Original Article

The Effectiveness of the Ankle Balance Taping Technique Compared to Sham Accompanied with Strengthening Leg Muscles Against Static and Dynamic Balance: A Single Blind, Randomized Control Trial

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Abstract

Introduction: *Recurrent lateral ankle ligament injuries in runners may lead to chronic ankle instability and balance impairment. Ankle Balance Taping (ABT) is a potential adjunctive intervention to improve balance function. Aim: This study aims to compare the effects of kinesio taping with Ankle Balance Taping (ABT) and Sham techniques accompanied by strengthening exercise on dynamic and static balance in runners with chronic ankle instability.*
Methods: *This single-blind randomized controlled trial included 36 male runners allocated by block randomization to the ABT group (n=19) or sham group (n=17). The intervention was given for 3 weeks. Dynamic balance was measured using the Star Excursion Balance Test (SEBT), while static balance was measured using the Stork Test. Data were analyzed using parametric or nonparametric tests according to data distribution, and effect size was calculated using Cohen's d.*
Results: *At week 3, the ABT group showed greater SEBT improvement than the sham group in the anterior (13.58±9.16 vs 1.24±1.11 cm; p<0.001; d=1.84), posteromedial (7.03±3.21 vs 4.42±4.07 cm; p=0.028; d=0.72), and posterolateral directions (10.73±7.46 vs 1.49±1.18 cm; p<0.001; d=1.68). No differences were found in the other five directions. Static balance improved in both groups without a significant between-group difference.*
Conclusion: *ABT as an adjunct to strengthening exercise provides short-term benefits mainly for dynamic balance in the anterior, posteromedial, and posterolateral directions, whereas static balance did not show superiority over sham.*

Keywords: *Ankle Balance Taping (ABT), Balance, Chronic ankle instability, Star Excursion Balance Test (SEBT), Stork Test*

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Keefektifan Teknik Ankle Balance Taping Dibandingkan Sham Disertai Latihan Penguatan Otot Kaki Terhadap Keseimbangan Statis Dan Dinamis : Uji Acak Terkontrol Tunggal

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Abstrak

Pendahuluan: *Cedera berulang ligamen lateral pergelangan kaki pada pelari dapat menyebabkan instabilitas pergelangan kaki kronis dan gangguan keseimbangan. Ankle Balance Taping (ABT) merupakan intervensi tambahan yang berpotensi memperbaiki fungsi keseimbangan.Tujuan: Membandingkan efek ABT dan sham taping, keduanya disertai latihan penguatan, terhadap keseimbangan dinamis dan statis pada pelari dengan instabilitas pergelangan kaki kronis.*
Metode: *Uji acak terkontrol tunggal ini melibatkan 36 pelari laki-laki yang dialokasikan dengan randomisasi blok ke kelompok ABT (n=19) atau sham (n=17). Intervensi diberikan selama 3 minggu. Keseimbangan dinamis diukur menggunakan Star Excursion Balance Test (SEBT), sedangkan keseimbangan statis menggunakan Stork Test. Data dianalisis dengan uji parametrik atau nonparametrik sesuai distribusi data, dan ukuran efek dihitung menggunakan Cohen's d.*
Hasil: *Pada minggu ke-3, kelompok ABT menunjukkan peningkatan SEBT lebih besar dibanding sham pada arah anterior (13,58±9,16 vs 1,24±1,11 cm; p<0,001; d=1,84), posteromedial (7,03±3,21 vs 4,42±4,07 cm; p=0,028; d=0,72), dan posterolateral (10,73±7,46 vs 1,49±1,18 cm; p<0,001; d=1,68). Tidak ada perbedaan pada lima arah lain. Keseimbangan statis membaik pada kedua kelompok tanpa perbedaan bermakna.*
Kesimpulan: *ABT sebagai tambahan latihan penguatan memberikan manfaat jangka pendek terutama pada keseimbangan dinamis arah anterior, posteromedial, dan posterolateral, sedangkan keseimbangan statis belum menunjukkan superioritas dibanding sham.*

Kata kunci: *Ankle Balance Taping (ABT), Keseimbangan, Instabilitas pergelangan kaki kronis, Star Excursion Balance Test (SEBT), Stork Test*

Introduction

Running provides substantial health benefits but is also linked to lower-extremity injuries. A systematic review reported that the ankle is among the most commonly affected anatomical regions in runners.[1] Recurrent lateral ankle sprains may progress to chronic ankle instability (CAI), a condition marked by recurrent sprains, episodes of giving way, perceived instability, and persistent functional impairment.[2]

Current models of CAI emphasize the interplay among mechanical deficits, altered sensorimotor control, reduced confidence, and activity-related constraints.[2] Clinical practice guidelines recommend structured therapeutic exercise, including strengthening, proprioceptive, balance, and neuromuscular training, as the foundation of conservative management.[3] Proprioceptive deficits are consistently observed in people with CAI and may contribute to impaired static and dynamic postural control.[4]

Kinesiology taping is often used as an adjunct to rehabilitation. Ankle Balance Taping (ABT) aims to provide cutaneous sensory stimulation and mild external support without rigidly restricting motion. Previous studies have reported immediate improvements in se-

lected balance outcomes after ABT or related taping techniques; however, effects are inconsistent and may depend on the taping method, comparator, outcome direction, and concurrent exercise.[5,6]

The Foot and Ankle Ability Measure (FAAM) has been adapted for Indonesian populations and can help identify functional limitations.[7] Nevertheless, few Indonesian studies have evaluated the additional effect of ABT compared with a sham condition while both groups continue strengthening and running. This study therefore aimed to compare the effects of kinesio taping using the ABT technique and sham taping, both accompanied by ankle-strengthening exercise, on dynamic and static balance in runners with CAI.

Methods

Study Design and Setting

A single-blind, two-group randomized controlled trial was conducted at Patriot Candrabhaga Stadium in Bekasi, Indonesia, from March to May 2019. Data analysis was conducted from June to November 2019. The single-blind design referred to participant blinding, in which participants were blinded to group allocation through the use of sham taping as the comparator intervention. Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Universitas Indonesia–Cipto Mangunkusumo Hospital (No. KET-326/UN2.F1/ETIK/PPM.00.02/2019; April 1, 2019). All participants provided written informed consent before enrollment.

Participants

Participants were recruited consecutively from the Care Each Other running community. Eligible participants were male runners aged 17–35 years with a body mass index of 18.5–24.9 kg/m², a running frequency of at least three sessions per week, a history of ankle injury, recurrent giving way, low-grade pain or swelling, mild ankle muscle weakness (manual muscle testing grade ≥4), and reduced FAAM scores (activities of daily living <90% and sport <80%). Exclusion criteria included acute ankle inflammation, neurological or visual disorders affecting balance, hip or knee pathology, restricted lower-limb joint range of motion, known allergy to kinesiology tape, or previous ankle surgery.

Allocation and Interventions

Participants were recruited consecutively from the running community and allocated to either the ABT group or the sham-taping group using block randomization. The ABT group received kinesiology tape applied using the Ankle Balance Taping technique, whereas the comparator group received sham taping. In the sham group, tape was applied using a similar shape and application direction but without stretch, in order to maintain participant blinding. Tape was replaced every 4–5 days. Both groups completed ankle and foot strengthening exercises with elastic resistance and supervised running three times per week for three weeks. Participants were instructed to continue their usual running activities. Hydrocortisone ointment was available if a local skin reaction occurred.

Outcome Measures

Balance was assessed at baseline and weekly for three weeks by a trained research assistant. Dynamic balance was evaluated using the eight-direction Star Excursion Balance Test (SEBT) in the following directions: anterior, anteromedial, medial, posteromedial, posterior, posterolateral, lateral, and anterolateral. The SEBT is a reliable and valid clinical test for assessing dynamic balance and postural control in individuals with lower-limb conditions. It has also been used to identify dynamic balance deficits and to evaluate response to rehabilitation programs.[8]

Static balance was evaluated using the Stork Test and recorded in seconds. The Stork Test is a simple clinical field test used to assess static balance through timed single-leg stance performance; therefore, standardized instructions and the same testing procedure were used across all assessment sessions to improve measurement consistency.

Baseline clinical assessment included history taking, physical examination, anterior drawer and talar tilt tests, manual muscle testing, pain assessment, and FAAM activities-of-daily-living and sport subscales. The FAAM has demonstrated validity and reliability for assessing functional limitations in individuals with foot and ankle disorders and has also been validated in athletes with chronic ankle instability.[9,10] The Indonesian version of the FAAM has also been shown to be valid and reliable for assessing functional limitation in patients with ankle instability.[7]

Sample Size and Statistical Analysis

The sample size was calculated a priori for comparison between two independent numerical outcomes. The calculation used a two-sided 5% significance level, 80% statistical power, 2.57 standard deviation, and 6.47 clinically meaningful mean difference between two groups, based on previous literature. The estimated minimum sample size was 9.49 participants per group. After allowing for an anticipated 20% drop-out rate, the minimum required sample size was rounded up to 11 participants per group, or 22 participants in total. In the present study, 36 participants were included in the final analysis, consisting of 19 participants in the ABT group and 17 participants in the sham group.

Data were analyzed using IBM SPSS Statistics version 20.0. Continuous variables were presented as mean±standard deviation, and categorical variables as counts and percentages. Baseline characteristics and between-group change scores were compared using parametric or nonparametric tests as appropriate. Within-group changes over time were also evaluated. Statistical significance was set at $p<0.05$ with 95% confidence intervals.

The main between-group analysis was based on change scores from baseline to week 3. Because outcomes were assessed repeatedly during the intervention period, interval changes were presented to describe the pattern of improvement over time. Between-group effect sizes for the primary baseline-to-week 3 change scores were calculated using Cohen's d. No formal correction for multiple comparisons was applied; therefore, p-values from multiple SEBT directions and repeated Stork Test interval comparisons were interpreted cautiously.

Results

Participant Flow

A total of 36 runners with chronic ankle instability were assessed for eligibility. No participants were excluded before randomization. All 36 participants were randomized and included in the final analysis, consisting of 19 participants in the ABT group and 17 participants in the sham-taping group. All participants received the allocated intervention. No participants were lost to follow-up or excluded from the final analysis. The participant flow diagram is presented in Figure 1.

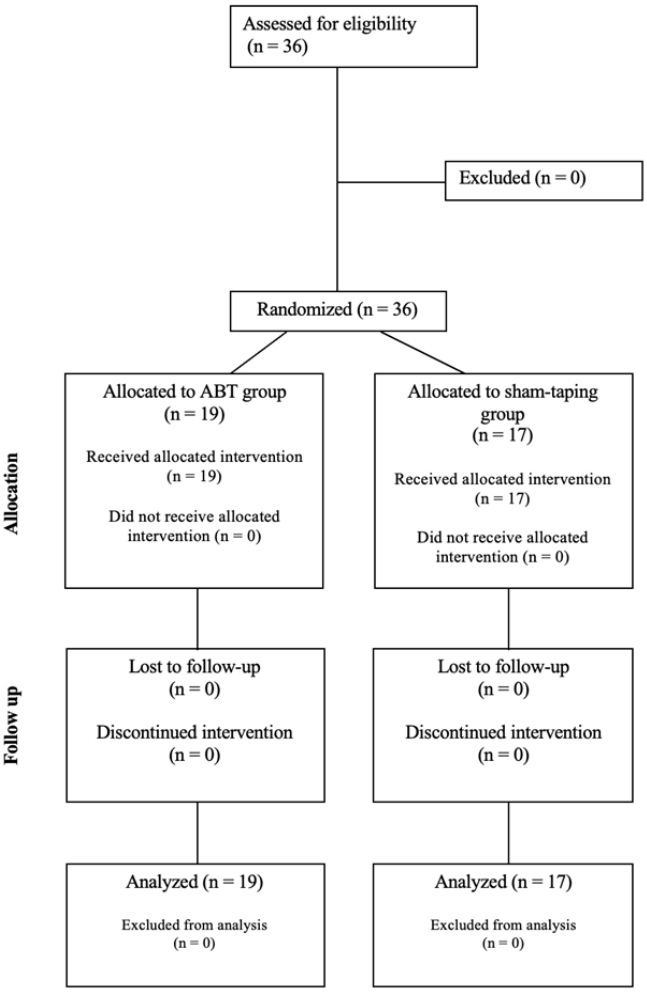

Figure 1. CONSORT Participant Flow Diagram.

Baseline Characteristics

Thirty-six male runners were included in the reported analyses: 19 in the ABT group and 17 in the sham group. Mean age was 24.37±5.56 years in the ABT group and 27.47±5.92 years in the sham group. Baseline demographic and clinical characteristics did not differ significantly between groups (Table 1). All participants reported giving way, and none had undergone ankle surgery.

Dynamic Balance

Changes in dynamic balance from baseline to week 3 are presented in Table 2. Compared with the sham-taping group, the ABT group showed significantly greater improvement in SEBT reach distance from baseline to week 3 in the anterior direction (13.58±9.16 cm vs 1.24±1.11 cm;

Table 1. Baseline Characteristics of the Study Groups

Characteristic	ABT (n=19)	Sham (n=17)	p-value
Age, years	24.37±5.56	27.47±5.92	0.114
Body weight, kg	60.53±10.61	59.71±8.26	0.799
Height, cm	163.37±8.50	162.06±6.91	0.618
Body mass index, kg/m²	22.59±2.52	22.73±2.55	0.874
Right injured ankle, n (%)	11 (57.9)	11 (64.7)	0.470
History of trauma, n (%)	17 (89.5)	15 (88.2)	0.662
Pain complaint, n (%)	3 (15.8)	5 (29.4)	0.446
Positive anterior drawer test, n (%)	16 (84.2)	15 (88.2)	0.351
Positive talar tilt test, n (%)	17 (89.5)	15 (88.2)	0.478
FAAM-ADL score	71.95±7.91	73.24±5.40	0.577
FAAM-Sport score	65.71±7.39	67.21±5.71	0.506

Data are mean±SD unless otherwise stated. ABT, Ankle Balance Taping; ADL, activities of daily living; FAAM, Foot and Ankle Ability Measure.

Table 2. Changes in Dynamic Balance Measured using the SEBT from Baseline to Week 3

SEBT direction	ABT, mean±SD (cm)	Sham, mean±SD (cm)	p-value	Cohen's d
Anterior	13.58±9.16	1.24±1.11	<0.001	1.84
Anteromedial	1.00±1.71	0.82±0.99	0.687	0.13
Medial	1.86±1.64	1.21±1.12	0.432	0.46
Posteromedial	7.03±3.21	4.42±4.07	0.028	0.72
Posterior	1.45±1.30	1.15±0.58	0.864	0.29
Posterolateral	10.73±7.46	1.49±1.18	<0.001	1.68
Lateral	1.03±0.57	0.71±0.43	0.615	0.63
Anterolateral	1.69±1.51	0.71±0.42	0.637	0.86

Abbreviations: ABT, Ankle Balance Taping; SEBT, Star Excursion Balance Test; SD, Standard deviation
Note: Values are mean change±SD. Positive values indicate increased reach distance. Cohen's d was calculated based on between-group differences in change scores from baseline to week 3.

p<0.001; Cohen's d=1.84), posteromedial direction (7.03±3.21 cm vs 4.42±4.07 cm; p=0.028; Cohen's d=0.72), and posterolateral direction (10.73±7.46 cm vs 1.49±1.18 cm; p<0.001; Cohen's d=1.68). No significant between-group differences were observed in the other five SEBT directions. Given that multiple SEBT directions were analyzed, these findings should be interpreted cautiously.

Static Balance

Changes in static balance measured using the Stork Test are presented in Table 3. Static balance improved in both groups during the 3-week intervention period. However, the between-group difference in change from baseline to week 3 was not statistically significant between the ABT group and the sham-taping group (32.99±0.85 seconds vs 31.95±0.91 seconds; p=0.143). Although some interval comparisons showed statistically significant differences between groups, the overall baseline-to-week 3 change did not demonstrate superiority of ABT over sham taping for static balance. Therefore, the static balance results should be interpreted as improvement in both groups rather than a clear between-group effect at week 3.

Adherence and Safety

All participants received the allocated intervention. No participants were lost to follow-up, discontinued the intervention, or were excluded from the final analysis. No skin reactions or other adverse events were reported during the study period.

Table 3. Changes in Static Balance Measured Using the Stork Test During the 3-week Intervention Period

Assessment interval	ABT, mean±SD (seconds)	Sham, mean±SD (seconds)	p-value
Baseline to week 1	9.70±0.95	5.61±1.09	0.021
Baseline to week 2	21.89±1.28	20.18±1.02	0.162
Baseline to week 3	32.99±0.85	31.95±0.91	0.143
Week 1 to week 2	12.19±1.39	14.57±1.18	0.075
Week 1 to week 3	23.29±1.31	26.35±1.05	0.036

Abbreviations: ABT, Ankle Balance Taping; SD, standard deviation.

Discussion

This trial found that adding ABT to strengthening exercise was associated with greater short-term improvement in dynamic balance in selected directions, particularly the anterior, posteromedial, and posterolateral directions. In contrast, static balance improved in both groups, and the baseline-to-week-3 change did not differ significantly. The results therefore support a direction-specific adjunctive effect of ABT rather than generalized superiority across all balance outcomes.

The pattern of dynamic improvement is broadly consistent with earlier ABT studies reporting short-term gains in balance after ankle sensory taping.[5,6] More recent experimental work also suggests that kinesiology tape may improve selected dynamic balance outcomes in people with CAI, although the magnitude and direction of benefit vary.[11,12] The observed early Stork Test advantage in the ABT group may reflect immediate sensory input or perceived stability; convergence by week 3 suggests that the shared strengthening and running program contributed substantially to later improvement.

The literature on kinesiology taping remains inconclusive. One systematic review concluded that kinesiology taping did not meaningfully improve ankle function or performance across heterogeneous populations.[13] Another review focused on athletes with CAI and reported moderate stabilizing effects for selected outcomes.14 A recent 2026 meta-analysis found only small, direction-specific benefits and rated the certainty of evidence as low or very low.15 The present findings should therefore be interpreted as supporting ABT as a low-cost adjunct, not as a substitute for structured rehabilitation.

Exercise is the primary evidence-based intervention for CAI. Meta-analyses show that balance training improves patient-reported function and dynamic balance, and that treatment dosage influences the magnitude of improvement.[16,17] Because both study groups received strengthening and continued running, improvement in both groups is expected. Sham taping may also be physiologically active through cutaneous stimulation, which can reduce the apparent contrast between groups.

The study has several strengths, including a randomized comparison, a sham-taping group, repeated weekly measurements, and recruitment of active runners. However, important limitations remain. The sample was small, exclusively male, limited to normal body mass index, and recruited from a single running community, limiting generalizability. Although all participants received the allocated intervention and no participants were lost to follow-up, detailed monitoring of exercise adherence and running activity outside the supervised sessions was limited. The three-week follow-up does not establish durability or injury-prevention effects. Although outcomes were measured repeatedly over three weeks, the analysis was based mainly on within-group and between-group change scores rather than repeated-measures modeling. In addition, no formal correction for multiple comparisons was applied across the eight SEBT directions and repeated Stork Test intervals. Therefore,

statistically significant findings, particularly for secondary or interval comparisons, should be interpreted cautiously. SEBT values were reported in centimeters without documentation of normalization to limb length.

Clinically, ABT may be considered when a short-term improvement in dynamic balance is desired, particularly in the early phase of rehabilitation or return to running. It should be combined with progressive strengthening, proprioceptive and balance training, and individualized load management. Future trials should use standardized CAI criteria, normalize SEBT or Y-Balance Test outcomes, specify primary endpoints, employ blinded outcome assessment, ensure transparent adherence and adverse-event reporting, apply statistical approaches that account for repeated measurements, and extend follow-up.

Conclusion

In male recreational runners with chronic ankle instability, the main finding of this study was that ABT combined with ankle-strengthening exercise provided greater short-term improvement than sham taping in selected dynamic balance outcomes, particularly in the anterior, posteromedial, and posterolateral SEBT directions. However, this effect was not observed consistently across all SEBT directions. Static balance improved in both groups, with no significant between-group difference in the baseline-to-week-3 change, indicating that the static balance findings should be interpreted cautiously. These findings suggest that ABT may be considered as an adjunct to exercise-based rehabilitation, rather than a stand-alone intervention. Larger trials with longer follow-up are needed to confirm the durability and clinical relevance of these findings.

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Conflict of Interest

The authors declare no conflict of interest.

Ethical Approval

Ethics Committee of the Faculty of Medicine, Universitas Indonesia–Cipto Mangunkusumo Hospital, No. KET-326/UN2.F1/ETIK/PPM.00.02/2019.

References

1. Francis P, Whatman C, Sheerin K, Hume P, Johnson MI. The Proportion of Lower Limb Running Injuries by Gender, Anatomical Location and Specific Pathology: A Systematic Review. J Sports Sci Med. 2019 Mar;18(1):21–31.
2. Hertel J, Corbett RO. An Updated Model of Chronic Ankle Instability. J Athl Train. 2019 Jun 1;54(6):572–88. https://doi.org/10.4085/1062-6050-344-18
3. Martin RL, Davenport TE, Fraser JJ, Sawdon-Bea J, Carcia CR, Carroll LA, et al. Ankle Stability and Movement Coordination Impairments: Lateral Ankle Ligament Sprains Revision 2021. Journal of Orthopaedic & Sports Physical Therapy. 2021 Apr;51(4):CPG1–80. https://doi.org/10.2519/jospt.2021.0302
4. Xue X, Ma T, Li Q, Song Y, Hua Y. Chronic ankle instability is associated with proprioception deficits: A systematic review and meta-analysis. J Sport Health Sci. 2021 Mar;10(2):182–91. https://doi.org/10.1016/j.jshs.2020.09.014
5. Kim MK, Shin YJ. Immediate Effects of Ankle Balance Taping with Kinesiology Tape for Amateur Soccer Players with Lateral Ankle Sprain: A Randomized Cross-Over Design. Medical Science Monitor. 2017 Nov 21;23:5534–41. https://doi.org/10.12659/MSM.905385
6. Bae Y-S. Spiral Taping Improves Performance on Star Excursion Balance Test in Individuals with Unilateral Chronic Ankle Instability. The Journal of Korean Physical Therapy. 2016 Dec 30;28(6):376–80. https://doi.org/10.18857/jkpt.2016.28.6.376
7. Fitria A. Uji kesahihan dan keandalan Foot and Ankle Ability Measure sebagai alat ukur keterbatasan fungsional penderita instabilitas pergelangan kaki pada populasi pasukan khusus [Thesis]. [Jakarta]: Universitas Indonesia; 2016.
8. Gribble PA, Hertel J, Plisky P. Using the Star Excursion Balance Test to Assess Dynamic Postural-Control Deficits and Outcomes in Lower Extremity Injury: A Literature and Systematic Review. J Athl

Train. 2012 May 1;47(3):339–57. https://doi.org/10.4085/1062-6050-47.3.08
9. Martin RL, Irrgang JJ, Burdett RG, Conti SF, Swearingen JM Van. Evidence of Validity for the Foot and Ankle Ability Measure (FAAM). Foot Ankle Int. 2005 Nov 1;26(11):968–83. https://doi.org/10.1177/107110070502601113
10. Carcia CR, Martin RL, Drouin JM. Validity of the Foot and Ankle Ability Measure in Athletes With Chronic Ankle Instability. J Athl Train. 2008 Mar;43(2):179–83. https://doi.org/10.4085/1062-6050-43.2.179
11. Wang X, Shao X, Yu R, Wang Y, Deng F, Adams R, et al. Acute effects of kinesiology tape on dynamic balance control in chronic ankle instability: An exploratory study. Physical Therapy in Sport. 2023 Jul;62:65–70. https://doi.org/10.1016/j.ptsp.2023.06.005
12. Hussein HM, Kamel WM, Kamel EM, Attyia MR, Acar T, Kanwal R, et al. The Effect of Kinesio Taping on Balance and Dynamic Stability in College-Age Recreational Runners with Ankle Instability. Healthcare. 2023 Jun 14;11(12):1749. https://doi.org/10.3390/healthcare11121749
13. Nunes GS, Feldkircher JM, Tessarin BM, Bender PU, da Luz CM, de Noronha M. Kinesio taping does not improve ankle functional or performance in people with or without ankle injuries: Systematic review and meta-analysis. Clin Rehabil. 2021 Feb 20;35(2):182–99. https://doi.org/10.1177/0269215520963846
14. Biz C, Nicoletti P, Tomasin M, Bragazzi NL, Di Rubbo G, Ruggieri P. Is Kinesio Taping Effective for Sport Performance and Ankle Function of Athletes with Chronic Ankle Instability (CAI)? A Systematic Review and Meta-Analysis. Medicina (B Aires). 2022 Apr 29;58(5):620. https://doi.org/10.3390/medicina58050620
15. Meng S, Fu X, Xu Y, Zhang X, Peng Z, Cao Y, et al. The effects of kinesio taping on dynamic balance in patients with chronic ankle instability: a systematic review and meta-analysis. Front Physiol. 2026 Apr 27;17. https://doi.org/10.3389/fphys.2026.1823162
16. Guo Y, Cheng T, Yang Z, Huang Y, Li M, Wang T. A systematic review and meta-analysis of balance training in patients with chronic ankle instability. Syst Rev. 2024 Feb 12;13(1):64. https://doi.org/10.1186/s13643-024-02455-x
17. Tang F, Xiang M, Yin S, Li X, Gao P. Meta-analysis of the dosage of balance training on ankle function and dynamic balance ability in patients with chronic ankle instability. BMC Musculoskelet Disord. 2024 Aug 31;25(1):689. https://doi.org/10.1186/s12891-024-07800-8