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A Comparative Study Of The Effectiveness Of Medial Shift Taping Of Patella Along With Ultrasound Verses Strengthening Exercises With Ultrasound In Knee OA

1Ritika Pallavi, 2Dr Aditya kashyap, 3Dr Vidhi Singh

1Physiotherapist , 2Assistant Professor , 3Assistant Professor

1Sanskriti University ,

2Sanskriti ,

3Sanskriti University

ABSTRACT

Introduction: Osteoarthritis is a chronic progressive, degenerative disorder characterized by cartilage loss. It is more prevalent disease in our society. It results in cystic degeneration of bone surrounding and narrowing of joint space. Worldwide osteoarthritis is estimated to be the fourth leading cause of disability in which 10% are males and 13% are females. Patella taping was initially developed to create a mechanical medial shift to the patella, thereby centralizing it and improving patellar tracking. Muscle strengthening and aerobic exercise are effective in reducing pain and improving physical function in patients with mild to moderate OA of the knee. The aim of study compare the effectiveness of medial shift taping of patella along with ultrasound and strengthening exercises with ultrasound and strengthening exercises.

Methodology: It is an experimental study of pre-test and post-test. The sampling method is Purposive random sampling and sample size is 60. These subjects with knee osteoarthritis were included and randomly assigned into 2 groups. Group - A received medial shift patella taping with ultrasound and strengthening exercise. Group B received ultrasound and strengthening exercises alone. Medial taping of patella is applied for 4 days with 3 days of rest in between. Outcome measures used are NPRS and WOMAC scale.

Results: In this study, 60 patients between the age group of 50-60 years, with a history of arthritis ranging in duration from 6 months to 2 years were taken. The sample consisted of 17 females and 13 males with all subjects having unilateral symptoms. The pre-and post-test values were statistically tested using t test for their level of significance. The results in this study showed a statistically significant improvement in the taping group ($p = <0.005$) 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%.

Conclusion: The result showed that the experimental group was better than the control group in reduction of pain and gaining improvement in functional ability.

Key words: Osteoarthritis, Medial Patella taping, NPRS and WOMAC scale

INTRODUCTION

Osteoarthritis is a chronic progressive, degenerative disorder characterized by cartilage loss. It is more prevalent disease in our society. It results in cystic degeneration of bone surrounding and narrowing of joint space.

Worldwide osteoarthritis is estimated to be the fourth leading cause of disability in which 10% are males and 13% are females. In Asia, prevalence rates of osteoarthritis knee were found to be high in elderly people, especially women.

Osteoarthritis is a common problem for many people after middle age; Osteoarthritis is sometimes referred to as degenerative or wears and tears arthritis. Osteoarthritis may result from an injury to the knee earlier in life. Fractures involving the joints surface, instability from ligament tears, and meniscal injuries can all cause abnormal wear and tear of the knee joint. Not all cases of osteoarthritis are related to prior injury, however research has shown that some people are prone to develop osteoarthritis and this tendency may be genetic.

In India, the prevalence of osteoarthritis range from 22% -39%. Knee OA has a high prevalence rate compared with other types of OA and its presentation starts at an earlier age group, particularly in younger age groups of obese women. About 13% of women and 10% of men aged 50 years and older have symptomatic knee OA.

The ARA (American Rheumatism Association) 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 disease.

MEDIAL SHIFT PATELLA TAPING

Patella taping **(Alonazi Asma et. al., 2021)** was initially developed to create a mechanical medial shift to the patella, thereby centralizing it and improving patellar tracking. In the appropriate hands and with the right technique, patellar taping is successful, and it is very effective in reducing the level of pain during activities that create large knee joint reaction forces. Taping can also help reduce short-term pain with activity.

McConnell taping is a bracing or strapping technique using a rigid, cotton mesh, highly adhesive tape which is used for neuromuscular reeducation as it affects biomechanics of the patient. It was developed to correct altered patellofemoral kinematics and allows participation in ADL's and allows engaging in physical therapy exercise pain free. This is accomplished by way of application of specialized adhesive

tape applied across the anterior aspect of patella, pulling from lateral to medial, to in effect "mediatize" the patellofemoral joint. As such the ability of the strapping procedure to maintain the mediatized position of patella is critical for the duration of physical activity.

STRENTHENING EXERCISE

Strengthening exercise is exercise which is designed to increase the strength of specific group of muscle. Strengthening exercise overload the muscle until the point of muscle fatigue. This force and overload of a muscle encourage the growth, increasing the strength. Muscle strengthening and aerobic exercise are effective in reducing pain and improving physical function in patients with mild to moderate OA of the knee.

A conservative treatment **(Alonazi Asma et. al., 2021)** of OA is focused on restoring standard patella tracking and strengthening the quadriceps muscle, which plays a vital role in maintaining the patella in its normal position. Patella taping was initially developed to create a mechanical medial shift to the patella, thereby centralizing it and improving patellar tracking. In the appropriate hands and with the right technique, patellar taping is successful, and it is very effective in reducing the level of pain during activities that create large knee joint reaction forces. Taping can also help reduce short-term pain with activity. The better results in the experimental group could be due to the effect of taping technique which provides reduction of pressure on lateral facet of the joint and thereby also prevent tracking of patella.

Ultrasound therapy is the form of mechanical energy that uses mechanical vibrations beyond the normal human sound range that is from 16 Hz to 20000Hz. Frequency used in therapy are typically 1.0 and 3.0 Hz.

Long-duration, low-intensity ultrasound significantly reduced pain and improved joint function in patients with moderate to severe osteoarthritis knee pain.

VISUAL ANALIOGUE SCALE (VAS) AND WOMAC

Pain was evaluated (**Kwansub Lee, 2016**) using the visual analogue scale (VAS), and daily living activity functions were evaluated using the WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index).

VISUAL ANALOGUE SCALE

The intensity of pain can be measured by VAS. You can use 10 cm lines marked with numbers from 0 to 10. Where, 0 means no pain and 10 means maximum pain. Subjects were asked to mark their pain on this line, depending on their severity. The clinical application of the Visual Analog Scale (VAS) provides a simple method for measuring subjective experience and has been shown to be effective and reliable in a variety of clinical and research applications. VAS is very commonly used scale for pain in healthcare investigate and practice.

NUMERIC PAIN RATING SCALE (NPRS)

- The Numeric Pain Rating Scale (NPRS) is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0–10 integers) that best reflects the intensity of the individual's pain (Rodriguez, 2001).

- According to McCaffery et al. (1989) and later on Stevens, Lin, and Maher, (2016) the Numeric Pain Rating Scale (NPRS -11) is an 11-point scale for the patient self-reporting of pain. It is for adults and children 10 years old or older.
- Patients were assessed for pre- and post-treatment pain severity using the NPRS scale. Measuring Results- Primary variables were self-reported using NPRS. The quadratic variable was strength.

The **WOMAC** index is most common used tool, introduced in 1988, for evaluating the health status of knee OA patients. It includes 33 items- clinical symptoms (5 questions), severity of joint stiffness (2 questions), degree of pain (9 questions) and ADL's (17 questions). Each question has 5 subscales where best situation scores as never or none and the worst one names as extreme or always. Higher score are representatives of better situation and less pain.

NEED FOR THE STUDY

This study is intended to find out the effective treatment for OA knee patients when treating with US and knee strengthening exercises by performing the trial. Furthermore, medial shift taping of patella is added to ultrasound and strengthening exercises to evaluate the efficacy for OA knee patients.

OBJECTIVES:

- A Study the effectiveness of ultrasound and strengthening exercises in osteoarthritis knee.
- To study the effectiveness of medial shift taping of patella with ultrasound and strengthening exercises.
- To compare the effectiveness of medial shift taping of patella along with ultrasound and strengthening exercises with ultrasound and strengthening exercises.

METHODOLOGY

60 subjects with knee osteoarthritis were included and randomly assigned into 2 groups. Group - A received medial shift patella taping with ultrasound and strengthening exercise. Group B received ultrasound and strengthening exercises alone. Medial taping of patella is applied for 4 days with 3 days of rest in between. Strengthening exercises include seated leg presses, leg extensions and leg curls. Inclusion of hip adduction and hip abduction and calf/toe presses can help with improving and maintaining appropriate knee mechanics. Exercise 4 days per week, with 2-3 sets per exercise at 8-15 repetitions per set. Ultrasound treatment of 1 MHz, frequency with application time of 5 minutes on the medial side and 5 minutes on lateral side of knee is given for 4 days in a week.

STUDY DESIGN/STUDY TYPE - Experimental study. It is an experimental study of pre-test and post-test.

SAMPLING METHOD - Purposive random sampling. **SAMPLE SIZE**- 60

- **INCLUSION CRITERIA-**

❖ Both male and female.

❖ Radiological changes in the knee typical of chronic primary osteoarthritis with involvement of Knee joint with no deformity.

❖ Negative screen for rheumatoid factor.

❖ Pain predominantly emerging only from knee.

- ❖ Patients with current radiographs of knee to find out disease severity and compartmental involvement.
- ❖ Primary knee osteoarthritis.
- ❖ 50-60 years both gender.

- **EXCLUSION CRITERIA-**

- ❖ Patients with primary chronic osteoarthritis of tibiofemoral joint.
- ❖ Arthritis of other cause such as septic arthritis, psoriatic arthritis, gouty arthritis, SLE.
- ❖ Muscle imbalance.
- ❖ Excessive subtalar joint pronation.
- ❖ Patella Alta.
- ❖ Position of femur i.e., anteversion or retroversion.
- ❖ Patients with any systemic disease.
- ❖ Peripheral vascular disease.
- ❖ Hip or spinal disorders causing pain in or around the knee.
- ❖ Any neurological involvement or disorder which may interfere with the treatment.
- ❖ Post-surgical conditions.
- ❖ Metals in or around knee.
- ❖ Congenital wasting of muscle around the knee.
- ❖ Wound
- ❖ Infection.
- ❖ Recent steroid injection to the knee.
- ❖ Any other neurological or musculoskeletal condition.
- ❖ Any symptoms or sign suggestive of another cause of knee pain.
- ❖ Fracture around knee.
- ❖ Intra articular injection.
- ❖ Peripheral vascular disease.
- ❖ Recent trauma

ORIENTATION OF THE SUBJECTS

Before treatment, all subjects were explained about the study and procedure to be applied and were asked to inform if they felt any discomfort during the course of the treatment. All the subjects who were interested to participate in the study were asked to sign the consent form before the treatment.

DATA COLLECTION PROCEDURE:

PROCEDURE

Participants referred by an orthopedic surgeon were selected and assessed as per the selection criteria. Consent form obtained by the participants.

Outcome measures used are NPRS and WOMAC scale. Then the procedure started by randomly dividing the participants in two groups: Group A and Group B.

Group -A received medial shift taping of patella, ultrasound with strengthening exercises.

Group-B received ultrasound with strengthening exercises.

Outcome measure was assessed at baseline before treatment on day 1st and the end of intervention on 3rd week.

Ultrasound treatment of 1MHz, frequency with application time of 5 minutes on the medial side and 5 minutes on lateral side of knee is given for 4 days in a week

STRENGTHENING EXERCISE

Supine lying, asks the patient to hold the patella in cephalic position for 10 seconds and then relax. The contraction is carried out for 10 repetitions with rest in between. A total of 50-75 contractions are usually done.

MEDIAL TAPING PROCEDURE

Position the patient in relaxed, supported long sitting with the knee aligned in a neutral position. The area of the knee to be taped is shaved and made clean. A 2.5 cm wide and 20 cm long white tape is secured at the lateral border of the patella and pulled medially. Soft tissue is taken up at the medial aspect of the thigh and then the tape is secured along the medial border of femoral condyle. The knee cap is taped for 4 alternate days in a week. There are two types of tapes that are applied to the patient's knee .The first tape applied is a white protective tape (micropore), which is meant to provide a firm surface for the more adhesive tape .The adhesive tape should not be applied directly to the skin. The white tape adheres to a smoothly shaven and non-oiled skin surface. Secondly, McConnell tape is applied. If the skin becomes irritated by the tape, the patient should remove the tape and treat the skin with topical ointment.

To assess the effect of taping, a pain provoking activity such as a single or double squat is performed immediately prior to taping and repeated afterwards .If the tape is applied correctly the post taping squat will be painless.

Similar to the VAS, the NPRS is anchored by terms describing pain severity extremes.

STATISTICAL ANALYSIS-

After completing the data collection, the data will be analyzed to conclude result of this study using NPRS scale and WOMAC scale.

STATISTICAL TOOLS

Statistical play an important role in any research work. For definite, arranged and Scientific Explanations and to know the relation between two variable statistics is used. Statistic in education is used to derive conclusion and to take a decision in the test after considering the data.

Table 1- Distributions of patients by age groups in group A and group B.

Age groups	Group A	%	Group B	%	Total	%
50-55yrs	13	23.33	14	36.67	18	30.00
56-60yrs	17	40.00	16	43.33	25	41.67
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	

This table depicts the mean age and standard deviation of study subjects. The mean age of subjects in Group A is 59 ± 4.65 while for Group B is 57.23% ± 3.87. Total mean age and standard deviation for whole study was 58.12% ± 4.33. The commonly affected age group in this study is 56-60 years.

Table 2: Distribution of patients by gender in group A and group B.

Sex	Group A	%	Group B	%	Total	%
Male	15	50.00	15	50.00	30	50.00
Female	15	50.00	15	50.00	30	50.00
Total	30	100.00	30	100.00	60	100.00

This table represents the distribution of subjects according to the gender. Both the groups had equal number of males and females that is 15 (50%)

Table-3: Comparison of group A and group B with respect to NPRS and WOMAC scale at 1st day, 3rd week and their differences by Mann Whitney U test.

Variable	Groups	Mean	SD	Sum of ranks	U-value	Z-value	P-value
1st day	Group A	7.07	1.01	883.00		-0.4731	0.6361
	Group B	7.20	0.89	947.00	418.00		
3rd week	Group A	3.57	1.17	559.50		-5.2559	0.0001*
	Group B	5.70	1.15	1270.50	94.50		
Difference	Group A	3.50	1.20	1288.50		-5.5220	0.0001*
	Group B	1.50	1.04	541.50	76.50		

*p<0.05.

This table depicts the comparison and difference of group A and group B with respect to NPRS and WOMAC scale at 1st day and 3rd week. The baseline scores of NPRS and WOMAC scale on day 1 in both the groups showed no significant difference (p=0.0001*). The mean pain scores at 1st day of group A is 7.07 ± 1.01 and of group B is 7.20 ± 0.89 while at 3rd week for group A is 3.57 ± 1.17 and group B is 5.70 ± 1.15.

Table 4: Comparison of group A and group B with respect to Lequesne knee scores at 1st day, 3rd week and their difference by t test

Variable	Groups	Mean	SD	t value	P-value
1st day	Group A	9.65	2.31	0.2271	0.8315
	Group B	9.53	1.61		
3rd week	Group A	4.48	1.15	-10.6290	0.0018*
	Group B	8.50	1.72		
Difference	Group A	5.17	1.66	12.3070	0.0065*
	Group B	1.03	0.80		

*p<0.05

This table represents the comparison and difference of group A and group B with respect to LKS at 1st day and 3rd 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 ± 2.31 and for group B is 9.53 ± 1.61 while at the 3rd week for group A is 4.48 ± 1.15 and for group B is 8.50 ± 1.72.

Table 5: Comparison of different time points i.e. 1st day and 3rd week with respect to NPRS and WOMAC scale 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	1st day	7.07	1.01	3.50	1.20	49.53	4.7616	0.0001*
	3rd week	3.57	1.17					
Group B	1st day	7.20	0.89	1.50	1.04	20.83	4.3493	0.0001*
	3rd week	5.70	1.15					

*p<0.05

This table depicts 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 =0.0001) but the percentage reduction in pain of group A is more as compared to group B.

Figure 5: Comparison of different time points i.e. 1st day and 3rd week with respect to NPRS and WOMAC scale in group A and group B

Table 6: Comparison of different time points i.e. 1st day and 3rd week with respect to NPRS and WOMAC scales 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	1st day	9.65	2.31	5.17	1.66	53.54	17.0739	0.0034*
	3rd week	4.48	1.15					
Group B	1st day	9.53	1.61	1.03	0.80	10.84	7.0926	0.0892*
	3rd week	8.50	1.72					

*p<0.05

This table depicts the comparison of percentage changes in LKS 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 ($p<0.0892$) however percentage improvement in group A is more than in group B.

DISCUSSION

This study is intended to find out whether medial shift taping of patella with strengthening and ultrasound proves beneficial in treatment of osteoarthritis knee in comparison with strengthening and ultrasound alone. Analysis of the number of individuals in sex and side variations between experimental and control group using Mann Whitney u test reveals that there is no significant difference in terms of sex and side allotment between both the groups. Analysis of the mean change in pain at knee had revealed a statistically significant difference at 5% level of significance in experimental group who received taping along with ultrasound and quadriceps strengthening exercises and home exercises than the control group who received ultrasound, strengthening exercises.

Analysis of the mean change in function at knee using Knee Joint Evaluation Scale had revealed a statistically significant difference at 5% level of significance in experimental group who received taping along with ultrasound, isometric strengthening exercises than control group who received ultrasound, strengthening exercises and home exercise alone.

Results obtained after analysis of pain in experimental group shows that there is 15.4% reduction in pain which is statistically significant in those patients who received taping technique when compared with control group at the end of day 7.Analysis of results regarding knee Joint Evaluation Scale in experimental group shows a significant improvement of 20.4% at the end of day 7.

Results obtained after analysis of pain in control group shows 4.6% improvement at the end of day 7 using ultrasound and strengthening exercise alone.

Analysis of results between pretest and posttest values of control group regarding Lequesne knee scores shows that there is improvement of function of 10.6% at knee following ultrasound and strengthening exercise on day 7.

Hence the posttest statistical analysis of experimental group results compared with control group results shows the superiority of medial shift taping of patella with strengthening and ultrasound proves beneficial in treatment of osteoarthritis knee in comparison with strengthening and ultrasound alone. This permits the rejection of null hypothesis.

The better results in the experimental group could be due to the effect of taping technique which provides reduction of pressure on lateral facet of the joint and thereby also prevent tracking of patella. Pain reduction is also due to the effect of short wave diathermy in increasing vasodilation, increasing rate of nerve conduction and elevation of pain threshold. The improvement in funcitional score is due to alteration of muscle strength, acceleration of enzymatic activity and increased soft tissue extensibility due to isometric quadriceps strengthening.

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 whiles 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 NPRS and

WOMAC scale for scoring the intensity of pain experienced by the subject and LKS that scored pain, maximum distance walked and activities of daily living. 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 NPRS and WOMAC scale scores than the group B.

Table 1 and figure 1 show the mean age and standard deviation of study subjects. The mean age of subjects in Group A is 59 ± 4.65 while for Group B is 57.23% ± 3.87. Total mean age and standard deviation for whole study group was 58.12% ± 4.33. A study shows that the commonly affected age group in knee OA is over 45 years of age. 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 Roentgen graphic 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. [53]

The incidence of knee OA is equal among males and females up to the age of 50 years after which it is more frequent among females than in males. [53] Also the severity of symptoms is more in females than males. [4]In this study, the distribution of subjects according to the gender shows that both the males and females were equally affected as shown in Table 2 and figure 2.

Table 3 and figure 3 represent the comparison of difference between the study group and control group for NPRS and WOMAC scale scores at 1st day pretreatment and 4th week post treatment. The mean pain scores at 1st day of group A is 7.07 ± 1.01 and of group B is 7.20 ± 0.89. The baseline characteristics show no statistical significant difference in both the groups. Following post treatment at 4th week, there was a significant reduction in pain with mean scores for group A being 3.57 ± 1.17 and for group B being 5.70 ± 1.15. However there was more significant reduction of pain in Group A as compared to Group B ($p<0.01$).

Table 5 and figure 5 depict the comparison of percentage change at different points of time within both groups with respect to NPRS and WOMAC scale scores. The percentage reduction of pain in group A at the end of 4th week was 49.53% with mean difference 3.50 ± 1.20 while the Group B showed a pain reduction of 20.83% with mean difference 1.50 ± 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.

The results in this study showed a statistically significant improvement in the taping group ($p = <0.005$) 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.

LIMITATIONS AND RECOMMENDATIONS

LIMITATIONS

- The study was conducted over a short period of time.
- Sample size taken for the study was small.
- Limited parameters of outcome measures were used.
- No follow- up was done.
- All measurements were taken by the researcher himself, hence bias can be expected.
- No blinding of procedures was done which could bias the measurement taken.
- All the measures were taken manually and this may introduce human error
- Which could affect the reliability of the study?
- This study is performed over a relatively short period of 3 weeks and does not prove that taping is either safe of effective in the long term.

CONCLUSION

In this study, 60 patients between the age group of 50-60 years, with a history of arthritis ranging in duration from 6 months to 2 years were taken. The sample consisted of 17 females and 13 males with all subjects having unilateral symptoms. The 60 subjects were divided in to two groups of 30 each and named experimental and control group. Experimental group was given medial taping technique in addition. Duration of the treatment was 4 alternate days in a week for 3 weeks. The outcome measures taken were NPRS and WOMAC scale which were recorded before and after the treatment. The pre-and post-test values were statistically tested using t test for their level of significance. The result showed that the experimental group was better than the control group in reduction of pain and gaining improvement in functional ability.

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