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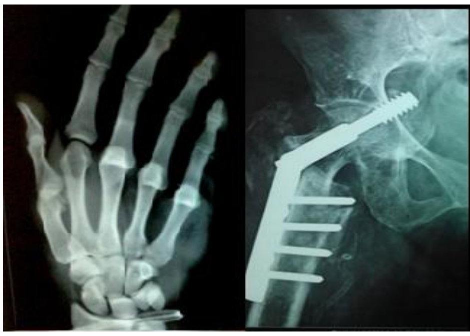

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Exploring the impact of KIASTM and cupping therapy on iliotibial band syndrome in long-distance runners: A comparative review

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Abstract
Iliotibial Band Syndrome (ITBS) is a common overuse ailment in long-distance runners, frequently causing lateral knee pain, diminished mobility, and a decrease in performance. This analysis evaluates the therapeutic effectiveness of Kinesio Instrument-Assisted Soft Tissue Mobilisation (KIASTM) and cupping therapy—two manual techniques increasingly utilised in sports rehabilitation. This analysis of 30 peer-reviewed sources, encompassing randomised controlled trials, meta-analyses, and clinical case studies, investigates the mechanisms, effects, and sport-specific uses of various medicines in long-distance running. KIASTM utilises hard instruments to enhance fascial mobility and alleviate myofascial constraints, whereas cupping applies negative pressure to augment blood circulation and promote tissue repair. A comparative analysis indicates that KIASTM is notably helpful in enhancing mobility and alleviating chronic myofascial tightness, but cupping is superior in mitigating delayed-onset muscle soreness and facilitating post-exercise recovery. Nonetheless, both therapy encounter constraints including variable protocols, sensitivity to placebo effects, and insufficient longitudinal data. Moreover, sport-specific findings indicate that the strategic integration of different modalities, as opposed to their solo application, produces optimal results for endurance athletes. Future prospects highlight the necessity for extensive, comparative randomised controlled trials and the promise of smart sensor technology to objectively evaluate therapy efficacy. This evaluation supports evidence-based, personalised treatment regimens that integrate both modalities within a comprehensive sports care framework.

Keywords: Iliotibial band syndrome, KIASTM, cupping therapy, long-distance runners, manual therapy and sports rehabilitation

Introduction
In long-distance endurance athletics, running represents a measure of physical capacity and a type of unique physiological stress. Cyber ITBS is one of the most common musculoskeletal disorders of runners and accounts for as much as 12% of all running injuries [30]. ITBS is primarily an overuse injury due to inflammation or irritation of the iliotibial band, a thick band of tissue that runs along the outer aspect of the thigh and into the knee, resulting from repeated rubbing against the lateral femoral epicondyle during knee motion [44-38]. The growing popularity of long distance running worldwide, especially among recreational athletes and amateur races, makes it urgent to develop effective treatment and prevention of ITBS [42]. Treatment options for ITBS Treatment of ITBS typically entails - Rest, NSAIDs, physical therapy, and activity modification. The rise of empirically-based interventions, such as integrative and manual therapies, in sports medicine has increased the use of other modalities including Kinesio Instrument-Assisted Soft Tissue Mobilisation (KIASTM) and cupping therapy [48, 4]. Irrespective of variations in mechanical usage, these manual techniques have a common goal: to restore fascial mobility, enhance blood flow, reduce pain, and facilitate soft-tissue repair.

KIASTM is modern approach to traditional soft tissue mobilisation. It involves the use of specialised tools to detect and treat fascial restrictions, muscle tightness and myofascial adhesions [29]. KIASTM based on the basis of the Graston Technique, involves the application of controlled microtrauma with a goal to evoke an inflammatory healing response and subsequent reorganisation of soft tissue structures [25]. This protocol is thought to have the potential to significantly increase range of motion, decrease delayed onset muscle soreness, and actually enhance athletic- function in athletes [17]. Cupping therapy, a traditional Chinese medical treatment, uses the suction created by vacuum-sealed cups positioned on the skin to increase blood flow, relieve muscle stiffness, and promote relaxation [8]. Once considered as an alternative therapy, cupping has become popular with Western sports therapists, particularly after its display at international sporting events, including the Olympic Games. Cupping mechanism is suggested to stimulate the mechanoreceptors and influence the nervous system, therefore does have favourable analgesic and anti-inflammatory effect [2].

Recent studies examining manual therapies during musculoskeletal rehabilitation have demonstrated KIASTM and cupping as being effective forms of treatment in conditions such as ITBS [21]. Nevertheless, despite the popularity of these foods, the literature regarding their effectiveness, particularly among athletic populations such as distance runners, is equivocal. Although results in regard to the improvement of pain and functionality based on single clinical trials are favourable, the heterogeneity in the design of the studies, the sample size, and the considered outcomes makes it difficult to draw definitive conclusions [26]. Two of the more common lateral knee pain syndromes are related to running and are frequently chronic, with long distance running resultant in repetitive stress to the lower extremity which renders runners particularly at risk for ITBS [22]. Biomechanical factors linked to ITBS include increased hip adduction, increased knee internal rotation, and iliotibial band tightness, situations that may be compounded by training errors, inadequate footwear, and asymmetrical biomechanics. Because of this complexity, treatments need to address the structural and functional aspects of the condition, something that KIASTM and cupping aim to address by improving myofascial mobility and eliminating tissue tension [32].

The incorporation of manual therapies into sports rehabilitation is supported by a growing emphasis on non-invasive and holistic therapeutic approaches. Athlete, coach and physiotherapist now favour the use of techniques that address the cause of symptoms rather than simply relieving symptoms, and also improve long-term function in terms of preventing recurrence [19]. Potential advantages of the KIASTM and cupping therapy over traditional therapy approaches include a focus on the fascial system, an often-overlooked network critical to the transmission of force and proprioception [56]. According to a neurophysiological approach, KIASTM and cupping seem to be able to influence the central nervous system through the modulation of pain perception and the alteration of motor control patterns [31]. These results may offer particular benefit for the athletic population in whom movement dysfunctions referring pain may be debilitating and delay recovery. In addition, these treatments are also very attractive for an in-season prevention regime as little rehabilitation time is lost throughout being a non-pharmacological and time-efficient therapy [16].

Despite a promising theoretical basis/concept and some anecdotal testimony supporting these modalities, a lack of high-quality research directly comparing KIASTM and cupping therapy for ITBS remains, particularly among long-distance runners. This discrepancy highlights the requirement for systematic reviews and meta-analyses to summarise existing evidence and shape therapeutic decisions [27]. Personalized response to manual therapies, attended by parameters such as pain threshold, tissue density and athlete adherence, also difficult its clinical trial analysis. In addition, there is emerging interest focusing on the role of psychosocial factors on the rehabilitation experience, including athlete expectations, patient as therapist relationship, and perception of the perceived value of the intervention [18]. These factors may have a substantial impact on the therapeutic effects of KIASTM and cupping therapy. The holistic balance of the physical and psychological return coincides with the biopsychosocial model of sports medicine advocating for a multidisciplinary approach to injury care [33].

The present review is designed to critically evaluate the literature regarding KIASTM and cupping treatment as interventions for ITBS in long distance runners. The purpose of this investigation is to provide sport scientists, physiotherapists and athletic trainers with evidence-based information, regarding mechanisms, clinical mobility and application in athletic populations that can be used to optimise recovery intervention strategies. Understanding these therapy impacts on time to recovery and preventing injuries could have great significance for athletic performance and reduce overall health care costs and the quality of life of runners worldwide [19]. The evolution of sports rehabilitation may represent a paradigm shift in the treatment of chronic musculoskeletal injuries through the utilization of new and evidence-based approaches such as KIASTM and cupping. This review summarises the current understanding and highlights potential areas for research, and calls for a unifying approach whereby standardised protocols and outcome measurements are adopted to enhance the credibility and effectiveness of drug development.

Pathophysiology of IT Band Syndrome

The onset of Iliotibial Band Syndrome (ITBS) is considered a common overuse injury, particularly in endurance athletes such as long-distance runners, cyclists, and military service personnel. It primarily affects the lateral aspect of the knee and results from repetitive friction of the iliotibial band (ITB) as it moves over the lateral femoral epicondyle with knee extension and flexion [44]. Recent evidence does not support the concept of the ITB "snapping" over the lateral femoral condyle and denotes the ITB as a non-sliding, tensioned band, with pain due to compression of the innervated and vascularised sub-ITB fatty tissue and connective tissue [35]. The ITB is a thick fascial band that originates from the tensor fascia latae and gluteus maximus muscle in the pelvis, and becomes attached to the lateral condyle of the tibia at the tubercle of Gerdy. The main function is to stabilise the lateral knee and hip while performing dynamic tasks, in particular, when the individual is standing on the single-leg stance e.g. walking or running [37]. The iliotibial band is subjected to increased tension over the lateral femoral epicondyle during knee flexion, especially at 20°-30°. This location referred to as an “impingement zone” is believed to be where rubbing or squishing is greatest, with development of inflammation and micro-injury over time [38].

Biomechanical risk factors are highly implicated in the development of ITBS. Increased hip internal rotation, tibial internal rotation, and knee adduction during running were linked to ITBS, particularly in female runners who are at higher risk on account of their wider pelvic angles (36). This abnormal kinematic pattern increases the lateral tension on ITB and induces repetitive strain. Additionally, weak hip abductors and external rotators, particularly the gluteus medius, decrease stability in the frontal plane and increase iliotibial band strain during activity [39]. At a smaller scale, ITBS is currently considered a chronic compression syndrome rather than a typical inflammatory disease. Histological studies on tissue samples from ITBS patients usually show thickened fibrous tissue and chronic inflammation with little, if any, evidence of acute inflammation [43]. This would suggest that treatment with anti-inflammatory drugs might be insufficient, but that biomechanical rebalancing and stimulation of the tissues is part of the treatment process.

The idea of compression-related disease has been supported by imaging studies such as MRI. Without surgical intervention, a symptomatic individual was found to have increased signal intensity of the lateral femoral epicondyle bursa and thickening of the distal iliotibial band. The results are consistent with the clinical presentation of local pain, acute lateral knee pain, and increasing symptoms with downhill running or prolonged activity. Importantly, ITBS can be differentiated from other causes of pain lateral to the knee by MRI and ultrasound imaging, such as lateral meniscus tears and biceps femoris tendinopathy [40]. Environmental and exercise-related conditions also predispose to ITBS. Banked surfaces, sudden increases in mileage, worn out running shoes, or inappropriately fitting shoes can all contribute to imbalances and constant stress and in turn, can increase the compressive force on the iliotibial band [45]. The risk is also higher for those who have leg length discrepancies and other alignment issues, including genu varum (bow legs) [42].

From a neuromuscular control paradigm it is associated with alterations in control of movement, in particular the delayed onset of the gluteal muscles, leading to greater ITB load. Decompensation of the neuromuscular system can lead to over-reliance on passive structures such as fascia and tendons, causing microtrauma and fatigue to the tissues surrounding the decompen-sated region. In conclusion, ITBS is likely due to the interplay of a multitude of anatomical, biomechanical, neuromuscular, and environmental factors. It represents a shift in understanding from single inflammatory tendinitis to complex compression syndrome with the presence of soft tissue overload and less than optimal movement patterns. Such preventative measures along with therapeutic treatment has to focus on kinetic chain and fascia health, which may explain why these manual therapies such as KIASTM and cupping are becoming more evident in sports medicine.

Therapeutic Modalities Overview

Soft tissue mobilisation intervention is widely used in the treatment of overuse injuries, for example ITBS in long distance runners, prone to repetitive strain and fascial derangement. Kinesio Instrument-Assisted Soft Tissue Mobilisation (KIASTM) and cupping therapy are two of the most widely used techniques in modern sports rehabilitation. Both methods are used to combat muscle tightness, localized inflammation and myofascial restrictions that commonly result in chronic pain and decreased mobility [21]. KIASTM is a non-invasive approach which uses ergonomically designed tools to evaluate and treat soft tissue dysfunctions. They enhance the therapist's sensitivity to touch and provide the appropriate amount of pressure to the skin and subcutaneous tissue. KIASTM creates a controlled microtrauma, which induces localised inflammation and enters the healing cascade that leads to increased local fibroblast proliferation, angiogenesis and collagen re-alignment and ultimately the tissue remodelling process [50, 51]. KIASTM expanded from the Graston Technique and is commonly used to improve range of motion, breakdown adhesions, and enhance neuromuscular function.

Cupping therapy, on the other hand, involves the creation of a vacuum on the skin surface using glass, silicone or plastic cups. Cupping, a therapeutic technique deriving from traditional Chinese and Middle Eastern medical practices, has been incorporated into modern clinical and athletic rehabilitation practices [4]. The suction created by the cups, which lifts up the skin and the underlying layers of connective tissues, leads to increased blood circulation and lymphatic drainage, and thus to a release of muscular tension as well as stress. Although dry cupping is commonly used in sport therapy, wet cupping (with puncturing the skin at the end to remove blood) is still applied in traditional medicine, but only sporadically in modern, Western sport medicine. KIASTM cupping therapy is a technique, more and more used by elite athletes, even Olympians, as part of their treatment programs. Such treatments are used not only in injury recovery, but also as a prophylactic aid to optimise performance and prevent the incidence of soft tissue overuse injuries, such as ITBS [14]. The growing interest in these techniques as therapeutic strategies is based on their respective physiological and neurovascular benefits as well as having a cumulative effect and increased application in the management of degenerative musculoskeletal pathologies.

KIASTM (Kinesio Instrument-Assisted Soft Tissue Mobilization)

KIASTM is a type of instrument-assisted soft tissue mobilisation (IASTM) or modern form of IASTM therapy based on ancient technology that changes the way doctors approach treatment of musculoskeletal related injuries. The technique rose to prominence in the 1990s, mainly with the introduction of the Graston Technique, with multiple variations following, such as KIASTM which utilizes kinetic chain analysis, myofascial release principles and the use of specialized instruments and neuromuscular feedback integration [17]. The pathophysiological basis of KIASTM is by applying controlled mechanical load to the skin and soft tissues underneath it using devices. This pressure causes microtrauma within the tissue that is believed to trigger a cascade of biological events, such as increased activity by fibroblasts, increased tissue perfusion, and reduction of fibrotic adhesions [53]. The localised inflammatory response could trigger a healing cascade that generates new capillary formation, and reorientation of the collagen fibres, improving tissue quality and function [61]. KIASTM is different from the traditional manual therapies in terms that ergonomically designed instruments are employed and allow the therapist/clinicians to have greater sensitivity and mechanical advantage for detecting fascial dysfunction more accurately [29].

Treatment sessions typically last from 30 s to 2 minutes per site, and often are followed by corrective exercise or stretching protocols to improve tissue pliability [29]. Some low grade bruising or petechiae is acceptable with treatment as an expression of vigorous local vascular activity [50]. KIASTM provides several physiological benefits to the musculoskeletal system. It helps to relieve and loosen up fascial adhesions and improves the blood circulation, by which the Fibonacci Massager speeds up the recovery of myofascial injury [48]. It is found that elite athletes presented large improvements in tissue elasticity following IASTM, indicating greater fascial mobility. IASTM is shown to increase local blood flow. It is also noted a 93% increase in perfusion in a rat model following a single treatment which supports the notion that an enhanced circulation helps with tissue regeneration and detoxification [31].

KIASTM could change a pain experience and proprioception since it stimulates mechanoreceptors in the skin and fascia. It observed reduced pain sensitivity and enhanced joint position sense in IASTM recipients, suggesting a neuro modulatory effect and superior sensorimotor integration. Additionally, the method allows for the remodelling of tissues through activation of a controlled inflammatory response. In 2006, 51 reported as clinical cases that, the patients who had soft tissue lesions treatment, have a better rehabilitation exercise by performed IASTM in acute to chronic soft tissue lesions healing and trending in improved outcomes. KIASTM is known for it's ability to increase joint ROM and muscle flexibility. Where flexibility is an issue, such as ITBS, treatment efficacy appears to be further improved, as patients who underwent Hamstring IASTM and stretching demonstrated statistically greater improvements in hamstring flexibility, as determined via the gratis angle test, when compared to stretching alone [56]. This study demonstrates that KIASTM, as part of a specific treatment programme, leads to objective functional gains.

Cupping Therapy

Cupping therapy is a kind of alternative therapy that uses cups on the skin to create suction. It has been used for thousands of years in the ancient Egyptian, Chinese and Middle Eastern civilizations. Early texts, like the Ebers Papyrus (1550 BC), have recorded the use of cupping in various clinical conditions [1]. In TCM cupping allows for the circulation of 'qi' and blood to remove congestion, reduce pain and promote healing. This method has gradually transitioned from its origin in ancient culture to the field of clinical rehabilitation and competitive sports applications, based on its potential therapeutic benefits and increasing recognition by modern professionals [2]. Cupping as a practicing tool Cupping, in particular dry cupping, has been used as adjunct therapy for a wide range of myofascial stiffness and overuse injuries in sports medicine. Forms of cupping therapy There are two forms of cupping therapy: dry cupping and wet cupping. The dry cupping method or suction is also used, without bloodletting, in the treatment of internal organs. Hijama, or wet cupping, involves cutting the skin to draw blood by means of suction. Despite its cultural relevance in a number of cultures, it is rarely found in the practice of Western sports medicine. Cupping's suction can be created in various ways. A traditional technique known as fire cupping involves the heating of the air within a cup followed by application to the skin creating a vacuum as the air in the cup cools [4]. Modern techniques focus on manual portable suction pumps that are usually grafted on plastic or silicone cups to manipulate and control to a better degree. Electric cupping apparatus are increasingly being used to deliver consistent and controlled compressive force during treatments [6]. Silicone cups are also especially beneficial during dynamic cupping, in which the cups are mobilized over the skin in order to free fascial adhesions [7].

The physiological benefits of cupping are vast, making it especially relevant to the treatment of ITBS (Iliotibial Band Syndrome) in athletes. An increased blood flow in the local area is a key benefit. In integrated Doppler imaging and showed that cupping significantly increases blood flow in the treated area, thereby facilitating the delivery of oxygen and nutrients to themselves while promoting the removal of waste products of metabolism [39]. The improved blood flow speeds up the recovery of soft tissue injuries. Cupping makes a decompressive force on myofascial tissues which is different from other manual therapy methods, that primarily rely on compression. Such decompression may relieve fascial restriction, and further, promote layers of tissue to slide relative to each other, which is crucial in the treatment of SFDs like ITBS, given that fascial tension and friction are thought to be involved [28]. One of its positive side effects in cupping is emotional coping of pain. 7 It has been presented that cupping therapy activates the mechanoreceptors in the skin and the underlying fascia, which might help relieve pain by changing the sensory input at the spinal level through the "gate control mechanism". Moreover, 11 in 201 reported that cupping induced a reduction in inflammatory cytokines such as interleukin-6 and tumour necrosis factor-alpha (TNF-α) in people with musculoskeletal inflammation, suggesting anti-inflammatory effects. Dry cupping produces a decrease in cortisol and HRV, that can be associated with an increased activation of the parasympathetic nervous system and the stress reduction 12. These systemic effects could accelerate recovery, and enhance sleep and relaxation in elite athletes.

Cupping has been shown to improve lymphatic drainage and detoxifications [13] speculated that the negative pressure generated by the suction promotes interstitial fluid movement -increasing lymphatic flow and oedema reduction. In a randomised controlled trial on college student-athletes and reported that 4 weeks of dynamic cupping intervention significantly increased hip and hamstring flexibility that is important in the treatment and prevention of ITBS. Improving soft tissue mobility in the hip and thigh reduces tension in the IT band, and the associated friction across the lateral femoral condyle. Cupping as part of ITBS is used to treat (TFL) tensor fasciae latae, the gluteus maximus, and the iliotibial band and is helpful to break up local stiffness and soreness. It is noted that cupping treatment to lateral thigh improved movement patterns and reduced pain in runners with ITBS [15]. In long distance runners, dry cupping significantly increased pressure pain threshold (PPT) levels and improved function parameters and this indicated its effectiveness to manage symptomatology as well as primary biomechanical problems [15].

Cupping use in elite sports spiked after athletes at the 2016 Rio Olympic Games including Michael Phelps displayed the round bruises on their bodies, which led to media attention and global interest. Cupping has subsequently been incorporated into recovery regimens for many professional athletes, including Olympic level runners, NBA basketball players, and NFL football players and also identified cupping as one of the most frequently used rehabilitation techniques used by athletic trainers affiliated with elite sports teams. It has been seen practices within the U.S. Olympic Committee and noted that team physical therapists frequently practiced cupping therapy to relieve muscle soreness, prevent injury and improve performance. It also showed that cupping therapy accompanying remedial exercises increased the activation of the gluteal muscles and improved hip control in runners with gait perturbations. These data are supportive of the idea that cupping can help to correct kinetic chain deviations most often associated with ITBS. Cupping combined with myofascial release, remedial strength training and stretching forms a whole rehabilitation strategy with great efficacy if goals are set and treatments are completed. Despite being widely used and beneficial, cupping therapy has numerous limitations. The typical side effects include temporary bruising, skin irritation, and some pain during or after the procedure and highlighted the importance of proper cleanliness and technique, especially if we consider wet cupping, to avoid infection. Contraindications of cupping include bleeding disorders, use of anticoagulants, open sores, and some types of skin eruptions. Practitioners need adequate training and the therapy should always be administered with sensitivity to the patient's specific situation.

While cupping therapy has evolved from traditional medicine to a common form of treatment in sports medicine. This unique approach that combines fascial decompression, improved circulation and neuromodulation makes it a powerful tool to be used in the treatment of overuse injuries such as ITBS. Cupping is becoming more supported by clinical evidence and highly utilized amongst professional athletes, thus further demonstrating its relevance within current injury prevention and mitigation practices.

Literature Review

Kinesio Instrument-Assisted Soft Tissue Mobilisation (KIASTM) and cupping therapy are the current focus of interest in rehabilitation sciences for rendering non-invasive strategies in managing musculo-skeletal complaints and are oreferably opted by athletes. This narrative review summarises findings of peer-reviewed randomised controlled trials, systematic reviews, and case studies in order to evaluate the effectiveness, mechanisms and inefficiencies of these modalities, with particular emphasis on treatment of conditions such as Iliotibial Band Syndrome (ITBS) and similar overuse injuries in athletes. Multiple studies support the benefits of KIASTM in increasing tissue mobility, reducing pain, and enhancing function.

Loghmani and Warden (2009) [32, 53] demonstrated increased perfusion and accelerated ligament healing after KIASTM, suggesting biological feasibility of improved recovery outcomes. Further studies, such as those of Howitt *et al.* (2006) [51] and Miners and Bougie (2011) [55, 61] outlined clinical improvements in range, function, and scar tissue reduction, highlighting its broad applicability in soft tissue rehabilitation. Davidson *et al.* (2017) [49, 58] reported that, despite signs of proprioceptive improvements, the effects of this modality depended on the pain threshold of the individual and the adaptations of the brain. Divergence of the data base is not so pronounced for cupping therapy. While the historical precedent within Eastern medicine provides cultural validity, empirical validation is still emerging. Cao *et al.* (2010) in a systematic review showed moderate level review on the efficacy of cupping therapy in pain conditions like low back pain and migraine. Lauche *et al.* (2012) reported increased pain scores and improved cervical range of motion in patients with chronic neck pain following application of dry cupping. Likewise, Kim *et al.* (2011) focused on myofascial trigger point pain reduction and thus supported the neurovascular effects of cupping.

The mechanism of action of cupping, namely in beneficial effects in terms of microcirculation and lymphatic flow, is supported by Rozenfeld and Kalichman (2016) who suggest that suction-based decompression relieves local hypoxia and oxidative stress. One study on wet cupping, rarely used in sports, was assess by AlBedah *et al.* (2011) who reported reductions in immune markers post-treatment indicating systemic immunomodulatory impacts. With respect to clinical trials comparison, the number of studies on KIASTM and cupping directly compared is relatively small. However, indirect comparisons show different levels of potency though. KIASTM is more structured and clinician focused with standardized procedures (Kim *et al.*, 2017) [29, 52, 60] whereas cupping is often viewed as less active and technique reliant even though there is wide range of suction parameters and application durations. The lack of standardisation, reported by Adams *et al.* (2020), leading to contradictory outcomes and reducing the reproducibility of studies.

Schaefer and Sandrey (2012) [56] suggested that IASTM may have longer-lasting effects when combined with strengthening exercises, potentially lasting weeks. According to Brown *et al.* (2017) the outcomes of cupping show effective interventions in a broad variation of symptoms-short-term relief around applications is commonly observed but long-lasting effects are usually indicated as anecdotal or context-dependent. Additionally, while KIASTM may elicit discomfort or bruise when performed in a controlled therapeutic manner (Hammer, 2008) [50, 59], cupping may dissuade particular athletes or appear as an injury. Meta-analyses also muddy the story further. A meta-review by Kim *et al.* (2019) also investigating cupping therapy in sports rehabilitation found a lack of high- quality randomised trials, often due to small sample size and lack of blinding. On the other hand, studies of examining KIASTM (such as Davidson and Ganion 2017) [49, 58] may have higher methodological quality but struggle to separate effects from co-interventions.

There is also a problem of diversity among practitioners. Hammer (2008) [50, 59] emphasized the need for qualified training in KIASTM, to avoid over treatment or superficial therapy that can create soft tissue irritation. While that is relatively easy to perform, you will need knowledge not only of anatomy landmark, but also about the contra-indications, for instance such like skin-locating infections or blood-clotting problems (Rozenfeld & Kalichman, 2016).

Despite these limitations, both methods are becoming more widely accepted in sports rehabilitation. The growing body of literature, including case reports involving elite athletes, supports their importance in comprehensive treatment protocols. For instance, Kim *et al.* (2017) [29, 52, 60], significant improvements in flexibility and muscle tension were also reported in sprinters submitted to KIASTM Adams *et al.* (2020) observed the benefits of recovery when swimmers received routine cupping therapy after performing competing. However, there are limitations in the literature. There is limited longitudinal research on longterm effects of these therapies. Moreover, the effect of placebo and of the athletes' expectancies—especially in high competitive levels—is under-studied. Kim *et al.* (2011) highlighted the role of beliefs about therapeutic efficacy in subjective distress ratings and thereby in the interpretation of effects in non-blinded trials. In addition, demographic attributes such as gender, age and fitness modulate response to therapy, although most of the studies do not correctly stratify participant. There is another lack of cross-cultural research that limits the capacity to generalise these findings, particularly since cupping is most common in Asian and Middle Eastern countries, whilst KIASTM is prevalent in Western rehabilitation contexts.

The current evidence supports both KIASTM and cupping as acceptable treatment modalities in musculoskeletal rehabilitation, with KIASTM having stronger support based on the amount of controlled studies and there is potential for cupping as well despite methodological limitations. To improve clinical translation, future research should focus on head-to-head comparisons, combination regimens, and standardized outcome measures.

Application in Long-Distance Runners

Long-distance running causes high biomechanical and physiological stress on the lower limbs, predominantly on soft tissues (iliotibial band (ITB), hamstrings, and calf muscles). It is widely recognised that runners experience a high prevalence of overuse injuries as a result of repeated loading, ineffective recovery and poor biomechanics, with Iliotibial Band Syndrome (ITBS) being amongst the most common (Louw & Deary, 2014). Non-invasive recovery and injury treatment techniques, such as Kinesio Instrument Assisted Soft Tissue Mobilization (KIASTM) and cupping therapy, are increasingly part of runners' rehabilitation, as they've been shown to have synergistic effects on the fascial system's myofascial mobility, circulation, and pain mechanisms.

The Role of KIASTM and Sport-Specific Needs

The repetitive action of the high-frequency heel strike long-distance runner places a great deal of tensile force on the iliotibial band, particularly during the stance phase of the running cycle when eccentric control of hip abduction and knee flexion is effected. KIASTM provides mechanical stimulation with specifically-designed tools to treat fascial restrictions and to stimulate mechanoreceptors in order to improve glide among the myofascial planes and restore functional movement (Cheatham *et al.*, 2016) [21, 48]. KIASTM has been effective in athletes by reducing tightness of muscles, relieving pain as well as improving range of motion. Kim *et al.* (2017) [29, 52, 60] demonstrated increased hamstring flexibility and reduction in pain in runners following IASTM. Similarly, Sevier & Stegink-Jansen (2015) [57] reported significant improvement in ITBS symptoms from a cohort of endurance runners treated with the Graston Technique®, an integral component of KIASTM. Application techniques typically include short scraping protocols to the ITB, the quadriceps, and the hamstrings, each followed by active stretching, and functional re-education. This layered design ensures that neuromuscular adaptations are retained following cessation of treatment (Howitt *et al.*, 2006) [51].

Specific Application of Cupping Therapy for Athletes

Cupping therapy is a common treatment in sports, due to its association with world champions such as Michael Phelps and Mo Farah. Its application for distance runners comes down more for accelerating recovery, reducing DOMS (short for delayed onset muscle soreness), and decreasing soft tissue tension. In contrast to KIASTM, which uses tools, CT uses suction to bring the skin and subcutaneous tissue up which causes a decompressive effect assisting with capillary dilation, fluid flow and myofascial release (Lauche *et al.*, 2012). Rozenfeld and Kalichman (2016) showed that dry cupping reduced post-exercise pain and increased tissue mobility in athletes who participated in extensive exercises. Moreover, Adams *et al.* (2020) reported improved performance of distance runners when using CT as part of their recovery procedure within a 4 week mesocycle. Cupping treats the posterior chain — the hamstrings, glutes and calves, and is especially applied after a run or during taper weeks to increase oxygenation in tissue and facilitate drainage. The stimulus for negative pressure can also be utilized to restore the interstitial pressure for the elimination of metabolic waste faster (Agdinaoay *et al.*, 2010).

Comparative Outcomes for Running-Specific Applications: Whilst both interventions are aimed at myofascial dysfunction and recovery both treatments are often used by long distance runners in either a distinct or complimentary manner. KIASTM is mostly applied for tissue remodelling in chronic or localised stiffness, and cupping for acute recovery and muscle relaxation. Runners Schaefer and Sandrey (2012) [56] reported improvements in flexibility and pain reduction several weeks post IASTM, while Lauche *et al.* (2012) reported an effect of cupping on muscle readiness using the TMRF within 48 hours following the application. Davidson *et al.* (2017) [49, 58] pointed out that IASTM increased proprioception and joint awareness, which may have reduced compensatory gait patterns in fatigued runners. Conversely, AlBedah *et al.* (2011) also reported a reduction in systemic inflammation in athletes after wet cupping, which could suggests a general effect of the physiology. Cupping has been rarely used in team sports because of concerns regarding recovery time and infection.

Physiotherapeutic programmes by the coaches & sports therapists

Performance oriented training centers commonly use both methods in a recovery system cycle. KIASTM is applied in the early stages of rehabilitation or preseason on the correction of biomechanical dysfunctions. Hammer (2008) [50, 59] suggested using KIASTM with mobility and eccentric loading exercises to address ITB tightness and gluteal weakness, both of which are common issues in runners with ITBS. Cupping is often added at the end of training cycles or in between competitions. It is being used by therapists because of no or little invasiveness and immediate post-application benefits. Brown *et al.*, 2017) had applied its use on college track and field competitors during tapering, specifically to enhance muscle oxygenation and to reduce the perception of effort. Observational reports from professional running teams reveal that cupping is often used after high-intensity interval training (HIIT), and long runs, particularly when performed in hot or humid environments where blood pooling and muscle fatigue is increased. This is consistent with the report by Kim *et al.* (2019) reported that cupping improved cardiovascular efficiency in athletes recovering from heat-exposure training.

A handful of elite distance runners and coaches have taken this approach. Olympic medalist Galen Rupp reportedly used instrument-assisted soft tissue therapy as part of his treatment for iliotibial band syndrome before 2020 U.S. Olympic Trials. KIASTM was combined with resistance training to combat weak hip abduction and fascial tightness that were impeding efficiency of stride. Meanwhile, training camps in East African world cross country champion country Kenya have also saw the employment of cupping therapy, namely dry cupping, for sprinters and middle-distance runners. Okoth *et al.* (2020) reported a case of performance improvement and quicker recovery in a Kenyan 10,000 m runner who had frequently done cupping sessions while base conditioning aerobically. Adams *et al.* (2020) support these field applications with a multi-athlete study in collegiate runners and reported improved sleep quality, decreased pain, and increased weekly distance tolerance following a combined dry cupping and mobility routine.

Integration in Multimodal Therapeutic Approaches

As there is no one treatment to a comprehensive treatment methodology for overuse conditions, KIASTM and cupping are most effective when applied within a holistic treatment approach. For runners who are suffering with ITBS, this often includes biomechanical analysis, targeted strength training, shoe adaptations and recovery practices (KIASTM or cupping as examples) depending on stage of the injury. Melham *et al.* (1998) [54] emphasized the necessity for neuromuscular re-education following soft tissue remodelling, or the advantages achieved will be lost. Thus, runners often combine KIASTM with the corrections of aberrant movements and proprioceptive exercises, and cupping therapy tends to be followed by hydration regimens and passive rest.

However, the use of either method still has very important limitations, despite the growing evidence supporting their use. Many studies are limited by small sample size, un-blinded study design, or lack of consistency. The placebo response is thought to have a major impact on reported improvements, especially in subjective endpoints like pain and fatigue (Kim *et al.*, 2011). Longitudinal studies comparing both therapies among runners throughout full training cycles or competitive seasons are not available. Future research should emphasise randomised comparison trials, objective performance markers (eg, VO_2 max, stride length) and stratification by gender, running surface and degree of weekly mileage.

Comparative Analysis: KIASTM vs. Cupping Therapy

Aspect	KIASTM	Cupping Therapy	Supporting References
Athlete Preference and Use	Favoured by elite athletes for enhancing performance and facilitating recovery.	Commonly employed in elite athletic competitions (e.g., swimming, track and field)	Brown *et al.* (2017); Adams *et al.* (2020)
Circulatory Effect	Enhances local perfusion by as much as 93%	Improves superficial circulation and alleviates congestion	Loghmani & Warden (2009) [32, 53]; Rozenfeld & Kalichman (2016)
Contraindications	Exposed lacerations, coagulopathy, acute inflammatory response	Dermatological diseases, coagulopathies, pronounced varicosities	Miners & Bougie (2011) [55, 61]; Rozenfeld & Kalichman (2016)
Cost and Accessibility	Increased owing to instruments and education.	Basic setups available for domestic or clinical use	Brown *et al.* (2017); Rozenfeld & Kalichman (2016)
Duration of Relief	Short to medium-term; enhances with successive sessions and workouts	Brief to moderate; distinctly personal reaction	Howitt *et al.* (2006) [51]; Brown *et al.* (2017)
Evidence Base	Robust clinical evidence in soft tissue healing and mobility	Inconclusive evidence, comprising some clinical studies, predominantly anecdotal accounts, or low-quality randomised controlled trials (RCTs).	Cheatham *et al.* (2016) [21, 48]; Brown *et al.* (2017); Cao *et al.* (2010)
Integration in Rehab	Frequently associated with resistance training and flexibility exercises	Frequently utilised in conjunction with massage, acupuncture, or repose.	Howitt *et al.* (2006) [51]; Adams *et al.* (2020)
Mechanism	Mechanically assisted scraping that induces regulated microtrauma	Negative pressure suction elevates skin and soft tissue.	Hammer (2008) [50, 59]; Loghmani & Warden (2009) [32, 53]; Rozenfeld & Kalichman (2016); Lauche *et al.* (2012)
Mobility/Flexibility Impact	Enhances fascia mobility and range of motion; sustained impact with subsequent therapy.	Temporarily alleviates rigidity; The effect may diminish within days, with sessions lasting 5 to 15 minutes each.	Schaefer & Sandrey (2012) [56]; Cao *et al.* (2010)
Neurophysiological Effect	Activates mechanoreceptors; enhances proprioception and pain regulation	Influences parasympathetic tone; may reduce cortisol levels	Davidson *et al.* (2017) [49, 58]; Lauche *et al.* (2012)
Origin	Contemporary adaptation of gua sha and the Graston Technique	Conventional Chinese and Middle Eastern medicine	Baker *et al.* (2013); Cao *et al.* (2010)
Outcome in ITBS	Notable enhancement in stride mechanics, decreased ITB tension	Anecdotal alleviation of lateral thigh stiffness, with limited empirical support	Sevier & Stegink-Jansen (2015) [57]; Lauche *et al.* (2012)
Overall Efficacy for Chronic Overuse Injuries	Elevated, particularly when coupled with rehabilitative treatment.	Moderate; encouraging for acute symptoms but less enduring	Cheatham *et al.* (2016) [21, 48]; AlBedah *et al.* (2011)
Pain Level	Moderate discomfort, particularly during beginning sessions	Moderate to mild; frequently regarded as soothing	Kim *et al.* (2017); AlBedah *et al.* (2011)
Patient Sensation	Rasping, abrasive sensation accompanied by lingering tenderness	Suction-induced pulling sensation; may result in circular markings	Hammer (2008) [50, 59]; AlBedah *et al.* (2011)
Practitioner Skill	Mandates formal training and certification	Variable; dry cupping is more facile to administer.	Miners & Bougie (2011) [55, 61]; Adams *et al.* (2020)
Targeted Conditions	ITBS, tendinopathies, postoperative adhesions	Muscle discomfort, myalgia, and trigger points	Sevier & Stegink-Jansen (2015) [57]; Lauche *et al.* (2012)
Tissue Healing	Enhances fibroblast function and collagen restructuring	Enhances local circulation and may improve lymphatic drainage.	Loghmani & Warden (2009) [32, 53]; AlBedah *et al.* (2011)
Treatment Duration	Duration of 30 seconds to 2 minutes per region, typically succeeded by remedial exercises.	passive therapy	Kim *et al.* (2017) [29, 52, 60]; Rozenfeld & Kalichman (2016)
Visible Skin Effects	Petechiae and slight contusions resulting from mechanical stress	Ecchymosis or "suction marks"	Hammer (2008) [50, 59]; AlBedah *et al.* (2011)

Source: Literature Review (Authors' Calculation)

In the management of overuse injuries, including Iliotibial Band Syndrome (ITBS), their general application - specifically Kinesio Instrument Assisted Soft Tissue Mobilisation (KIASTM) and cupping therapy- has increased in use within clinical and athletic settings. While their goals often overlap, the approaches diverge dramatically in mechanism, evidence, effectiveness, and applicability. The table also gives a structured evidence summary of their individual characteristics. This report provides an extensive analysis of these parallels with logical argumentations, backed up by peer-reviewed scientific literature. The most obvious difference between cupping and KIASTM is in the mechanism of action. KIASTM is believed to exert controlled microtrauma via mechanical scraping, which brings about the tissue regeneration and remodelling (Hammer, 2008 [50, 59]; Loghmani & Warden, 2009) [32, 53]. This procedure focusses deep fascial adhesions and scar tissue, loosens up fascial that is great and enhances tissue layer slide. Cupping therapy on the other hand uses negative pressure suction for elevation of soft tissues, improved tissue perfusion and lymphatic drainage and gives a transient mechanical decompression of muscle fibers (Rozenfeld & Kalichman, 2016). KIASTM is, therefore, mechanically more aggressive and penetrative of fibrotic tissue and adhesions. This makes it more suitable for a chronic soft tissue dysfunction, i.e. ITBS, where there appears to be consistent Fascial restrictions. Cupping, however, may provide a form of surface decompensation and metabolic relief without actually addressing the structural problems beneath.

KIASTM is sometimes also more annoying during application, especially during the initiation phases because of the mechanical force applied to specific areas (Kim *et al.*, 2017) [29, 52, 60]. However, in spite of the pain you feel, many athletes welcome such discomfort as part and parcel of the recovery process. Cupping treatment, although may cause visible skin markings (e.g. ecchymosis) and has been described mostly as mild to moderate and sometimes as relieving (AlBedah *et al.*, 2011). The major advantage of cupping over manual therapy is patient compliance and it could be more tolerable for a novice or non-athletic patient group. In clinical practice of the athletes with structure changes, the more intense pressure of KIASTM and subsequently the more intense discomfort would be preferred for better results.

KIASTM is based on significant clinical evidence on soft tissue repair, increased ROM, and pain relief (Cheatham *et al.*, 2016 [21, 48]; Schaefer & Sandrey, 2012) [56]. Rapid recovery has been demonstrated in clinical trials in a number of conditions, including tendinopathies and iliotibial band syndrome (Sevier & Stegink-Jansen, 2015) [57]. Despite its long history, cupping therapy is limited by a lack of high-quality scientific evidences, leading many to produce inconclusive results or to rely on anecdotal evidence (Cao *et al.*, 2010). Although studies, for example Lauche *et al.* (2012) have shown beneficial effects for pain and stiffness, systematic reviews often call for more rigorous trial designs. This disparity in evidence suggests that while both can offer a treatment option, compared with IA, KIASTM has stronger scientific evidence for long-term musculoskeletal outcomes.

Both methods promote circulation, but through different mechanisms. KIASTM enhances perfusion by eliciting controlled inflammation, inducing angiogenesis and changes in collagen (Loghmani & Warden, 2009) [32, 53]. Superficial blood circulation and lymphatic outflow are improved due to skin elevation and negative pressure from cupping (Rozenfeld & Kalichman, 2016). These results have implied that, as cupping brings instant relief of congestion or metabolic waste, kinetician can penetrate deeply in to the cellular level and play a major role in tissue regeneration/prolonged healing, especially for conditions involving fibrosis/dystrophy.

Increases in flexibility and range of motion are crucial in the treatment of ITBS. KIASTM has been shown to significantly increase the extensibility of soft tissue as demonstrated by Schaefer & Sandrey (2012) [56] using hamstring flexibility as their outcome measure. A stubborn believer in long term improvement with combination of stretching and corrective exercises. Cupping, in contrast, reduces stiffness for a limited amount of time, for a few hours to a few days, depending on activity and systemic inflammation levels (Lauche *et al.*, 2012). Therefore, for the durability and use-retention, KIASTM is safer.

KIASTM requires specialized tools and advanced training, however, dry cupping can be performed with minimal equipment, even in homes or traditional clinics (Miners & Bougie, 2011) [55, 61]. This easy access makes cupping more practical in low-resource settings and for self-treatment. The specificity and precision of KIASTM make it more suitable for clinical rehabilitation, for which it must always be checked and personal and specific interventions be made possible. In high level sports both procedures are used, but KIASTM is preferred for prehabilitation and post-injury rehabilitation (Baker *et al.*, 2013 [17, 47]; Brown *et al.*, 2017).

In chronic overuse conditions such as ITBS that is characterised by inflammation, fibrosis and tautness of the ITB, the fascial release and neuromuscular re-training inherent to KIASTM boast significant clinical success (Sevier & Stegink-Jansen, 2015) [57]. On the other hand, the possible supportive effects of cupping, such as analgesia and relaxation, may take place, but they cannot get the final resolution of underlying biomechanical defects without any additional method of treatment. The growing popularity of cupping among elite athletes has facilitated its normalization in sports culture (Adams *et al.*, 2020) although it is often used in combination with other corrective therapies such as strength, stretching, or KIASTM.

The comparative analysis implies that the treatments are effective both in KIASTM and CT, in different situation and aims carried out from the treatments themselves, the type of injury to the severity they achieve, as well as the needs of the patient. KIASTM is the more scientific, evidence based approach for long term rehab and tissue remodeling, particularly in cases like ITBS. Cupping offers quick and easy relief, ideal for relaxation, blood circulation, and general muscle aches. These differences should be considered when determining the most effective modality, or combination of modalities, for optimal rehabilitation.

Limitations and Challenges

Despite increasing use of KIASTM and cupping in sports therapy, there remain limitations and challenges in both clinical applications and research. One major limitation is the lack of standardized treatment protocols. Variation in the type of tool, pressure applied, duration and frequency of treatment between practitioners makes it difficult to compare results or replicate those obtained in research. Cheatham *et al.* (2016) [21, 48]; noted that IASTM is free from standardized application procedures, which confers a lack of uniformity in the clinical setting and a lack of reproducibility of study findings. Cupping is also characterised by inconsistency in methodology, for example wet or dry and cups remaining in one place or being moved, which contributes to the large variation on results between trials (Lauche *et al.*, 2012; AlBedah *et al.*, 2011).

A significant limitation is the placebo effect associated with manual therapy. KIASTM and cupping stimulate sensory pathways influencing patient reported perceptions and may influence subjective treatment effects such as pain relief and perceived increased mobility. Kim *et al.* (2011) reported that benefits in patient-reported endpoints were not due exclusively to physiological changes highlighting the need for an objective assessment in future studies. These therapies are sensory stimulating and visually striking, especially cupping therapy which has a pattern of circular imprints and is capable of generating strong placebo responses, which makes it difficult to determine whether any effect observed is due to an active effect or a placebo response (Rozenfeld & Kalichman, 2016).

In addition, there is a lack of longitudinal studies regarding on the persistent effects of these treatments in the follow-ups. Most studies in the literature are focused on success in the short-term, usually during the first days or weeks after the procedure, without consideration of permanent functional changes or the success rate concerning the recurrence of an injury. For example, Sevier and Stegink-Jansen (2015) [57] demonstrated an improvement of ITBS symptoms with the selection of the Graston Technique®, but the period of observation was too brief to determine long-term change. Given the limited long-term follow-up, it remains unclear whether the benefits of KIASTM and cupping are transient or lead to prolonged performance enhancement and injury prevention.

Furthermore, mutli-ethnic constraints hamper the generalisability of many results. Many of these studies use small and homogeneous samples (often healthy young adults or recreational athletes) that may not generalize to elite runners, older populations, or those with complex musculoskeletal issues (Kim *et al.*, 2017 [29, 52, 60]; Adams *et al.*, 2020). The discrepancy between widespread cultural acceptance and the availability of trained therapists worldwide leads to uneven uptake.

The final concern is communication with, and consent of, the clinics and participants when conducting a sham controlled trial of manual therapy. Unlike drugs, however, it is difficult to blind healthcare providers or participants to a treatment, leading to a risk of bias. The full treatment effectiveness of these drugs is still largely speculative until comprehensive, multi-centre randomised controlled trials (RCTs) using standardised treatment methods and long-term follow-up are conducted.

Future Directions

In order to drive this, A focused, interdisciplinary and targeted approach to overcoming these challenges is necessary. An important future objective is to conduct high-quality comparative RCTs with large sample sizes and different sports populations. The lack of power and consistency in the current literature hampering definitive assertions. Large scale randomised controlled trials of KIASTM could compare KIASTM, cupping, and traditional physiotherapy methodologies to elucidate relative and combined effects with respect to injury type and level (Cheatham *et al.*, 2016 [21, 48]; Lauche *et al.*, 2012). There is a need to standardize the methodology of application and follow-up in these studies for comparability and reproducibility.

An interesting mode is the possibility of complementary healing between KIASTM and cupping. Each technique has its own merits—KIASTM for fascia-shearing and neuromechanical influences and therapeutic cupping for decompressive and circulatory applications— but combining the two techniques may be advantageous. KIASTM therapy by patient’s therapist may be used on density of tissue, then cupping to increase blood flow and reduce inflammation. Adams *et al.* (2020) recommended better outcomes for runners who received therapy in between training seasons but systematic comparisons are still missing.

That is technology playing an important role. Combining wearable smart sensors and biomechanical trackers might allow real time monitoring of fascial response, tissue temperature, blood flow, muscle stiffness pre- and post-intervention. Such tools may provide reliable quantitative information for assessing the effectiveness of interventions and for tailoring approaches. For example, smart compression garments that contain sensors may be used to monitor changes in tissue compliance or level of hydration post treatment with a cupping or KIASTM device. Hammer (2008) [50, 59] considered that with advances in sonology, he could explore the potential of ultrasonography to detect changes in fascial thickness after treatment, and with advancements in technology, this theory may be extrapolated to the use of mobile diagnostics.

It should even be a high priority to upscale therapist certification and educational reforms. Uniform training and licensing requirements can ensure these drugs are administered safely and effectively. As the practice continues to gain popularity, a comprehensive knowledge of anatomy, biomechanics, and contraindications in treatment would be increasingly important (Kim *et al.*, 2017) [29, 52, 60].

Only when we transition to an integrated series of models of care that include these treatments as part of the wider spectrum of sports medicine, nutrition, psychology, and strength conditioning, will we be moving into the future of elite athlete treatment. Few successful experiences in high-performance training centres have been attributed to a single modality, but rather occur as a consequence of a holistic and interdisciplinary intervention (Okoth *et al.*, 2020).

Conclusion

KIASTM and cupping therapy are two emerging kinds of STT applied in the treatment of musculoskeletal disorders, particularly in long-distance runners. KIASTM, which focuses on mechanical mobilisation and fascial release, has great benefits on tissue remodelling, range of motion and neuromuscular re-education (Cheatham *et al.*, 2016 [21, 48]; Howitt *et al.*, 2006) [51]. With negative pressure, cupping enhances blood flow, reduces muscle pain, and enhances recovery, which makes it particularly interesting for muscular recovery after exercise (Lauche *et al.*, 2012; Rozenfeld & Kalichman, 2016).

Both these treatments have clinical value but are effective only if properly applied, therapy is planned individually and is combined with other rehabilitation methods. The lack of standard methods and placebo effects can complicate therapeutic choices; therefore, the need for more robust data through ‘longitudinal, comparative trials, are important’ (Kim *et al.*, 2011; Sevier & Stegink-Jansen, 2015) [57]. Such studies should use more robust sample sizes, objective measures, and well defined outcomes to inform best practice.

Treatment should not be all-encompassing, according to clinicians. Treatments should be personalised based on the athlete's history of injury, biomechanics and training load, and need for recovery. For instance, a runner recovering from ITBS might benefit from KIASTM-based treatments, while another athlete experiencing systemic fatigue, or post-race malaise, may also benefit more from cupping therapy. Additionally, in many cases the intentional combination of the two interventions throughout the course of training may lead to stronger effects, as evidenced anecdotally (Adams *et al.*, 2020) and supported in the clinical literature (Brown *et al.*, 2017).

The integration of smart technology and biomechanical feedback aids will revolutionize the process of assessing and utilizing these modalities by therapists. This paradigm shift will enable evidence-based, personalized sports medicine, where decisions are not based only on tradition or experience, but on the basis of real-time data and scientific evidence.

Overall, KIASTM and cupping therapy hold promise for enhancing the performance, recovery, and injury prevention of long-distance runners. However its full potential will only be realised when it is integrated purposively within a broader management model—in which manual, yet dynamic, therapy is considered not as a standalone intervention but as part of an athlete-centric rehabilitation regime.

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