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Effect of Physical Therapy Approaches for the Treatment of Iliotibial Band Syndrome: A Systematic Review

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ABSTRACT Iliotibial band syndrome (ITBS) is a common overuse injury, which involves lateral knee pain after activities with repetitive knee flexion and extension. It's typically seen in athletes especially runners, cyclists as well as in triathlon. This syndrome is an inhibiting factor that affects the athlete's participation, results and performance. This study aimed to investigate the efficacy of physical therapy methods and techniques in ITBS management. A computerized research was conducted in Google Scholar, PubMed and PEDro. A total of 14 studies were included. GT mobilization showed pain relief and negative Ober's test. Self-stretch of the ITB with a FR contributes to short-term increases in flexibility. Deep transverse frictions did not seem to modify symptoms and are not recommended as a therapeutic approach. Therapeutic currents reduce pain in an average of 2 days. Trigger point release showed a significant decrease in pain and an improvement in function ability. The comparison of shockwave therapy and soft tissue mobilization techniques led to pain reduction without significant difference, while the comparison of dry needling and shockwave therapy showed improvement in pain and limb function in both groups. Research has shown that physical therapy approach can include many techniques and methods for a successful treatment of ITBS. Further research is needed in order to fully examine the effects of each treatment in large number of patients with ITB.

INDEX TERMS iliotibial band syndrome, physical therapy, rehabilitation, cyclists, runners

I. INTRODUCTION

Iliotibial band syndrome (ITBS) is a common overuse injury mainly affecting long distance runners and cyclists and causes severe or searing pain 2cm above and outside of the joint line with the knee in 30° of flexion {Formatting Citation}. Patients report that jogging, downhill or attempting to lengthen their stride causes an increase in the frequency and intensity of their symptoms [2]. However, palpation can also reproduce sensitivity and pain at the same point [3]. In the early stages of the syndrome the onset of symptoms usually happens after completing an activity with repetitive knee flexion and extension [2]. Pain starts early during athletic activity and may be present during rest as the condition progresses [2], [4]. According to research individuals with ITBS likely exhibit greater hip adduction, greater knee internal rotation, and greater hip external rotation [5], [6], [7].

The pathophysiology of the syndrome is considered as controversial. The numerous theories on the pathophysiology of the syndrome include anteroposterior friction of the iliotibial band (ITB) on the lateral femoral epicondyle at 30° of knee flexion during knee flexion and extension activities, inflammation of the bursa over the lateral femoral epicondyle due to repetitive friction of the ITB on the lateral femoral epicondyle or presence of adipose tissue at the site of inflammation [8], [9]. In any case 30° knee flexion is considered to be a point of pain in a patient with ITBS, which occurs mainly during the heel strike or stance phase of running [9].

Physical therapy is a conservative form of treatment for the ITBS. During the acute phase are used cryotherapy, iontophoresis or phonophoresis, activity modification and medication in order to reduce inflammation and pain [10]. Oral nonsteroidal anti-inflammatory drugs and corticosteroid

injections can be used to relief patient's ITBS symptoms [11], [12], [13], [14]. As the inflammation reduces - subacute phase - begin to eliminate myofascial restrictions in the affected area and includes approaches like: stretching, soft tissue mobilization techniques and specific patellar mobilization techniques [14], [15], [16]. Recovery and strengthening phase follows which includes exercises in open and closed kinetic chain, as well as high impact - plyometric exercises aiming to improve strength of hip muscles especially hip abductors and gluteus [15], [17]. Then, patients with ITBS can return to activity once they can perform strengthening exercises without pain and accomplish specific criteria. The ultimate goal of return to activity phase is athletes return to their before injure sport level [10], [16]. In rare cases where symptoms persist despite conservative treatment, surgical intervention is considered necessary [18], [19].

Patients with ITBS respond well to conservative treatment. However, in rare situations where symptoms and functional limitations persist for more than 6 months despite conservative treatment, surgical intervention is considered necessary [19]**.** Surgical procedures of ITBS include options like: partial resection of the ITB, percutaneous ITB release, arthroscopy, bursectomy and Z-plasty lengthening [20], [21], [22], [23]. It can also be used a combination of lengthening the ITB and removing part of the bursa, the Z-Plasty Lengthening and Bursectomy Technique [23]. In the retrospective study of Boothby, Troop and Alan Barber (2007) [24] 11 patients received ITBS Z-Plasty Lengthening and referred decrease in pain and return to activities as long term effects. A case series by Hariri *et al.* (2009) [25] showed decrease in knee pain and return to activity after ITB bursectomy in 12 patients with ITBS.

However, studies and systematic reviews provide limited evidence to suggest any significant benefit in the conservative management of ITBS. Systematic reviews by Ellis, Hing and Reid (2007) [26] and Van der Worp et al., (2012) [27] emphasize in the poor quality and quantity research of conservative treatment of ITBS. Moreover, systematic reviews by Van der Worp et al., (2012) [42] and Bolia *et al.*, (2020) [28] compared the effectiveness between operative and conservative treatment of the syndrome. There is only a systematic review by Miccio *et al.*, (2021) [29] examined the effectiveness between the methods in the conservative treatment of ITBS including 12 studies. This review aimed to investigate the efficacy of physical therapy methods and techniques on rehabilitation of ITBS.

II. METHODS

For this review a global literature search was conducted in Google Scholar, PubMed and PeDro electronic databases. The databases mentioned were consulted with the following keywords: Iliotibial Band Syndrome, physical therapy, rehabilitation. In the review were included clinical studies referring to conservative management techniques of ITBS which written in the English language between 1992 to 2021. Exclusion criteria were articles dealing with other knee diseases or surgical treatment of ITBS.

The results are presented as per the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) reporting guideline (supporting checklist/diagram). [30] Eligibility screening of the studies was conducted in a blinded standardized way by two independent reviewers (S.D and Ev.T.) Titles and abstracts were screened, and duplicate articles were excluded. After screening titles and abstracts, full paper copies were retrieved. Full text screening was also performed blinded by the same reviewers (S.D and Ev.T.). Disagreements between authors during any stage of the screening process were resolved by consulting a third reviewer (Em.T.). Fourteen studies met the inclusion criteria and included in this review (Figure 1).

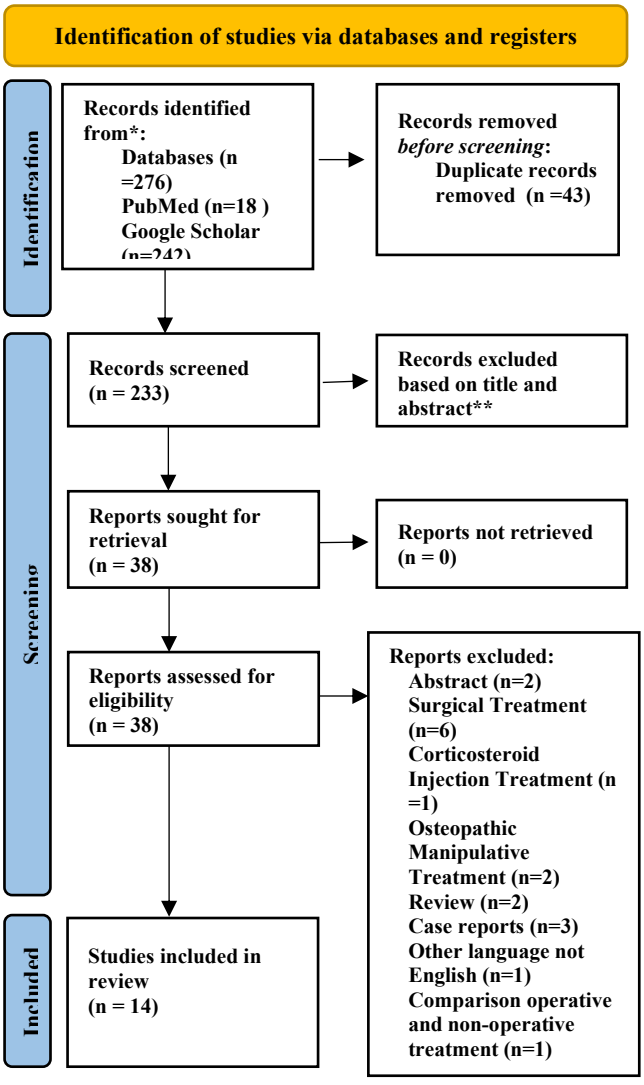

Figure 1. Flow diagram of the selection of the studies included,

III. RESULTS

The randomized clinical trial b Hansen et al. (2012) [31] investigated the effects of Graston Technique (GT) on

symptoms, range of motion and flexibility in individuals with ITBS. A total of 14 subjects with a positive Ober's test and a history of physical activity participated in this study and were divided into 2 groups. The experimental group (n=7) received 2 GT treatments on the ITB and a control group (n=7) received a sham GT treatment on the posterior lateral thigh during 1 week. The outcome measures were Ober's test, palpation and VAS pain scale, which recorded before and after the intervention. Results showed decrease in pain in both groups after each treatment. In the experimental group, 5 subjects had a negative Ober's test and 0/10 on the VAS scale after treatment. In the control group, subjects experienced little to no pain relief on the VAS scale.

The clinical trial by Schwellnus et al. (1992) [32] examined the effects of deep transverse frictions in 17 athletes with ITBS. Subjects were randomly divided into 2 groups (A and B) from day 3-14 of treatment. Both groups received daily stretching and ice therapy twice a day from day 1-14, and ultrasound therapy and stretching from day 3-14 in both groups. Subjects in group A received transverse frictions from day 3-14. All subjects had a functional treadmill running test (maximum time 30 minutes) on days 0, 3, and 7 and reported their pain per minute. Outcomes measures were total pain and percentage of peak pain during running, daily pain scores and average scores. Results showed a significant decrease in daily pain scores, total pain, and percentage of peak pain during running for both groups, with no differences between the 2 groups.

Amico, et al., (2021) [33] in their study examined the effects of Foam Roller (FR) on the ITB on hip adduction range of motion and the short-term time of any Range of Motion (ROM) changes. A total of 34 subjects with a positive Ober's test and assessment of hip adduction participated in this study. All subjects received 2 sessions on separate days: in one

TABLE 1

Studies included in the review concerning soft tissue mobilization.

Authors	Sample	Intervention	Result
Hansen et al., (2012)	N=14 Positive Ober's test history of physical activity	Experimental group (n=7): 2 GT treatments on the ITB Control group (n=7): sham GT treatment on the posterior lateral thigh for 1 week.	Results showed decrease in pain in both groups after each treatment. Experimental group: 5 people with a negative Ober's test and 0/10 on the VAS scale Control group: little to no pain relief on the VAS scale.
Schwellnus et al.,(1992)	N=17 Athletes with ITBS	Day 1-14: daily stretching and ice therapy twice a day Day 3-14: ultrasound therapy and stretching both groups Group A: transverse frictions for days 3-14	Results showed a significant decrease in daily pain scores, total pain, and percentage of peak pain during running for both groups, with no differences between the 2 groups.
Amico et al., (2021)	N=34 Positive Ober's test	1st session: 3 sets of 20 second FR on ITB with 20-s rest 2nd session: 5-min walk	Results showed that hip adduction ROM during the Ober's test was significantly greater in FR than in walking immediately after innervations and 3 min after. There were no differences 10, 15, or 20 min after FR or walking.
Vaughan & McLaughlin (2014)	N=18 asymptomatic	3-min session of FR	Lower thigh pain threshold significantly increased immediately after the intervention, but this difference improved 5 minutes later
MacMahon, et al., (2000)	N=5 Runners with ITBS	3 randomized treatments over 3 sessions: soft tissue mobilization, local heat application and rest	Soft tissue mobilization increased hip and knee flexibility Heat pad application increased functional hip abductor strength
Hyun-sook &Tae-lim (2012)	N=21 healthy with no ITB tightness	Self-stretches: 1) side lying position with the healthy lower limb below (hip and knee in flexion) and the affected in hip extension and adduction, 2) standing position with lateral trunk flexion and the affected leg in hip extension and adduction, 3) same as 2 with the upper limbs above the head and shifted to the unaffected leg, 4) same as 3 with arms moving down and diagonally.	Results showed significant differences between the 4 self-stretches apart from self-stretches 1, 2. Self-stretch 4 was the greatest in stretching the ITB, while low-intensity and long-duration stretch for the ITB is self-stretch 1.

session a 20 second FR at the ITB with 20-s rest between 3 sets, and in the other session a 5-min walk. Each session was followed by a series of Ober's test repeated less than 1 min, 3, 10, 15, and 20 min after the interventions to test hip adduction ROM changes over time. Results showed that hip adduction ROM during the Ober's test was significantly greater in FR than in walking immediately after innervations and 3 min after, but there were no differences 10, 15, or 20 min after FR or walking.

The study by Vaughan and McLaughlin (2014) [34] investigated the effect of FR on pain threshold. In the study participated18 asymptomatic subjects and performed a 3-min session of FR. Pain threshold was assessed from 3 points along the ITB with an algometer before and 5 minutes after the intervention. The results showed that lower thigh pain threshold presents a statistically significantly increased immediately after the intervention, but this difference improved 5 minutes later.The study by MacMahon, et al., (2000) [35] compared the effects of soft tissue mobilization and a heat pad in the treatment of ITBS. This study included 5 runners with ITBS, who received 3 randomized treatments over 3 sessions: soft tissue mobilization, local heat application and rest. Runners performed 2 independent measurements before and after each session. One involved stretching from a standing position for 30 seconds for 4 times using 7 reflex markers, a four-camera system and a force plate. The other measurement was made with a dynamometer during isometric abduction (20°) of the hip of the affected leg which performed 4 times for 3 seconds. The results showed that each intervention led to significant changes except of rest. Soft tissue mobilization increased hip and knee flexibility and heat pad application increased functional hip abductor strength.

The study by Hyun-sook Kim & Tae-lim Yoon (2012) [36] examined the effects of 4 self-stretches of the ITB. A total of 21 healthy subjects with no ITB tightness involved in this study. The self-stretches performed were: 1) side lying position with the healthy lower limb below (hip and knee in flexion) and the affected in hip extension and adduction, 2) standing position with lateral trunk flexion and the affected leg in hip extension and adduction, 3) same position and posture as 2 with the upper limbs above the head and shifted to the unaffected leg, 4) same position and posture as 3 with arms moving down and diagonally. The results showed significant differences between the 4 self-stretches apart from self-stretches 1, 2. Self-stretch 4 was the greatest in stretching the ITB, while low-intensity and long-duration stretch for the ITB is self-stretch 1 (Table 1).

A. THERAPEUTIC CURRENTS

Research by Bischoff *et al.* (1995) [37] compared the effectiveness of phonophoresis and knee immobilization for the treatment of ITBS. Subjects with positive the Noble's and Ober's tests were divided into 2 groups. Group P (n = 13) received phonophoresis using ultrasound therapy with 10% hydrocortisone, continuous output 1 MHz, 1.5-2.0 cm² ultrasound head for 5 minutes daily, for a maximum of 10 treatments, or until recovery was complete (2 weeks). Group I (n = 13) had knee immobilization. All subjects received rest, 5–7 minute ice massage 3 times each day, stretching, and 800 mg of ibuprofen. Ever yday examination was performed until subjects were pain free. After painless examination, stretching and running on a treadmill at 6.5 or more miles per hour followed. The results showed a statistically significant difference from initial diagnosis to painless examination between group I (8 days) and group P (2 days), and the recovery rate in less than 10 days was significantly higher in group P (100%) than in group I.

The study by Zaky (2009) [38] compared the effects of pain trigger point release and ultrasound therapy. A total of 30 subjects with chronic ITBS were randomly divided into 2 groups, each receiving 9 treatments over 3 weeks. Group A (n=15) received trigger point release with pressure applied by the therapist's thumb, for 8-12 seconds and a total pressure time of 5 minutes (on each point) followed by exercises. Group B (n=15) received ultrasound therapy on pulse mode, frequency 1 MHz and intensity of 1 W/cm² for 2 minutes at each point and the same exercises followed. The exercises were ITB stretch (2 sets of 4 repetitions) and hip abductor strengthening exercises (3 sets of 10 repetitions). Outcome measures were pain intensity, hip adduction active ROM and lower extremity functional capacity. The results showed a significant improvement in pain and functional capacity in group A than in B and a significant improvement in hip adduction active ROM in both groups.

The randomized controlled clinical trial of Weckström and Söderström (2016) [39] compared shockwave therapy (Radial Extracorporeal Shockwave Therapy, RSWT) and soft tissue mobilization techniques (Manual Therapy, ManT, mobilization techniques) in ITBS treatment. 24 runners with ITBS (positive Noble's test and positive treadmill test) were divided into 2 groups. In RSWT group (n = 11) received to 3 pain trigger points 4600 pulses and 700 pulses. While the ManT group (n = 13) received massage with emphasis on 3 pain trigger points on the ITB. Both groups received 3 treatments/week and an exercise program (side-lying hip abduction exercise, pelvic lift exercise and forward lunges) for at least 4 weeks. Primary outcome measures were defined as the mean difference in pain during treadmill running at 4, 8 weeks and 6 months follow-up. The results showed pain reduction in both groups at 4- and 8-weeks follow-up, with no difference between 2 groups.

The randomized clinical trial by Maghroori et al. (2021) [40] compared the effects of Dry Needling (DN) and Shockwave Therapy (SWT). Subjects were randomly divided into 2 groups: DN (n=20) received dry needling to various trigger points for 15 minutes 2 times a week for 4 weeks and SWT (n=20) received shockwave therapy of 500 pulses once a week for 4 weeks and an additional 2000 pulses at 3 pain trigger points. Both groups performed ITB stretches. The results showed a decrease in pain and an improvement in limb function in both groups, while the pain

TABLE 2
Studies included in the review concerning electrotherapy.

Authors	Sample	Intervention	Result
Bischoff et al., (1995)	N=26 Positive Noble's Test Positive Ober's Test	Group P (n = 13): phonophoresis with 10% hydrocortisone, continuous output 1 MHz for 5 minutes daily Group I (n = 13): knee immobilization Both groups: rest, 5–7-minute ice massage 3 times each day, stretching, 800 mg ibuprofen	Results showed a statistically significant difference from initial diagnosis to painless examination between group I (8 days) and group P (2 days), and the recovery rate in less than 10 days was significantly higher in group P (100%) than in group I.
Zaky (2009)	N=30 with chronic ITBS	Group A (n=15): trigger point release with pressure by the therapist's thumb, for 8-12 seconds Group B (n=15) ultrasound therapy on pulse mode, frequency 1 MHz and intensity 1 W/cm² for 2 minutes at each point Both groups: ITB stretching (2 sets of 4 repetitions) and hip abductor strengthening exercises (3 sets of 10 repetitions)	Results showed a significant improvement in pain and functional capacity in group A than in B and a significant improvement in hip adduction active ROM in both groups.
Weckström & Söderström (2016)	N=24 runners with ITBS Positive Noble test Positive treadmill test	RSWT group (n = 11) 4600 pulses and 700 pulses to 3 pain trigger points ManT group (n = 13) massage with emphasis on 3 pain trigger points on the ITB. Both groups: 3 treatments/week and an exercise program (side-lying hip abduction exercise, pelvic lift exercise and forward lunges) for at least 4 weeks.	Results showed pain reduction in both groups at 4 and 8 weeks follow-up, with no difference between 2 groups.
Maghroori, et al., (2021)	N=40	DN (n=20): dry needling to various trigger points for 15 minutes 2 times a week for 4 weeks SWT (n=20): shockwave therapy of 500 pulses once a week for 4 weeks and an additional 2000 pulses at 3 pain trigger points Both groups: ITB stretches	Results showed decrease in pain and improvement in limb function in both groups, while the pain score 4 weeks follow-up was significantly better in the DN group.

score 4 weeks follow-up was significantly better in the DN group (TABLE 2).

B. KINESIOTAPE

Research by Shivananda *et al.*, (2014) [41] compared the effects of cryotherapy and kinesiotaping. A total of 60 runners with grade 2 and 3 ITBS and a positive Modified Thomas test and treadmill test were randomly divided into 2 groups. Group I (n=30) received ice therapy for 15-20 minutes, while group II (n=30) kinesiotape on the ITB. Both groups performed stretches for the ITB, hip flexors and abductors, knee extensors, hamstrings, and gluteal muscles for 3 sets of 20-second with 10 seconds of rest between each set. All subjects followed 1 session per day for 14 days. Before, on the 7th day of the intervention and after the intervention, measurement of ROM with a goniometer and assessment of pain scale VAS were performed. The results showed that hip flexion and hip abduction significantly improved in group I than in II and knee flexion and pain reduction were significantly improved in group II than in group I (TABLE 3).

C. REHABILITATION

The prospective study by Beers *et al.*, (2008) [42] investigated hip abductor strength following a physical therapy approach with emphasis on abductor strengthening in individuals with ITBFS. 16 subjects received a 6-week rehabilitation program with 1 or 2 sessions per week, which included 2 stretches and 3 strengthening exercises (lateral hip abduction, pelvic stabilization, and forward-backward lunges). At the 1st week, subjects received ultrasound therapy with a continuous output of 0.5 W/cm², 3mHz frequency for 5 minutes, increased to 1.0 W/cm² for remaining 5 weeks. Hip abductor strength (bilaterally) was measured at 0, 2, 4, and 6 weeks using a hand-held dynamometer. The results showed a significant difference in hip abduction strength between injured and healthy lower

TABLE 3

Study included in the review concerning Kinesiotape.

Authors	Sample	Intervention	Result
Shivananda *et al.*, (2014)	N= 60 Runners with grade 2 and 3 ITBS Positive Modified Thomas test	Kinesiotape group (n=30) Ice therapy group (n=30) Both groups: stretches for ITB, hip flexors and abductors, knee extensors, hamstrings, and gluteal muscles for 3 sets of 20-second with 10 seconds of rest for 14 days	Results showed that hip flexion and hip abduction significantly improved in group I than in II and knee flexion and pain reduction were significantly improved in group II than in group I.

limb before the intervention, which was ameliorated after 6 weeks of intervention.

The study by McKay *et al.*, (2020) [43] examined the effectiveness of 3 different exercise programs in reducing ITBS symptoms, lower extremity functional ability, balance and strength. In the study 24 female runners with a positive Noble's test participated and were randomly divided into 3 groups: A-stretching group (n = 8), the B-conventional exercise group (n = 8) (clamshells exercises, Side-lying hip abduction, Supine bridge) and C-experimental group-hip strengthening exercise (n = 8) (such as Side plank, Side plank with hip abduction, Lateral monster walk, Hip hikes, Single leg squat). The results showed a statistically significant improvement in balance and lower extremity functional ability in A-stretch group, without statistical differences between the 3 groups.

Imeri and Gheitasi's (2020) [44] quasi-experimental study examined the effectiveness of a hip abductor strengthening exercise program in reducing ITBS symptoms and improving lower limb function. A total of 32 elite distance runners with a positive Noble's test were randomly divided into 2 groups: the experimental (n=16) and the control group (n=16). The control group continued their routine. The experimental group received a gradual progression protocol 3 times a week for 8 weeks (exercises from lying to side to standing, from symmetrical to asymmetrical, including upper extremity movements, balance and functional exercises such as Side plank with clamshell, Side plank, Side-Lying Hip Abduction, Lateral Monster Walk, Monster walking with external shoulder rotation, Hip Hikes, Scott motion on one leg, Skater-running man, Plank motion with one bent leg). The results showed that the hip abductor strengthening protocol reduced significantly pain and increased significantly function of the lower limbs after the intervention and 3 months follow-up (Table 4).

IV. DISCUSSION

This review aimed to investigate the efficacy of physical therapy methods and techniques in effective and on time rehabilitation of ITBS. A total of 14 studies, 361 patients with ITBS were included in this review.

Only one study examined the effectiveness of GT, which is a soft tissue mobilization technique that aim to reduce fibrous adhesions, release trigger points and increase flexibility of the ITB and the muscles around during the subacute phase. The research by Hansen et al., (2012) [31] led to a reduction in pain in both groups. The control group received sham treatment with GT on the posterior thigh and reported symptom relief due to the presence of trigger points or tightness in hamstrings. The experimental group showed a decrease in symptoms, while 5 people had a negative Ober's test and 0/10 on the VAS scale after intervention.
The clinical trial by Schwellnus et al., (1992) [32] examined the effects of deep transverse frictions and led to a significant decrease in pain in both groups, with no significant differences. The research concluded that deep transverse frictions are not recommended in a physiotherapy program. In addition, a Cochrane review concluded that there was no sufficient evidence for the use of deep transverse frictions. Friction was thought to be an important factor in the ITBS development and it would be preferable to decrease any additional local friction as part of intervention.

The use of FR in the research by Vaughan & McLaughlin, (2014) [34] showed a significant increase in pain threshold immediately after treatment, however, the results changed 5 minutes later. In aggrement the study by Amico et al., (2021) [33] FR led to an increase in hip adduction ROM immediately after the treatment and 3 minutes later.

Research by Hyun-sook & Tae-lim (2012) [36] examined the effectiveness of 4 self-stretches of the ITB in increasing flexibility. The results showed that stretch 4 (standing position with lateral trunk flexion and hip extension and adduction of the affected leg and moving arms down and diagonally) was the most effective, while stretch 1 from a side lying position (affected lower limb in hip extension and adduction) is an indicative stretch of long duration and low intensity. On the other hand, research by Fredericson *et al.*, (2002) [45] compared the effects of 3 standing ITB self-stretches in 5 distance runners. In A stretch, the patient extends and adducts the hip behind the healthy one with lateral trunk flexion towards the healthy side. B stretch was the same as A with the difference that patient's arms were above his head. C stretch, had the same position as B with trunk flexed diagonally towards the healthy side. The results showed significant improvements in ITB length with all 3 self-stretches, however, B-stretch tended to be more effective in the change in ITB length and hip adduction.

TABLE 4

Studies included in the review concerning rehabilitation.

Authors	Sample	Intervention	Results
Beers et al., (2008)	N=16	6-week rehabilitation program with 2 stretches and 3 strengthening exercises (lateral hip abduction, pelvic stabilization, and forward-backward lunges) 1st week: ultrasound therapy with a continuous output of 0.5 W/cm², 3mHz frequency for 5 minutes and 1.0 W/cm² for remaining 5 weeks.	Results showed a significant difference in hip abduction strength between injured and healthy lower limb before the intervention, which was ameliorated after 6 weeks of intervention.
McKay et al., (2020)	N=24 Female runners Positive Noble's test	A-stretching group (n = 8) B-conventional exercise group (n = 8): clamshells exercises, Side-lying hip abduction, Supine bridge C-experimental group-hip strengthening exercise (n = 8): Side plank, Side plank with hip abduction, Lateral monster walk, Hip hikes, Single leg squat	Results showed a statistically significant improvement in balance and lower extremity functional ability in A-stretch group, without statistical differences between the 3 groups.
Imeri & Gheitasi (2020)	N=32 Elite distance runners Positive Noble's test	Control group (n=16): routine program Experimental group (n=16): gradual progression protocol 3 times a week for 8 weeks (exercises from lying to side to standing, from symmetrical to asymmetrical, including upper extremity movements, balance and functional exercises)	Results showed that the hip abductor strengthening protocol reduced significantly pain and increased significantly function of the lower limbs after the intervention and 3 months follow-up.

Research by Beers *et al.*, (2008) [42] showed a significant difference in hip abductor strength between healthy and injured leg before intervention which was ameliorated after 6 weeks of abductor strengthening. Imeri and Gheitasi's (2020) [44] study on hip abductor strengthening resulted in a significant decrease in pain, improvement in lower extremity functionality after the intervention and 3 months follow-up. Research by McKay et al., (2020) [43] examined the effectiveness of 3 different exercise programs: stretching, conventional exercise and experimental strength training with the results showing a significant improvement in balance and lower extremity function ability in the A-stretch group, without, differences between the 3 groups.

The review also included studies that evaluate the effects of therapeutic currents on ITBS management. Research by Bischoff *et al.* (1995) [37] compared the effects of phonophoresis and knee immobilization and the results showed that subjects who received phonophoresis experienced reduced pain in an average of 2 days, while the other group in 8, a statistically significant difference. Zaky (2009) [38] compared the effects of trigger point release (group A) and ultrasound (group B) with results showing a significant decrease in pain and an improvement in function ability in group A. Weckström and Söderström (2016) [39] compared shockwave therapy and soft tissue mobilization techniques and led to pain reduction without significant difference. Research by Maghroori et al. (2021) [40] comparing dry needling and shockwave therapy showed improvement in pain and limb function in both groups.

Based on the results of existing research, the use of GT mobilization showed pain relief and negative Ober's test, and self-stretch of the ITB with a FR contributes to short-term increases in flexibility. Therapeutic currents on ITBS management reduces pain in an average of 2 days. Trigger point release results showed a significant decrease in pain and an improvement in function ability. The kinesiotape use showed significantly great improvement in some hip and knee range of motion and pain relief. The comparison of shockwave therapy and soft tissue mobilization techniques led to pain reduction without significant difference, while the comparison of dry needling and shockwave therapy showed improvement in pain and limb function in both groups. Finally, deep transverse frictions presented no significant improvements, thus this approach is not supported by the researchers.

V. CONCLUSION

This study aimed to investigate the efficacy of physical therapy methods and techniques in ITBS management. Based on the results of a literature review of 14 studies that have been reviewed, it can be concluded that the treating physical therapy approaches that was obtained for ITBS is the use of GT, self-stretch with FM, trigger point release, kinesiotape, shockwave therapy, soft tissue mobilization, dry needling and deep transverse. The appropriate method for treating ITBS was found that some of these methods were suitable and which could be recommended. The benefits of this study can be used as a reference to determine the treatment protocol for people

with ITBS, as well as a research material. The limitation of this review is that there was sparse literature concerning each method, thus no clear conclusions can be drawn. Further research is needed in order to fully examine the effects of each treatment in large number of patients with ITB.

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