DOI: 10.7860/JCDR/2026/85126.23296

Research Protocol

Orthopaedics Section

Effect of Kinesio Taping on Pain, Balance, and Spinal Posture in Lower Cross Syndrome: A Randomised Clinical Trial Research Protocol

VAISHALI RAI[1], AARUNEE SRIVASTAVA[2], CHAKSHU JOT KAUR[3], SANDEEP PATTNAIK[4]

ABSTRACT

Introduction: Lower Cross Syndrome (LCS) is one of the most common postural dysfunctions characterised by an imbalance in muscles involving tightness in the hip flexors and lumbar extensors, along with weakness in the abdominal and gluteal muscles. This often leads to anterior pelvic tilt, increased lumbar lordosis, balance impairment, and chronic lower back pain.

Need of the study: Kinesio Taping (KT) has shown potential benefits in managing pain and postural dysfunction, evidence specific to LCS remains limited and inconclusive. Therefore, a randomised clinical trial is proposed to systematically evaluate its effects on pain, balance, and spinal posture in this population.

Aim: To determine the efficacy of KT on pain intensity, impaired balance, and abnormal spinal posture in individuals suffering from LCS.

Materials and Methods: This two-arm, parallel-group, randomised clinical trial will be conducted at Maharishi Markandeshwar (Deemed to be University) from January 2025 to December 2026. Thirty-six individuals diagnosed with LCS will be divided into either the experimental group or the control group. Each group will receive a four-week conventional physiotherapy programme consisting of standardised stretching and strengthening exercises. Whereas the experimental group will also receive KT applied with 10-15% tension to the erector spinae and quadratus lumborum, while the control group will receive sham taping with 0% stretch. Outcomes will include pain intensity, balance, and posture, to be assessed using the Numeric Pain Rating Scale, Berg Balance Scale, and REEDCO Posture Assessment Scale, respectively, at baseline and post-intervention. Not-normally distributed variables will be analysed using the Mann–Whitney U test (between groups) and the Wilcoxon signed-rank test (within groups), while normally distributed variables will be analysed using independent and paired t-tests. Statistical significance will be set at $p<0.05$.

Keywords: Lordosis, Low back pain, Pain measurement, Physical therapy modalities, Posture

INTRODUCTION

LCS is a postural dysfunction characterised by muscular imbalance around the lumbopelvic region, leading to chronic lower back pain, swayback posture, and associated balance impairments [1]. It is classically described as an “S” shaped postural pattern in the lower back region, characterised by weak abdominal muscles and gluteus maximus muscle paired with tight hip flexors, including the iliopsoas and rectus femoris, along with lower back extensors, hip adductors, gastrocnemius, and soleus muscles [2]. Such a pattern is also termed as distal or pelvic crossed syndrome due to uneven distribution of muscle strength and tension around the pelvis.

Over time, such an altered recruitment pattern associated with LCS may predispose individuals to develop Low Back Pain (LBP) later. In particular, the lower fibres of erector spinae may fire first, followed by the gluteus. Consequently, the lower lumbar segments, especially L4-L5 and L5-S1 region, may become overloaded, compressed, and hypermobile. Such excessive loading of the lumbar spines and hip joints can contribute to joint stiffness, irritation, and inflammation of the joints and the surrounding soft tissues, including the intervertebral discs [1]. Epidemiologically, among 84% of individuals reporting LBP, 23% of those eventually develop chronic LBP [3] When LCS coexists with LBP, it may cause the upper body to sway more in the transverse plane at the lumbar level, making walking and gait termination more challenging. These biomechanical disturbances may also contribute to structural alterations to the connective tissues within the lower back region. As a result, the impaired sensory integration, motor control, and neurocognitive functioning may compromise balance or postural control. Additionally, kinesiophobia, anxiety related to work demands, and fear of pain are also possible complications that may further negatively influence and aggravate disability and functional limitations [4]. Moreover, altering pelvic position will have an impact on the lumbopelvic complex functioning, which leads to changes in overall posture and movement patterns. Consequently, this may result in asymmetries within the upper and lower body, as the lumbopelvic-hip complex serves as a functional link between the lower and upper extremities [5].

Considering the multifactorial nature of LCS, an integrated approach to treatment focusing on muscular dysfunction and proprioceptive control can be clinically beneficial. In recent times, Kinesio Taping (KT) has gained attention as a potential therapeutic approach to modulate muscle function, improve movement patterns, and reduce symptoms, thus becoming a prospective intervention. KT is an elastic therapeutic taping technique used primarily in rehabilitation to provide external support to the body parts while still allowing movement, thus promoting neuromuscular control. It is a technique that involves the application of a thin adhesive tape, made from a mixture of cotton and elastomeric fibre, having a backing made from heat-activated acrylic, designed to be lightweight and breathable. It is applied with a controlled tension along the tape while positioning the muscle to be taped in a stretched state [6]. Similarly, Sahin HB et al., have investigated the effectiveness of KT combined with therapeutic exercises across multiple musculoskeletal conditions, including carpal tunnel syndrome, where it produced significantly greater improvements in pain intensity, symptom

severity, and hand grip strength [7]. The findings of the study on rotator cuff tendinopathy demonstrated a significant decrease in pain and disability [8]. Likewise, a sham-controlled trial on the knee osteoarthritis population reported significant improvements in pain severity, joint stiffness, and overall ability to perform activities of daily living following three days of KT compared to both sham and no-taping controls [9].

Kinesiology taping has the potential to not only facilitate muscle activation/relaxation but also restore a balance in muscle strength and lumbopelvic alignment within patients with lumbar spine conditions.

REVIEW OF LITERATURE

Literature suggests that KT is effective as an adjunct for the management of chronic LBP, especially when applied to improve range of motion, motor control, and level of muscular endurance [10]. There are several studies that evaluated its effectiveness on different outcomes, such as pain, posture, coordination, and balance in patients suffering from LBP.

Opara JA et al., evaluated the effectiveness of KT on posture, balance, gait, coordination, and pain in patients with chronic LBP. In the experimental group, KT was applied over the lumbar spine (L1–L5) versus balance control training using visual feedback in the control group for three weeks and the study concluded that KT is an effective adjunct treatment for improving all the outcomes in patients with chronic LBP. The limitation of the study was a small sample size, short follow-up, and the absence of a sham taping group [11].

Another study conducted by Castro-Sánches AM et al., investigated the effectiveness of KT in individuals with chronic non-specific LBP. In the experimental group, KT was employed over the lumbar spine, while the control group received a sham tape application for seven days. In this study, KT was found to produce small short-term improvements in pain, disability, and trunk muscle endurance in chronic non-specific LBP patients. The limitation of the study was the short duration of intervention, lack of long-term follow-up, and exclusion of combined physiotherapy approaches [12].

Likewise, Usunkulaoğlu A et al., conducted a study to determine the effectiveness of KT compared with sham taping in individuals with chronic non-specific LBP. KT was applied six times at three-day intervals over 15 days in the experimental group, while the control group received sham taping as well as a home-based exercise program for both groups. The conclusion of the study was that KT provided significant short-term benefits in pain, range of motion, and disability. Long-term benefits were observed only for range of motion and disability. It also had some of the limitation like the absence of an exercise-only group, and the young and narrow age group of participants limits its generalisability [13].

Lastly, a study conducted by Bernardelli RS et al., investigated the effects of KT on postural balance in patients with chronic LBP. In the experimental group KT was administered to the lumbar region using muscle relaxation and space-opening techniques, whereas no intervention was given in the control group. The study concluded that KT improves postural balance. This study had some limitations like absence of pain outcome measures and lack of a sham taping [14].

Since LCS is characterised by long-term LBP, muscular imbalance, impaired balance, and abnormal positioning of the spine; KT has tremendous potential for such patients. Nevertheless, although KT has been suggested to be useful in the management of some symptoms of LCS, the actual literature investigating the impact of KT in patients who are diagnosed with LCS is still limited and not sufficiently investigated. Therefore, the present study aims to evaluate the efficacy of KT on pain, balance, and abnormal spinal posture in individuals with LCS, while also comparing its outcomes with the sham taping approach.

Primary objectives:

- To evaluate the effectiveness of KT combined with conventional physiotherapy on pain intensity, balance, and abnormal spinal posture in individuals with LCS.
- To evaluate the effectiveness of sham taping combined with conventional physiotherapy on pain intensity, balance, and abnormal spinal posture in individuals with LCS.

Secondary objectives:

- To compare the effectiveness of KT combined with conventional physiotherapy versus sham taping combined with conventional physiotherapy on pain intensity, balance and on abnormal spinal posture in individuals with LCS.

Null Hypothesis (H_0): Individuals with LCS who receive KT combined with conventional physiotherapy will show no significant difference in pain intensity, balance, or spinal posture compared to those receiving sham taping combined with conventional physiotherapy.

Alternate Hypothesis (H_1): Individuals with LCS who receive KT combined with conventional physiotherapy will show a significant difference in pain intensity, balance, and spinal posture compared to those receiving sham taping combined with conventional physiotherapy.

MATERIALS AND METHODS

A two-arm, parallel-group, randomised clinical trial will be conducted at Maharishi Markandeshwar (Deemed to be University) from January 2025 to December 2026. The current proposed study has been approved by the Institutional Ethics Committee of Maharishi Markandeshwar University with the ethical number IEC-3089. Furthermore, the trial has also been prospectively registered with the Clinical Trial Registry-India (CTRI) and assigned registration ID CTRI/2025/04/085291. Informed consent of the patient will be obtained before commencing of the study.

Inclusion criteria:

- Participants aged between 20-50 years of age;
- Both male and female participants;
- Participants diagnosed by LCS;
- Participants with pain intensity of 4 or higher on the Numeric Pain Rating Scale (NPRS);
- Participants willing to participate in the study.

Exclusion criteria:

- Individuals with skin infections or fragile or broken skin over the lower back region.
- Individuals with acute injuries in the lower back.
- Individuals allergic to the tape.
- Individuals with LBP attributed to non-specific causes, and specific causes such as prolapsed intervertebral disc, spondylolisthesis, or spondylosis, etc.
- Individuals with impaired cognitive function.

Sample size: The sample size was calculated using G*Power software (Version 3.1.9.7), using the test family 't tests,' and statistical test 'Means: Difference between two independent means (two groups)', based on the effect size (Cohen's d) from the pilot study findings with a sample of 24 participants, 12 in each group, using a two-tailed α level of 0.05 and a power of 80%. The effect size was derived using the mean difference between groups and the pooled standard deviation, based on the formula:

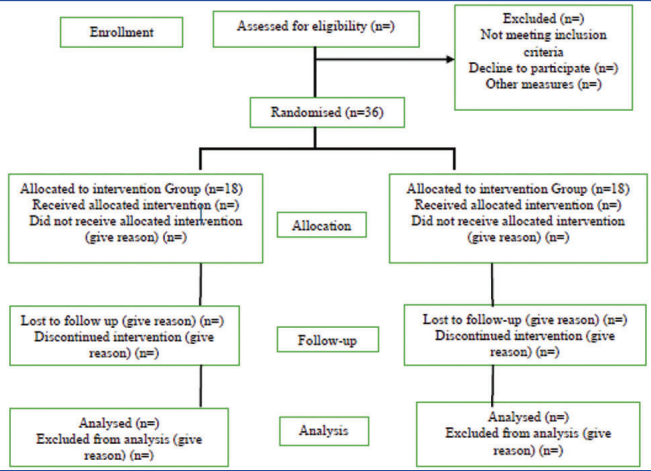
$$d=\frac{M1-M2}{SD\ pooled}$$

d=Cohen's d
M1=Mean of Group 1
M2=Mean of Group 2
SD=Standard Deviation

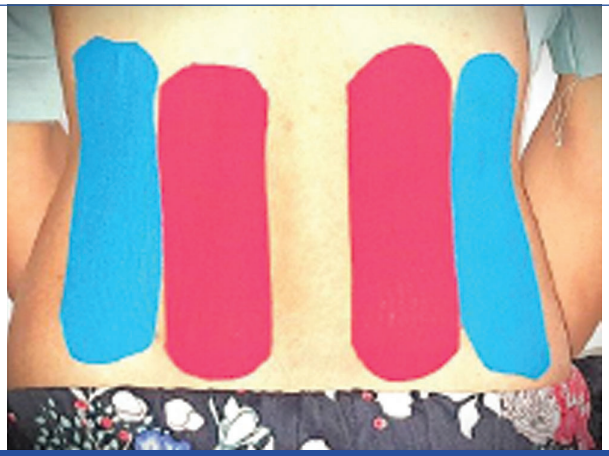
The findings of the pilot study and calculated sample size are as following:

Pain intensity measured using NPRS showed values of 2.58±0.66 in Group-1 and 4.58±0.79 in Group-2, with an effect size of 2.74 and a required sample size of eight. Since the observed sample size following the calculation was very small, a total of 36 participants based on convenience sampling is planned for inclusion to maintain consistency and ensure methodological validity. The participants enrolled in the pilot study will not be included in the final study.

Participants reporting to the department with LBP will be screened and assessed for the diagnosis of LCS. Once LCS is diagnosed and confirmed, individuals who meet the study's eligibility criteria will be informed about the study and asked to sign a consent form. Eligible participants will then be randomised to either the experimental group or control group [Table/Fig-1], with equal distribution (1:1). A simple randomisation sequence will be generated using a computer-based randomisation method through the software Research Randomiser (version 4.0). Allocation concealment will be maintained through the use of sequentially numbered, sealed, opaque envelopes. These envelopes will be prepared by an independent person not involved in participant recruitment or assessment and will be opened only after participant enrolment. Randomisation sequence generation, participant enrolment, and determination of the timing of randomisation will be carried out by one of the authors (CJK). Both groups will participate in a four-week physiotherapy program of 12 sessions of standardised stretching and strengthening exercises. In addition, the experimental group will receive KT, while the control group will receive sham taping [Table/Fig-2,3]. Data analysis will be performed after completion of 12 sessions over four weeks. Outcome assessments will be conducted by an Independent Assessor (AS) who will remain blinded to the group allocation and intervention procedures to minimise assessment bias. [Table/Fig-4] presents the study timeline and assessment schedule.



[Table/Fig-1]: CONSORT flow diagram.



[Table/Fig-2]: Kinesio Taping with 10-15% stretch.

Group	Exercise Protocol	Taping Protocol	Duration
Experimental Group	Stretching: Leg gathers, rectus femoris, psoas, piriformis stretches (3 sets ×8 repetitions) Strengthening: Side-lying clam shells, hip abduction, cat-cow, top-to-floor exercises (3 sets ×8 repetitions)	Kinesio Taping applied to erector spinae and quadratus lumborum with 10-15% stretch towards muscle origin; applied three times weekly and removed after one day.	4 weeks (12 physiotherapy sessions)
Control Group	Same stretching and strengthening exercises (3 sets×8 repetitions)	Sham tape applied to same muscles with 0% stretch; applied 3 times weekly and removed after 1 day.	4 weeks (12 physiotherapy sessions)

[Table/Fig-3]: Details of the intervention protocol for both study groups.

Study period / Items	Enrollment	Allocation	Post-allocation		Close-out
Time point*	**-T1**	**T0**	**T1**	**T2**	
Enrollment:					
Eligibility screen	×				
Informed consent	×				
Medical history	×				
Allocation		×			
Intervention:					
Experimental group			→	→	
Control group			→	→	
Assessment:					
Demographic characteristics	×				
NPRS			×	×	
REEDCO posture assessment scale			×	×	
Berg balance scale			×	×	

[Table/Fig-4]: Study timeline and assessment schedule.
SPIRIT Checklist: T1: Pre-intervention; T2: Post-intervention
NPRS: Numeric pain rating scale;
REEDCO Posture assessment scale;
BBS: Berg balance scale

Outcomes:

1. Numeric pain rating scale:

The NPRS is a widely used pain intensity assessment tool on an 11-point scale from 0 (no pain) to 10 (worst pain). It demonstrates good reliability with test-retest correlations ranging from r=0.79 to r=0.96, indicating its consistency across measurements. Additionally, the NPRS shows validity in measuring perceived pain, making it effective for clinical use in various patient populations.

2. REEDCO posture assessment scale:

The REEDCO Posture Assessment Scale is a tool used to evaluate postural deviations systematically from head to toe. It has demonstrated high reliability, with inter-rater reliability coefficients ranging from 0.899 to 0.915 and test-retest reliability values between 0.81 and 0.95. The scale also shows good validity, correlating well with other established postural assessment methods, making it effective for clinical evaluations [15].

3. Berg balance scale:

The BBS demonstrates excellent inter-rater and intra-rater reliability, with Intraclass Correlation Coefficients (ICCs) typically ranging from 0.97 to 0.98 for both inter-rater and intra-rater reliability. Test-retest reliability is also high, with ICCs reported between 0.886 and 0.945 in older adults in nursing homes, and 0.98 in people with hemiparesis. The BBS has demonstrated strong content validity, established through expert consensus during its development. Its construct validity is evidenced by strong item-to-total correlations ($r > 0.4$ for most items) [16].

These outcomes will be recorded at baseline (immediately before the first intervention session) and post-intervention (after the completion of 12 treatment sessions). Secondary data will be recorded for each participant following every session of intervention, and in cases of participant dropout, the last data recorded will be considered as final data, so that it can be used for intention-to-treat analysis if needed. No follow-up assessment will be conducted beyond the post-intervention evaluation.

STATISTICAL ANALYSIS

Statistical analysis will be performed using SPSS software version 26. To assess data normality, the Shapiro-Wilk test will be employed. If data is observed to be normally distributed, parametric tests (independent t-tests for between-group comparisons and paired t-tests for within-group comparisons) will be used. For non-normal data, non-parametric tests (Mann-Whitney U test for between-group comparisons and Wilcoxon signed-rank test for within-group comparisons) will be applied. A p-value of <0.05 will be considered statistically significant.

The study will follow the Standard Protocol Items: Recommendation for Interventional Trials (SPIRIT) guidelines.

REFERENCES

[1] Naga DN, Sahari S, Bukry SA. Motor control on gait performance among individuals with lower crossed syndrome: A scoping review. Med J Malaysia. 2024;79:169. PMID: 38555902.

[2] Mehta TB, Sharma A. Lower cross syndrome: Specific treatment protocol versus generalised treatment protocol. A randomised single-blinded trial. Folia Medica. 2024;66(5):662-72. Available from: https://doi.org/10.3897/folmed.66.e135838.

[3] Burile G, Phansopkar P, Deshmukh NS. Prevalence of lower cross syndrome in housemaids. Cureus. 2024;16(4):01-09. Available from: https://doi:10.7759/cureus.57425.

[4] Haddas R, Sandu CD, Mar D, Block A, Lieberman I. Lumbar decompression and interbody fusion improves gait performance, pain, and psychosocial factors of patients with degenerative lumbar spondylolisthesis. Global Spine J. 2021;11(4):472-79. Available from: https://doi.org/10.1177/2192568220911044.

[5] Puagprakong P, Kanjanasilanont A, Sornkaew K, Brady WS. The effects of lower crossed syndrome on upper body posture during sitting in female office workers. Muscles Ligaments Tendons J. 2022;12(4). Available from: https://doi.org/10.1142/S1013702525500039.

[6] Wu WT, Hong CS, Chou LW. The kinesio taping method for myofascial pain control. Evid Based Complement Alternat Med. 2015;2015(1):950519. Available from: https://doi.org/10.1155/2015/950519.

[7] Sahin HB, Kara F, Cakir E, Akkaya GS. Effects of kinesio taping in carpal tunnel syndrome treatment: A randomised controlled trial. Med Bull Haseki. 2025. Doi: 10.4274/haseki.galenos.2025.69885.

[8] Taik FS, Karkouri S, Tahiri L, Aachari I, Moulay Berkchi J, Hmamouchi I, et al. Effects of kinesiotaping on disability and pain in patients with rotator cuff tendinopathy: Double-blind randomised clinical trial. BMC Musculoskelet Disord. 2022;23(1):90. Doi: 10.1186/s12891-022-05046-w.

[9] Rahlf,AL, Braumann K, Sech A. (n.d.). Kinesio taping improves perceptions of pain and function of patients with knee osteoarthritis: A randomised, controlled trial. J Sport Rehabil. 2019;28(5):481-87. Doi: 10.1123/jsr.2017-0306.

[10] Nelson NL. Kinesio taping for chronic low back pain: A systematic review. J Bodyw Mov Ther. 2016;20(3):672-81. Doi: 10.1016/j.jbmt.2016.04.018.

[11] Opara JA, Fiałkowski T. The effect of kinesiology taping on posture, balance, and gait in patients suffering from low back pain. Diagnostics. 2024;14(22):2506. Doi: 10.3390/diagnostics14222506.

[12] Castro-Sánches AM, Lara-Palomo IC, Matarán-Peñarrocha GA, Fernándes-Sánches M, Sánches-Labraca N, Arroyo-Morales M. Kinesio Taping reduces disability and pain slightly in chronic non-specific low back pain: A randomised trial. J Physiother. 2012;58(2):89-95. Doi: 10.1016/S1836-9553(12)70088-7.

[13] Usunkulaoğlu A, Aytekin MG, Ay S, Ergin S. The effectiveness of Kinesio taping on pain and clinical features in chronic non-specific low back pain: A randomised controlled clinical trial. Turk J Phys Med Rehabil. 2018;64(2):126-32. Doi: 10.5606/tftrd.2018.1896.

[14] Bernardelli RS, Scheeren EM, Fuentes Filho AR, Pereira PA, Gariba MA, Moser ADL, Bichinho GL. Effects of kinesio taping on postural balance in patients with low back pain: A randomised controlled trial. J Bodyw Mov Ther. 2019;23(3):508–514. Doi: 10.1016/j.jbmt.2019.01.002.

[15] Vongsirinavarat M, Jitmal R, Nuntapornsak A. The interrater reliability of REEDCO posture score among thai healthy adolescents. Iran Rehabil J. 2025;23(2):201–208. Doi: 10.32598/irj.23.2.2232.1.

[16] Viveiro LA, Gomes GC, Bacha JM, Junior NC, Kallas ME, Reis M, et al. Reliability, validity, and ability to identity fall status of the Berg Balance Scale, Balance Evaluation Systems Test (BESTest), Mini-BESTest, and Brief BESTest in older adults who live in nursing homes. J Geriatr Phys Ther. 2019;42(4):E45-E54. Doi: 10.1519/JPT.0000000000000215.

PARTICULARS OF CONTRIBUTORS:

1. Postgraduate Scholar, Department of Physiotherapy (Orthopaedics), Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Mullana, Ambala, Haryana, India.
2. Postgraduate Scholar, Department of Physiotherapy (Orthopaedics), Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Mullana, Ambala, Haryana, India.
3. Postgraduate Scholar, Department of Physiotherapy (Orthopaedics), Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Mullana, Ambala, Haryana, India.
4. Assistant Professor, Department of Physiotherapy (Orthopaedics), Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Mullana, Ambala, Haryana, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Sandeep Pattnaik,
Assistant Professor, Department of Physiotherapy (Orthopaedics), Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Mullana, Ambala-133207, Haryana, India.
E-mail: physiosandeep94@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]

- Plagiarism X-checker: Nov 01, 2025
- Manual Googling: Feb 17, 2026
- iThenticate Software: Feb 19, 2026 (2%)

ETYMOLOGY: Author Origin

EMENDATIONS: 6

AUTHOR DECLARATION:

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Oct 30, 2025**
Date of Peer Review: **Jan 06, 2026**
Date of Acceptance: **Feb 21, 2026**
Date of Publishing: **May 01, 2026**