INTERNATIONAL JOURNAL OF
PHYSICAL THERAPY RESEARCH & PRACTICE

AN OFFICIAL JOURNAL OF SAUDI PHYSICAL THERAPY ASSOCIATION

Original Article

Assessing the Awareness and Practices of Physical Unveiling the Power of Dynamic Cupping and Instrument-Assisted Soft Tissue Mobilization in Stepping into Comfort for High Heel Wearers: Alleviating Calf Pain and Enhancing Balance

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Article Info

Received : 13th January 2024
Accepted : 24th January 2024
Published : 12th February 2024

To Cite:. Nidhi Ambawat, Ankita Sharma, Zoya Zaidi, Shishir Nigam, Shobhit Saxena, Moattar Raza Rizvi. Unveiling the Power of Dynamic Cupping and Instrument-Assisted Soft Tissue Mobilization in Stepping into Comfort for High Heel Wearers: Alleviating Calf Pain and Enhancing Balance. International Journal of Physical Therapy Research & Practice 2024;3(2):132-143

Abstract

Aims & Objective: Wearing high heels regularly can lead to biomechanical issues, including tight calf muscles and shorter gastrocnemius muscle fascicles, which compromise musculoskeletal health, affect gait and balance, and heighten the risk of falls. This study compares the effects of two interventions, Instrument-Assisted Soft Tissue Mobilization (IASTM) and Dynamic Cupping Therapy (DCT), on flexibility, balance, and pain reduction in women who regularly wear high heels. **Methods:** Thirty female participants regularly wearing high heels were randomly assigned to either IASTM or DCT interventions. Outcomes were assessed using measures of flexibility (knee to wall test), balance (App-Coo test), and pain thresholds (algometer). **Results:** Both IASTM and DCT groups exhibited significant increases in flexion, with IASTM showing a larger mean difference (-3.80, $p < 0.01$) compared to DCT (-2.73, $p < 0.01$). Balance with open and closed eyes significantly improved in both groups, with IASTM displaying larger mean differences (0.63, $p < 0.01$, and 0.57, $p = 0.001$, respectively) compared to DCT (0.46, $p < 0.01$, and 0.40, $p < 0.01$, respectively). Regarding pain reduction, both interventions were effective, but IASTM had a larger mean difference (1.28, $p < 0.01$) compared to DCT (0.87, $p < 0.01$). **Conclusion:** Both IASTM and DCT interventions effectively improved flexibility, balance, and reduced pain in women wearing high heels.

Key Words: Dynamic cupping therapy, IASTM, Instrument-Assisted Soft Tissue Mobilization, High heels, Calf pain, Balance, Flexibility, Pain

Introduction

The calf musculature, comprising the gastrocnemius and soleus muscles anchored to the robust calcaneal tendon, is integral to postural stabilization and gait dynamics. This complex plays a pivotal role in locomotion and weight-bearing activities, where the soleus muscle primarily counteracts the inertia of body weight during walking, and the more rapidly responding gastrocnemius facilitates acceleration(Farrag & Elsayed, 2016). However, the habitual wearing of high-heeled footwear introduces significant biomechanical challenges, predominantly affecting the gastrocnemius muscle(Pannell & MD, 2012). Regular use of high heels has been linked to a notable 12% decrease in the average fascicle length of the medial gastrocnemius muscle, minimally influencing the soleus muscle and Achilles tendon dimensions(Zöllner et al., 2015).

Wearing high heels leads to altered gait mechanics, increased risk of muscle strains, higher knee joint forces, and shortened plantar flexors. This highlights the biomechanical challenges posed by high heels on the lower extremity(Hamandi & Ruken, 2020). Another study emphasizes that wearing high-heeled shoes significantly affects lower extremity biomechanics and balance in females. This includes changes in gait characteristics, increased ground reaction forces, and poor static and dynamic balance compared to wearing flat shoes or being barefoot(Zeng et al., 2023). High heels force a plantar flexed foot position, leading to inefficient energy use and requiring muscular adaptations. This position causes excessive actin-myosin overlap, pushing muscles beyond their optimal range. Over time, calf muscles adapt by shortening and realigning actin-myosin overlap. These changes affect ankle joint range of motion, causing a supinated position. This reduces shock absorption effectiveness and increases ligament sprain risk. High heel use may compromise muscle efficiency, causing discomfort, fatigue, and injury risk. In dynamic activities like running or jumping, these alterations can result in gait changes, injuries, and compensatory adjustments (Karas & Hoy, 2002; Novacheck, 1998).

Limited calf muscle flexibility impairs this, leading to shorter strides, instability, and slower walking speed (Lee & Chang, 2019). Calf muscles also aid venous return from the lower limbs, particularly the soleus muscle(Reček, 2006). High heels alter biomechanics, reducing step length, ankle angle, walking speed, and increasing cadence and ground reaction forces(Cronin, 2014). Weakness in these muscles can affect knee mechanics and potentially cause early degenerative changes(Esenyel et al., 2003). Prolonged high heel use affects lower limb biomechanics and musculoskeletal health, highlighting the need to limit heel height to reduce injury risk (Hamandi & Ruken, 2020).

Positional Release Therapy has shown significant effects on calf muscle tightness, improving cadence, ankle dorsiflexion, and plantar flexion range of motion, while significantly reducing pain compared to Active Release Therapy(Maqsood et al., 2023). High-frequency therapy has immediate effects like decreased pennation angle and passive peak torque to ankle dorsiflexion, suggesting potential for long-term benefits(Kim et al., 2020). IASTM (Instrument-Assisted Soft Tissue Mobilization) and DCT (dynamic cupping therapy) are manual therapy techniques used by healthcare professionals to address musculoskeletal issues and promote healing. IASTM is a therapeutic approach that employs specialized tools to manipulate and massage soft tissues, primarily used for conditions linked to muscle tightness or scar tissue. A single session of IASTM has been shown to effectively reduce pain intensity and functional disability in patients with non-specific low back pain, suggesting its utility in managing calf muscle-related issues(Jain et al., 2022). Additionally, IASTM is effective in increasing ankle dorsiflexion range of motion and reducing pain(Shah et al., 2021). Comparisons have shown that IASTM is more effective than compressive myofascial release in improving ankle dorsiflexion in individuals with active calf muscle trigger points(Vijayakumar et al., 2019). Dynamic Cupping therapy, involving the movement of suction cups over the skin with oil, is known to enhance blood circulation, relax muscle tissue, and release fascial adhesions. Ten-minute sessions of cupping therapy at specific negative pressures have been found more effective in reducing muscle stiffness compared to shorter sessions(Li et al., 2022). Significant pain reduction has also been observed in individuals with mechanical neck pain following dynamic cupping treatment(Jani & Tank, 2020). Furthermore, the combination of IASTM and cupping therapy has been indicated to improve pain and function in individuals with medial tibial stress syndrome (Deshmukh & Phansopkar). The efficacy of myofascial trigger point dry cupping in reducing pain and enhancing functional outcomes has been demonstrated in patients with plantar heel pain(AlKhadhrawi & Alshami, 2019).

The impact of high heels on the calf muscles, specifically the gastrocnemius and soleus, as well as their tendons, has been a subject of interest in biomechanical and physiological research. While specific studies focusing solely on IASTM and dynamic cupping therapy for calf muscle treatment, particularly in relation to high heel usage, are limited, the ongoing research in related areas provides valuable insights. These therapies, known for their effectiveness in addressing soft tissue dysfunctions, could be potentially beneficial for treating conditions caused by altered biomechanics due to prolonged high heel wear. The aim of this study is to compare the effects of cupping therapy and IASTM on flexibility, balance, and calf pain in women who regularly wear high heels.

Methodology

This was pre and post experimental comparative and parallel-arm design where the subjects were distributed equally into two groups. The research received approval from the Department Ethical Committee (DEC), at Faculty of Allied Health Sciences, Manav Rachna International Institute of Research & Studies, India and was given the referral number MRIIRS/FAHS/DEC/PT/2019-23/BPT-07, dated January 8, 2023. The study was executed in consensus with the Declaration of Helsinki recommendations.

Prior to the trial's commencement, participants were provided with comprehensive information about the potential risks and benefits associated with the treatment modalities being studied. They were required to read and provide their consent before participating. Individuals who met the inclusion criteria were given a detailed information sheet outlining the study procedures, and their participation was contingent upon furnishing written informed consent.

The inclusion criteria for this study target women aged 17-35 who have regularly worn high heels for a minimum of 6 months, typically on 3 to 4 days each week. Furthermore, participants should primarily use heels with a height exceeding 3 centimeters. On the other hand, exclusion criteria encompass individuals with cardiovascular or neurological issues, recent lower limb injuries, a history of lower limb surgery, leg length discrepancies, contraindications for Instrument-Assisted Soft Tissue Mobilization (IASTM) (Gupta et al., 2023) and Dynamic Cupping Therapy (DCT), a predominant preference for wedge heels, and those with a history of deep vein thrombosis. These criteria are thoughtfully crafted to ensure the study's relevance and validity within the selected demographic while considering potential medical and biomechanical factors that could impact the research outcomes.

Recruitment and allocation for this study were conducted through a convenience sampling approach. A total of 30 female participants who met the specified inclusion criteria were recruited into the study. The 30 participants were then divided into two distinct groups: one group would IASTM, and the other group would undergo DCT. This allocation process was based on the participants' preferences or availability for each specific therapy, as determined through convenience sampling. While convenience sampling may introduce some selection bias, it was chosen in this study to reflect real-world scenarios where individuals self-select their preferred treatment options.

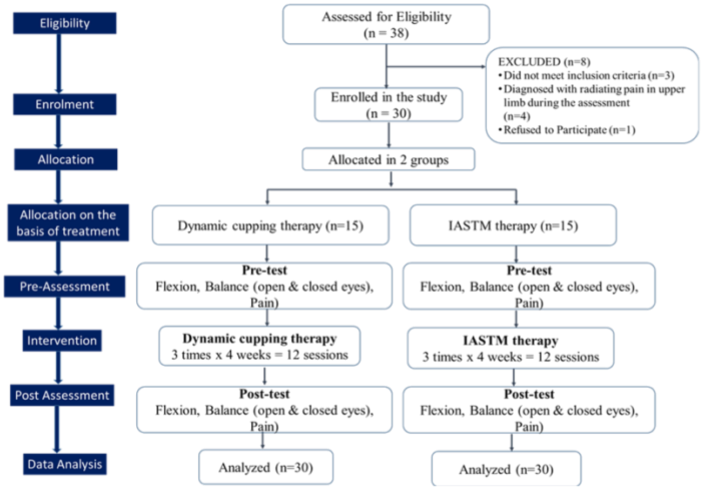

Figure 1: Flow diagram of the study design

Blinding was not feasible in this study due to the inherent nature of IASTM and DCT. These manual therapies involve direct physical contact between therapists and participants, making it evident to both parties which treatment is being administered.

Attempting to blind participants or therapists would compromise the transparency of the study and could undermine the participants' informed consent, given the tactile and sensory nature of these interventions.

Intervention

Instrument-Assisted Soft Tissue Mobilization (IASTM) therapy: To initiate the IASTM therapy, the first step was ensuring the patient's comfort, which often involved placing them in a prone position and uncovering the calf area by either rolling up or removing any obstructing garments. Before commencing the IASTM intervention, a thorough assessment of the patient's calf region was conducted. This assessment aimed to identify areas of tenderness, tension, or myofascial trigger points through palpation or by gathering information from the patient regarding their symptoms and areas of discomfort. To facilitate smooth motion and minimize patient discomfort, a small amount of lubricant or emollient cream was applied to the calf region, reducing friction between the skin and the IASTM instrument. With a firm grip on the IASTM tool, gentle pressure was applied to the specified calf region. The massage technique involved gradual, brief movements aligned with the muscle fibers, following the longitudinal axis of the calf muscles. Throughout the treatment, a consistent and controlled pressure was maintained, ensuring tissue stimulation without causing undue pain or discomfort. IASTM was directed toward specific areas of the calf that required attention, such as taut or sensitive muscles, myofascial trigger points, or areas with limited mobility. To effectively target these regions, the edges or contours of the IASTM tool were utilized. Patient comfort and response were continuously monitored through open communication. Patients were asked about the level of pressure they were experiencing and any accompanying sensations. Adjustments to pressure or technique were made based on the patient's feedback. The duration of an IASTM session could vary depending on individual needs and responses, typically lasting between 5 to 15 minutes.

Dynamic cupping therapy (DCT): In the DCT therapy, patients were comfortably positioned either in a prone or seated posture, ensuring that the calf region was exposed and accessible for treatment. Careful selection of appropriately sized cups was undertaken to secure a tight seal when applied to the calf, ensuring optimal therapeutic efficacy. Prior to cup placement, a small amount of lubricant or oil was thoughtfully administered to the calf area to minimize friction, facilitating the smooth movement of cups over the skin surface during the therapy. The technique of dynamic cupping involved compressing the cups and gently situating them onto the calf area, exerting the necessary force to generate negative pressure. These cups were systematically arranged on the calf, maintaining proper spacing between them to ensure comprehensive coverage of the targeted treatment zones. The duration of dynamic cupping therapy varied based on individual comfort levels and specific treatment objectives, typically falling within the range of 5 to 15 minutes. Ongoing patient observation was a critical aspect of the treatment process, allowing for necessary adjustments to the treatment duration, aligning with the patient's comfort and response. In instances where patients reported discomfort, cups were promptly removed by delicately releasing the suction, achieved through the application of gentle pressure to the skin surrounding the cup's perimeter. This meticulous approach ensured the safety and effectiveness of dynamic cupping therapy for calf-related concerns.

Both IASTM and DCT techniques were administered three times weekly over a four-week period, totaling twelve sessions prior to post-treatment measurements, aligning with the approach employed in previous research (Cheatham et al., 2019).

Outcome Measures

Flexibility for Calf Muscle Tightness: The "Knee to Wall Test" was employed to assess calf muscle flexibility in both limbs(Warneke et al., 2023). An indication of calf tightness was recorded when the measurement fell below 6 cm. To conduct this test, centimeter markings up to 12 cm from the wall were made using a ruler, with 0 cm at the wall. Participants were instructed to position the big toe of one foot at the 6 cm mark from the wall and take a step back with the other leg, maintaining knee extension while keeping the heel in contact with the ground. Subsequently, participants were asked to touch the wall with the knee of the foot placed at the 6 cm mark, ensuring alignment of the hip, knee, and second toe, while keeping the heel grounded.

The distance from the wall to the toe was measured and recorded. The test was repeated for both limbs.

APP COO Test: The APP-Coo-Test, designed for smartphones and tablets and based on a triaxial accelerometer, was utilized to assess both static and dynamic balance deficits. A Samsung Galaxy A51 (Android 12) was placed on the breastbone and secured with an elastic band(Arcuria et al., 2019; Porwal et al., 2023). The APP detected trunk oscillations using a triaxial low-acceleration sensor, offering acceleration measurements on three perpendicular axes. This test evaluated trunk oscillation in various static positions, including "Feet Together" and "On a Broad Base" (30 cm distance between both malleoli). The test commenced when the patient activated the APP's start button, and a second countdown signaled the beginning of the test. Upon completion, a red dot moved across a virtual grid, providing a quantitative assessment of body sways in the longitudinal, frontal, and transverse axes during the task. Patients were instructed to stand and maintain stability with their eyes open or closed, feet together, or on a broad base.

Pain Measurement: Algometers, instruments for quantifying pain sensitivity or pain thresholds, were employed(Aboodarda et al., 2015). Patients assumed a comfortable prone position, ensuring relaxation and adequate support. The pressure application involved using the algometer's probe to exert a consistent and perpendicular force on the area of maximal pain. The force was systematically regulated at a constant rate (e.g., 1 kilogram per second) until the patient reported a transition from pressure to discomfort. Patients conveyed this transition using verbal prompts like "pain" or "discomfort" or physical gestures. Upon expression of discomfort, the pressure measurement was recorded on the algometer, representing the patient's pain tolerance or susceptibility in the specific area or region of examination.

Statistical analysis

Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 24 (IBM, USA). The collected data, including variables such as flexion, balance, and pain, were entered into SPSS for processing and statistical calculations. Descriptive statistics, such as means and standard deviations, were computed to summarize the characteristics of the data. The independent t-test was used in the data analysis to examine any significant differences in the outcome variables between the IASTM (instrument-assisted soft tissue mobilization) group and the DCT (dynamic cupping therapy) group. Further, to compare the mean differences between groups, paired t-tests were performed. The significance level was set at $p<0.05$ to determine statistical significance.

Results

The independent t-tests were conducted to examine the differences in various outcome variables between the IASTM (Instrument-Assisted Soft Tissue Mobilization) and DCT (Dynamic Cupping Therapy) groups at the baseline before the intervention.

For the BMI (Body Mass Index), the mean in the IASTM group was 20.43 ± 0.87, and in the DCT group, it was 20.64 ± 0.72. There was no statistically significant difference in mean BMI between the two groups (t= 0.72, p= 0.48). Moving on to the high heel height (cm) variable, the IASTM group had a heel height of 2.23 ± 0.35, while the DCT group had a mean of 2.38 ± 0.21 with no significant differences in high heel height between the two groups (t= 1.42, p= 0.17). Regarding the duration of high heel usage (months), the IASTM group had a mean duration of 14.52 ± 1.38, and the DCT group had a mean duration of 13.46 ± 2.01 which was not significant (t= -1.68, p= 0.10). Finally, for duration of Standing (hours), the IASTM group had a mean duration of 4.82 ± 1.35, and the DCT group had a mean duration of 4.19 ± 1.76, with no significant differences in duration of standing between the two groups (t= -1.10, p= 0.28).

For the Flexion variable at baseline, the mean score in the IASTM group was 6.07±1.83, while the DCT group had a mean score of 6.53±1.51. The t-value was -0.76, with a p-value of 0.45, indicating no significant difference in mean Flexion scores between the two groups at baseline. The mean difference was -0.47, and the 95% confidence interval ranged from -1.72 to 0.79.

In the case of Balance with Open Eyes at baseline, the IASTM group had a mean score of 4.89±0.6, while the DCT group had a mean score of 4.63±0.33. The t-value was 1.48, and the p-value was 0.15, suggesting no significant difference in mean Balance with Open Eyes scores between the two groups at baseline. The mean difference was 0.26, and the 95% confidence interval ranged from -0.10 to 0.63. Similarly, for Balance with Closed Eyes at baseline, the IASTM group had a mean score of 5.01±0.63, and the DCT group had a mean score of 4.77±0.17. The t-value was 1.62, with a p-value of 0.12, indicating no significant difference in mean Balance with Closed Eyes scores between the two groups at baseline. The mean difference was 0.10, and the 95% confidence interval ranged from -0.03 to 0.22. Lastly, for the Pain variable at baseline, the IASTM group had a mean score of 2.1±0.53, while the DCT group had a mean score of 1.97±0.46. The t-value was 0.75, and the p-value was 0.46, indicating no significant difference in mean Pain scores between the two groups at baseline. The mean difference was 0.14, and the 95% confidence interval ranged from -0.24 to 0.51.

In summary, the independent t-tests did not reveal any significant differences between the IASTM and DCT groups for the measured outcome variables at the baseline before the intervention. These findings provide valuable insights into the comparability of these two treatment modalities at the study's outset.

Table 1: Independent t test to compare different outcome measures at the baseline before the intervention between IASTM (Instrument-Assisted Soft Tissue Mobilization) and DCT (Dynamic Cupping Therapy)

Outcome Variables	Group	Mean±SD	t	p	SE	95% Confidence Interval	
						Lower	Lower
BMI	IASTM	20.43±0.87	0.72	0.48	0.29	-0.39	0.81
	DCT	20.64±0.72					
High Heel Height (cm)	IASTM	2.23±0.35	1.42	0.17	0.11	-0.07	0.37
	DCT	2.38±0.21					
High heel usage in months	IASTM	14.52±1.38	-1.68	0.10	0.63	-2.89	-0.31
	DCT	13.46±2.01					
Standing hours/day	IASTM	4.82±1.35	-1.1	0.28	-0.63	-1.80	0.54
	DCT	4.19±1.76					
Flexion	IASTM	6.07±1.83	-0.76	0.45	0.61	-1.72	0.79
	DCT	6.53±1.51					
Balance Pre Open	IASTM	4.89±0.6	1.48	0.15	0.18	-0.10	0.63
	DCT	4.63±0.33					
Balance Pre Closed	IASTM	5.01±0.63	1.62	0.12	0.06	-0.03	0.22
	DCT	4.77±0.17					
Pain	IASTM	2.1±0.53	0.75	0.46	0.18	-0.24	0.51
	DCT	1.97±0.46					

Note: t – independent t test statistical value; p – level of significance; SE- Standard Error difference

Table 2: Paired t-tests assessing changes in outcome variables from baseline (Pre) to post-intervention (Post) within the IASTM (Instrument-Assisted Soft Tissue Mobilization) and DCT (Dynamic Cupping Therapy) groups

Outcome Variables	Groups	Pre	Post	SEM	95% CI		t	p
					Lower	Upper		
Flexion	IASTM	6.07±1.83	9.87±2.17	0.31	-4.47	-3.13	-12.19	p<0.01
	DCT	6.53±1.51	9.27±1.58	0.21	-3.18	-2.29	-13.25	p<0.01
Balance Open Eye	IASTM	4.89±0.6	4.27±0.18	0.13	0.35	0.91	4.88	p<0.01
	DCT	4.63±0.33	4.17±0.14	0.08	0.30	0.62	6.11	p<0.01
Balance Closed Eye	IASTM	5.01±0.63	4.44±0.22	0.13	0.29	0.86	4.31	0.001
	DCT	4.77±0.17	4.37±0.13	0.04	0.32	0.49	10.18	p<0.01
Pain	IASTM	2.1±0.53	0.82±0.45	0.15	0.97	1.60	8.75	p<0.01
	DCT	1.97±0.46	1.1±0.23	0.12	0.62	1.12	7.41	p<0.01

Note: SD – Standard deviation; CI – Confidence interval; t – paired t test statistical value; p – level of significance; SEM- Standard Error of Mean

Table 2 presents the results of paired t-tests assessing changes in outcome variables from baseline (Pre) to post-intervention (Post) within the IASTM (Instrument-Assisted Soft Tissue Mobilization) and DCT (Dynamic Cupping Therapy) groups. In both the IASTM and DCT groups, significant improvements in flexion were observed. The mean flexion score in the IASTM group increased significantly from 6.07±1.83 at baseline to 9.87±2.17 post-intervention, with a mean difference of -3.80 (t = -12.19, p < 0.01). Similarly, the DCT group demonstrated a significant increase in mean flexion score from 6.53±1.51 to 9.27±1.58, with a mean difference of -2.73 (t = -13.25, p < 0.01).

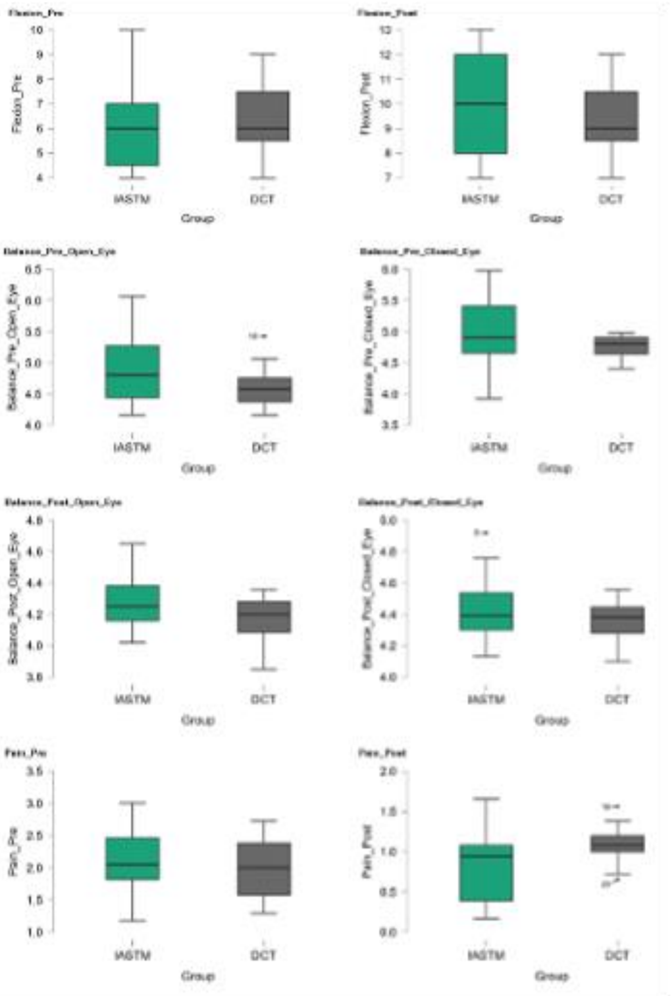

Figure 2: Box plot showing the comparison of different outcome measures between IASTM (Instrument-Assisted Soft Tissue Mobilization) and DCT (Dynamic Cupping Therapy).

Both groups exhibited significant improvements in balance with open eyes. The mean balance score in the IASTM group increased significantly from 4.89±0.6 to 4.27±0.18, resulting in a mean difference of 0.63 (t = 4.88, p < 0.01). Similarly, the DCT group showed a highly significant improvement, with the mean balance score increasing from 4.63±0.33 to 4.17±0.14, and a mean difference of 0.46 (t = 6.11, p < 0.01). Significant improvements in balance with closed eyes were observed in both groups. The IASTM group displayed a significant increase, with the mean balance score changing from 5.01±0.63 to 4.44±0.22, and a mean difference of 0.57 (t = 4.31, p = 0.001). In the DCT group, the mean balance score increased significantly from 4.77±0.17 to 4.37±0.13, resulting in a mean difference of 0.40 (t = 10.18, p < 0.01).

Both groups experienced significant reductions in pain levels. In the IASTM group, the mean pain score decreased from 2.1±0.53 to 0.82±0.45, with a mean difference of 1.28 (t = 8.75, p < 0.01). Similarly, the DCT group showed a highly significant reduction, with the mean pain score decreasing from 1.97±0.46 to 1.1±0.23, and a mean difference of 0.87 (t = 7.41, p < 0.01).

The paired t-test results demonstrate significant improvements in flexion, balance (with open and closed eyes), and pain levels within both the IASTM and DCT groups following the respective interventions. The t-values and p-values provide statistical evidence of these improvements, highlighting the effectiveness of both treatment modalities in enhancing the participants' physical and pain-related outcomes.

DISCUSSION

Wearing high heels regularly can lead to significant calf muscle pain and other related consequences. Prolonged use of high heels often results in the shortening and tightening of the calf muscles, leading to discomfort and pain(Qureshi & Akbar, 2019). This change in muscle length can also alter gait and posture, potentially causing a chain reaction of musculoskeletal issues. Over time, the continuous strain on the calf muscles from high heels can increase the risk of injuries like muscle strains or Achilles tendonitis.(Zöllner et al., 2015).

Furthermore, this habitual elevation of the heel can lead to a decreased range of motion in the ankle, compounding the risk of falls and affecting overall mobility(Farrag & Elsayed, 2016). One study found that walking in high heels increases electromyography (EMG) activity in these calf muscles and their tendons. This increased EMG activity suggests that high heels may place additional strain or demand on these muscles and tendons(Lee et al., 2001). Physiotherapy offers a comprehensive approach to treating calf muscle pain caused by frequent high heel use. The treatment typically starts with stretching exercises aimed at lengthening and relieving the tension in the shortened calf muscles(Cleland et al., 2009). Strengthening exercises are also incorporated to improve muscle function and support the ankle and lower leg structures.

Manual therapy techniques, such as massage and mobilization, can be used to enhance joint mobility and alleviate muscle stiffness. Instrument Assisted Soft Tissue Mobilization (IASTM) and dynamic cupping therapy are modern adaptations of traditional techniques, gaining popularity for their effectiveness in treating soft tissue dysfunctions. Both IASTM and dynamic cupping therapy are praised for their broad therapeutic applications, ease of use, affordability, minimal side effects, and rapid results in treating various diseases. A notable study by AlKhadhrawi et al, 2019, highlighted the effectiveness of dry cupping therapy in reducing pain intensity and improving functional outcomes in patients with plantar heel pain, demonstrating the potential of these therapies in clinical practice. The study in question focuses on evaluating the comparative effects of Instrument Assisted Soft Tissue Mobilization (IASTM) and cupping therapy on three key aspects – flexibility, balance, and pain – specifically in the calf muscles of women who regularly wear high heels(AlKhadhrawi & Alshami, 2019).

The outcomes of our study indicated noteworthy improvements in calf muscle flexibility with the application of both treatment modalities. However, a pivotal observation was that IASTM manifested a superior mean difference in effectiveness in comparison to cupping therapy. Supporting our findings, recent studies in the field of physical therapy have shown that IASTM is effective in increasing range of motion and decreasing pain perception in subjects with mobility impairments. This is complemented by research indicating that IASTM can enhance range of motion and reduce muscle stiffness, thus validating our observations regarding the effectiveness of IASTM in improving flexibility. This results resonates with a study by Shah, Ghumatkar, and Kumar (2021) that concluded IASTM as more effective in treating calf pain in high heel wearers compared to Active Release Technique (ART)(Shah et al., 2021). Kim, Jae-Eun et al. (2017) conducted a study highlighting the significant effects of cupping therapy and passive stretching on muscle flexibility and range of motion in healthy subjects(Kim et al., 2017). Lee, Jee-Hyun et al. found that both active movement myofascial decompression and static myofascial decompression positively affect muscle flexibility, range of motion, and functional movement in young adults(J.-H. Lee et al., 2021). A study by Uludag, Veysel and Öksüzoglu, Xhardo, Kristo et al. (2022) demonstrated the efficacy of IASTM and cupping therapy in improving muscle flexibility and range of motion in the recovery of ankle sprains(XHARDO et al., 2022). Additionally, the work of Harrison K et al. (2017) aligns with our findings, demonstrating an enhanced flexibility of the hamstrings through IASTM when compared to proprioceptive neuromuscular facilitation stretching(Harrison et al., 2020). This distinction in the efficacies of IASTM and cupping therapy can be attributed to the inherent mechanisms of action associated with each technique. IASTM, a method involving specialized tools to manipulate soft tissue, is hypothesized to activate the body's intrinsic repair mechanisms. This activation not only improves tissue mobility but also facilitates an increase in local blood circulation, potentially contributing to the release of muscle tension and enhancement of tissue elasticity. Such physiological responses are conducive to improved flexibility and an expanded range of motion, a vital component in the prevention of muscle fatigue and injuries.

The results of the study further showed significant improvement of balance following IASTM and DCT therapy. However, it was particularly noted that the use of IASTM led to a more pronounced improvement. Excessive muscle tension and trigger points can negatively affect muscle function, leading to balance issues. By reducing tension and promoting muscle relaxation, IASTM can improve the overall balance and stability of the lower extremities (Croft et al., 2022). The marked improvement in balance with the use of IASTM could be attributed to its effectiveness in addressing deeper layers of soft tissue, thus potentially offering a more comprehensive mobilization and healing process. A study on IASTM in individuals with chronic ankle instability (CAI) found a significant 4.45 cm improvement in anterior reach during the Y-Balance Test (YBT). However, there were no significant changes observed in posteromedial or posterolateral reaches in the YBT following IASTM treatment (Croft et al., 2022; H. W. Lee et al., 2021). The findings of another study suggest that IASTM rehabilitation exercise can enhance ankle stability, muscle power, and body balance in taekwondo players with chronic ankle instability (Park et al., 2020).

In a recent study, Instrument-Assisted Soft Tissue Mobilization (IASTM) has shown promising results in alleviating pain when compared to cupping therapy, particularly in individuals experiencing discomfort related to the shift in body weight onto the balls of their feet and toes, often associated with wearing high heels. This shift in weight distribution can lead to conditions such as metatarsalgia, characterized by pain in the ball of the foot. Furthermore, the use of high heels can limit the natural movement of the foot, particularly affecting the ankle and arch. This restriction may result in muscle imbalances, stiffness, and reduced shock absorption, all contributing to pain and fatigue in the lower extremities. Arif Karmali et al. in 2019 conducted as study involving IASTM and found it clinically significant in reducing the pain intensity for various musculoskeletal conditions(Karmali et al., 2019). Myofascial trigger points (MTrPs) are hyperirritable nodules within skeletal muscles that often manifest as pain, weakness, and functional limitations. IASTM, a technique employing handheld instruments to apply pressure and friction to soft tissues, has shown promise in addressing these issues. In a study by Dawn T. Gulick et al. in 2017, a brief five-minute intervention employing three specific IASTM techniques was found to effectively increase the Pressure Pain Threshold (PPT) of MTrPs over a course of six treatments spanning three weeks(Gulick, 2018). These findings suggest that IASTM could be considered a safe and effective approach for reducing pain and enhancing functionality in individuals dealing with MTrPs.

Limitations of the study

This study has several limitations that should be acknowledged. The small sample size restricts the generalizability of the findings, and a larger sample would have provided more reliable results. The lack of long-term follow-up data prevents us from understanding the sustainability of the observed effects. The absence of a control group makes it challenging to determine the specific effects of the interventions, while the lack of blinding introduces the potential for bias.

Conclusion

The study compared the effects of two interventions, IASTM and DCT, on flexibility, balance, and pain reduction. Both interventions demonstrated significant improvements in flexibility and balance, with IASTM showing slightly larger mean differences. This suggests that both IASTM and DCT are effective in enhancing these physical performance aspects. However, when it comes to pain reduction, IASTM had a larger mean difference compared to DCT, indicating that IASTM may be more effective in alleviating pain. Overall, both IASTM and DCT show promise as therapeutic options for improving flexibility, balance, and managing pain. However, individual patient characteristics and preferences should be considered when deciding which intervention to use. Further research is needed to explore the underlying mechanisms and long-term effects of these interventions, as well as to identify alternative treatments that can effectively address pain while maintaining or improving other aspects of physical performance.

References

Aboodarda, S., Spence, A., & Button, D. C. (2015). Pain pressure threshold of a muscle tender spot increases following local and non-local rolling massage. BMC musculoskeletal disorders, 16(1), 1-10.

AlKhadhrawi, N., & Alshami, A. (2019). Effects of myofascial trigger point dry cupping on pain and function in patients with plantar heel pain: A randomized controlled trial. Journal of bodywork and movement therapies, 23(3), 532-538.

Arcuria, G., Marcotulli, C., Galasso, C., Pierelli, F., & Casali, C. (2019). 15-White Dots APP-Coo-Test: a reliable touch-screen application for assessing upper limb movement impairment in patients with cerebellar ataxias. Journal of Neurology, 266, 1611-1622.

Cleland, J. A., Abbott, J. H., Kidd, M. O., Stockwell, S., Cheney, S., Gerrard, D. F., & Flynn, T. W. (2009). Manual physical therapy and exercise versus electrophysical agents and exercise in the management of plantar heel pain: a multicenter randomized clinical trial. journal of orthopaedic & sports physical therapy, 39(8), 573-585.

Croft, B. D., Aronson, P. A., & Bowman, T. G. (2022). Effects of Instrument Assisted Soft-Tissue Mobilization on Dynamic Balance in Those with Chronic Ankle Instability. Trauma Care, 2(2), 197-204.

Cronin, N. J. (2014). The effects of high heeled shoes on female gait: a review. Journal of electromyography and kinesiology, 24(2), 258-263.

Deshmukh, N. S., & Phansopkar, P. Effect of graston technique and cupping therapy on pain and function in individuals with medial tibial stress syndrome: a research protocol.

Esenyel, M., Walsh, K., Walden, J. G., & Gitter, A. (2003). Kinetics of high-heeled gait. Journal of the American Podiatric Medical Association, 93(1), 27-32.

Farrag, A., & Elsayed, W. (2016). Habitual use of high-heeled shoes affects isokinetic soleus strength more than gastrocnemius in healthy young females. Foot & ankle international, 37(9), 1008-1016.

Gulick, D. T. (2018). Instrument-assisted soft tissue mobilization increases myofascial trigger point pain threshold. Journal of bodywork and movement therapies, 22(2), 341-345.

Gupta, U., Sharma, A., Rizvi, M. R., Alqahtani, M. M., Ahmad, F., Kashoo, F. Z., . . . Ahamed, W. M. (2023). Instrument-Assisted Soft Tissue Mobilization Technique versus Static Stretching in Patients with Pronated Dominant Foot: A Comparison in Effectiveness on Flexibility, Foot Posture, Foot Function Index, and Dynamic Balance. Healthcare,

Hamandi, S. J., & Ruken, D. M. (2020). Biomechanical study with kinematic and kinetic descriptions of the effect of high-heeled shoes in healthy adult females based on gait analysis. IOP Conference Series: Materials Science and Engineering,

Harrison, K., Carver, M., Dietrich, W., Mc Devitt, J., Vanic, K., & Rozea, G. (2020). The Use of Instrument Assisted Soft Tissue Mobilization Verse Massage and Proprioceptive Neuromuscular Facilitation Stretching Techniques on Improving Hamstring Flexibility. International Journal of Orthopaedics Research, 3(1), 35-45.

Jain, P., Saharan, A. K., Vishnoi, C. S., Bhati, M. P. S., & Sharma, P. (2022). Single IASTM and cupping therapy session improves pain and disability in patients with non-specific low back pain. GSC Advanced Research and Reviews, 11(3), 045-050.

Jani, R., & Tank, K. (2020). Immediate Effect of Dynamic Cupping on Pain in Teachers with Mechanical Neck Pain: An Experimental Study. Indian Journal of Physiotherapy & Occupational Therapy Print-(ISSN 0973-5666) and Electronic–(ISSN 0973-5674), 14(2), 154-159.

Karas, M. A., & Hoy, D. J. (2002). Compensatory midfoot dorsiflexion in the individual with heelcord tightness: implications for orthotic device designs. JPO: Journal of Prosthetics and Orthotics, 14(2), 82-93.

Karmali, A., Walizada, A., & Stuber, K. (2019). The efficacy of instrument-assisted soft tissue mobilization for musculoskeletal pain: A systematic review. Journal of Contemporary Chiropractic, 2, 25-33.

Kim, J.-E., Cho, J.-E., Do, K.-S., Lim, S.-Y., Kim, H.-J., & Yim, J.-E. (2017). Effect of cupping therapy on range of motion, pain threshold, and muscle activity of the hamstring muscle compared to passive stretching. Korean Society of Physical Medicine, 12(3), 23-32.

Kim, J.-h., Park, J.-h., Yoon, H.-b., Lee, J.-h., & Jeon, H.-s. (2020). Immediate effects of high-frequency diathermy on muscle architecture and flexibility in subjects with gastrocnemius tightness. Physical Therapy Korea, 27(2), 133-139.

Lee, C.-M., Jeong, E.-H., & Freivalds, A. (2001). Biomechanical effects of wearing high-heeled shoes. International journal of industrial ergonomics, 28(6), 321-326.

Lee, H. W., Beak, H. J., Yoon, E.-J., & Kim, J. (2021). Effect of Instrument-Assisted Soft Tissue Mobilization on Ankle of Range of Motion and Balance in Older Women: A Preliminary Study. The Asian Journal of Kinesiology, 23(2), 2-8.

Lee, J.-H., Kim, T.-H., Kang, S.-Y., Kum, D.-G., Lee, S.-Y., Do, K.-S., . . . Kim, J.-E. (2021). The Effects of Active Movement Myofascial Decompression Therapy and Static Myofascial Decompression Therapy on Range of Motion, Muscle Strength, Functional Movement in Young Adults. Journal of The Korean Society of Integrative Medicine, 9(3), 165-173.

Lee, J., & Chang, J. (2019). The effect of calf stiffness on gait, foot pressure and balance in adults. The Journal of Korean Physical Therapy, 31(6), 346-350.

Li, Y., Mo, P.-C., Jain, S., Elliott, J., Bleakney, A., Lyu, S., & Jan, Y.-K. (2022). Effect of durations and pressures of cupping therapy on muscle stiffness of triceps. Frontiers in Bioengineering and Biotechnology, 10, 996589.

Maqsood, S., Mehmood, M., Saleem, S., Ihsan, K., Ghaffar, T., & Batool, K. (2023). Comparative Effects of Active Release Technique and Positional Release Therapy in Female Students with Tightened Calf Muscles. Journal of Health and Rehabilitation Research, 3(2), 855-860.

Novacheck, T. F. (1998). The biomechanics of running. Gait & posture, 7(1), 77-95.

Pannell, S. L., & MD, U. (2012). The postural and biomechanical effects of high heel shoes: a literature review. Journal of Vascular Surgery.

Park, J.-H., Rhyu, H.-S., & Rhi, S.-Y. (2020). The effects of instrument-assisted soft tissue mobilization rehabilitation exercise on range of motion, isokinetic strength, and balance in chronic ankle instability taekwondo players. Journal of exercise rehabilitation, 16(6), 516.

Porwal, S., Rizvi, M. R., Sharma, A., Ahmad, F., Alshahrani, M. S., Raizah, A., . . . Alkhamis, B. A. (2023). Enhancing Functional Ability in Chronic Nonspecific Lower Back Pain: The Impact of EMG-Guided Trunk Stabilization Exercises. Healthcare,

Qureshi, M. Y., & Akbar, B. (2019). A cross-sectional study determining pain in lower back and calf muscles among females due to high heel shoe wear. Health Sci, 8, 70-74.

Reček, Č. (2006). Conception of the venous hemodynamics in the lower extremity. Angiology, 57(5), 556-563.

Shah, J. T., Ghumatkar, M., & Kumar, A. (2021). Comparison between the Immediate Effects of Instrument Assisted Soft Tissue Mobilization and Active Release Technique in Individuals Wearing High Heels. International Journal of Health Sciences and Research, 11(10), 186-195.

Vijayakumar, M., Jaideep, A., Khankal, R., Gazbare, P., & Abraham, B. (2019). Effectiveness of compressive myofascial release vs instrument assisted soft tissue mobilization in subjects with active trigger points of the calf muscle limiting ankle dorsiflexion. Int J Health Sci Res, 9(4), 98-106.

Warneke, K., Wirth, K., Keiner, M., & Schiemann, S. (2023). Improvements in Flexibility Depend on Stretching Duration. International Journal of Exercise Science, 16(4), 83.

Xhardo, K., Cordun, M., Baltag, O. M., Teodorescu, V., & Iacob, G. S. (2022). Aspects Regarding the Recovery Of The Ankle Sprain By Myofascial Techniques. Studia Universitatis Babes-Bolyai, Educatio Artis Gymnasticae, 67(3).

Zeng, Z., Liu, Y., Hu, X., Li, P., & Wang, L. (2023). Effects of high-heeled shoes on lower extremity biomechanics and balance in females: a systematic review and meta-analysis. BMC Public Health, 23(1), 726.

Zöllner, A. M., Pok, J. M., McWalter, E. J., Gold, G. E., & Kuhl, E. (2015). On high heels and short muscles: a multiscale model for sarcomere loss in the gastrocnemius muscle. Journal of theoretical biology, 365, 301-310