



COMPARATIVE EFFECTIVENESS OF KINESIO TAPING AND LOW-DYE TAPING FOR PLANTAR FASCIITIS: A TWO-WEEK RANDOMIZED TRIAL

Meraj Nabi Siddiqui

Assistant Professor, Department of Physiotherapy, Vinoba Bhave University

ABSTRACT

Background: Plantar fasciitis (PF) is a prevalent source of heel pain linked to mechanical overload and faulty foot biomechanics. Taping is commonly used to offload the plantar fascia, yet head-to-head evidence comparing Kinesio taping (KT) with Low-Dye taping (LDT) is limited.

Objective: To compare short-term effects of KT and LDT—each combined with iontophoresis and stretching—on pain, stiffness, and function in adults with PF.

Methods: Forty-five participants (21–60 years; 14 females/31 males) meeting standard PF criteria were randomized into three groups ($n=15/\text{group}$): KT, LDT or control. All groups received 12 sessions over two weeks (6/week). KT and LDT groups received taping plus acetic-acid iontophoresis (40 mA·min, up to 4 mA) and plantar fascia/calf stretching; controls received iontophoresis + stretching only. Outcomes were Patient-Specific Functional Scale (PSFS), Visual Analogue Scale (VAS) for pain, VAS morning stiffness (MS) and VAS residual stiffness (RS) recorded at baseline, 1 week and 2 weeks. Statistics: paired t-tests, one-way ANOVA with post-hoc comparisons ($\alpha=0.05$).

Results: All groups improved significantly within-group on most outcomes over 2 weeks ($p \leq 0.05$). Between-group ANOVA showed significant differences favouring taping groups for PSFS at 2 weeks ($F=6.67$, $p=0.03$) and VAS-pain at 1 week ($F=14.83$, $p<0.001$) and 2 weeks ($F=13.05$, $p<0.001$). Between-group differences were not significant for MS at 2 weeks ($p=0.12$) or RS at 2 weeks ($p=0.34$). Post-hoc analyses indicated $\text{KT} \approx \text{LDT}$ (no significant difference) while each outperformed control on pain and function. Minor tape-related skin irritation occurred in a few participants.

Conclusion: Over two weeks both KT and LDT—when combined with iontophoresis and stretching—yield superior short-term improvements in pain and function versus iontophoresis + stretching alone. KT and LDT were clinically comparable in this timeframe.

KEYWORDS: Plantar Fasciitis, Plantar Fascia, Kinesio Taping, Low-Dye Taping, Iontophoresis, Stretching

INTRODUCTION

Plantar fasciitis (PF) is among the most common causes of adult heel pain, typically localized near the medial calcaneal tubercle where the plantar fascia originates. Repetitive micro-tearing and degenerative changes, often driven by biomechanical faults (e.g., pes planus, pes cavus, over-pronation, limb length discrepancy, excessive tibial torsion/femoral anteversion), contribute to symptoms that are classically worst with first steps in the morning and may lessen with activity before worsening again with prolonged loading.

Conservative care spans load modification, cryotherapy, NSAIDs, plantar fascia and calf stretching, intrinsic foot strengthening, heel pads/orthoses, ultrasound/phonophoresis, iontophoresis, night splints and extracorporeal shock wave therapy—with variable evidence. Taping strategies seek to support the medial longitudinal arch, reduce tensile load on the fascia and optimize foot mechanics. Low-Dye taping (LDT) can elevate the arch and reduce pronation; Kinesio taping (KT) aims to modulate muscle tone, pain, and alignment while permitting

motion. Despite widespread clinical use, direct comparisons of KT and LDT for PF are scarce. This trial addresses that gap.

METHODS

Study Design

Single-center, three-arm, parallel-group, randomized experimental study with repeated measures at baseline (Day 0), Week 1 (\approx Day 6), and Week 2 (\approx Day 12). Allocation ratio 1:1:1. Analysis was conducted on an intention-to-treat basis with a per-protocol sensitivity analysis.

Participants

Eligibility Criteria

Inclusion

1. Age 18–65 years.
2. Pain at the heel or plantar mid-foot consistent with plantar fasciitis (PF) defined as:
 - pain at first steps on awakening, and
 - pain with walking or jogging.
3. VAS pain $> 5/10$ during the first few minutes of walking

in the morning.

4. Symptom duration > 6 months (chronic PF).

Exclusion

1. Foot/ankle surgery or PF treatment (including anti-inflammatory medications) in the last 6 months.
2. Prior fracture of the ankle or foot.
3. Clubfoot.
4. Diabetes mellitus.
5. Assistive device required for ambulation.
6. Bilateral plantar heel pain.
7. Pregnancy.
8. Local/systemic infection.
9. Neurological abnormalities affecting lower-limb function.

Recruitment and Screening

Potential participants were pre-screened by outpatient physiotherapists and sports medicine clinicians. A standardized screening form documented demographics, history, inclusion/exclusion checks and baseline VAS (morning first-step). Eligible volunteers underwent informed consent and baseline testing.

Sample Size

A pragmatic target of N=45 (n=15/group) was set based on site throughput and resources. (Note: for future replication, an a priori power analysis for a 3×3 mixed design with $\alpha=0.05$ and power=0.80 detecting a moderate group×time interaction would typically yield ~12–18 participants per arm depending on assumed correlation and effect sizes; our n=15/group is within that range.)

Randomization, Allocation Concealment, and Blinding

- Sequence generation: computer-generated permuted blocks (sizes 3 and 6) in a 1:1:1 ratio.
- Concealment: sequentially numbered, opaque, sealed envelopes prepared by an independent administrator.
- Blinding: Due to visible taping, participant and treating therapist blinding was not feasible. Outcome assessors and the statistician were blinded to group assignment. Participants were instructed not to reveal their allocation during assessments.

Interventions

All participants received 12 sessions over two weeks (6 sessions/week on alternating days). Participants maintained usual daily activities but were asked to avoid new treatments (e.g., orthoses, night splints, oral analgesics/NSAIDs) for the study duration.

Common Co-interventions (All Groups)

1. Acetic-acid iontophoresis applied to the most tender plantar region:
 - Dose: 40 mA·min; current: up to 4 mA; duration: ~10 min/session.
 - Electrode placement: active (negative) electrode over maximal tenderness; dispersive electrode proximal along the plantar surface or lower leg as per device manual.

- Solution: clinical-grade acetic acid (per site pharmacy protocol).
 - Device: Phyaction unit (Model 323 254) with regular safety checks (see Instrumentation/Calibration).
2. Stretching program (home and reinforced in clinic):
 - Plantar fascia stretch: seated, ankle dorsiflexed, hallux and toes dorsiflexed; hold 30–60 s; 2 sets, twice daily.
 - Gastrocnemius/Soleus stretch: standing wall stretch (knee extended for gastrocnemius; knee flexed for soleus); hold 30–60 s; 2 sets each, twice daily.
 - A printed handout with pictures and dosage was provided; adherence recorded in a log.

Experimental Group 1: Kinesio Taping (KT) + Common Co-interventions

- Tape: Kinesio Tex Gold (5 cm × 5 m), hypoallergenic cotton with ~130–140% extensibility.
- Application (by a certified physiotherapist):
 1. Gastrocnemius (Y-strip): anchor at Achilles insertion; two tails to medial and lateral heads; ~133% stretch mid-tape; no tension on anchors/ends.
 2. Plantar fascia (palm/“fan” split): anchor at posterior calcaneus; four tails to metatarsal heads 1–5; ~133% stretch mid-segments; no tension at ends.
- Wear schedule: continuous support; reapplied each session; skin inspected prior to re-taping.



Experimental Group 2: Low-Dye Taping (LDT) + Common Co-interventions

- Tape: Zinc-oxide adhesive athletic tape (non-elastic).
- Application sequence:



1. Arch wrap: from dorso-lateral 5th MTPJ → around heel (avoid fat pad) → medial border → end at dorso-medial 1st MTPJ (×2 layers).
 2. Oblique locks: from plantar medial forefoot → diagonally under calcaneo-cuboid → around heel → diagonally plantar lateral → end proximal to 5th MTPJ (×2 layers).
 3. Stirrups/transverse straps: overlapping strips across plantar surface from malleolar level to MTPJs.
 4. Forefoot dorsal securing strap to prevent tape “bursting” and tension loss.
- Wear schedule: continuous support; reapplied each session with skin checks.

Control Group: Common Co-interventions Only

- Acetic-acid iontophoresis and stretching as above; no taping.

Procedures

Baseline Visit (Day 0)

1. Consent and eligibility reconfirmed; medical history documented.
2. Anthropometry: weight, height, BMI.
3. Side and site marking of maximal tenderness.
4. Outcomes collected:
 - VAS pain (during activity; 0=no pain, 10=worst imaginable).
 - VAS morning stiffness (first steps after waking).
 - VAS residual stiffness (stiffness remaining after “warming up”).
 - PSFS: participants list three important activities limited by PF; each rated 0–10 (0=unable; 10=pre-morbid). Average PSFS score recorded. Standardized script ensures consistent instructions.
5. Randomization and first treatment session as per group

Treatment Visits (Sessions 2–12)

- Pre-session checks: skin integrity, adverse events (AEs), adherence to home program, co-interventions.
- Treatments: iontophoresis; stretches (taught/supervised); taping (KT or LDT) per allocation.
- Documentation: current intensity, electrode positions, total dose, tape pattern, wear tolerance.

Reassessments

- Week 1 (~Day 6) and Week 2 (~Day 12): VAS (pain, morning stiffness, residual stiffness) and PSFS repeated by a blinded assessor using the same script and anchors.

Outcomes

Primary Outcome

- Pain (VAS, 0–10) during functional activity.

Secondary Outcomes

- Function (PSFS, 0–10 average) of three patient-selected tasks.
- Morning stiffness (VAS, 0–10).
- Residual stiffness (VAS, 0–10).

Statistical Analysis Plan

General Approach

- Analyses performed using SPSS v16 (or equivalent).
- $\alpha=0.05$ (two-tailed).
- Assumptions checked (normality, homogeneity). Transformations considered if violated; if unresolved, robust or nonparametric alternatives used.

Primary Analysis (Preferred)

- Two-way mixed ANOVA / linear mixed-effects model with Group (KT, LDT, Control) as between-subjects factor and Time (Baseline, Week 1, Week 2) as within-subjects factor, including Group×Time interaction.
- Post-hoc pairwise comparisons with correction (e.g., Bonferroni) at each timepoint and for change scores.

Secondary/Supporting Analyses (Reflecting Original Plan)

- Within-group change: paired t-tests (Baseline→Week 1, Baseline→Week 2, Week 1→Week 2).
- Between-group differences at each timepoint: one-way ANOVA with post-hoc tests.

Covariates and Exploratory Analyses

- BMI and age explored as covariates if baseline imbalance is present.
- Side (left/right) and sex explored descriptively.

RESULTS

Participants

N=45 (14 females, 31 males). Mean (\pm SD) BMI: KT 25.98 \pm 3.27, LDT 26.36 \pm 2.95, Control 24.53 \pm 4.63; groups differed on BMI at baseline. Other characteristics were broadly comparable.

Primary Findings

- Function (PSFS):
 - Between groups: NS at baseline; significant at 1 week ($p=0.05$) and 2 weeks ($F=6.67$, $p=0.03$), favoring taping groups over control.
 - Within groups: All improved 0→2 weeks; control showed no additional gain from week 1→2 ($p=0.11$).
- Pain (VAS):
 - Between groups: NS at baseline; significant at 1 week ($F=14.83$, $p<0.001$) and 2 weeks ($F=13.05$, $p<0.001$),

favoring taping groups.

- Within groups: All improved 0→2 weeks; week 1→2 change was small/NS in LDT ($p=0.08$) and control ($p=0.06$).
- Morning stiffness (VAS-MS):
 - Between groups: significant at 1 week ($p<0.001$); NS at 2 weeks ($p=0.12$).
 - Within groups: robust 0→1 and 0→2 weeks improvements; week 1→2 change NS in KT ($p=0.06$), significant in LDT and control.
- Residual stiffness (VAS-RS):
 - Between groups: baseline difference present ($p<0.001$); NS at 1 week ($p=0.53$) and 2 weeks ($p=0.34$).
 - Within groups: all groups improved significantly across all intervals ($p<0.001$).

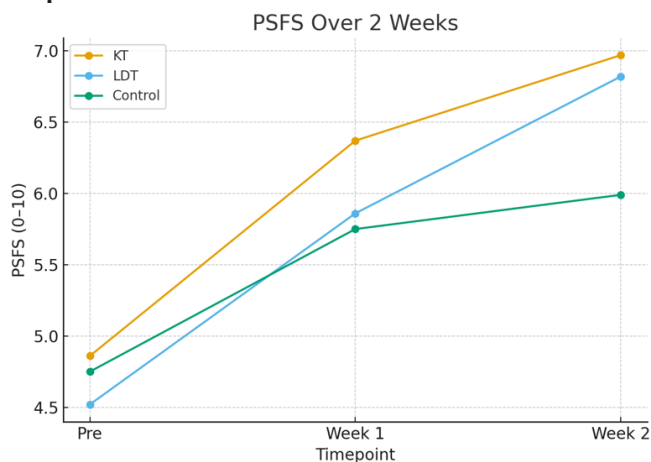
Post-hoc Summary (2 weeks)

- KT vs LDT: no significant differences across outcomes (e.g., VAS pain $p\approx 0.98$; PSFS $p\approx 0.85$).
- Each vs Control: significant advantages for pain and function (e.g., KT vs Control and LDT vs Control, $p\leq 0.04$ for PSFS; $p<0.001$ for VAS pain).

Adverse Effects

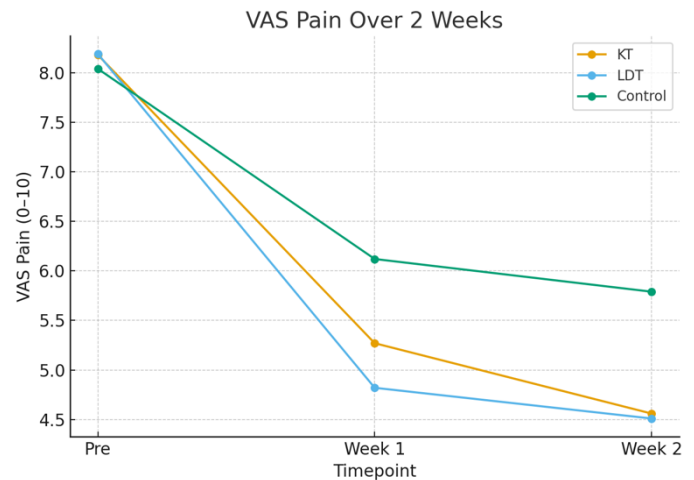
Minor skin irritation/dryness in a few participants; two discontinued due to sensitivity to adhesive tape

Graphs



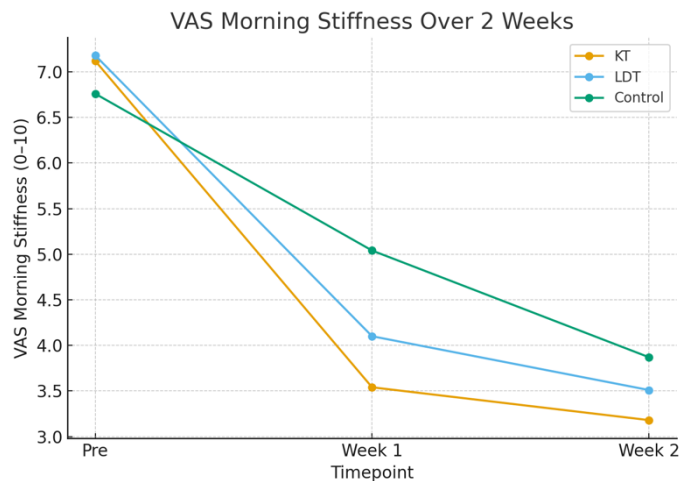
1. PSFS Over 2 Weeks (Function)

- All groups improved from baseline to Week 2.
- KT and LDT improved more than Control; KT is highest at Week 2 LDT close behind.
- Control shows a small plateau from Week 1→2 matching the stats (no extra gain).



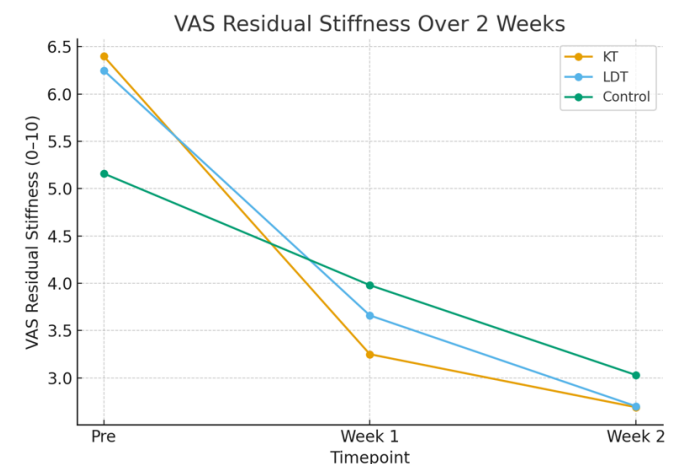
2. VAS Pain Over 2 Weeks

- Pain drops sharply for KT and LDT by Week 1; Control improves but less.
- By Week 2, KT \approx LDT (lowest pain, almost identical) and both clearly beat Control—this mirrors the significant ANOVA and post-hoc.



3. VAS Morning Stiffness Over 2 Weeks

- Big early drop in all groups (especially KT by Week 1).
- By Week 2 scores converge (KT \approx LDT \approx Control ~ 3 –3.9) so between-group differences are small/non-significant.



4. VAS Residual Stiffness Over 2 Weeks

- Strong reductions in all three groups from baseline.
- Convergence at Week 2 (~2.7–3.0) means no meaningful differences between groups, despite a baseline mismatch.

DISCUSSION

This randomized trial compared Kinesio taping (KT) and Low-Dye taping (LDT)—each combined with iontophoresis and stretching—against iontophoresis + stretching alone in chronic plantar fasciitis.

Main findings. Both taping groups produced greater short-term improvements in pain (VAS) and function (PSFS) than control at 1 and 2 weeks, with no meaningful difference between KT and LDT. All groups improved in morning and residual stiffness, and by Week 2 the between-group differences in stiffness were not significant. Within-group patterns mirrored this: the control group plateaued on PSFS from Week 1→2; LDT showed little additional pain change from Week 1→2; KT showed little additional morning stiffness change from Week 1→2 while residual stiffness improved in all groups.

Interpretation. PF reflects abnormal loading of the plantar fascia from altered foot biomechanics (e.g., pes planus with excess pronation or pes cavus with reduced shock absorption). LDT likely reduced fascial strain by supporting the medial longitudinal arch and limiting pronation, redistributing plantar pressures. KT likely provided elastic, dynamic support and proprioceptive input that reduced tensile load on the fascia/Achilles complex without restricting motion. These different mechanisms led to clinically comparable outcomes over two weeks.

Role of co-interventions. Significant improvement in the control arm indicates meaningful effects of acetic-acid iontophoresis plus targeted stretching. Iontophoresis may aid symptom relief by facilitating removal of irritant deposits and modulating local tissue chemistry, while stretching improves flexibility and reduces fascial tension. The combination with taping plausibly offers additive benefits.

Safety. Minor tape-related skin reactions occurred; two participants discontinued because of irritation. Routine skin checks and, when needed, hypoallergenic underwrap are advisable.

Clinical implications. For short-term management of chronic PF clinicians may choose either KT or LDT alongside stretching (and iontophoresis where appropriate) guided by patient preference, skin tolerance, activity needs, cost, and therapist expertise, rather than expecting one taping method to outperform the other within two weeks. Longer follow-up studies with broader functional measures could clarify durability and subgroup responses.

Key Findings

After one and two weeks of intervention, all three groups—including the control group (iontophoresis + stretching only)—demonstrated statistically significant improvements in PSFS,

VAS pain, VAS morning stiffness and VAS residual stiffness. However between-group analysis revealed that the most consistent and clinically relevant improvements were observed in both taping groups compared with the control group.

For the PSFS no significant change was noted in the control group between week 1 and week 2 whereas the KT and LDT groups showed continuous improvements. In the KT group, significant reductions were observed across all outcome variables although no significant difference was found between week 1 and week 2 for morning stiffness. Residual stiffness, however, improved significantly which aligns with previous findings where Kinesio taping combined with electrotherapy modalities (such as TENS and ultrasound) produced better short-term outcomes compared to electrotherapy alone.

Biomechanical Rationale

The underlying pathophysiology of plantar fasciitis is largely biomechanical. Excessive load on the plantar fascia either due to pes cavus (high arches) or pes planus (flat feet) alters normal foot biomechanics and increases strain at the fascial origin.

- In pes cavus the rigid high arch reduces the ability of the foot to absorb ground reaction forces thereby increasing tensile stress on the plantar fascia, calf muscles, and Achilles tendon.
- In pes planus, ligamentous laxity leads to excessive motion and poor arch stability causing overstretching of the plantar fascia during gait.

Application of KT on the plantar fascia and gastrocnemius muscles appears to reduce the pulling force on these structures thereby decreasing strain preventing overuse and facilitating tissue repair. This mechanism explains the observed clinical improvements in the KT group.

Effects of Low-Dye Taping

The LDT group showed significant improvements in PSFS and stiffness but failed to demonstrate significant pain reduction between week 1 and week 2. The likely benefit of LDT lies in its mechanical action of supporting the medial longitudinal arch, thereby offloading the plantar fascia during weight bearing. This reduces abnormal stress and promotes healing.

Previous studies also reported that LDT provided small but notable improvements in “first-step pain” compared to sham interventions, though the differences were not always statistically significant. A notable clinical trial by Osborne and colleagues showed that combining acetic-acid iontophoresis with LDT was more effective than dexamethasone iontophoresis plus LDT for short-term pain and stiffness relief. They further suggested that extending such treatment protocols over four weeks could enhance therapeutic benefits.

Adverse Events

A potential drawback of prolonged LDT use is skin irritation or breakdown. In this study two female participants discontinued due to skin sensitivity and three other participants reported dryness or discoloration at the end of treatment. This highlights the importance of monitoring tape-related adverse effects in clinical settings.

Role of Iontophoresis and Stretching

Iontophoresis was incorporated across all groups and has been widely validated for soft tissue pathologies such as tennis elbow and tendinitis. In this study the control group (iontophoresis + stretching only) demonstrated significant short-term improvements though less than those observed with taping. The mechanism of action is attributed to the increased solubility of calcium deposits and the enhanced removal of inflammatory metabolites when acetic acid is delivered trans dermally using direct current.

Stretching of the plantar fascia and calf muscles was also an essential component of all treatment arms. Previous studies have shown that stretching when combined with modalities such as phonophoresis or ultrasound yields superior results compared to stretching alone. Stretching enhances flexibility, decreases fascial and calf tightness and helps reduce mechanical loading on the plantar fascia. Our findings reinforce the value of combining stretching with adjunctive therapies.

Comparative Analysis: KT vs LDT

Although both KT and LDT improved outcomes, the difference between them was subtle. KT provides dynamic support without restricting motion, reducing tensile forces via skin-lifting effects and improved proprioception. In contrast LDT offers more rigid biomechanical support, reducing pronation and redistributing plantar pressures across the foot.

Biomechanically LDT limits forefoot hypermobility and decreases loading of the second and third metatarsals thereby reducing fascial tension. It also resists elongation of the foot during loading further offloading the plantar fascia. Meanwhile, KT maintains functionality while reducing strain making it particularly popular among athletes. Despite their different mechanisms both approaches yielded similar clinical outcomes in this trial.

CONCLUSION

Both Kinesio taping and Low-Dye taping when combined with iontophoresis and stretching were effective in improving pain, stiffness, and function in patients with plantar fasciitis. Although the biomechanical principles differ—KT emphasizing dynamic support and proprioception and LDT emphasizing structural control—the short-term outcomes of both interventions were comparable. Clinicians may therefore choose between these methods based on patient preference tape tolerance, cost and activity level.

Limitations

1. The broad age range of participants (21–60 years) may have introduced heterogeneity in responses.
2. Diagnostic confirmation relied on clinical assessment only; imaging modalities such as ultrasonography, MRI could have provided greater diagnostic accuracy.
3. The study used PSFS but did not include more comprehensive functional outcome tools such as the Foot Function Index (FFI).
4. No reliability testing was performed for biomechanical measures (e.g., calcaneal inversion/eversion angles).

5. The cost of Kinesio tape is relatively high, making continuous application over 12 sessions potentially expensive for patients in real-world clinical practice
6. Short duration (2 weeks); no medium-/long-term follow-up.
7. Imaging confirmation (USG/MRI/X-ray) not uniformly employed.

CONCLUSION

In adults with chronic plantar fasciitis, Kinesio taping and Low-Dye taping each combined with iontophoresis and stretching are superior to iontophoresis + stretching alone for short-term pain relief and functional gains. Over two weeks, KT and LDT perform similarly allowing clinicians to individualize taping choice based on context and patient factors.

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