HIP PROPRIOCEPTION INSUBJECTS WITH FUNCTIONAL ANKLE INSTABILITY

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ABSTRACT

Background: After an acute lateral ankle sprain, functional ankle instability (FAI) accounts for 40–75 % of the residual disability. FAI has been linked to deficits in muscle strength, balance, and sensory motor system.

Aim of Study: To assess the impact of functional ankle instability on hip proprioception.

Subjects and Methods: sixty individuals of both genders were selected, there age range from 19 to 25 years. The FAI group included 30 participants (21 females, 9 males) and the control group consist of 30 normal subjects (24 females, 6 males). Participants were assessed by functional ankle disability index (FADI). Hip proprioception was assessed using the bubble inclinometer. Their mean ± SD for age and BMI were 23.1 ± 1.54 years and 23.37 ± 1.71 kg/m² respectively.

Results: the hip active repositioning error increase significantly in the FAI group correlate to control group.

Conclusion: the functional ankle instability is associated with increase hip active repositioning error or hip proprioception deficit.

Key words: Functional ankle instability - hip proprioception – functional ankle disability index FADI – bubble inclinometer.

I. INTRODUCTION:

Lateral ankle sprains are a common injury in high school, college, and competitive sports. up to 75% of patients continue to report residual dysfunction that lasts for years. The most common injury mechanism is a combined footplanter flexion, inversion and adduction.(1).

Muscle weakness is associated with an increased risk of recurrent injuries and chronic ankle instability. Electromyographic (EMG) activities of peroneus longus and tibialis anterior muscles are critical to support foot dynamic balance. The continuous movement of unstable joint will be develop osteoarthritis in articular surfaces of joint (2,3).

The functional ankle instability (FAI) refers to the sensation of joint instability or giving way which occur after recurrent sprains. The factors contribute to FAI include deficits in ankle proprioception, muscle strength, and delay peroneal reaction time, or a combination of them which result in dysfunctions in postural control (4,5).

Ankle instability causes a longterm adaptive mechanical changes in musculoskeletal system. So, recognize the pathomechanical implications of ankle instability is mandatory in treating subject with these dysfunctions and preventing additional disabilities(6).
Proprioceptive messages and accompanying control mechanisms play a critical role in preservation of functional joint stability. Hip stabilizers impairment is related to neuromuscular control and might cause increased anterior cruciate ligament (ACL) risk of injury in female athletes (7).

There were changes in somatosensory afferent inputs from ankle and central sensorimotor control dysfunction after ankle sprain, may result in proximal joint alterations to compensate for functional impairments (8).

Subjects and Methods:
Selection of cases: This non-causal correlation study was conducted in Physical Therapy Outpatient Clinics, in Faculty of Physical Therapy, Cairo University from January to June 2021.

Inclusion criteria:
Subject was included if:

- They complained of functional ankle instability (repeated giving way episodes at least 2 times after the primary ankle sprain).
- They had not undergone physical therapy rehabilitation at the time of the study and for at least 3 months ago.
- They had BMI will be less than 25 kg/m².
- They had the willingness and ability to participate in the study.

Exclusion criteria:
Subjects were excluded if they had:
- Any swelling disorders at lower limb joints.
- Recent ankle surgery.
- Limitation in range of motion of lower limb joints.
- Fracture in the lower limb.
- Neurological or vestibular disorder.
- Lumbar disc with radiation to lower limb.

Ethical consideration:
Ethical approvals were obtained from the Research Committee in Faculty of Physical Therapy, Cairo University and the Ethical and Research Committee of Musculoskeletal Disorders and Surgery Department with number P.T.REC/012/003072 at date 5/1/2021.

- The necessary official permission to implement study was obtained from the manager of outpatient clinics at Cairo University Hospitals.

Assessment instrumentation: Baseline Bubble Inclinometer
Proprioceptive measurements taken with an inclinometer is a practical and inexpensive method to promote rehabilitation programs. We used it for measuring the hip joint position sense. There is Fabrication Enterprises Inc. P.O. Box 1500 White Plains, NY 10602 (USA) trade mark of Goldberg 2012.

Assessment procedure:
Subjects were asked to flex the hip to the target angle 45 degree from neutral position zero degree with closed eyes. They were trying to replicate the target angle for 3 times. The angles were recorded, with the amount of error in degrees is represented as shown in Figure (1).

Statistical analysis:
Normal distribution of data was checked using the Shapiro-Wilk test. Levene’s test was conducted to test the homogeneity between groups. Unpaired t-test were conducted for subject characteristics comparison between both groups. Chi-squared test was used for gender distribution comparison between groups. Unpaired t test was conducted for active repositioning error comparison, between groups. The level of significance for all statistical tests was established at p < 0.05. All statistical analysis was conducted through the statistical package for social studies (SPSS) version 25 (IBM SPSS, Chicago, IL, USA).

II. RESULTS

Subject characteristics:

In terms of mean age, BMI, and sex distribution there was no significant difference between the two groups (p > 0.05).

Out of 30 subjects with FAI, 14 (47%) subjects had the right side affected and 16 (53%) subjects had the left side affected. The mean ± SD FADI of the FAI group was 67.53 ± 10.34% with a minimum value of 52% and maximum value of 84% as shown in Table 1.

<table>
<thead>
<tr>
<th>Sex</th>
<th>FAI group</th>
<th>Control group</th>
<th>MD</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Females</td>
<td>21 (70%)</td>
<td>24 (80%)</td>
<td>-0.3</td>
<td>-0.64</td>
<td>0.52</td>
</tr>
<tr>
<td>Males</td>
<td>9 (30%)</td>
<td>6 (20%)</td>
<td>(χ² = 0.8)</td>
<td>0.37</td>
<td></td>
</tr>
</tbody>
</table>

Comparison of active repositioning error between FAI and control groups:

There was a significant increase in active repositioning error in FAI group compared with that of the control group (p < 0.001), as shown in Figure (2).

<table>
<thead>
<tr>
<th>FAI group</th>
<th>Control group</th>
<th>MD</th>
<th>t-value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active repositioning error (degrees)</td>
<td>9.5 ± 3.58</td>
<td>3.73 ± 2.42</td>
<td>5.77</td>
<td>7.28</td>
</tr>
</tbody>
</table>

SD, standard deviation; MD, Mean difference; p-value, level of significance
III. DISCUSSION

The study findings revealed that there were deficits in hip proprioception in the FAI group compared with the control group. This may be attributed to damage of ankle articular and ligaments mechanoreceptors. Thus, disruption of signals from the ankle joint mechanoreceptors into the central nervous system would result in significant disturbances of joint position perception, and movement sense (9).

It may be connected to neuromuscular control dysfunction, occurring after ankle sprain. Such as, postural control deficits occur in the injured and uninjured contralateral limbs this indicates that a centrally mediated mechanism is contributing to the neuromuscular deficits (10). As well as increased time to stabilize after jumping, and postural sway, are likely a result of a previous ankle sprain (11).

So patients with FAI have poor sensory motor integration of the whole lower limb (12, 13), and in such way this may affects hip proprioception. The study results may be associated to mechanical chain, as ankle sprain activates subtalar joint supination leading to femoral, and pelvis external rotation adaptation (14).

Muscle weakness can be caused by a lack of proprioception. Muscle weakness has a greater impact on functional ability limitations in patients with poor proprioception than in patients with accurate proprioception (16). So, delayed activation of hip abductors in FAI may impair the hip joint stability, affecting neuromuscular control and proprioception of hip.

It was concluded that a lateral ankle sprain causes weakness of the bilateral gluteus maximus, biceps femoris, and hip abductors. It was noted that comprised alpha motor neuron pool excitability in the proximal limb muscles (11, 15). Therefore, the FAI may cause defect in hip proprioception through impairing the function of proximal muscles.

Hip proprioception in FAI subjects has not been studied yet. This was the first study investigates about hip proprioception in subject with FAI, so it was not possible for us to compare our results with other studies.

The finding of this study is supported by the study found that individuals with FAI had a more delayed time to stabilization after sudden balance disturbance which reveal trunk instability (17). In addition, the distal joint instability may lead to knee joint neuromuscular impairments as subjects with CAI had deficits in ankle plantar flexion and knee flexor and extensor torque (18).

The limitations of this study were due to difference between participants in severity of FAI, also due to personal difference in lifestyle, psychological status and Co-operation which might affect the result of the measurement. The results of the study can only be used to compare the deficits in FAI participants to healthy control participants. Unfortunately, hip proprioception has not been studied yet, so it was not possible for to compare our results with other studies. Hip proprioception should regard in treatment program of ankle instability. More research should be conducted to determine the correlation between hip proprioception deficit and muscle strength impairments in FAI participants. More research should be carried out to evaluate cervical proprioception.
in patients with FAI. Other studies should be conducted to assess hip proprioception difference between FAI, CAI, and coper groups.

REFERENCE: