000$ ) with 38-40% of pain reduction. Also the pain reduction in this study remained even after 3 weeks after discontinuing the therapy, thus having a carryover effect. In our study, the percentage reduction in pain was greater, that is 49.53%. Though in our study the carryover effect was not evaluated, taping the patella medially in combination with ultrasound still gave a beneficial effect for the subjects which can be considered in the future research. The cause of pain reduction due to patella remains unknown however the authors hypothesized that subtle change in patellar position may alter the magnitude or distribution of patellofemoral joint pressures or stress on joint structures. Changes in proprioceptive acuity, quadriceps strength and neuromotor control of the knee with taping have been also postulated as some of the mechanisms of pain reduction because of taping. [29] In another study by Hinman et al, the immediate effects of patella taping were evaluated on pain and disability in individuals with knee osteoarthritis as compared to untapped or neutral tape techniques. The therapeutic tape group improved significantly ( $p < 0.001$ ) in step test and the percentage reduction of pain was 50%. In our study too, the percentage reduction of pain was 49.53%. The patellofemoral OA is correlated with

patellar malalignment and this in turn is associated with increased peak patellofemoral contact pressures and loading of the lateral facet. Improving patellar alignment was one of the mechanisms of pain reduction in this study. Also, the infrapatellar fat pad is pain-sensitive, often inflamed secondarily to other knee joint pathology and proposed as a source of pain in knee OA. Therapeutic tape, by shortening the soft tissue of the fat pad, may relieve pain based on the principle that inflamed soft tissue does not respond well to stretching. [30] According to Dr John Z Srbely in his review of current literature on ultrasound in the management of osteoarthritis, two studies concluded that ultrasound had positive therapeutic effects; nine studies consistently reported that ultrasound has therapeutically beneficial effects on pain and functional outcomes. Five studies reported that ultrasound has positive cartilage healing properties and one experimental study demonstrated increased intra-articular absorption of high molecular weight molecules (hyaluronan) using ultrasound phonophoresis. In this study, both the study and the control group were given ultrasound and both showed a significant improvement. The benefits of ultrasound can be used as an adjunct with other therapeutic interventions. In this study, an addition of tape proved to show more benefit in the form of reduction of pain and improvement in knee function. Ultrasound demonstrates the ability to evoke a broad range of therapeutically beneficial effects which may provide safe and effective applications in the management of osteoarthritis. [21]

Table 3 and figure 3 depict the comparison of the Lequesne Knee Score between group A and group B at 1st day and 4th week using the t test. During post treatment, at 4th week, group A showed a mean improvement by  $4.48 \pm 1.15$  while group B showed  $8.50 \pm 1.72$ . Results conclude that there was more significant improvement in LKS in group A than group B ( $p < 0.01$ ).

Table 5 and figure 5 show the comparison of percentage change within the study groups with respect to LKS using the paired t test. The percentage change in group A from 1st day to 4th week is 53.54% ( $5.17 \pm 1.66$ ) and in group B is 10.84% ( $1.03 \pm 0.80$ ) suggesting that both the groups showed significant improvement however group A showed more improvement than group B.

In our study, both the groups showed a positive result however the combination of ultrasound and medial patella taping showed a better improvement on pain and knee scores than only ultrasound. Arnab et al studied the efficacy of patellar taping for knee osteoarthritis as compared to the conventional physiotherapy. In their study, the experimental group was given medial glide taping with ultrasound as while control group received conventional physiotherapy in the form of strengthening exercises and flexibility exercises. Results showed that the experimental group had greater gains in attaining functional abilities and pain relief compared to conventional group which was identical to our study. The experimental group has shown a positive effect of combining ultrasound and taping in knee OA patients, this can be used to compare the other therapy protocols in future research. [31] The aim of patellar taping is to create a mechanical medial realignment of the patella, thus centralizing it within the trochlear groove and improving patellar tracking. Patella taping affects the function of the quadriceps or the ability of the patellofemoral joint to withstand joint reaction forces. [36] Larsen et al studied the radiographic examination of medial glide taping technique of patellar taping on healthy individuals. The purpose of this study was to radiographically determine the effectiveness of the medial glide patella taping. The results showed that medial glide taping was effective in moving the patella medially and thus improving its tracking on the femur. In the experimental knees, there was a significant response to the taping procedure with the patella moving medially



in 85% of the individuals. They also concluded that patella taping prevents excessive lateral shift of patella. [37]

In a study by Lee Herrington, the results demonstrated that taping increased overall quadriceps peak torque or force generating ability due to the possible repositioning of the patella that brings about a change in the leverage offered to the quadriceps by the patella, thus maximizing the mechanical advantage of the quadriceps causing less patellofemoral joint compression. Taping brings about a change in afferent input into the dorsal horn decreasing the inhibition placed upon alpha motor neuron excitability. Alternatively, the taping unloads the mechanically irritated and swollen periarticular soft tissues, such as the synovium, instantaneously relieving pain. [38]

Another mechanism by which the patella reduces pain and improves function is by the earlier activation of VMO thus improving patella retracing. [39] In a study by Ernst et al where the effects of patella taping were studied on knee kinetics of patients with patellofemoral pain syndrome, the results suggested that the patella taping improved the knee extensor moment and power during weight bearing activities. [40] In our study, taping was combined with ultrasound in the experimental group. Studies show that ultrasound increases tissue extensibility, increases blood flow, helps in modulation of pain and reduces muscle spasm and joint stiffness through its thermal effects. Ultrasound Phonophoresis shows a positive cartilage healing properties and increases intra-articular absorption of high molecular weight molecules (hyaluronan). [20,28] Though in our study phonophoresis was not administered, this can be used as one of the therapeutic approach in further research.

In our study, taping was given to realign the patella, centralize its position within the trochlea groove and improve patellar tracking. Ultra sound has been proved to have beneficial therapeutic effects in these patients. We assume that correction

of patellar malt racking and the therapeutic effects of ultrasound would have shown greater improvement in the study group as compared to control group. However there were certain limitations in this study. The sample size was small, Carryover effect after the discontinuation of the therapy was not considered and comparison of effects of the two treatments was not done based on gender. Hence, long term follow up of the subjects can be considered to know the effect of tape after it is discontinued. Effect of Combination of taping and ultrasound based on gender also needs to be assessed. The taping and ultrasound combination can be compared with any other therapy protocols to know the superiority among them. Radiological and EMG studies can be done to demonstrate any changes in the patella position or quadriceps activity post application of tape. An addition of placebo in the intervention can give a clear picture of the effect of combined treatment.

## CONCLUSION

This study shows that combination of taping along with ultrasound shows a greater reduction of pain as measured by visual analogue scale and better improvement in the functional activities as depicted by Lequesne Knee Score. Therefore we conclude that combination of taping and ultrasound is an effective and beneficial therapy protocol in treating patients with knee osteoarthritis.

## REFERENCES

1. Levangie P. K, Norkin C. Joint Structure and Function. 4th ed. Jaypee Brothers, New Delhi. 394-427.
2. Mc Alindon, Dieppe. Osteoarthritis: definitions and criteria. *Annals of the Rheumatic Diseases*, 1989; 48: 531-532.
3. Franssen Marlene, Bridget Lisa, March Lyn, Brooks P. The epidemiology of osteoarthritis in Asia. *International journal of Rheumatic Diseases*, 2011; 14: 113-121.
4. Heidari B. Osteoarthritis: prevalence, risk factors, pathogenesis and features:

- Part 1. Caspian J Internal Medicine, 2011; 2: 205-212.
5. Mahajan A., Verma S., Tandon V. Osteoarthritis. JAP 2005 July; Vol 53: 635-641.
  6. Altman R et al. Development of criteria for the classification and reporting of osteoarthritis, Classification of Osteoarthritis of the Knee. Arthritis and Rheumatism 1986 August; Vol. 29 (8).
  7. Peat G., Thomas E., Duncan R. et al. Clinical classification criteria for knee osteoarthritis: performance in the general population and primary care. Ann. Rheum. Dis. 2006; 65: 1363=1367.
  8. Peter W.F.H. et al. KNGF Guidelines for Physical Therapy in patients with Osteoarthritis of the hip and knee. Dutch Journal of Physical Therapy 2010; Vol 120.
  9. Turek S. Orthopedics: Principles and their application. 4th ed. Vol.2. Lippincott-Raven Publishers; 1998; 1367-1370.
  10. Robin Poole A. An introduction to the pathophysiology of osteoarthritis. Frontiers in Bioscience 4.1999 October; 662-670.
  11. Hasan M., Shuckett R. Clinical features and pathogenetic mechanisms of osteoarthritis of hip and knee. BC Medical Journal 2010 October; Vol.52, (8).
  12. Hochberg M. C. et al. American College of Rheumatology 2012 Recommendations for the Use of Non pharmacologic and Pharmacologic Therapies in Osteoarthritis of the Hand, Hip, and Knee. Arthritis Care & Research 2012 April; Vol. 64 (4): 465-474.
  13. Jordan K. M. et al. EULAR Recommendations 2003: an evidence based approach to the management of knee osteoarthritis: Report of a Task Force of the Standing Committee for International Clinical Studies Including Therapeutic Trials (ESCISIT). Ann. Rheum. Dis. 2003; 62: 1145-1155.
  14. Bennell K., Hinman R Evidence based clinical assessment Knee Joint Osteoarthritis. Australian Physiotherapy Association 2005 September.
  15. Dandees H. M. Evidence-based physiotherapeutic management for knee osteoarthritis: A knowledge translation study 2011 December.
  16. Brosseau L. et al. Ottawa Panel Evidence-Based Clinical Practice Guidelines for Therapeutic Exercises and Manual Therapy in the Management of Osteoarthritis. Physical Therapy 2005; Vol. 85 (85): 907-971.
  17. Crossley K, Cowan S. M., Benell K. L., Mc Conell J. Patella taping: is clinical success supported by scientific evidence? Manual therapy 2000; 5:142-150.
  18. Magee D. J. Orthopedic Physical Assessment. 5th edition. Elseiverpublications.738-761.
  19. Cushnaghan et al taping the patella medially: a new technique for osteoarthritis of knee joint? BMJ 1994; 308: 753-755.
  20. Srbely J. Ultrasound in the management of osteoarthritis: part I: a review of the current literature; JCCA 2008: 30-37.
  21. Luksurapan W, Boonhong J. Effects of Phonophoresis of Piroxicam and Ultrasound on Symptomatic Knee Osteoarthritis. Archives of Physical Medicine and Rehabilitation 2013 February; Vol. 94 (2): 250-255.
  22. Boonstra, Anne, Schiphorst, Henrica, Roy. Reliability and validity of visual analogue scale in patients with musculoskeletal pain. International Journal of rehabilitation research 2008; Vol. 31: 165-169.
  23. Faucher, Poiraudau, Lefevex-Colau, Revel. Assessment of test-retest reliability and construct validity of the Lequesne index in knee osteoarthritis. Joint bone spine [Internet].2003 December; 70: 521-525. Available at URL: <http://www.sciencedirect.com/science/article/pii/S1297319X03000708>.
  24. Rujtes, Nuesch, Strerchi, Juni. Therapeutic ultrasound for osteoarthritis of knee or hip: review. The Cochrane Collaboration. 2010.
  25. Falconer et al. Effect of ultrasound on mobility in osteoarthritis of knee: a randomized controlled trial. Arthritis care and research 1992 March; Vol.5 (1).

26. Kozanoglu E., Basaran S., Guzel R., Guler-Uysal F. Short term efficacy of ibuprofen phonophoresis versus continuous ultrasound therapy in knee osteoarthritis. *Swiss med. Wkly.* 2003; 133: 333-338.
27. Mascarin et al. Effects of kinesiotherapy, ultrasound and electrotherapy in management of bilateral knee osteoarthritis: prospective clinical trial. *BMC Musculoskeletal Disorders.*2012; 13: 182.
28. Tascioglu F., Kuzgun S., Armagan O., Ogutler G. Short term effectiveness of ultrasound therapy in knee osteoarthritis. *The Journal of International Medical Research.* 2010; 1233-1242.
29. Hinman, Crossley, McConnell, Bennell. Efficacy of knee tape in the management of osteoarthritis of the knee: blinded randomised controlled trial. *BMJ* 2003 July; Vol. 327.
30. Hinman R., Crossley K., Mc Conell J., Benell K. Immediate effects of adhesive tape in pain and disability in individuals with knee osteoarthritis. *British society for Rheumatology* 2003; 42: 865-869.
31. Chandra A. et al. A study on the efficacy of patellar taping for knee osteoarthritis as compared to conventional physical therapy. *IJCRR* 2012 November; Vol.04 (22): 91-98.
32. Mc Conell J. The management of chondromalacia patella: a long term solution. *The Australian Journal of Physiotherapy* 1986; Vol. 32 (4).
33. Aminaka N., Gribble P. Patella taping, Patellofemoral pain syndrome, Lower extremity kinematics and dynamic postural control. *Journal of Athletic training* 2008; 43: 21-28.
34. Park Y. S., Kim H. J. Effects of taping method on pain and ROM of the knee joint in elderly 2005 April; 35 (2): 372-81. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/15860951>.
35. Mody G., Woolf A. The Global Burden of Musculoskeletal Disorders. *Business Briefing: North American Pharmacotherapy.*
36. Bockrath K. et al. Effects of patella taping on patella position and perceived pain. *Journal of the American College of Sports Medicine* 1993 September; 25(9): 989-92.
37. Larsen B. et al. Patellar taping: a radiographic examination of the Medial Glide Technique. *American Journal of Sports Medicine* 1995; Vol. 23(4).
38. Herrington L. The effect of patellar taping on quadriceps peak torque and perceived pain: a preliminary study. *Physical Therapy in Sport* 2001; 2: 23-28.
39. Gilleard W., Jenny McConnell, David Parsons. The effect of patellar taping on the onset of vast us medial is obliquus and vast us lateral is muscle activity in persons with patellofemoral pain. *Physical Therapy* 1998 January Vol. 78(1).
40. Ernst G.P., Kawaguchi J, Saliba E. Effect of patella taping on knee kinetics of patients with patellofemoral pain syndrome. *Journal of Orthopedics and Sports Physiotherapy.* [Internet] 1999November; 661-7. Available from URL:<http://www.ncbi.nlm.nih.gov/pubmed/10575643>

How to cite this article: Inamdar N, Ravi Savadatti R. A study to find the combined effect of knee tape with ultrasound and ultrasound alone in patients with knee osteoarthritis. *Int J Health Sci Res.* 2016; 6(10):118-128.

\*\*\*\*\*