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A treatment strategy for recurrent (ankle injuries) in Muay Thai athletes

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Abstract. **Objective:** An efficient solution for stabilization is the mobilization of the joints for the arthrokinematics affected by the positional defect of the CAI (i.e. chronic ankle instability). This study put to comparison the impacts of ankle dorsi flexion range of motion (DFROM) as well as dynamic balance ability (DBA) in the patients who have CAI using PJM (i.e. passive joint mobilization), a technique typically been used in previous works, and active joint mobilization (AJM), a technique which could have a greater impact on cortical excitability with the spontaneous movement. **Design:** rehabilitation program to treat recurrent ankle. **Methods:** A total of 10 players from the Iraqi clubs Muay Thai team were registered, 5 from each of the AJM and PJM groups. A total of 12 intervention sessions overall, lasting 10 mins each, were given to each participant over the course of three weeks. AJM employed angular motion of the joints to produce the patient's voluntary motion regarding lateral malleolus posterior gliding as well as medial malleolus anterior gliding, respectively, while PJM utilized Maitland's mobilization approach to perform mobilization of the joints with the talus in the posterior direction. Tape was used for measuring the ankle's DFROM, and the balance system was used to assess the ankle's DBA. **Results:** With the exception of DBA-right and DBA-anterior variables with regard to PJM group, considerable enhancements were seen following intervention in AJM as well as groups of the PJM. DBA-anterior, DFROM, DBA-right, and DBA-posterior, measures showed statistically significant differences between the PJM group and the AJM group. **Conclusions:** Joint mobilization, such as voluntary movement, was more successful thanks to the overall improvement regarding DBA and DFROM. The ankle's neuromuscular system is significantly impacted in the case when voluntary movement is present.

Keywords. Muay Thai players, rehabilitation, treat recurrent ankle, Joint instability, Musculoskeletal manipulations, Postural balance

Introduction

A frequent musculoskeletal injury is an ankle sprain [1]. Additionally, ankle sprains frequently repeat and their symptoms frequently linger [2]. Similar to this, CAI is brought on by recurrent sprains following index injury [3, 4]. The recurrence swelling and pain throughout the activity as well as the weakening of muscles surrounding the ankle joint are characteristics of CAI symptoms [4]. CAI might be highlighted as a typical sensorimotor malfunction because to its high recurrence rate and protracted suffering. This reduced conscious perception is a sign of a problem with efferent motor control and afferent somatosensory information [5]. In a research paper that has been conducted on cortical excitability, it has been shown that patients

with CAI and healthy people had different levels of joint laxity and cortical excitability. It was also discovered that patients with ankle instability who had TMS had lower levels of cortical excitability. Due to chronic state of the joint laxity's high cortical excitability, both cortical excitability and joint laxity must be decreased [6, 7]. Put differently, CAI has a significant impact on the neurological system, which controls how the body moves. Thus, enhancing neuromuscular function is the primary goal of the rehabilitation program for CAI patients. This could be indicated through a reduction in joint position sensation brought on by injury-related damage to peroneal nerve as well as ankle ligament receptors [8, 9]. Anterior to posterior talocrural joint mobilization, one of the standard treatments for CAI, efficiently reduces CAI and might reveal certain neuromuscular mechanisms through increasing the stiffness of the musculotendinous fibers in the fibula [11]. The therapist's PJM, which involves no active movement, only affects the neuromuscular process. Since persistent mobilization by a therapist could have stronger impact on the cortical excitability, AJM is assessed by patient's active repetition that is combined with pain-free motion. As re-education on the patterns of the pain-free motion is implied in the field of the neuro-science theory, which aims at central nervous system levels of the motion correction under instructions of the therapist [12–15]. Joint mobilization coupled with the voluntary movements will have a greater impact on neuro-muscular system in CAI patients compared to PJM, which is equivalent to traditional joint mobilization. As a result, the range of balance and motion are put to comparison and validated in this research to determine the impact of voluntary movement.

Methods

Study design.

A total of 12 intervention sessions (AJM and PJM) and two evaluation sessions (post-intervention and baseline) were included in the rehabilitation program for treating recurrent ankle injuries. The DFROM regarding the ankle joint served as the end measure's major variable, while DBA served as the outcome measure's secondary variable.

Participants

A total of 5 of the 10 Muay Thai players from the Iraqi team who had been diagnosed with an ankle sprain were eventually enrolled in the research. The following were the requirements for inclusion: (i) self-reported instability and a sense of "giving way," (ii) a minimum of 2 sprains on same side in previous two years, (iii) a history of just one ankle sprain, (iv) receiving no other treatment throughout the research, and (v) feeling different in the sensation in comparison with the ankle that is intact. The criterions of exclusion are (i) history of the bilateral injury of the ankle, (ii) acute sprain of the ankle within the past six months, (iii) Ankle sprain-related bone injury, (iv) previous back or lower extremity surgery, and more [16]. According to the ethical guidelines of Helsinki Declaration, all of the participants have been told about this study's goal and methodology before it began. Only those who freely completed a consent form with full disclosure were included.

Randomization and blinding

With the use of random allocation software (v1.0; Baghdad Univ., Iraq), participants were divided into PJM and AJM groups at random and in blind fashion.

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Intervention

Two physical therapists with no less than five years of the clinical skills and training in the orthopedic manual physical therapy carried out AJM and PJM interventions on affected foot for then minutes every session. Four times each week over three weeks [17], participants have received 12 sessions in total.

Passive joint mobilization.

When doing PJM, Maitland's grade III mobilization technique is used (high amplitude in joint's end range and 1-s vibration in middle range by the linear motions with the felt tissue resistance) [18]. Physical therapist had placed the subject in a supine posture and gripped the talus and tibia in one hand each while performing the mobilization of the joints in posterior direction with hand holding talus (Figure1).

Active joint mobilization

The subject would lay on their back with their knees bent in AJM. The therapist supported medial and lateral malleoli with 1 hand each. This therapist simultaneously placed participant's soles against sternum then applied plantar pressure to them. Lateral malleolus could therefore glide in a posterior manner, while medial malleolus might glide anteriorly. The participant's joint motion is passively recognized in the first method, whereas voluntary motion is involved in the second (Figure 2) [19-21].

Outcomes

Before and two weeks following intervention, participants take part in this research and had been tested for the DBA and DFROM (baseline and post-intervention).

Dorsiflexion motion range

A weight-bearing lunge has been used to gauge the ankle's DFROM. The therapist set tape measure to the floor, in a parallel manner to a flat, unprotruding wall in order to avoid movement. The participant's foot has been measured by placing the second toe and heel parallel to the measuring tape, and separating the participant's foot as much as possible from the measuring foot. The distance between the 1^{st} and 2^{nd} toes have been 10cm,

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Passive joint mobilization.

and the knees were bent to the point where they had met the wall. The heel could only be flexed as far without leaving the ground for the maximum amount of ankle instep flexion [22]. To be safe, the body's trunk must not be tipped forward and must just be bent at the knee towards the direction of the wall. The foot has been moved forward in a case when the knee might reach the wall while bending, and backward if the knee has been simply touching the wall. The ankle angle was determined by measuring the ankle 3 times for the left foot and the right foot, respectively, and taking the mean value of those measurements. The minimum detectable change is between 1.10 and 1.50cm, and the intraclass correlation coefficient for DFROM's inter-rater reliability is a high 0.99 [23] [24].

Dynamic balance ability

DBA has been assessed with the use of Biodex Balance System (Biodex Medical Systems Inc., Iraq) while the individual was standing on both feet. The balance measurement apparatus included a sensor for left-right and anterior-posterior motion, a fixed circular scaffold, a computer for analysis and data transmission, a monitor for visual target checking, and a computer for the data output from the analysis. There were 4 main categories, which include the printers. Stronger balance ability indicates higher score. The two arms were

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gathered across the chest at the moment of measurement, the body's center of gravity was adjusted to match the target, and the foot position has been precisely measured for preventing movements [25]. The scaffold was not fixed during DBA evaluation; instead, it may be modified in a number of phases, from least stable to most stable, ranging from 1 to 12. In the presented research, DBA was calculated by selecting one of eight phases for the amount of stool movement. The foot position was left unchanged, much like in the examination of static balance ability, yet task duration and route have been recorded through the setting of target point and shifting the center of the body to get there. The measurements have been taken twice for 20s, separated by a 10-s pause. According to reports [26], the Biodex Balance System's measurement of DBA had an ICC ranging between 0.42 and 0.8 and adequate intra-tester reliability.

Size of the Sample

In research through Lomas Vega and Cruz-Daz (16), the size of the sample has been determined by adjusting motion range in CAI patients prior to and just following joint mobilization. With the use of Gxpower 3.10 (G-power 3.10; Heinrich-Heine-Universität Düsseldorf, Germany), estimated Cohen's d has been 1.36, and 26 samples were needed in the case when the two groups and power were adjusted to 0.95. According to the central limit theorem and expected dropout. 10 Muay Thai players from the Iraqi team have been included in the research.

Statistical analysis

Use of the IBM SPSS Statistics v. 25 (SPSS v25.0; IBM, Iraq) has been used for all of the statistical analyses. Both the independent chi-squared and t-test were utilized in order to conduct homogeneity test on continuous as well as categorical data, respectively. A paired t-test has been utilized for comparing the differences prior to and following the interventions, whereas an independent t-test has been utilized in order to confirm the impact of the differences between the groups. To estimate the treatment's impact, Cohen's d and partial eta squared (p) have been utilized. The RM ANOVA has been utilized for calculating 7. The thresholds for statistical significance (a) have been all set at 0.05.

Table1: **5 players from the Iraqi team named Muay Thai who had an ankle sprain**.

	PJM (n = 5)	AJM (n = 5)	X2/t
Sex (male/female)	8/5	7/6	0.522
Age (years)	24.30 ± 2.72	22.55±2.39	1.844
Height (cm)	166.11 ± 8.76	167.22 ± 10.41	-0.330
Weight (kg)	64.2 14.29	68.2 16.64	-0.745
BMI (kg/m²)	22.33 ± 3.16	23.23 ± 3.50	-0.811

Results

Between April and May 2023, this research paper was carried out. There were 5 players recruited in all, and none dropped out (Figure 3). The overall features of the players are shown in Table 1. There have not been any notable inter-group variations.

Dorsiflexion motion range

Prior to and following intervention, there has been a statistically significant enhancement in PJM (d=-1.140, P less than 0.001) and AJM (d = -2.9, P less than 0.001) groups.

AJM group had shown a higher improvement when compared to PJM group (p=0.330, P less than 0.010; Table2).

Dynamic balance ability

With regard to DBA-total, PJM (d = -1.33, P less than 0.001) and AJM (d = -1.610, P less than 0.002) groups considerably enhanced the difference between prior to and following the intervention. There has not been any discernible inter-group difference (Table2, p=0.047, P more than 0.05). PJM group did not significantly enhance in DBA-anterior (d= -0.71, P more than 0.05), but AJM group significantly improved (d=-2.6, P less than 0.002). In light of this, AJM group considerably outperformed the PJM group (p = 0.434, P less than 0.002; Table 2). Both PJM (d = -0.74, P less than 0.010) and AJM group (d = 1.84, P less than 0.002) showed a substantial enhancement in DBA-posterior. In comparison to PJM, the AJM group improved more (p 0.369, P less than 0.002; Table 2). Both the PJM group (d = 1.67, P less than 0.010) and AJM group (d = -1.730, P less than 0.002) saw a substantial enhancement in DBA-left. No significant inter-group difference was present (p=0.01, P more than 0.05; Table 2). When it came to DBA-right, the PJM group didn't exhibit any discernible improvements (d = -0.65, P more than 0.050), while AJM group did (d = -2.23, P more than 0.002). There were substantial differences between the pre- and post-treatment groups, although a different sub-analysis (repeated-measures analysis of variance) revealed that AJM group had improved more significantly than PJM group (p=0.229, F = 8.321, P less than 0.010; Table2).

Discussion

In the presented research, impacts on ankle DBA and DFROM in CAI patients using AJM have been evaluated, a technique which could have a higher impact on the neuro-muscular system with voluntary movements, to PJM, a technique which has usually been used in prior works. Considerable improvements have been seen in the two groups following intervention, with the exception of DBA-anterior and DBA-right in PJM group, when AJM and PJM were given to CAI patients a total of ten times. Additionally, in DBA-anterior, DFROM, DBA-right, and DBA-posterior, AJM showed noticeably more enhancement compared to PJM. Joint mobilization significantly affected each dependent variable for DBA-anterior, DFROM, DBA-posterior, and DBA-right (p more than 0.14) [27]. PJM and AJM groups' significant enhancement in ankle DFROM had a large effect (d more than 0.80) [28]. Those findings are consistent with other research that shown a significant enhancement in CAI patients who underwent anterior to posterior talocrural joint mobilization [18, 29]. Additionally, similar outcomes to those of earlier investigations have been found in voluntary movements [30, 31]. The findings of this investigation are supported by the least detectable DFROM change for the CAI patients that have been reported in other works, which has been apparently 0.85cm [32]. This is the rationale behind using the same technique as in earlier research, where the talus has been glided from the anterior to the posterior with the mobilization of the joint [33]. The increased ankle DFROM led to the hypothesis that the anterior talus position fault altered the posterior talar glide. Consequently, AJM and PJM involved posterior talus gliding and produced a noticeable enhancement. PJM and AJM groups significantly improved in the DBA variables and had moderate to high effect (0.5<d<0.8). Comparable findings . [34], who found that AJM combined with movement in dynamic balance significantly improved postural control. The star excursion balancing test, a factor which could suggest DBA, also revealed substantial differences in some trials, much to how AJM outperformed PJM significantly [16, 35, 36]. AJM was found to be successful and majorly used in musculoskeletal diseases and

dysfunctions of numerous peripheral joints in a research [12]. A different association between joint laxity and cortical excitability was found between healthy persons and those with CAI, according to another research [7]. As a result, the movement pattern altered by ankle instability could be changed through the DBA enhancement found in this work, allowing it to escape chronic state[41.42.]. According to functional near-IR spectroscopy study, CAI patients need to activate their supplementary motor regions more than healthy individuals do in order to plan their movements and use movement strategies [37.38.39.40]. This research's primary drawback is that it only included people who were similarly young players and recruited from clubs in Iraq. Because of the single-center approach, it was challenging to find a significant number of participants, and it might be challenging to extrapolate our findings to other groups. Future studies must select hospitals or certain sports teams, and they must generalize and recruit more individuals. Lastly, more research on brain imaging is required to show that voluntary motions can cause cortical excitability.

Conclusion

In conclusion, minimizing dynamic balance and ankle dorsiflexion, traits of CAI patients, could be accomplished with joint mobilization. On the other hand, joint mobilization employing voluntary movement could further enhance the cortical excitability in the postural control, according to functional factors like DBA. Dynamic balance was greatly enhanced in the case when a voluntary movement was made, just like in the study's findings.

Conflicts of interest

The researchers claim no conflict of interest.

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