Original Article

EFFICACY OF WEIGHT BEARING DISTAL TIBIOFIBULAR JOINT MOBILIZATION WITH MOVEMENT (MWM) IN IMPROVING PAIN, DORSIFLEXION RANGE AND FUNCTION IN PATIENTS WITH POSTACUTE LATERAL ANKLE SPRAIN

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ABSTRACT

BACKGROUND: Various treatments in physiotherapy are available for ankle sprain with no consensus like taping, bracing, splinting, cryotherapy, electrotherapy modality like ultrasound, laser therapy, interferential therapy and HVGS, joint mobilization. Mulligan’s mobilizations-with movement (MWM) have been proposed as novel manual therapy technique to improve joint ROM by combining physiological and accessory joint movements. He developed a suite of treatment techniques on the basis of his theory of positional faults and altered joint kinematics following injuries affecting spinal and peripheral joints.

OBJECTIVE: To find out the efficacy of distal tibiofibular joint MWM in conjunction with conventional treatment over conventional treatment alone for improving pain, dorsiflexion range and lower extremity function in patients with post acute lateral ankle sprain.

SUBJECT AND METHODS: 30 lateral ankle sprain subjects were randomized into 2 groups: Group 1(n=15) were received distal tibiofibular joint MWM along with conventional treatment and Group 2 (n=15) subjects were received conventional treatment only. Treatment consist of 3 sessions spread over 1 week, each session 48 hours apart and data is recorded at beginning and end of treatment regimen.

RESULTS: Independent t-test showed statistical significant improvement in only weight bearing lunge measure for dorsiflexion (p=0.008) in group 1 over group 2 and paired t-test was used for within group analysis which showed significant improvement in both the groups in all the outcome variables (p=0.000).

DISCUSSION AND CONCLUSION: Both the groups demonstrated significant improvement in pain, range and lower extremity function in lateral ankle sprain and distal tibiofibular joint mobilization with movement in conjunction with conventional treatment will be significantly more effective than conventional treatment alone in improving weight bearing ankle dorsiflexion range (Weight bearing lunge measure) in post acute lateral ankle sprain. So distal tibiofibular joint mobilization with movement is worth considering for further exploration in lateral ankle sprain patients.

KEYWORDS: Lateral ankle sprain, Distal tibiofibular joint MWM, Weight bearing lunge measure of dorsiflexion.

INTRODUCTION

The lateral ligament complex of the ankle, described as the body’s “most frequently injured structure” (Garrick, 1977), is mechanically vulnerable to sprain injury. At extremes of plantarflexion and inversion, influenced by the shorter medial aspect of the ankle mortise, the relatively weak anterior talofibular ligament (ATFL) and calcaneofibular ligament (CFL) are prone to varying grades of rupture, often via minimal force. 1
Worldwide approximately 1 ankle sprain occurs per 10000 persons/day, and an estimated 2 million acute ankle sprains occur each year in the United States. Three-quarters of ankle injuries involve the lateral ligamentous complex, with an equal incidence between males and females.\(^2,3\)

Subsequent losses of joint range, particularly dorsiflexion and muscle strength results in significant gait dysfunction, descending stairs, kneeling and running. Inadequate rehabilitation of dorsiflexion range is proposed to lead to long term pain and ankle instability.\(^1,4\) Recent data by yang and vicenzino highlights the presence of dorsiflexion deficit not only in the acute stage, but also in the subacute stage and one reason for continued pain and elevated risk for reinjury may be limited ankle joint mobility and is observed in 20-40\% of patients after ankle sprain.\(^1,5\)

In ankle sprain Mulligan advise talocrural and distal tibiofibular joint mobilization with movement. Efficacy of talocrural joint mobilization with movement has been proven in weight bearing position in lateral ankle sprain in subacute stage as well as in recurrent ankle sprain.\(^1,2,4,6\).

Mulligan 1995 suggested that 2/3rd of all ‘lateral ligament’ injuries solely involve the tibiofibular joint and hypothesized that the distal fibula subluxes anteriorly and caudally during plantarflexion inversion injury of the ankle.\(^7\)

Mulligan suggested basis for distal tibiofibular joint mobilization with movement that a positional fault of the ubula (movement of the lateral malleolus anteriorly during dorsiuexion) often occurred after ankle sprains and claims that a posterosuperior mobilization performed on the distal tibioubular joint could be expected to improve dorsiuexion and regain normal ubular motion and may increase functional ability.\(^8\)

Need of the Study

Despite preliminary evidence on efficacy of distal tibiofibular positional fault there is paucity of literature on efficacy of distal tibiofibular joint MWM in lateral ankle sprain. Results of the present study may help us to formulate a comprehensive and more effective treatment plan in patients of lateral ankle sprain.

METHODS

30 male and female patients diagnosed with lateral ankle sprain by an orthopaedician who are in their postacute phase, who volunteer to participate in the study, meeting the inclusion and exclusion criteria would sign an institutionally approved informed consent form after understanding the procedure as explained in figure 1. Patients are assessed for pain (VAS), dorsiflexion range (weight bearing lunge measure, NWB universal goniometer), and lower extremity function (LEFS). Inclusion criteria was diagnosed cases of lateral ankle sprain, age between 15-45 years, postacute phase (2-6 weeks), Unilateral lateral ankle sprain, anterolateral ankle tenderness less than equal to grade 2, patients who can read and understand english. Exclusion criteria was history of previous ankle sprain and giving way, influence of pain killer during the study, any abnormal sensation or radiation of pain in lower limbs, patient on anticoagulant medications, patients with skin problems like infection, blisters, ulcers, haematoma, Any ankle and foot deformity, ankle instability, grade 3 sprain and other systemic illness.

Pain assessed using a 10 cm visual analogue scale, marked “no pain” at one end and “worst pain imaginable” at the other of 10 cm line. A patient is asked to indicate his/her perceived pain intensity.\(^9\) In Weight bearing lunge measure of dorsiflexion, patient is required to place their foot perpendicular to the wall and lunge their knee toward the wall. The foot is progressively moved away from the wall until the maximum range of dorsiflexion is reached without the heel lifting. The most frequent measurement taken at this point is distance from the foot to the wall by tape.\(^10\)

The Lower Extremity Functional Scale (LEFS) is a questionnaire containing 20 questions about a person’s ability to perform everyday tasks. The LEFS can be used by clinicians as a measure of patients’ initial function, ongoing progress and outcome, as well as to set functional goals. The LEFS can be used to evaluate the functional impairment of a patient with a disorder of one or both lower extremities. It can be used to monitor the patient over time and to evaluate the effectiveness of an intervention.\(^11\)
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Fig. 1: Flowchart of procedure.

Fig. 2: Distal tibiofibular MWM – Weight bearing.

Group 1: Distal tibiofibular joint mobilization with movement (Weight bearing) + Conventional treatment:
Patient places affected foot on stool or chair while standing. Application of posterosuperior glide on distal end of fibula and while this positioning is maintained, allow the patient to lean forward over his foot to force dorsiflexion (figure 2). It is given as 10 repetitions 3 sets with 1 minute rest between sets for 3 sessions, 48 hours apart for 1 week. \(^1\,\,^12\)

Group 2: Conventional treatment only:
Talocrural joint mobilization - Patient places affected foot on stool or chair while standing. Belt is placed around therapist’s hips and the patient’s lower leg about 4cms above the insertion of tendoachiliis. Between the belt and tendoachiliis, a small folded towel placed for comfort. Wrap the web between the thumb and index finger of one hand, reinforced by the other around talus as close to the joint as possible. Pull the tibia and fibula forward with the belt as the patient holding the back of chair, flexes forward over his foot. \(^1\,\,^13\)

Exercises - Range of motion exercises i.e. achillis stretching in non weight bearing and weight bearing positions, Alphabet exercises (3 times/day, 15-30 sec hold). Muscle strengthening exercises (isometric and concentric) using contralateral foot for dorsflexors, plantar flexors, invertors and evertors (3 sets 5-10 reps 3 times/day). Toe curls and marble pickups (2 sets 10 reps 2 times/day). Toe raises, heel walk and toe walk (3 sets 10 reps 2 times/day). \(^14\,\,^15\)

Data Analysis
Data were managed on a Microsoft excel spread sheet. The analysis was done using SPSS version 19. Means and standard deviation of pre and post values of pain (VAS), Dorsiflexion range (weight bearing lunge measure and universal goniometer) and Lower extremity function (LEFS) for both experimental group and control group were computed. Paired t-test was used for within group analysis and independent t-test for between group analyses for all the outcome variables.
RESULTS AND TABLES

In this section, the results of the present study are presented. In all there were 7 males, 8 females in both group 1 and group 2 (14 males and 16 females). Basic demographic characteristics of both groups did not show any significant difference at baseline values of age, weight, height, BMI, VAS, WBLM, DF (goniometer) and LEFS. In between group analysis, there were no significant improvements in pain on VAS (pd"0.352), lower extremity function (pd"0.062). There was significant improvement in dorsiflexion range on WBLM (pd"0.008) and no significant improvement on universal goniometer in non weight bearing position. (table1) However there was improvement on mean difference of pre and post values between the two groups.

In within group analysis there was significant difference between pre and post values of pain (VAS), dorsiflexion range (WBLM and DF) and lower extremity function (LEFS) in both group 1 and group 2 (p=0.00) as shown in table 2.

**DISCUSSION**

In between group analysis results of present study show that distal tibiofibular joint mobilization with movement group significantly improved weight bearing Dorsiflexion range(weight bearing lunge measure) of motion in patients with post acute lateral ankle sprain over conventional therapy alone i.e. control group.

Mulligan has hypothesized positional fault at
distal fibula that subluxes anteriorly and caudally during plantar flexion and inversion injury of the ankle. There is preliminary evidence of Radiographic positional faults in sub-acute and chronic ankle sprain that supports this hypothesis. Kavanagh (1999) measured change in bone position with application of the anteroposterior glide MWM of the inferior tibiofibular joint. The author claimed that the data supported the proposal of anterior-caudal positional fault of the inferior tibiofibular joint in ankle sprain patients.

Hubbard et al in his two successive studies assessed the position of distal fibula in individual with chronic ankle instability and sub-acute lateral ankle sprain respectively using fluoroscopy imaging and distance from anterior margin of distal fibula in relation to the distal tibia was measured in millimeters. He concluded that fibula was positioned more anterior in relation to tibia on their involved ankle in relation to their uninvolved limb.

In a lab study, limitation of ankle Dorsiflexion was decreased in cadavers by distal tibiofibular joint mobilization in which fibula was displaced by cyclic loading postero-superiorly and then maximum dorsiflexion pre and post was compared which came effective for increasing the range of dorsiflexion.

In a single case study of 1998 by O’Brien, the technique involved the physiotherapist sustaining a non weight bearing posterior glide to the distal fibula for acute ankle sprain, while the patient actively inverted the ankle several times. There were rapid improvements in range of motion of inversion and dorsiflexion range in weight bearing, and immediate decreases in pain and also improvement in function.

The ûbula has been found to function in weight bearing approximately 6.4% of the applied loads, according to Takebe et al. Hence correction of its positional fault might have attributed to weight bearing dorsiflexion range of motion improvement.

Although there was no statistical significant improvement in pain (on VAS) and lower extremity function (LEFS) in the experimental group over the control group but mean scores of pain and LEFS were better in experimental group.

The minimal detectable change (MDC) and minimal clinically important difference (MCID) of the LEFS is 9 scale points. In the present study all patients could achieve the MDC & MCID in the experimental group where as only 9 patients could achieve MDC & MCID in the control group. Thus, experimental group is showing an edge over the conventional physiotherapy alone in LEFS scores.

Mulligan hypothesizes that 2/3rd of all lateral ligament injuries solely involve the tibiofibular joint or are due to combination of damage to distal tibiofibular joint and to ATFL ligament which was supported by Kavanagh (1999) who did a lab study to measure positional fault at distal tibiofibular joint in acute or chronic ankle sprains and found positive results in 1/3 rd of the patients. But in the present study by no means we could check for positional fault at distal tibiofibular joint in each group and hence there might be an uneven distribution of patients having distal tibiofibular joint positional fault.

In the present study, within group analysis showed significant improvement in all the outcome variables namely pain (VAS), dorsiflexion range (WBLM & universal goniometer) and lower extremity function (LEFS) in both the experimental and conventional therapy group ie control group.

In the experimental group the significant improvement, apart from the positional fault correction can be attributed to the hypoalgesic effects of manual therapy which was given in form of MWM.

The effect of Mulligan’s mobilisation with movement technique at talocrrural joint was studied by Collins et al (2004) with sub acute ankle sprains on dorsiflexion range of motion for pre- to post-application in one session was found, compared to placebo and control group.1 The clinical rationale given for anteroposterior glide component of the weight bearing dorsiflexion MWM is to reduce any residual anterior displacement of the talus. Mulligan proposed that correction of the restricted posterior glide, via repetitions of dorsiflexion with a sustained anteroposterior talar mobiliz-
ation (mechanically similar to posterolateral tibial glide on talus), restores the normal joint kinematics even after release of the glide. It also has been proven that effect of mobilizations with movement at talocrural joint performed in weight bearing position in individuals with subacute and recurrent lateral ankle sprain demonstrated a positive effect on improving pain and dorsiflexion range on weight bearing lunge measure than MWM in non weight bearing position.2, 4, 22

Early post injury exercise can improve the healing and strength of damaged ligament by increasing collagen formation and reducing adhesion, improved tissue nutrition, minimized muscle wasting, and minimal loss of strength are also benefits of early exercise.14,23

Despite incomplete adherence to home regime still patients showed statistically significant improvement in all outcome measure in both groups. The present picture is close to the clinical practice scenario.

In the present study patients were not under the influence of pain killers so the improvement came in both the groups can be attributed to the therapy given to each group.

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Conflicts of interest: None

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