

Effectiveness of Kinesiological Taping with Exercise Programme Versus Exercise Programme Alone on Pain Intensity and Lower Limb Function in Patients with Tibiofemoral Osteoarthritis: a Comparative Study

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ABSTRACT

Background: Tibiofemoral osteoarthritis (TFOA) is associated with pain, muscle weakness, and impaired lower-limb function. Exercise is commonly used in conservative management, while kinesiological taping may provide additional symptomatic and functional benefits. **Objective:** To compare the effects of an exercise programme combined with kinesiological taping with an exercise programme alone on pain intensity and lower-limb function in individuals with TFOA. **Methods:** Thirty-six participants meeting the study criteria were randomly assigned to Group A (kinesiological taping plus exercise; n=18) or Group B (exercise alone; n=18). Both groups received treatment for 6 weeks. Pain intensity was assessed using the Numerical Pain Rating Scale (NPRS), lower-limb functional performance using the 30-second Sit-to-Stand Test, and muscle strength using manual muscle testing (MMT) of the quadriceps, hamstrings, and gluteus medius. **Results:** Both groups improved significantly from pre-test to post-test ($p < 0.001$). Between-group analysis of pre-post change demonstrated significant differences in favour of Group A for NPRS ($p = 0.001$), Sit-to-Stand Test ($p = 0.010$), quadriceps MMT ($p = 0.045$), hamstrings MMT ($p = 0.026$), and gluteus medius MMT ($p = 0.003$). **Conclusion:** In this study, adding kinesiological taping to an exercise programme produced greater improvements in pain intensity and lower-limb function than exercise alone in participants with TFOA.

Keywords: Tibiofemoral osteoarthritis, Kinesiological taping, Exercise programme, Pain intensity, Sit-to-Stand Test, Manual muscle testing

INTRODUCTION

Osteoarthritis (OA) is a degenerative joint condition that commonly affects weight-bearing joints, including the knee. Knee OA may involve the tibiofemoral (TF) and patellofemoral (PF) compartments and is associated with pain, muscle weakness, and functional limitations. The burden of OA is substantial, and age is associated with an increased prevalence of knee OA.^{1,2}

The PF and TF compartments may contribute differently to symptoms and disability. Evidence summarized in the present thesis indicates that PF involvement is frequently associated with knee pain and disability, while structural changes and disease progression can involve both compartments.³⁻⁷

Muscle impairment is an important feature of knee OA. Quadriceps weakness is common, and impairments may also involve the hamstrings and hip musculature. Exercise therapy, including strengthening programmes, has been shown to improve pain and physical function in people with knee OA.^{13,14,18} Hip abductor weakness has also been described in symptomatic knee OA, supporting the inclusion of proximal muscle strengthening in rehabilitation.^{15,16}

Kinesiological taping has been investigated as an adjunct to exercise and other conservative interventions. Proposed effects include mechanical support, modification of patellar position, altered sensory input, and changes in pain and neuromuscular function. Previous trials and systematic reviews have reported beneficial effects of taping on pain and function in knee OA.^{19,23,25-30,34}

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



Although evidence exists for taping in knee OA, the present study focused specifically on individuals with tibiofemoral OA, with or without patellofemoral involvement, and examined whether adding kinesiological taping to an exercise programme produced additional benefits compared with exercise alone. Therefore, the aim was to compare the effects of the two interventions on pain intensity and lower-limb function.

MATERIALS AND METHODS

2.1 Study Design and Setting

The study was conducted as a comparative study at Champions Clinic, Manjeri, Malappuram District, Kerala, and City Life Care Clinic, Perinthalmanna, Malappuram District, Kerala. The total study duration was 2 months and the treatment duration was 6 weeks.

2.2 Participants and Sampling

A total of 36 participants with unilateral tibiofemoral osteoarthritis were included, with 18 participants in each group. Purposive sampling was used. Participants were randomly assigned to Group A or Group B after baseline demographic and outcome assessment. The inclusion criteria were unilateral TFOA with or without PF OA, male or female participants, pain greater than 3 on the NPRS, age 55–65 years, and radiographic TFOA of grade 2 or higher according to the Kellgren-Lawrence grading scale.

Participants were excluded if they had rheumatoid arthritis, knee surgery within the previous 6 months, allergy to kinesiology tape, use of pain medication, acute neurological or orthopaedic conditions, secondary OA, or balance problems.

2.3 Ethical Considerations

Written informed consent was obtained from all participants before participation. The thesis includes an Institutional Ethics Committee approval certificate and certificate of completion. No IEC approval number was available in the extracted study text.

2.4 Outcome Measures

Pain intensity was assessed using the 11-point Numerical Pain Rating Scale (NPRS), ranging from 0 (no pain) to 10 (worst pain). Lower-limb functional performance was assessed using the 30-second Sit-to-Stand Test, which records the number of complete stands performed from a chair in 30 seconds. Manual

muscle testing (MMT) was used to assess the quadriceps, hamstrings, and gluteus medius.

2.5 Intervention

Both groups received the same exercise programme for 6 weeks, five days per week, with two sessions per day and approximately 45 minutes of treatment per session. The exercise programme included quadriceps isometrics, theraband glute bridge, resisted clamshells, resisted hip abduction, and front-supported mini squats. The glute bridge and resisted clamshells were introduced from the second week, resisted hip abduction from the second week, and front-supported mini squats from the third week.

Group A received kinesiological taping in addition to the exercise programme. The tape was applied to guide patellar trajectory, with emphasis on the tilt component. The tape was applied with the knee slightly flexed; the reported application used approximately 25–50% tension at the inferior pole and 15–25% tension around the patella toward the vastus medialis and lateralis. The tape was left in place for 5 days and reapplied on the first day of each week. Group B received the same exercise programme without taping.

2.6 Statistical Analysis

Data were summarized using frequency, percentage, mean, and standard deviation. Paired t-tests were used for within-group pre-post comparisons, and independent-samples t-tests were used for between-group comparisons and comparisons of pre-post change. Chi-square testing was used to compare gender distribution. Pearson correlation was used to examine relationships among outcome measures and demographic variables. Statistical significance was set at $p < 0.05$. Analysis was performed using SPSS version 29.0.10.

RESULTS

Thirty-six participants completed the study, with 18 participants in each group. The overall mean age was 58.36 ± 2.65 years, mean height was 165.56 ± 8.38 cm, mean weight was 68.58 ± 8.82 kg, and mean BMI was 25.70 ± 3.09 kg/m². There were 19 males (52.8%) and 17 females (47.2%). Gender distribution did not differ significantly between the groups ($\chi^2 = 0.111$, $p = 0.738$). Baseline age, height, weight, and BMI were also not significantly different between groups ($p > 0.05$).

3.1 Participant Characteristics

Variable	Overall (n=36)	Group A (n=18)	Group B (n=18)
Age, years, mean±SD	58.36±2.65	57.67±2.54	59.06±2.65
Height, cm, mean±SD	165.56±8.38	165.89±8.78	165.22±8.21
Weight, kg, mean±SD	68.58±8.82	69.00±8.51	68.17±9.35
BMI, kg/m ² , mean±SD	25.70±3.09	25.06±2.17	25.08±3.87
Male, n (%)	19 (52.8)	10 (55.6)	9 (50.0)
Female, n (%)	17 (47.2)	8 (44.4)	9 (50.0)

3.2 Within-Group Changes

Outcome	Group	Pre-test Mean±SD	Post-test Mean±SD	t	p
NPRS	A: Taping + exercise	6.67±0.84	0.28±0.46	44.61	<0.001*
NPRS	B: Exercise only	6.06±1.26	0.83±0.51	19.00	<0.001*
Sit-to-Stand	A: Taping + exercise	11.11±2.74	17.28±2.97	-21.79	<0.001*
Sit-to-Stand	B: Exercise only	9.50±2.62	14.06±1.92	-8.78	<0.001*
Quadriceps MMT	A: Taping + exercise	3.78±0.43	5.00±0.00	-12.12	<0.001*
Quadriceps MMT	B: Exercise only	3.89±0.32	4.83±0.51	-6.27	<0.001*
Hamstrings MMT	A: Taping + exercise	3.28±0.58	5.00±0.00	-12.72	<0.001*
Hamstrings MMT	B: Exercise only	3.61±0.50	4.89±0.32	-9.44	<0.001*
Gluteus medius MMT	A: Taping + exercise	3.00±0.49	4.94±0.24	-15.30	<0.001*
Gluteus medius MMT	B: Exercise only	3.00±0.49	4.39±0.50	-11.75	<0.001*

*p<0.05; t = paired-samples t-test.

3.3 Between-Group Comparison

Outcome	Group A Mean Change±SD	Group B Mean Change±SD	t	p
NPRS	6.39±0.61	5.22±1.17	3.77	0.001*
Sit-to-Stand	-6.17±1.20	-4.56±2.20	-2.73	0.010*
Quadriceps MMT	-1.22±0.43	-0.94±0.64	-1.98	0.045*
Hamstrings MMT	-1.72±0.57	-1.28±0.57	-2.32	0.026*
Gluteus medius MMT	-1.94±0.54	-1.39±0.50	-3.20	0.003*

*p<0.05; t = independent-samples t-test..

Both groups showed statistically significant improvement in NPRS, Sit-to-Stand Test, and MMT scores from pre-test to post-test (p<0.001). Between-group analysis of pre-post change showed significantly greater improvement in Group A for NPRS, Sit-to-Stand Test, quadriceps MMT, hamstrings MMT, and gluteus medius MMT. The largest between-group effect in the reported change analysis was observed for gluteus medius MMT (p=0.003).

DISCUSSION

The present study examined whether adding kinesiological taping to an exercise programme provided additional benefits over exercise alone in participants with TFOA. Thirty-six participants aged 55–65 years received treatment for six weeks. Both groups demonstrated significant improvements in pain intensity, lower-limb functional performance, and muscle strength, while the combined taping and exercise group demonstrated greater pre-post changes.

The reduction in NPRS in both groups is consistent with evidence that exercise therapy can reduce pain and improve physical function in knee OA.¹⁸ The

greater reduction observed in the taping-plus-exercise group is also consistent with systematic-review and randomized-trial evidence summarized in the thesis regarding the potential benefits of kinesiology taping for pain and function in knee OA.^{19,23,25-30,34}

The improvement in the Sit-to-Stand Test in both groups indicates improved functional performance following the six-week exercise programme. The greater change in Group A may reflect the additional effects of taping together with strengthening exercises. The thesis discusses proposed effects of taping on patellar alignment, pain, proprioceptive input, and neuromuscular control, while exercise contributes to muscle adaptation and improved physical function.

Improvements in quadriceps, hamstrings, and gluteus medius MMT were observed in both groups. The study included hip strengthening because hip muscle weakness is commonly reported in people with knee OA, and previous evidence has supported hip abductor strengthening as part of rehabilitation.^{15,16} The greater pre-post changes in the taping-plus-exercise group suggest that the combined intervention may provide additional functional benefit; however, the post-test between-group comparisons for quadriceps and hamstrings reported in the thesis were not statistically significant, whereas the change-score analysis showed significant between-group differences. This distinction should be retained when interpreting the findings.

The study therefore supports the use of an exercise programme for TFOA and suggests that kinesiological taping may provide additional benefit when used as an adjunct. The findings should be interpreted in view of the small sample size, short intervention period, supervised treatment schedule, and exclusion of bilateral TFOA.

CONCLUSION

In this comparative study, both kinesiological taping combined with exercise and exercise alone improved pain intensity, lower-limb functional performance, and muscle strength in participants with tibiofemoral osteoarthritis. The combined intervention produced significantly greater pre-post improvements in NPRS, Sit-to-Stand Test, and MMT measures than exercise alone. Kinesiological taping may therefore be considered as an adjunct to exercise in the conservative management of TFOA, while larger studies with

longer follow-up are required to confirm the long-term effects.

6. Limitations

- The study involved a small sample size.
- The study duration was relatively short.
- Exercises were performed under supervision five times per week.
- Patients with bilateral TFOA were not included.

7. Future Scope

- Future studies should include larger samples to improve robustness and generalizability.
- Longer intervention periods and follow-up assessments are needed to examine long-term effects.
- Objective measures such as electromyography, gait analysis, or isokinetic testing may provide additional information.
- Further research into mechanisms and cost-effectiveness may inform clinical practice.

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Conflict of Interest

Not reported in the thesis.

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