

The effects of spodetrig massage combined with whole-body, abdominal, and core training on pain, dynamic postural control, and change-of-direction performance

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Abstract:

Background: Athletes with lower-limb injuries commonly undergo rehabilitation to support return to training and competition. However, many continue to experience residual pain, postural deficits, and incomplete functional recovery, which may hinder return-to-play. Spodetrig massage (trigger-point release and soft-tissue mobilization) may improve tissue function, reduce muscle tension, and promote neuromuscular recovery. When combined with structured exercise therapy (whole-body, abdominal, and core training), it provides complementary benefits for postural control and change-of-direction performance. **Purpose:** To examine the effects of Spodetrig massage combined with whole-body, abdominal, and core training on pain, dynamic postural control, and change-of-direction performance in male athletes after non-specific lower-limb injury. **Methods:** A randomized controlled pretest-posttest design was used. Eighty male athletes were allocated to a treatment group (TG; n = 40) or a control group (CG; n = 40). TG received Spodetrig massage plus structured exercise training twice a week for eight weeks, while CG continued usual activity. Outcomes were pain (Visual Analog Scale), dynamic postural control (Y-Balance Test), and change-of-direction performance (T-Test). Data were summarized using descriptive statistics. Assumptions of normality and homogeneity were then assessed using the Kolmogorov–Smirnov and Levene’s tests. Changes within groups were examined using paired-samples t-tests, while differences between groups (at pretest, posttest, and for change scores) were analyzed using independent-samples t-tests. Statistical significance was established at $p < .05$. All analyses were conducted using SPSS version 25. **Results:** The combined intervention significantly reduced pain levels, improved dynamic balance, and enhanced the ability to change direction. Compared with CG, TG showed greater improvements in pain (TG: 2.38 ± 1.18 ; CG: 4.50 ± 1.10), dynamic balance (TG: 89.28 ± 7.36 ; CG: 77.36 ± 5.66), and change-of-direction performance (TG: 10.59 ± 1.10 s; CG: 12.32 ± 1.25 s) (all $p < .05$). **Conclusion:** Spodetrig massage combined with whole-body, abdominal, and core training is effective in reducing pain and enhancing functional performance to support return-to-play readiness after non-specific lower-limb injury. These findings support the use of integrated treatment strategies to facilitate effective return-to-play in injured athletes.

Keywords: Spodetrig massage; core training; dynamic postural control; change of direction; lower-limb injury; return to play

Introduction

Lower-limb injuries are among the most frequently reported injuries across sports in Indonesia each year. Such injuries are common because training and competition often involve intense, repetitive loading and tight schedules (Kisner & Colby, 2007; Smiley et al., 2024; Wegener et al., 1997). The injuries typically affect bones, muscles, joints, ligaments, or tendons (Goes et al., 2020; Mizumura & Taguchi, 2024) and can impair strength, balance, motor control, and overall movement function (Fulton et al., 2014; Sloanhoffer et al., 2018; Wegener et al., 1997; Zemková & Zapletalová, 2022). Accordingly, athletes should target modifiable risk factors, such as inadequate warm-up, fatigue/overtraining, inappropriate equipment, and previous injury, to reduce persistent symptoms and recurrence (Goes et al., 2020; Klügl et al., 2010; Sukarmin et al., 2021). Besides the clinical burden, lower-limb injuries also have significant performance, economic, and organizational implications in sport settings. Athletes who experience incomplete recovery often demonstrate reduced competitive readiness, decreased performance consistency, and increased risk of reinjury, which may disrupt

training cycles and long-term athlete development. For teams and sports organizations, this implication means lost training time, increased rehabilitation costs, and suboptimal performance outcomes.

To date, multiple approaches have been investigated to optimize rehabilitation and return to play after lower-limb injury, including postoperative care (Kemler et al., 2025), autologous blood injection, eccentric exercise, and anti-inflammatory therapies (Bell et al., 2013), high-volume injection with eccentric exercise (Boesen et al., 2017), anti-inflammatory treatment (Coombes et al., 2010), and eccentric exercise therapy (Everhart et al., 2017). Other work has examined transverse friction massage and cryotherapy combined with eccentric training on a decline board for chronic patellar tendinopathy. Additional treatments used for jumper's knee include rest, anti-inflammatory medications, stretching and strengthening, eccentric training, extracorporeal shockwave therapy, ultrasound-guided sclerosing, and surgical options. Pharmacological and biological interventions (e.g., NSAIDs, platelet-rich plasma, aprotinin, autologous growth factors) have also been discussed (Sterne et al., 2019). During lower-limb injury rehabilitation, athletes who have passed initial symptom-resolution criteria (e.g., no or mild pain, restored range of motion, improved balance, and other clinical indicators) often still require advanced training to reduce reinjury risk and to safely return to training and competition (return to play) (Ménétrey et al., 2014). High recurrence rates are commonly linked to premature exposure to excessive training loads when muscles, tendons, and ligaments have not yet fully recovered. In addition, recovery indicators may appear acceptable while functional deficits persist, particularly under competition demands. As research continues to explore conventional treatments, alternative therapies like massage and acupuncture have also gained attention for their role in managing knee injuries. Previous studies have shown that knee injuries are pathologically closely related to inflammation. Thus, modalities like massage manipulation (Liza et al., 2023) are greatly needed to improve blood circulation (Rosser, 2004). Previous studies observed that massage manipulation also enhances muscle-tendon strength and flexibility, improves knee function performance, and reduces the incidence of knee injuries (Belzer & Cannon, 1993; Coppack, Etherington, & Wills, 2011; Emery, Cassidy, Klassen, Rosychuk, & Rowe, 2005; Hwang, 2019; Kisner & Colby, 2007). Some of the most effective massage techniques for treating knee injuries include trigger-point, friction, deep-tissue massage, deep-friction massage, and the minimal skin pressure technique. Acupuncture and chiropractic manipulation are also examples of alternative approaches commonly used by therapists (Allen, 2016; Boguszewski, Szkoda, Adamczyk, & Białoszewski, 2014; Fritz, 2013). Despite advances in rehabilitation science, there is a persistent gap between clinical recovery (e.g., pain reduction and range-of-motion restoration) and functional readiness for sport-specific demands. Although return-to-play programs are increasingly recommended, prior interventions have focused on single therapeutic segments. Current evidence suggests that while isolated interventions such as manual therapy or exercise-based rehabilitation can provide benefits, their independent application may limit overall effectiveness in addressing the multifactorial nature of lower-limb injuries. Many rehabilitation programs still emphasize either passive recovery modalities or generalized strengthening without adequately integrating sport-specific functional demands. This highlights the need for comprehensive, integrated strategies that systematically progress athletes through (i) symptom reduction, (ii) restorative training, and (iii) reintegration to sport-specific activity (Kisner & Colby, 2007). The reduction phase targets inflammation and pain control. Meanwhile, the restorative phase focuses on improving the range of motion, muscular strength, and muscular endurance. Finally, the reintegration phase emphasizes sport-specific movement capacity, cardiovascular conditioning, and maintenance programming for strength, flexibility, conditioning, and skill execution (Buckthorpe et al., 2025). To address this gap, treatments for patients with lower limb, both massage and physical therapy, can be combined to accelerate the rehabilitation process. This series of programs includes 2 interventions: 1) massage therapy, 2) exercise therapy. The present study adopts an integrated approach, combining Spodetrig massage with structured exercise therapy interventions within a return-to-play framework. The Spodetrig massage is a therapy that comprises four types of massage: soft-tissue massage, sports massage, deep-tissue massage, and trigger-point massage. Meanwhile, exercise therapy interventions consist of four phases: maximum protection, moderate protection, minimum protection, and return to play. The study extends a previously tested protocol in knee injury rehabilitation (Ilham et al., 2024) to non-specific lower-limb injuries. Spodetrig massage is positioned not only as a relaxation or symptom-management technique but also as a supportive therapy for return to play through improvements in change-of-direction ability and dynamic postural control. This integrated framework is expected to enhance rehabilitation efficiency better than isolated modalities. Therefore, there is a need to explore approaches that combine complementary therapeutic modalities within a structured return-to-play framework. This study adopts an applied experimental approach to evaluate the combined effects of Spodetrig massage and exercise therapy on key rehabilitation outcomes. Specifically, it aims to evaluate the combined effects of these interventions on key rehabilitation outcomes, including pain, dynamic postural control, and change-of-direction performance. By looking at both recovery and performance, this study provides practical ways to help athletes return to their sport safely.

Material & methods

This study employed a quasi-experimental design in accordance with the 1964 Declaration of Helsinki and subsequent amendments. The study was conducted at the sports medicine clinic of Universitas Negeri

Padang (Padang, West Sumatra), and the entire research process took 1 year from 2024 to 2025. Two groups were involved: a treatment group and a control group. These groups have received ethical approval from the Research Ethics Committee of Universitas Negeri Padang (Approval No. 36.44/KEP/VI/2024). The study procedures were considered ethically appropriate in accordance with the WHO (2011) standards and the CIOMS (2016) guidelines, including social value, scientific value, fair distribution of burdens and benefits, risk management, avoidance of undue inducement/exploitation, confidentiality and privacy, and informed consent.

Participants

Participants were recruited purposively from local sports clubs and rehabilitation settings and provided written informed consent. To be included in the analysis, this study set inclusion criteria: (1) male athlete, (2) current non-specific lower-limb pain/discomfort, (3) self-reported balance problems involving the hip, knee, or ankle, and (4) limitations in lower-limb range of motion. Meanwhile, participants who were (1) previously having lower-limb surgery/reconstruction and (2) diagnosed with arthritis or rheumatic joint disease were excluded. Eighty male athletes were allocated to either the treatment group (TG; $n = 40$), which received Spodetrig massage plus exercise therapy (whole-body, abdominal, and core training), or the control group (CG; $n = 40$).

Procedure

To begin with, the study undertook several procedures, such as conducting preliminary investigations, obtaining ethical approval and research permits, and ensuring the availability of the required research infrastructure, including access to sports medicine and rehabilitation facilities.

As this study was conducted across multiple years (2024–2025), the ethical approval was renewed to cover the full data-collection period and protocol implementation (Approval No. 45.01/KEP/V/2025). After that, participants were recruited and randomized into the CG and TG. Baseline measurements of pain level, dynamic balance, and change-of-direction ability were collected in both groups. The TG received the Spodetrig massage and exercise therapy program for 8 weeks, whereas the CG did not receive any treatment. Posttests were conducted immediately after the 8-week program to assess pain, dynamic postural control, and COD performance. To ensure consistency in the delivery of interventions, the research team responsible for administering the massage and exercise therapy programs was trained and coordinated. The intervention combined Spodetrig massage (sports, deep-tissue, trigger-point, and soft-tissue techniques) with phased exercise therapy progressing from maximum protection to return-to-play, delivered twice weekly (Best et al., 2008; Deetz & Petrie, 2022; Joseph et al., 2012; Kushartanti & Ambardini, 2020; Kisner & Colby, 2007).

Measurement/Instruments

After the interventions were conducted, data were collected at several points. Pain intensity was assessed using the Visual Analog Scale (VAS), while dynamic postural control was assessed using the Y-Balance Test (composite score). Finally, the change-of-direction performance was assessed using the T-Test (time in seconds).

Statistical analysis

Statistical analysis was performed using IBM SPSS version 25. Assumptions were checked using Kolmogorov–Smirnov tests (normality) and Levene’s tests (homogeneity of variances). After calculating the descriptive statistics for all variables, within-group changes from pre- to posttest were analyzed using paired-samples t-tests. Then, differences between the CG and TG at each time point, as well as mean change scores, were evaluated using independent-samples t-tests. The threshold for statistical significance was set at $p < .05$ (two-tailed).

Results

Sample demographics

Baseline characteristics for the CG and TG were quite similar, such as in age (29.15 ± 7.20 vs 28.43 ± 11.20 years), height (170.04 ± 6.12 vs 171.06 ± 4.62 cm), and body mass (71.11 ± 2.20 vs 69.23 ± 6.12 kg). The resulting BMI was 25.40 ± 1.20 kg/m² for the CG and 24.83 ± 1.23 kg/m² for the TG. Before the inferential analysis, normality and homogeneity were assessed using Kolmogorov–Smirnov and Levene’s tests, respectively. As shown in Table 1 and Table 2, all assumptions met the threshold for normality and homogeneity $p > .05$.

Table 1. Kolmogorov–Smirnov normality test results for outcome variables

Time point	Outcome	K-S Z	p	Interpretation
Pretest	Pain (VAS)	0.073	0.200	Normal
	Y-Balance composite	0.070	0.200	Normal
	T-Test time	0.080	0.200	Normal
Posttest	Pain (VAS)	0.053	0.200	Normal
	Y-Balance composite	0.096	0.067	Normal
	T-Test time	0.076	0.200	Normal
Change (post–pre)	Pain (VAS)	0.099	0.052	Normal
	Y-Balance composite	0.080	0.200	Normal
	T-Test time	0.081	0.200	Normal

As shown in Table 1, Kolmogorov–Smirnov test results were non-significant for all outcomes (all $p \geq .052$). This indicates that the data did not deviate significantly from a normal distribution. Thus, the analysis can proceed to the parametric statistical procedures.

Table 2. Levene's test for homogeneity of variances across groups

Time point	Outcome	Levene F	p	Interpretation
Pretest	Pain (VAS)	3.665	0.059	Homogeneous
	Y-Balance composite	0.549	0.461	Homogeneous
	T-Test time	0.923	0.340	Homogeneous
Posttest	Pain (VAS)	3.734	0.057	Homogeneous
	Y-Balance composite	0.935	0.336	Homogeneous
	T-Test time	3.728	0.057	Homogeneous
Change (post–pre)	Pain (VAS)	3.703	0.058	Homogeneous
	Y-Balance composite	3.721	0.056	Homogeneous
	T-Test time	3.715	0.057	Homogeneous

As shown in Table 2, Levene's tests were non-significant for all outcomes (all $p \geq .056$), supporting the homogeneity of variances assumption. This finding supports the use of independent-samples t-tests for between-group comparisons.

Effects of Spodetrig Massage Plus Exercise Therapy on Pain Level (VAS)

This section provides the results for pain intensity outcomes at pretest and posttest, including both within-group and between-group comparisons. Between-group comparisons for pain outcomes are summarized in Table 3, and within-group pretest–posttest patterns are illustrated in Figure 1.

Table 3. Between-group comparisons of pain intensity (VAS) at pretest, posttest, and change (posttest–pretest)

Time point	TG (mean $\pm$ SD)	CG (mean $\pm$ SD)	t	p
Pretest	5.93 $\pm$ 0.94	5.97 $\pm$ 0.84	-0.201	0.841
Posttest	2.38 $\pm$ 1.18	4.50 $\pm$ 1.10	-8.323	< .001*
Change (post–pre)	3.56 $\pm$ 0.77	1.48 $\pm$ 0.57	13.659	< .001*

Note. Values are mean $\pm$ SD. Independent-samples t-tests were used for between-group comparisons. * $p < .05$.

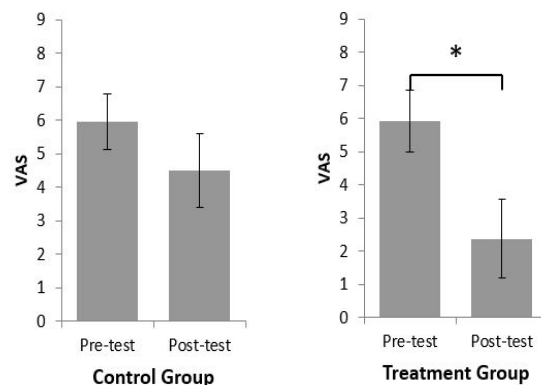


Figure 1. Mean ($\pm$ SE) pain intensity (VAS) at pretest and posttest in TG and CG. Asterisk indicates a significant within-group pretest–posttest change (paired t-test, $p < .05$).

As shown in Table 3, baseline pain (VAS) between groups ($p > .05$) was not different. After 8 weeks, TG reported significantly lower pain than CG ($p < .001$). Additionally, the pain reduction (posttest–pretest) was significantly greater in TG than in CG ($p < .001$). The effectiveness of the program in reducing pain levels can be calculated as follows:

$$(1) \text{ Relative pain reduction in TG (\%)} = (\text{posttest–pretest change} / \text{pretest}) \times 100 = (3.56 / 5.93) \times 100 = 60.03\%.$$

Meanwhile, the reduction in pain level in the control group is denoted:

$$(2) \text{ Relative pain reduction in CG (\%)} = (\text{posttest–pretest change} / \text{pretest}) \times 100 = (1.48 / 5.97) \times 100 = 24.79\%.$$

Based on these calculations, pain decreased by approximately 60.03% in TG and 24.79% in CG, indicating higher effectiveness of the combined intervention.

Effects of Spodetrig Massage Plus Exercise Therapy on Dynamic Postural Control (Y-Balance)

Between-group comparisons for Y-Balance outcomes are summarized in Table 4, and within-group pretest–posttest patterns are illustrated in Figure 2.

Table 4. Between-group comparisons of dynamic postural control (Y-Balance composite score) at pretest, posttest, and change (posttest–pretest)

Time point	TG (mean ± SD)	CG (mean ± SD)	t	p
Pretest	70.10 ± 7.03	70.24 ± 5.76	1.298	0.198
Posttest	89.28 ± 7.36	77.36 ± 5.66	8.126	< .001*
Change (post–pre)	17.18 ± 3.72	7.11 ± 3.21	12.953	< .001*

Note. Values are mean ± SD. Independent-samples t-tests were used for between-group comparisons. *p < .05.

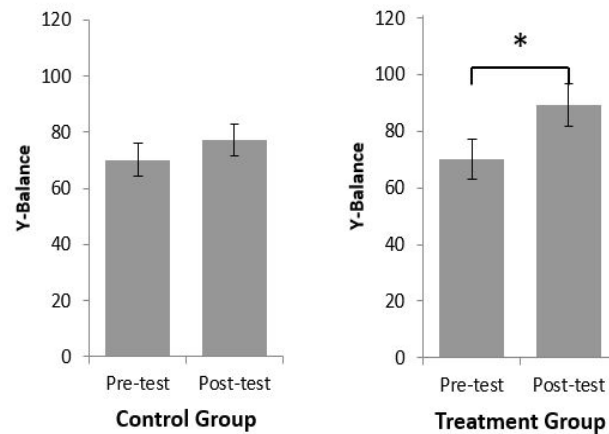


Figure 2. Mean (±SE) Y-Balance composite score at pretest and posttest in TG and CG. Asterisk indicates a significant within-group pretest–posttest change (paired t-test, p < .05).

Independent-samples comparisons indicated no statistically significant difference in baseline Y-Balance composite score between CG and TG ($t(78) = 1.30$, $p > .05$). However, after the intervention, the TG achieved significantly higher balance scores compared to the CG ($t(78) = 8.13$, $p < .001$), with the mean values of 89.28 ± 7.36 and 77.36 ± 5.66 , respectively. The change score (posttest–pretest) was also significantly greater in TG than in CG ($t(78) = 12.95$, $p < .001$). The effectiveness of the program in increasing dynamic postural balance can be calculated as follows:

$$(3) \text{ Relative increase in Y-Balance composite score in TG (\%)} = (\text{posttest–pretest change/pretest}) \times 100 = (17.18 / 70.10) \times 100 = 24.51\%.$$

Meanwhile, the increase in dynamic postural balance in the control group is calculated as follows:

$$(4) \text{ Relative increase in Y-Balance composite score in CG (\%)} = (\text{posttest–pretest change/pretest}) \times 100 = (7.11 / 70.24) \times 100 = 10.12\%.$$

These calculations indicate that the program increased dynamic postural control by approximately 24.51% in TG compared with 10.12% in CG, supporting the effectiveness of the intervention.

Effects of Spodetrig Massage Plus Exercise Therapy on Change-of-Direction Performance (T-Test)

This section reveals that agility and change-of-direction performance, as measured by the T-Test, showed significantly greater improvements in the TG compared to the CG. Between-group comparisons for T-Test outcomes are summarized in Table 5, and within-group pretest–posttest patterns are illustrated in Figure 3.

Table 5. Between-group comparisons of change-of-direction performance (T-Test time, s) at pretest, posttest, and change (posttest–pretest)

Time point	TG (mean ± SD)	CG (mean ± SD)	t	p
Pretest	13.33 ± 1.10	13.42 ± 1.27	-0.324	0.747
Posttest	10.59 ± 1.10	12.32 ± 1.25	-6.603	< .001*
Change (post–pre)	2.74 ± 0.60	1.09 ± 0.53	13.103	< .001*

Note. Values are mean $\pm$ SD. Independent-samples *t*-tests were used for between-group comparisons. **p* < .05.

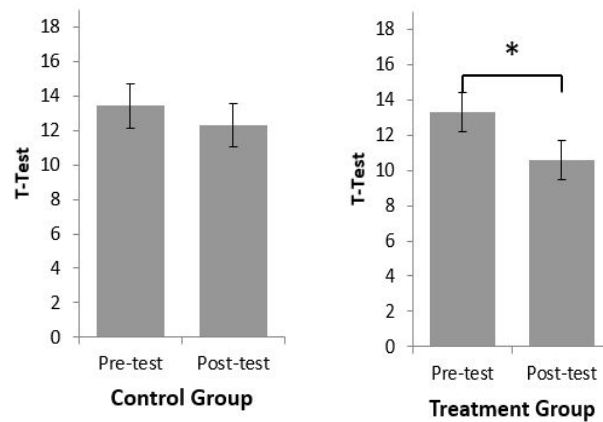


Figure 3. Mean ($\pm$ SE) T-Test time at pretest and posttest in TG and CG. Asterisk indicates a significant within-group pretest–posttest change (paired *t*-test, *p* < .05).

As shown in Table 5, there was no difference in the T-Test time baseline between CG and TG (*p* > .05). However, after 8 weeks, TG completed the T-Test significantly faster than CG (*p* < .001), and the improvement (posttest–pretest) was greater in TG than in CG (*p* < .001). The effectiveness of the program in increasing the ability to change direction was calculated as follows:

$$(5) \text{ Relative improvement in T-Test time in TG (\%)} = (\text{pretest–posttest change/pretest}) \times 100 = (2.74 / 13.33) \times 100 = 20.56\%.$$

Meanwhile, the increase in ability to change direction in the control group is mathematically counted as follows:

$$(6) \text{ Relative improvement in T-Test time in CG (\%)} = (\text{pretest–posttest change/pretest}) \times 100 = (1.09 / 13.42) \times 100 = 8.12\%.$$

These effectiveness calculations indicate that greater improvement in T-Test performance was observed in TG (approximately 20.56%) than in CG (8.12%).

Discussion

This randomized controlled pretest–posttest trial evaluated whether an 8-week return-to-play program that integrated Spodetrig massage with progressive therapeutic exercise could reduce pain, improve dynamic postural control, and enhance change-of-direction (COD) performance in male athletes with non-specific lower-limb injury. Compared with usual activity, this study found that the combined intervention produced larger improvements across all outcomes. Relative change calculations showed that pain decreased by approximately 60.03% in the treatment group, far higher than in the control group (24.79%). Meanwhile, the Y-Balance composite score increased by 24.51% versus 10.12%, and T-Test time improved by 20.56% versus 8.12%. While baseline values did not differ between groups, clear differences emerged at posttest and for change scores (Tables 3–5; Figures 1–3). These findings support the notion that combining manual therapy with structured exercise is effective in restoring function and sport readiness.

Pain relief was the most pronounced response. The Spodetrig protocol combined sports massage, deep-tissue massage, trigger-point techniques, and soft-tissue mobilization. Such techniques may influence pain through combined mechanical and neurophysiological pathways, including changes in tissue sensitivity and improved comfort during movement (Best et al., 2008; Deetz & Petrie, 2022; Joseph et al., 2012; Kushartanti & Ambardini, 2020). In return-to-play contexts, pain is not only a symptom but also a constraint on training exposure. It can limit load tolerance, alter technique, and promote protective strategies that reduce the quality of strength and motor-control work. The larger reduction observed in the treatment group, therefore, likely had downstream benefits, enabling more consistent participation in progressive exercise and reducing pain-related inhibition during functional tasks. A key interpretation is that manual therapy and graded exercise contributed complementary effects. Manual therapy may provide an early window of symptom relief, whereas therapeutic exercise rebuilds capacity and control from protection to sport reintegration (Buckthorpe et al., 2025; Kisner & Colby, 2007). When these components are combined, improved comfort may allow higher-quality execution of strengthening, balance, and movement drills, increasing the effective training stimulus. Over repeated sessions, progressive loading can improve tissue tolerance and neuromuscular function. Thus, it can reduce symptom provocation during everyday and sport-specific movements. This “symptom–capacity” interaction is consistent with rehabilitation approaches that pair symptom management with systematic progression rather than relying on a single modality.

The study also noted that the combined treatments improved dynamic postural control, with the treatment group's Y-Balance composite scores increasing by 24.51%, higher than the control group (10.12%) (Table 4; Figure 2). This is clinically relevant because dynamic balance underpins single-leg control required for landing, cutting, and direction changes, and deficits commonly persist after lower-limb injury (Wegener et al., 1997; Zemková & Zapletalová, 2022). The gains may reflect reduced pain and protective co-contraction, improved tolerance to end-range positions following soft-tissue work, and enhanced lumbopelvic control from whole-body and core-focused training (Joseph et al., 2012; Kisner & Colby, 2007; Kushartanti & Ambardini, 2020).

Another finding was an improvement in Change of Direction (COD) performance, with T-Test time decreasing by 20.56% in the treatment group versus 8.12% in controls (Table 5; Figure 3). Because COD relies on rapid deceleration, braking strength, re-acceleration, and trunk-lower-limb control under high lateral forces, the combined gains in pain reduction and neuromuscular control likely contributed to more efficient multi-directional movement. The protocol was also practical to deliver (two sessions/week for eight weeks) and progressed logically from maximum protection to return-to-play, allowing load and task complexity to be matched to athlete tolerance. In applied settings, using VAS, Y-Balance, and the T-Test together can strengthen progression decisions by capturing both symptom status and functional readiness, since pain relief alone may not reflect persistent balance or performance deficits.

Despite the promising results, interpretation of this study should be cautious because the sample included only male athletes. Additionally, injuries were broadly categorized as non-specific lower-limb injury without clinical subtyping (region, pathology, chronicity, or sport demands), and outcomes were measured only immediately post-intervention, leaving durability and reinjury implications uncertain. After that, this study did not monitor training load and outside activity, and participant blinding was not feasible. These limitations have introduced variability in exposure and expectancy effects despite randomization and baseline equivalence. For these reasons, future studies should include mixed-sex samples, stratify by injury characteristics, add longer follow-up with reinjury surveillance, and directly compare exercise therapy alone, Spodetrig massage alone, and the combined protocol to clarify additive effects, sequencing, and dosing; incorporating objective neuromuscular measures and load monitoring would further strengthen mechanistic understanding and clinical translation.

Conclusions

This study shows that an integrated 8-week return-to-play program combining Spodetrig massage with progressive whole-body and core-focused exercise can meaningfully improve recovery in male athletes with non-specific lower-limb injury. In addition to reducing pain, the program enhanced dynamic postural control and change-of-direction (COD) performance, reflecting not only clinical improvement but also restoration of functional and sport-specific capacity. However, it should be noted that effective rehabilitation should move beyond pain reduction toward rebuilding movement quality and performance readiness.

These findings support a shift in rehabilitation practice toward a more integrated, return-to-performance approach. Rather than applying manual therapy and exercise separately, combining them appears to create a more effective pathway. Spodetrig massage helps prepare the body in the early stages, while progressive exercise develops control, stability, and tolerance to load. Together, they enable a smoother and more efficient transition back to sport. In practice, this program is simple, feasible, and cost-efficient, requiring only two sessions per week and basic field-based monitoring. This makes it highly relevant for coaches and practitioners aiming to optimize recovery and reduce reinjury risk in real-world settings. However, the findings are limited to male athletes and short-term outcomes. Therefore, future research should include more diverse populations and examine long-term effects to strengthen and refine this approach.

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Declaration of generative AI and AI-assisted technologies in the writing process

The author used ChatGPT and Mendeley to assist with literature search, summarization, reference management, and manuscript clarity. All outputs were reviewed and edited, and the author assumes full responsibility for the final content.

Conflicts of interest - There is no conflict of interest to declare.

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