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Sukces czy porażka? Czyli jak wygląda sytuacja w zakresie szczepień ochronnych w Polsce?

Cztery uczelnie – Centrum Medyczne Kształcenia Podyplomowego, Warszawski Uniwersytet Medyczny, Akademia Leona Koźmińskiego i Uniwersytet SWPS zorganizowały konferencję naukową w ramach Projektu „Budowanie zaufania do szczepień ochronnych z wykorzystaniem najnowszych narzędzi komunikacji i wpływu społecznego".
Podczas czterech paneli dyskusyjnych eksperci, naukowcy, lekarze, psycholodzy, przedstawiciele instytucji publicznych dyskutowali na temat szans i wyzwań stojących przed system szczepień w Polsce.

Nie da się zaprzeczyć faktom – szczepienia ochronne są najefektywniejszą metodą zwalczania chorób zakaźnych. Podnoszenie zaufania do szczepień, które przekłada się na poziom wyszczepienia populacji, jest więc kluczowym wyzwaniem stojącym przed wszystkim odpowiedzialnymi za zdrowie publiczne w Polsce.

Dużym sukcesem i krokiem w dobrym kierunku było wprowadzenie szczepień w aptekach – podkreślił prof. Jarosław Pinkas, Konsultant Krajowy w dziedzinie zdrowia publicznego.

Niemniej, mimo szeroko prowadzonej kampanii medialnej, Polska należy do krajów o najniższym poziomie wszczepienia przeciw COVID-19 w Europie (niespełna 60% populacji zostało w pełni zaszczepionych). Co roku w naszym kraju przeciw wirusowi grypy szczepi się jedynie 4-6% osób. Według danych PZH-NIPZ liczba uchyleń od szczepień obowiązkowych wśród dzieci w okresie od 2016 do 2020 roku wzrosła 2-krotnie z 23 tys. do 50.5 tys.

„Szczepienia przeciwko grypie u pracodawców bardzo zmniejszają absencję w pracy, ta sama prawidłowość dotyczy szczepień rotawirusowych" – mówił prof. Marcin Czech

Z danych uzyskanych przez Warszawski Uniwersytet Medyczny wynika, że postawy mieszkańców Polski wobec szczepień nie są spójne. Może to w przyszłości spowodować dalszy spadek poziomu wyszepienia populacji, a w dalszej perspektywie wzrost zagrożenia epidemiologicznego.

W ramach panelu prowadzonego przez Uniwersytet SWPS zastanawiano się nad przyczynami postaw wobec szczepień. Pierwszym skojarzeniem, jakie większość Polaków wypowiada po haśle „szczepienia" jest „koronawirus". I choć rzeczywiście od końca 2020 roku szczepienia przeciwko COVID-19 stały się jednym z bardzo ważnych elementów debaty publicznej, to przecież rosnąca liczba osób uchylających się od szczepień na takie choroby jak odra czy krztusiec była ważną kwestią społeczną już przed marcem 2020 roku.

Jednym z kluczowych wyzwań stojących przed system szczepień w Polsce jest walka z fake newsami, podkreślali eksperci Akademii Leona Koźmińskiego.
Czy dezinformację naukową można interpretować w kategoriach cyberwojny?
Czy jest to zagrożenie porównywalne z katastrofą klimatyczną, bądź rozwojem technik AI? Jaką rolę odgrywają w tym procesie media społecznościowe? To pytania z którymi musimy się jak najszybciej zmierzyć.

Mimo wszystko wysoka wyszczepialność w Polsce to sukces wszystkich profesjonalistów medycznych i osób działających na rzecz zdrowia publicznego. Wciąż zdecydowana większość Polaków dokonuje właściwych wyborów zdrowotnych. To optymistyczny wniosek płynący z konferencji CMKP, WUM, SWPS i ALK. Jednak nic nie jest dane raz na zawsze – pojawiające się wyzwania powinny mobilizować lekarzy, naukowców, edukatorów, przedstawicieli administracji publicznej do szukania nowych sposobów dotarcia z komunikatem zachęcającym do szczepień i podejmowania zdecydowanych działań na rzecz walki z dezinformacją.

Efficacy of instrument assisted soft tissue mobilization on chronic ankle instability

Skuteczność mobilizacji wspomaganej tkanek miękkich w przypadku przewlekłej niestabilności

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Abstract

Purpose. To investigate the effect of instrument assisted soft tissue mobilization (IASTM) on ankle pain, range of motion, balance, and Ankle and Foot Outcome Score (FAAOS) in patients with chronic ankle instability.
Methods. Randomized controlled trial. Overall, 50 patients of both genders with age ranged from 20–35 years with chronic ankle instability were recruited and divided randomly into two equal groups; Group (A) (control group), received traditional physical therapy treatment (dynamic balance training) for 4 weeks, Group (B) (experimental group), received the same traditional PT treatment in addition to IASTM for 4 weeks. Pre- and post-treatment assessment using Visual analogue scale (VAS), Plastic goniometer, Biodex balance system and FAAOS were done for all patients.
Results. The comparison between both groups post-treatment revealed statistically significant reductions in VAS, as well as overall stability index in favour of experimental group (B) ($p < 0.001$) and a significant increase in FAAOS, dorsiflexion, planter flexion, inversion and eversion range of motion in favour of experimental group (B) ($p < 0.001$).
Conclusion. Instrument assisted soft tissue mobilization has a significant effect on reducing pain, increasing range of motion and improving balance and function in patients with chronic ankle instability.

Keywords

chronic ankle instability, instrument assisted soft tissue mobilization, foot and ankle outcome score

Streszczenie

Cel. Badanie wpływu mobilizacji tkanek miękkich wspomaganej instrumentem (IAASTM) na ból w stawie skokowym, zakres ruchu, równowagę i wynik oceny stawu skokowego i stopy (FAAOS) u pacjentów z przewlekłą niestabilnością stawu skokowego.
Metody. Randomizowana kontrolowana próba. Ogółem zrekrutowano 50 pacjentów obu płci w wieku 20–35 lat z przewlekłą niestabilnością stawu skokowego i podzielono losowo na dwie równe grupy; Grupa (A) (grupa kontrolna) była poddawana tradycyjnej fizjoterapii (trening równowagi dynamicznej) przez 4 tygodnie. Grupa (B) (grupa eksperymentalna) była poddawana temu samemu tradycyjnemu leczeniu fizjoterapeutycznemu oraz mobilizacji IASTM przez 4 tygodnie. U wszystkich pacjentów przeprowadzono ocenę przed i po leczeniu za pomocą wizualnej skali analogowej (VAS), goniometru, systemu równowagi Biodex i FAAOS.
Wyniki. Porównanie obu grup po leczeniu wykazało statystycznie istotne zmniejszenie wyniku w skali VAS, a także ogólnego wskaźnika stabilności na korzyść grupy eksperymentalnej (B) ($p < 0,001$) oraz istotny wzrost zakresu FAAOS, zgięcia grzbietowego, zgięcia podeszwowego, zakresu inwersji i ewersji na korzyść grupy eksperymentalnej (B) ($p < 0,001$).
Wniosek. Mobilizacja tkanek miękkich wspomagana instrumentem ma znaczący wpływ na zmniejszenie bólu, zwiększenie zakresu ruchu oraz poprawę równowagi i funkcji u pacjentów z przewlekłą niestabilnością stawu skokowego.

Słowa kluczowe

przewlekła niestabilność stawu skokowego, wspomagana mobilizacja tkanek miękkich, wynik oceny stopy i stawu skokowego

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Introduction

Chronic Ankle Instability (CAI) is defined as the perception by the patient of an abnormal ankle with a plethora of symptoms including recurrent sprains, pain, swelling, instability and avoidance of activities. CAI is treated with rehabilitative strategies initially, if there is no improvement surgical treatment is indicated if rehabilitation failed. Anatomic reconstruction is recommended as it preserves the primary ligaments and restores the original mechanical stability [1].

Ankle instability is divided in 2 types: mechanical and functional. The former is characterized by abnormal laxity of ligamentous restraints, and is a sign, whereas the functional instability shown by abnormal function characterized by recurrent episodes of ankle giving way is a symptom. These 2 distinct forms of instability can exist independently, but frequently occur together: a patient may show minimal laxity (ie, mechanical instability), but report a recurrent sensation of or several actual episodes of ankle giving way (ie, functional instability) [2].

Persons with CAI typically report that their ankle frequently "gives way" while they are involved in sporting events or even during relatively non stressful activities. In addition to the loss of function, persons with CAI are likely at a greater risk for developing ankle osteoarthritis [3]. A considerable amount of evidence suggests that the pathogenesis of CAI involves diminished sensation after repeated damage to the ligaments and embedded mechanoreceptors of the ankle [4]. Distorted sensory input reduces the body's ability to generate an effective and timely defensive response to protect the ankle, especially after an unexpected and rapid inversion perturbation. Indeed, subsequent research has shown that persons with CAI have altered ankle proprioception (positional awareness), increased postural unsteadiness or reduced balance (most notably while standing on one limb), reduced reaction times in local muscles and altered recruitment patterns of muscles throughout the entire lower limb [5].

Assessments of mechanical instability can be divided to history and clinical tests. The history of an initial ankle sprain must precede the symptoms of CAI. The change in the level of activities must also be recorded to gauge the expected improvement after intervention. In terms of clinical tests, an initial assessment of the standing hindfoot alignment should be performed. The affected ankle should then be evaluated for range of motion and muscle strength. Following that, the anterior drawer test can be performed. The test is positive if the ankle can be translated anteriorly > 10mm in a plantarflexed position. The talar tilt can be examined clinically or radiographically on inversion stress. A positive test will show a talar tilt of > 10 degrees. In addition, assessment tools for functional ankle instability assesses the postural control and proprioceptive responses such as the star excursion balance test, peroneal reaction times, landing patterns and gound reaction forces and time to peak torque. Imaging studies for assessment have been reported as Standard plain radiographs which include a weight bearing anteroposterior, lateral and mortise views of the ankle. Comparative stress radiographs using the anterior drawer test and talar tilt test may be used to assist in assessment as well. Computed Tomography was used to measure the hindfoot alignment in CAI patients [6]. Magnetic Resonance Imaging evaluation is useful to rule out associated pathologies or when other clinical findings such as tenderness and swelling warrant it. In a recent study by Khor and Tan, they performed MRI of the ankle for 64 patients with acute ankle inversion injury and found only 22% presented with isolated lateral ligament complex injuries but 78% of the patients had a multitude of concomitant injuries such as bone bruising, deltoid ligament injuries, tendon pathology, occult fractures and osteochondral lesions [7].

In a Systematic review the reviewed studies using functional rehabilitation interventions tools were associated with improved ankle stability for both postural control and self-reported function, but more studies may be needed with more consistent effect sizes and confidence intervals to make a definitive conclusion [8].

Instrument Assisted Soft Tissue Mobilization is a process in which the clinician uses a set of hand-held instruments to break down the scar tissue and fascial restrictions in soft tissues (muscles, ligaments, tendons, fascia, and nerves). IASTM is applied using specially designed instruments to provide a mobilizing effect to soft tissue (e.g., scar tissue, myofascial adhesion) to decrease pain and improve range of motion (ROM) and function [9]. The use of the instrument is thought to provide a mechanical advantage for the clinician by allowing deeper penetration and more specific treatment, while also reducing imposed stress on the hands [10].

IASTM is a popular form of myofascial therapy but its efficacy has not been fully determined due to the paucity and heterogeneity of evidence. There is a gap between the current research and clinical practice. A consensus has not been established regarding the optimal IASTM program, type of instrument, dosage time, and outcomes measures. The current evidence seems to lack the methodological rigours necessary to validate the efficacy of IASTM itself or any of the IASTM protocols [11].

The variability in study protocols including the study population, type of IASTM intervention, dosage time, and outcome measures make it difficult to determine the optimal treatment protocol. Future studies are needed to assess the different IASTM tools and IASTM protocols such as Graston using strict methodology and fully powered controlled trials. So this study was conducted to provide a scientific baseline concerning the effect of IASTM on ankle pain, ROM, balance and function in patients with chronic ankle instability.

Subjects and methods

Design

A randomized control trail was conducted to investigate the impact of IASTM on pain, ankle ROM, balance and FAAOS in patients with CAI. Data were collected pre and post treatment from June 2021 to March 2022. The study was approved by the local ethics and research committee of Cairo University (approval number: P.T.REC/012/002477).

Participants

Fifty patients with CAI of both genders with age ranged from 20 to 35 years were recruited from the outpatient clinic of Faculty Of Physical Therapy, Cairo University, Cairo, Egypt.

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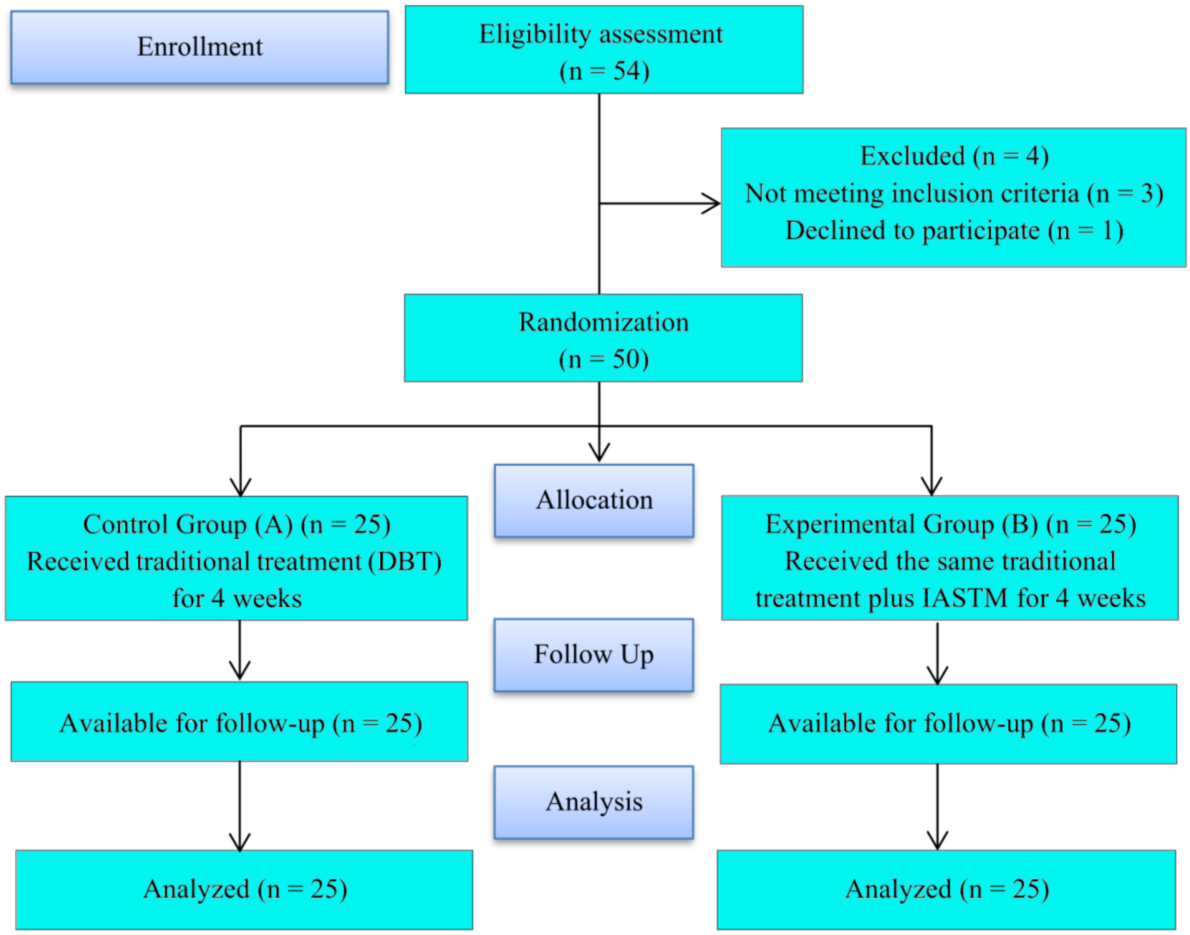

Figure 1. Flow chart of the study

Sample size calculation was performed prior to the study using G*POWER statistical software (version 3.1.9.2; Franz Faul, Universitat Kiel, Germany) based on data of VAS from pilot study on 5 subjects in each group and revealed that the appropriate sample size for this study was 25 in each group. Calculations were made using $\alpha = 0.05$, power 80% and effect size = 0.81 and allocation ratio N2/N1 = 1. Inclusion criteria included each patient had the diagnosis of CAI who had at least 1 significant unilateral inversion sprain of either ankle that resulted in pain, swelling, and loss of function within the last year, followed by more than 1 repeated injury and the perception of ankle instability or "giving way" with no reported history of ankle sprains within the 6 weeks before participation,. Exclusion criteria included individuals who reported no history of ankle sprain or no perception of giving way in the ankle (were found to have a grade III ankle laxity with no end feel as assessed by the anterior drawer, talar tilt, and medial subtalar glide tests), history of lower extremity surgery, balance disorders, neuropathies, diabetes, or other conditions known to affect balance, Obesity with BMI > 30 kg/m^2or failure to complete at least 75% of the treatment and training sessions also resulted in exclusion from the study [12].

Randomization

The recruited patients were randomly assigned, after signing consent form, into two equal groups. A single blind randomization was carried out by assigning the odd numbers to group (A) (control group) and the even numbers were assigned to group (B) (experimental group). Following randomization, there was no dropping out of subjects from the study, Figure 1.

Interventions

Group (A) (control group) included 25 participants who received traditional P.T treatment of CAI for 4 weeks, whereas Group (B) (experimental group) included 25 participants who received the same traditional PT treatment plus IASTM for 4 weeks.

The traditional physical therapy program

All participants in both groups (A & B) received twelve sessions of traditional PT treatment for CAI which was comprised of warming up in the form of dynamic self stretching routine using flexibility band approximately 10 minutes long involved both legs. The warm-up started with the left leg before moving to the right leg to stretch the ankles invertors, evertors, gastrocnemius, and Achilles. On completion, the therapist moved to stretch the hamstring, groin, iliotibial band, quadriceps and hip flexor. Stretching performed slowly, hold for 30 seconds for each muscle group [13]. After stretching, patients received dynamic balance-training (DBT) program that included five activities for approximately 20 min; approximately 4 minutes for each activity [14]. The progressive DBT program was designed

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to challenge a subject's ability to maintain a single-limb stance (standing on the affected ankle) while performing various balance activities. These activities intended to promote the restoration of functional variability within the sensorimotor system. Activities included 1) hop to stabilization, 2) hop to stabilization and reach, 3) hop to stabilization box drill, 4) progressive single-limb stance balance activities with eyes open, and 5) progressive single-limb stance activities with eyes closed. Each activity was progressed based on errors as subjects progressed through potentially 7 levels of difficulty based on their performance across the 4-week program. During each session, subjects performed dynamic balance activities designed to challenge recovery of single-limb balance efficiently after a perturbation and to effectively develop spontaneous strategies to execute movement goals. As a subject develops proficiency within the program, the task and environmental constraints placed on the sensorimotor system had been progressively increased. The program consisted of 4 exercises for single-limb hops to stabilization, 5-repetition hop to stabilization and reach, unanticipated hop to stabilization, and single-limb-stance activities [15]. Clinically, the history of patients with CAI reveals past recurrent ankle sprains and severe inversion injury. They take special precautions against weight bearing for prolonged period, strenuous activities that may engage the ankle and foot in a position of further strain, and walking on rugged surfaces; wearing braces would just provide partial relief [16, 17].

Instrument assisted soft tissue mobilization

Each participant in group (B) received IASTM for twelve sessions, three sessions per week for four weeks. The treatment time was 8 minutes. Graston instrument assisted soft tissue mobilization (GISTM) treatment is followed with static stretching and strengthening exercises for the ankles invertors/evertors, gastrocnemius, and Achilles, hamstrings, groin, iliotibial band, quadriceps and hip flexor.

The GISTM instrument had been glided over the subjects' skin (within the limit of pain) with varying levels of indentation from the instrument. Restrictions were released when found. GISTM treatment progression for the ankle started with the posterior leg first followed by the anterior and lateral leg (table 1) [12].

Table 1. Graston Instrument – Assisted Soft Tissue Mobilization

Patient position	Range of motion	Strokes and anatomical area
Prone, foot over end of table	Add active plantar flexion and dorsiflexion range of motion.	Sweep plantar fascia and gastrocnemius/soleus. Sweep heel pad, metatarsals, calcaneal insertion. Localize restrictions within gastrocnemius/soleus and Achilles. Mobilize soft tissue on medial and lateral side between Achilles and fibula. Mobilize fascia from calcaneus → metatarsal head and back.
Supine, foot over end of table	Add passive ankle range of motion.	Sweep dorsum of foot→ anterior tibialis → sweep between toes. Sweep dorsum of foot and anterior tibialis to isolate restrictions. Frame medial and lateral malleoli. Sweep first and fifth metatarsals. Mobilize soft tissue of talocrural and distal tibia/fibula joint. Sweep up and down medial and lateral aspect of tibia.
Side-lying with pillow between knees.		Sweep peroneals.

Outcome measures

Visual analogue scale (VAS)

Each subject made a mark on the 10-cm line to accurately describe pain level at that instant. The primary researcher then measured the mark from left to right in millimeters. Simple and reproducible, the VAS has been shown to produce reliable and valid estimates of pain intensity [18–20].

Ankle ROM

Maximal non-weight-bearing active ankle ROM was measured within the limit of pain to the nearest degree using a Baseline 360° clear plastic goniometer (Medco Sports Medicine, Tonawanda, NY). The measurement was performed with the patients in supine lying position with the knee slightly flexed and stabilized proximally with a belt and the foot outside the treatment table for both plantar flexion and dorsiflexion, The stationary arm of the goniometer was placed along the midline of the fibula from the fibular head to lateral malleolus, and the movable arm was along the midline of the fifth metatarsal. The goniometer axis was placed approximately 1.5 cm inferior to the lateral malleolus. The subject was asked to plantar flex the ankle as far as possible; after the measurement was recorded, the subject dorsiflexed the ankle as far possible [21]. For inversion and eversion the subjects were instructed to sit at the edge of the treatment table with the proximal leg stabilized with a belt. The stationary arm of the goniometer was placed along the anterior midline of

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tibia, in line with tibial crest, The goniometer axis was on the Anterior aspect of talocrural joint, midway between medial and lateral malleoli and the movable arm is placed along the anterior midline of second metatarsal. The average of 3 trials was used for all measurements [22].

Overall stability index (OSI)

Ankle balance was assessed using the Biodex balance system (BBS), which consists of a mobile platform that allows up to 20° of surface tilt in 360° ROM. The platform, which is interfaced with computer software (version 1.32; Biodex Medical Systems) generates the Overall Stability Index (OSI), Anterior-Posterior Stability Index (APSI), and Medial-Lateral Stability Index (MLSI) from the degree of tilt. The APSI and MLSI represent platform displacements from the horizontal in the sagittal (Y) and frontal (X) planes, respectively, and the OSI is a composite of the APSI and MLSI. Higher values represented poorer stability, whereas lower values represented better stability. The test was performed at level 8 with participants barefoot in single-legged stance. They were instructed to step on the BBS platform with their eyes open, assume a comfortable position while keeping their knees slightly flexed (15°), look straight ahead at the monitor, and place their hands on their hips. Foot-position coordinates were registered to ensure that the same position was used for all tests. We instructed participants to keep a cursor, which represented the center of the platform, in the center of the bull's eye on a visual feedback screen. Only 3 practice trials were performed to reduce any learning effects, and 3 test evaluations were then performed. Each trial lasted 20 seconds with a 10-second rest between trials. The average of the 3 test evaluations was used for data analysis. Failed trials were not recorded and were removed from the data analysis. A trial was considered a failure if the participant used the handlebars of the platform to maintain balance, put the free foot on the platform, or completely lost his or her balance [23].

Foot And Ankle Outcome Score

Foot and Ankle Outcome Score (FAAOS) was developed to assess the patients opinion about a variety of foot and ankle related problems. FAOS has this far been used in patients with lateral ankle instability, Achilles tendinosis, and plantar fasciitis. FAOS consists of 5 subscales; Pain, other Symptoms, Function in daily living, Function in sport and recreation, and foot and ankle-related Quality of Life. The last week is taken into consideration when answering the questionnaire. Standardized answer options are given (% Likert boxes) and each question gets a score from 0 to 4. A normalized score (100 indicating no symptoms and 0 indicating extreme symptoms) is calculated for each subscale. FAOS is patient-administered, the format is user friendly, and takes about 10 minutes to fill out. FAOS has been used in patients 20-60 years old. FAOS reliability has been confirmed in patients with lateral ankle instability [24].

Statistical analysis

Unpaired t-test was conducted for comparison of subject characteristics between groups. Chi- squared test was used for comparison of sex distribution between groups. Normal distribution of data was checked using the Shapiro-Wilk test. Levene's test for homogeneity of variances was conducted to ensure the homogeneity between groups. Mixed design MANOVA was performed to compare within and between groups effects on VAS, ankle ROM, OSI and FAOS. The level of significance for all statistical tests was set at $p < 0.05$. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 for windows (IBM SPSS, Chicago, IL, USA).

Results

Subject characteristics

Table 2 showed the subject characteristics of study and control groups. There was no significant difference between groups in their mean values of age, weight, height and BMI ($p < 0.05$). Also, there was no significant difference in the distribution of sex between groups ($p < 0.05$).

Table 2. Basic characteristics of participants

	Study group Mean ± SD	Control group Mean ± SD	t-value	p-value
Age [years]	27.24 ± 4.78	26.2 ± 4.91	0.75	0.45
Weight [kg]	71.96 ± 11.15	71.44 ± 8.09	0.18	0.85
Height [cm]	167.2 ± 8.25	164.32 ± 10.69	1.06	0.29
BMI [kg/m²]	25.62 ± 3.47	26.36 ± 2.71	−0.83	0.41
Sex [n, %]				
Females	14 (56%)	13 (52%)	(χ^2 = 0.08)	0.77
Males	11 (44%)	12 (48%)		

SD: Standard deviation; χ^2: Chi squared value; p-value: Probability value

Effect of treatment on VAS, ankle ROM, OSI and FAOS

Mixed MANOVA revealed that there was a significant interaction of treatment and time ($F = 20.19$, $p = 0.001$). There was a significant main effect of time ($F = 217.31$, $p = 0.001$). There was a significant main effect of treatment ($F = 2.66$, $p = 0.02$).

Within group comparison

There was a significant decrease in VAS and OSI and a significant increase in FAOS post treatment in the study and control groups compared with that pre treatment ($p < 0.001$). The percent of change VAS, FAOS and OSI in study group was 71.17,

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41.55 and 41.42% respectively and that in control group was 48.57, 26.35 and 30.27% respectively (table 3).
There was a significant increase in ankle ROM post treatment in the study and control groups compared with that pre treatment ($p < 0.001$). The percent of change dorsiflexion, planter flexion, inversion and eversion ROM in study group was 35.36, 20.8, 28.44 and 34.56% respectively and that in control group was 19.17, 6.52, 9.21 and 10.54% respectively (table 4).

Between groups comparison
There was no significant difference between groups pre-treatment ($p > 0.05$). There was a significant decrease in VAS and OSI of study group compared with that of control group post treatment ($p < 0.001$). Also, there was a significant increase in FAOS, dorsiflexion, planter flexion, inversion and eversion ROM of study group compared with that of control group post treatment ($p < 0.001$) (table 3–4).

Table 3. Mean VAS, FAOS and OSI pre and post treatment of the study and control groups

		Pre Mean ± SD	Post Mean ± SD	MD	% of change	p-value
VAS	Study group	4.44 ± 1.15	1.28 ± 0.79	3.16	71.17	0.001
	Control group	4.2 ± 1.11	2.16 ± 0.98	2.04	48.57	0.001
		***p* = 0.46**	***p* = 0.001**			
FAOS	Study group	297.47 ± 22.44	421.07 ± 31.95	−123.6	41.55	0.001
	Control group	305.56 ± 35.17	386.07 ± 39.15	−80.51	26.35	0.001
		***p* = 0.33**	***p* = 0.001**			
OASI	Study group	4.08 ± 0.6	2.39 ± 0.33	1.69	41.42	0.001
	Control group	4.03 ± 0.55	2.81 ± 0.37	1.22	30.27	0.001
		***p* = 0.77**	***p* = 0.001**			

SD: Standard deviation; MD: Mean difference; p-value: Level of significance

Table 4. Mean ankle ROM pre and post treatment of the study and control groups

		Pre Mean ± SD	Post Mean ± SD	MD	% of change	p-value
Dorsiflexion	Study group	17.76 ± 5.17	24.04 ± 4.23	−6.28	35.36	0.001
	Control group	16.48 ± 5.15	19.64 ± 4.94	−3.16	19.17	0.001
		***p* = 0.38**	***p* = 0.001**			
Planter flexion	Study group	32.88 ± 3.64	39.72 ± 2.61	−6.84	20.8	0.001
	Control group	33.76 ± 3.97	35.96 ± 3.58	−2.2	6.52	0.001
		***p* = 0.41**	***p* = 0.001**			
Inversion	Study group	17.16 ± 2.07	22.04 ± 2.01	−4.88	28.44	0.001
	Control group	17.8 ± 1.95	19.44 ± 2.59	−1.64	9.21	0.001
		***p* = 0.26**	***p* = 0.001**			
Eversion	Study group	11.92 ± 2.03	16.04 ± 1.9	−4.12	34.56	0.001
	Control group	12.52 ± 2.55	13.84 ± 2.26	−1.32	10.54	0.001
		***p* = 0.36**	***p* = 0.001**			

SD: Standard deviation; MD: Mean difference; p-value: Level of significance

Discussion

According to the data analysis in the current study, the results of conventional program and instrument assisted soft tissue mobilization group on pain intensity revealed that There was a significant decrease in VAS and OSI and a significant increase in FAOS and ankle ROM post treatment in the study and control groups compared with that pre treatment. There was a significant decrease in VAS and OSI of study group compared with that of control group post treatment. Also, there was a significant increase in FAOS, dorsiflexion, planter flexion, inversion and eversion ROM of study group compared with that of control group post treatment.
The results of the present study supported the authors" hypothesis that adding the IASTM to the conventional physical therapy program was more efficient in improving balance, ankle range of motion, ankle pain and ankle and foot functions than

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the conventional physical therapy program alone in adults with chronic ankle instability

The findings of this study revealed improvement in balance measured by biodex balance system after the application of IASTM in patients with chronic ankle instability. Improvement can be attributed to the efficacy of IASTM in providing a mobilizing effect to soft tissue (e.g., scar tissue, myofascial adhesion) to decrease pain and improve range of motion (ROM) and function [25]. IASTM could stimulate connective tissue remodeling via resorbing excess fibrosis and encouraging collagen repair and regeneration through fibroblast recruitment [11, 26]. That helps to provide myofascial release and improve mobility of underlying tissue by its effect of connective tissue remodeling [27]. IASTM helps to increase the local temperature, improve the circulation by producing vasodilataion of the capillaries, improve tissue nutrition/oxygenation and improve removal of local metabolites from the muscles [28].

It was reported that performing the rehabilitation program was important, as the CAI rehabilitation group had greater improvements in the Foot and Ankle Disability Index (FADI) and FADI Sport scores than a CAI control group and a healthy group. Using the ankle-joint functional-assessment tool. It was suggested that progressive, comprehensive rehabilitation may serve to minimize lower extremity reach deficits and perceived deficits in ADLs and sport-specific skills [29].

It was noted a clear improvement in FADI and FADI Sport scores for the balance-training group that truly based on the balance training program. In their study, the balance-training group's posttest scores were greater than their pretest scores and the control group's posttest scores. It was found that 4 weeks of balance training significantly improved self-reported function, static postural control, and dynamic postural control as assessed with the star excurtion balance test (SEBT). These measures were specifically chosen to provide patient-oriented laboratory and clinical evidence, respectively, of the effectiveness of balance training in this population with CAI [14].

Similar improvements occurred on the Ankle Joint Functional Assessment Tool when comparing a group with CAI to a group of healthy controls who underwent balance training. They found that individuals who underwent 4 weeks of training on the BBS had improvements in self-reported function, regardless of group membership. As a result of training, the balance ability of the trained limb in both the experimental group and nonimpaired group improved significantly to reach almost identical SIs. These improvements in balance ability appear to reflect improved neuromuscular ability along with enhanced functional joint stability, because the functional assessment questionnaire scores demonstrated the same treatment effects illus trated by the balance scores. The results of this study suggest that the balance training protocol used in this study is an effective means of improving both unstable and healthy ankle joint proprioception, as assessed through single-leg standing ability [30].

The findings of this study were in line with the results of a case report that involves a 20-years-old college football player who had failed conservative treatment for his chronic ankle pain and associated functional limitations caused by post-traumatic scar tissue. A new physical therapy modality consisting of an augmented form of soft tissue mobilization was employed in an attempt to improve or resolve the patient's excessive scar tissue. The athlete's ankle pain with activity ceased, his ROM increased, the surgical scar matured, and the excessive fibrotic connective tissue around the ankle softened and diminished. Specifically, dorsiflexion increased from 5 to 10°; plantarflexion increased from 35 to 47°; inversion increased from 20 to 42°; and eversion increased from 15 to 26°. Also, soleus flexibility increased from 10 to 18°. Pain at rest remained at zero and pain with activity decreased from 6 out of 10 to 0 out of 10. The athlete also stopped taking nonsteroidal anti-inflammatory medication for his ankle pain [31].

The findings of this study were parallel to a case study of a 35-year-old female who had a 2-years history of postnatal chronic calf pain, she developed calf pain during the last trimester of her pregnancy following severe lower leg edema. The calf pain was present for the 2 years following delivery and was described as a dull ache, typically aggravated by direct pressure on the calf, prolonged standing, and stairs. After nine treatments incorporating an IASTM approach, soft tissue mobility, pain, calf strength, and lower extremity functional scale score all improved and her symptoms were abolished [32].

It was reported that pain is caused by inflammation. When an injured tissue becomes inflamed, immune cells are recruited and phagocytosis occurs. Pain is induced when tissue fragments decomposed by phagocytosis or substrates secreted by various immune cells stimulate type III and IV nerve endings. In particular, following sport injuries, if the injured area is not treated properly or rehabilitated adequately, then chronic inflammation may lead to tissue degeneration and become a cause of long-term pain. Theoretically, control of inflammation can be considered as a potential reason for the ability of IASTM to reduce pain [33].

A case report of 10-years-old little league football player with Planter fasciitis presented with bilateral plantar foot pain of 3 weeks' duration. The verbal rating scale for pain was a 6 of 10, and he described the pain as a sharp sensation. He was treated with chiropractic manipulation of the ankle mortise bilaterally, GISTM of the gastrocnemius and soleus muscles, and stretching of the triceps surae and plantar fascia on a wobble board. The patient was instructed to continue the stretching routine at home. During his third office visit, squat retraining and glute-bridging exercises were added to his home exercise program. After 6 treatments, the patient reported verbally that his symptoms were 100% improved and that he was no longer experiencing pain in the morning or during his activities of daily livings, such as playing football [34].

There is agreement between the findings of this study and the findings of the study which found that GISTM-treated patients with heel pain experienced clinically meaningful improvement in self-reported pain and function levels. The group of patients selected for this case series treated with GT combined with a home stretching program who experienced both a statistically significant and clinically meaningful improvement in all dependent measures, The primary outcome measure used in this study was the number of reported successes on the Global Rating of Change (GRC). Secondary exploratory analysis inclu-

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ded the patient's level of pain as measured with the Numeric Pain Rating Scale (NPRS) and the patient's perceived level of disability as a result of their plantar heel pain was measured by the lower extremity functional scale (LEFS). It has been reported that a GRC score of 5 or greater indicates a meaningful improvement and was used as a cutoff for determining a successful outcome. In this case series, 7 of 10 patients surpassed this value, indicating that they exhibited perceived improvement in their condition since receiving GT in combination with a home stretching. [35].

Our findings are in disagreement with a previous study which reported that the effect of GISTM was unclear as a treatment for CAI but did not cause more pain or disability in this study. However, VAS scores in this study were low at baseline and may not be able to demonstrate greater change, thus creating a floor effect. GISTM has not been known to benefit dynamic postural stability directly, Positive benefits using GISTM have been evident in other studies. As the effects of GISTM with a DBT program are unclear, additional studies should be conducted to further evaluate their combined use for subjects with CAI [12].

The results of this study are in conflict with the findings of the study that found that the involved ankle with CAI demonstrated decreased inversion stiffness when compared to the contralateral uninvolved ankle. No difference in the neutral zones between the involved and contralateral uninvolved ankles was found. The 4-week balance training intervention failed to show any significant effect on the passive stiffness and neutral zone measured in this study. This study was unique in that it examined the effect of balance training on the neutral zone in addition to stiffness in the ankles with CAI [36].

On the contrary, the current study results are in contrast with a pilot study, in which 11 healthy, young males received one treatment of GISTM to one calf while the opposite calf served as an untreated, internal control. No significant differences were found in the passive properties of treated vs. untreated calf muscles before, immediately after or at 24 h, 48 h or 72 h postintervention; nor was there a difference in physical measures or muscle biopsy inflammatory markers. However, a significant increase in self reported pain and decrease in function were found at 72 h post treatment. It is important to note that only one treatment session was provided in this study, whereas common clinical practice typically involves at least 4-8 sessions for conditions affecting the calf region [37].

Study limitations

The current study was limited by extraneous factors that may have interfered with the results of this study, these factors are related to variations in life style between patients as activity level, being working/non-working, ergonomical design of the surrounding environment of participants at home and/or work. Another limitation was the psychological factor of the participants during the period of application of the study.

Conclusion

Adding the instrument assisted soft tissue mobilization to the conventional physical therapy program improved balance, ankle joint pain, ankle range of motion and ankle and foot functions in patients with chronic ankle instability more than the conventional physical therapy program alone. The instrument assisted soft tissue mobilization might be used as a useful adjunctive therapy in treating patients with chronic ankle instability.

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