



Effectiveness of Proprioception training and Mulligan's mobilization in subjects with lateral ankle sprain

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ABSTRACT

Ankle sprains are common problem in daily activity its occurring at an estimated rate of more than 23,000 per day in the United States. (Kannus P, Renstrom et. Al 1991). The anterior talofibular ligament is the most commonly injured ligament and is most susceptible to injury during a plantar flexion and inversion mechanism. (Kannus P.et.al2010). Re injury may be greater in high risk of sports, athletes in reinjured rate of 73% was reported, Individuals with repeated sprained ankle may have the symptoms like pain during the activity, weakness, swelling, and functional disability. The primary objective is evaluating the effectiveness of Functional outcome in Mulligans mobilization group and compared with proprioception Group in subjects with lateral ankle sprain Participants. The purpose of the study is comparing mulligan methods versus proprioception training in lateral ankle sprain. In this study 30 subjects with unilateral ankle sprain were selected, they assigned into 2 groups consisting of 15 subjects each-Group A (control) and Group B (experimental). Group A received proprioception training methods. In group B received mulligan's mobilizations to the affected ankle joint. After the 4 weeks of the treatment, measured the ROM, and ankle functional status, it will be measuring by GONIOMETER and AJFAT (ankle joint functional assessment tool). In this study mulligan's mobilization group improve ankle dorsiflexion and functional activity in subjects with lateral ankle sprain. Group A is given ROM exercises, strengthening exercises and Group B is given mulligan's mobilization. By statistical analysis our study demonstrates that significant difference From the results the values for ROM with values of (-6.92) and (-2.048) pre and post intervention shows more effective in experimental group than the control group. For the ankle joint function by AJFAT pre and post intervention values of (-0.1) and (-6.4) indicate significant difference .

Keywords: Ankle joint functional assessment tool (AJFAT); Goniometry; Mulligan's mobilizations; strengthening exercises.

INTRODUCTION

Ankle sprains are common problem in daily activity its occurring at an estimated rate of more than 23,000 per day in the United States. (Kannus P, Renstrom et. Al 1991). The incidence of ankle sprain in every year affected rate of 2.15 per 1,000 persons in the United States. Ankle sprain occurring rate of 49.3% reported athletic related activities, basket-ball injury is contributing up to 41.1%. (Kannus P, Renstrom et. al 2010). The anterior talofibular ligament is the most commonly injured ligament and is most susceptible to injury during a plantar flexion and inversion mechanism. (Kannus P.et.al2010). Most sprains were sustained during sports and other activities became dominant. Sixty-one per-

cent of the lesions were located around the lateral ankle, and 24% were located on the lateral midfoot (Holmer P. et al 2008). The combined motion of plantar flexion and inversion is a common mechanism of injury and routinely leads to the diagnosis of a lateral ankle sprain. Brian Mulligan has study is explained mechanism of injury result in a positional fault of the fibula in lateral ankle sprain, and the ATFL pulls on the fibula at the distal tibiofibular joint creating a positional fault between the tibia and fibula. The positional changes fighting to the ligament sprain, is the main source of pain, dysfunction, and decreased range of motion (Mulligan B et.al 2013). Ankle injuries are the most commonly reported injuries in running and jumping athletes (Freeman MR et al 2011). As a "tendency for the foot to give way after an ankle sprain". Recurrent ankle slips are common in the athletic population. Majority of injured athlete do not complete the rehabilitation phase after an injury. Balance training is underutilized in our country, it is widely studied in developed countries by using various stability trainers (Leanderson J. et al 2011). It is a positive result of balance training in improving the functional stability of the ankle joint. In olden days, balance

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boards have been primarily used in elementary schools to teach movement skills and more recently they have also been used in rehabilitation programs (Thomas E. Hyde et al, 1999). Balancing on these board develops balance and the musculature needed for control. The incidence rate was higher in women than males of after the age group of 40 yrs but its highest for young males. Ankle injuries may result in the player experiencing disability and residual symptoms, (Smith rw et al 2001). The common symptoms of sprain is pain, sense of instability, crepitus, and weakness (Yeung MS et al 1999). Acute lateral sprains individuals 74% develop residual symptoms defined as "chronic ankle instability" (Wikstrom EA et al., 2010). The re-injury may be greater in high risk of basket ball players an injury rate of 73% were rate reported (McKay GD, et al., 2001). Manual therapy is used by a physiotherapist for the treatment of musculoskeletal joint dysfunction (Reid SA, et al., 2014). The important factor of mobilizations is that pain should always be reduced or eliminated during the application (Marrón-Gómez D, Rodríguez-Fernández ÁL et al., 2015). Ankle inversion sprain are the most common in during plantar flexion and inversion of the foot. Individuals who suffer from ankle sprains are most likely to reinjure the same ankle. External support with orthotic or taping is widely used to prevent ankle sprains among athletes and to establish its effectiveness many studies have been done (Mohammadi F et al., 2007).

The principles of moment with mobilization application is require pain-free application of the technique and guide the therapist in adjusting hand placement, force application, and the line of drive of the mobilization to produce the desired outcome (Vincenzinobi et al., 2011). Acute ankle sprains having reduction in dorsiflexion range of motion and sub acute ankle sprain dorsiflexion is limited. Ankle sprains is most commonly affecting in the age group between 20 to 40 years. One's estimation is that there is one ankle sprain per day per 10,000 of population (Reid SA, et al., 2014). Manual therapy is used by a physiotherapist for the treatment of musculoskeletal joint dysfunction (Reid SA, et al., 2014). The component mobilizations are that pain should always be reduced during the application (Marrón-Gómez D, Rodríguez-Fernández ÁL et al., 2015).

AIM OF THE STUDY

The aim of the study is find out the effectiveness of proprioception training and Ankle Mobilization in patients with lateral ankle sprains.

OBJECTIVES OF THE STUDY

The primary objective is evaluating the effectiveness of Functional outcome in Mulligan's mobilization group and compared with proprioception Group in subjects with lateral ankle sprain Participants.

Secondary objective is investigate the ROM outcome in Mulligan's mobilization group and compared with proprioception Group in subjects with lateral ankle sprain Participants in increasing the dorsiflexion range

METHODOLOGY

STUDY DESIGN

This study was the pre and post experimental study design where the participants were randomly allocated into control and experimental groups. The participants in the control group receives proprioceptional training and experimental group receives mulligan's mobilization. The participants of both gender with age 35-50 years of lateral ankle sprain general population were participated. As per the advice of institutional board of ethical committee members the study participants were explained clearly about the benefits of exercise, rights to withdraw from the study at any point, privacy of study participants details before the study.

PROCEDURE

The study was conducted on 30 participants with lateral ankle pain, at PPG college of physiotherapy, Coimbatore, India with functional balance impairments were included in this study. Participants with major surgeries in lower extremities, lower limb fractures, a history of bilateral ankle sprains and tumor and wounds around the involved ankle were excluded from the study. The control group (A) was given 4 weeks of preproception training. The Experimental group (B) were given 4 weeks of Mulligan's mobilization and strengthening exercises. Both groups were evaluating ROM and functional status of ankle joint before starting the treatment and end of the 4th week of treatment with use of goniometry and AJFAT.

Mulligan mobilization

Movement with mobilization of dorsiflexion MWM technique was performed on the symptomatic talocrural joint, it is described by Mulligan 1999. Subject is relaxed and stands on a treatment couch, by using a non-elastic seat belt, it is placed around the distal tibia and fibula of the subject affected side of the ankle joint of with a foam cushioning to achilles tendon and around therapist's pelvis. Therapist transmit the tension on the seat belt by the backward translation and a postero-anterior tibial glide is given, talus and forefoot were fixed within the web space of one hand close to the anterior joint line, with other hand placed anteriorly on the proximal tibia and fibula to direct the knee over the 2nd and 3rd toes for maintenance of consistent alignment of the distal leg and foot. During slow active dorsiflexion, a sustained glide is given to the end of pain free range. Three sets of 10 repetitions were applied; with one minute relax in between the exercises. Physical therapist frequently uses this manual therapy after injury to improve range of motion, to facilitate normal function. After 6 weeks of treatment ROM and ankle joint functional

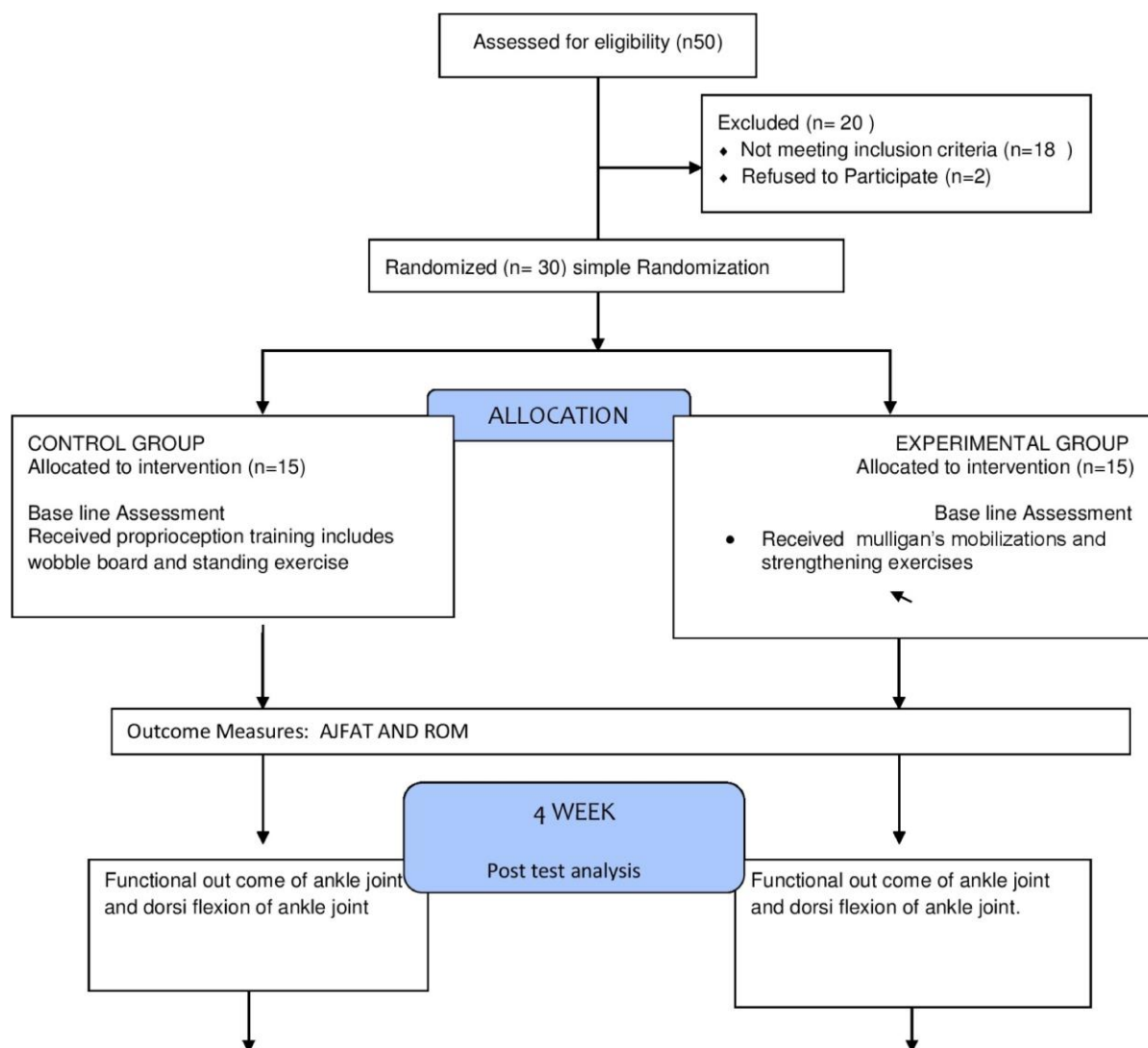


Figure 1: FLOW CHART

status are measured Goniometer, and AJFAT (ankle joint functional assessment tool) measured.

Proprioception training

In this training includes various methods of wobble board exercises, uni lateral, bilateral standing methods and free exercise with prescribed interval program.

Statistical analysis

Descriptive analysis was used to analyses the data in each subject [Gr A& Gr B WILCOXON SIGNED RANKS TEST was performed Inter (within) groups (Gr A & Gr B). For strength PAIRED-T-TEST was performed. MANN-WHITNEY TEST was performed Intra (between) groups (Gr A & Gr B) and for strength INDEPENDENT-T-TEST was performed. SPSS 9, MS EXEL, R Language were used.

RESULTS & DISCUSSION

In this study mulligan's mobilization combined with strengthening excises group used to improve ankle dor-siflexion and functional activity in subjects with lateral ankle sprain. Group A is given proprioception training and Group B is given with mulligan's mobilization. By

statistical analysis our study demonstrate that signifi-cant difference of the results the values for ROM with values of (-6.92) and (-2.048) pre and post intervention and it is less than 0.05 suggest that significant difference for ROM between group A and group B. Ankle joint function by AJFAT pre and post intervention values of (-0.1) and (-6.4) indicate significant difference. In this present study results shown improvement in both the groups it is more in group B. In group A improvement is present because of exercises. In strengthening exercises range of motion must be regained before functional rehabili-tation is initiated. Most of the study hypotheses have been advanced, physiological modulation of pain and mechanical alteration of tissues. Freeman et.al explained that when ligament tissue is disrupted during lateral ankle sprain, the mechanoreceptors and afferent nerves are also disturbed because the nervous tissue holds less tensile strength than ligamentous tissue (Ghadi P, Verma C et al., 2013). Functional treatment keeps the stretched ligaments at reasonable anatomical alignment and adequate length during healing process. Wobble board training was effective in reducing the number of recurrent injuries and prevent the functional

Table 1: Proprioception training program lateral ankle sprain

Balance component	Activity	Hold time	Repetition	Training sessions per day
1 st Week Static	i) Single leg stance in floor with eyes open	10 Sec	6	2 times
	ii) Single leg stance in floor with eyes closed	10 Sec	6	2 times
2 nd Week Static	i) Single leg stance in floor with eyes open	10 Sec	6	2 times
	ii) Single leg stance in floor with eyes closed	10 Sec	6	2 times
3 rd Week Dynamic	i) Double leg stance with eyes open on the balance board	10 Sec	6	2 times
	ii) Double leg stance with eyes closed on the balance board	10 Sec	6	2 times
4 th Week Dynamic	i) Single leg stance with eyes open on the balance board	10 Sec	6	2 times
	ii) Single leg stance with eyes closed on the balance board	10 Sec	6	2 times

Table 2: Comparison of post test results of experimental group and control group of ankle dorsiflexion

S.No	Ankle Dorsiflexion ROM	Mean	standard deviation	Mean difference	Calculated t-value
1.	Group A	14.89	1.631	5.74	6.92
2.	Group B	20.63	0.59		

Table 3: Comparison of post-test values in experimental group and control group of AJFAT

Post test	Mean	SD	Mean difference	Mann-Whitney U value
Group A	19.27	2.034	22.46	7.5
Group B	41.73	1.919		

instabilities (Tsirakis V, Perry J Carl et al., 2006). Mat-tacola et al explained Proprioceptive training is started for the recovery of balance and postural control. The body reacts to perturbations in various ways sensory input is received from all parts of the body and transfers to central nervous system via effort pathways this balance training exercises useful to normalize neuromuscular control (Marrón-Gómez Rodríguez-Fernández et al., 2015; Fujii M, Suzuki D, Uchiyama E et al., 2015; Hard TJ, Hertel J et al., 2008; Miller J et al., 1999; Mulligan BR et al., 1993; Djordjevic OC, Vukicevic D et al., 2012).

The improvement is more in the group B, because Mulligans mobilisation technique provides sufficient sensory input to activate the endogenous pain inhibitory system. Abbott et.al explained this MWM effects is a neurophysiological in nature. Tactile and compressive stimuli may influence the spinal cord neurons inhibiting nociception and the motor neurone pool, and it's a way to retrain the spinal cord circuit by allowing the patient to experience repetitive pain free movement. This may help to switch off maladapted spinal cord circuitry, re-establishing normal levels of nociception and motor neurone pool excitation (Marrón-Gómez D, Rodríguez-Fernández et al., 2015; Fujii M, Suzuki D, Uchiyama E et al., 2015). Most of the therapists accepted that the mobilization should be performed at the final range of movement helps in the plastic deformation part of the tissue response to force, to effect these mechanical alterations. Mulligan explained that treatment is always applied parallel to the treatment plane. In this study, the

mobilization was performed starting of the joint's range of motion and not at the end of the range of motion. In addition, there was an immediate reduction in pain, as evidenced by the improvement in pain-free dorsiflexion range of movement, it is not likely response from a mechanical event early posterior talocrural joint mobilization in treatment of lateral ankle sprains resulted in more effective restoration of dorsiflexion range of motion than conventional treatment. Dorsiflexion range of motion can be limited by tightness in the Gastrocnemius and Soleus muscle of the ankle joint and capsular soft tissue restrictions. Lewit et.al explained that joint movement can be decreased as a result of reflex muscle splinting it prevents further damage and reduces nociceptor discharge from the joint by holding it in the midrange position (Miller J et al., 1999). Lundberg et .al have shown that end range passive movements have a reflex inhibitory effect on the muscle acting over the joint (Fujii M, Suzuki D, Uchiyama E et al., 2015). Lateral ligament of the ankle healed by new collagen tissue is laid down on the injured ligament; this healing is due to healing of mechanoreceptors and afferent nerve fibers.

CONCLUSION

This study concluded that mulligan's mobilization along with functional therapy has more effective results in improving ankle dorsiflexion and functional activity in affected ankle in all individuals or sports persons.

REFERENCES

- Kannus P, Renstrom P. Treatment for acute tears of the lateral ligaments of the ankle: operation, cast, or early controlled mobilization. *J Bone Joint Surg Am*. 1991;73 (2);305-312.
- Waterman B, Owens B, Davey S, Zacchilli M, Belmont P. The Epidemiology of Ankle Sprains in the United States. *J Bone Joint Surg Am*, 2010; 92 (13);2279-2284.
- "Play-by-Play" Sport Specific Results and Recommendations. National Athletic Trainers' Association. Available at <http://www.nata.org/play-by-play>. Accessed August 31 2013.
- Hubbard T, Hicks-Little C. Ankle ligament healing after an acute ankle sprain: an evidence-based approach. *J Athl Train*. 2008;43 (5):523-529
- Mulligan B. Manual Therapy: Nags, Snags, MWMs, etc. New Zealand: Plan View Services Ltd.; 2010.
- Vicenzino B, Hing W, Rivett D, Hall T. Mobilisation with movement: the art and science. Elsevier Australia: Melinda McEvoy; 2011.
- Han K, Ricard MD, Fellingham GW. Effects of a 4-week exercise program on balance using elastic tubing as a perturbation force for individuals with a history of ankle sprains. *Journal of orthopaedic & sports physical therapy*. 2009 Apr;39 (4):246-55.
- Friel K, McLean N, Myers C, Caceres M. Ipsilateral hip abductor weakness after inversion ankle sprain. *Journal of athletic training*. 2006;41 (1):74.
- Seah R, Mani-Babu S. Managing ankle sprains in primary care: what is best practice? A systematic review of the last 10 years of evidence. *British medical bulletin*. 2010 Aug 14;97 (1):105-35.
- Van der Wees PJ, Lenssen AF, Hendriks EJ, Stomp DJ, Dekker J, de Bie RA. Effectiveness of exercise therapy and manual mobilisation in acute ankle sprain and functional instability: a systematic review. *Australian Journal of Physiotherapy*. 2006 Jan 1;52 (1):27-37.
- Vela LI, Denegar C. The disablement in the physically active scale, part II: The psychometric properties of an outcomes scale for musculoskeletal injuries. *J Athl Train*. 2010;45 (6):639-641.
- Bahr R, Rahr I. Incidence of acute volleyball injuries: a prospective cohort study of injury mechanisms and risk factors. *Scand J Med Sci Sports*. 1997;7:166-171.
- Eechaute C, Vaes P, Duquet W. The chronic ankle instability scale: Clinimetric properties of a multidimensional, patient-assessed instrument. *Phys Ther Sport*. 2008;9 (2):57-66.
- Green T, Refshaug K, Crosbie J, Adams R. A randomized controlled trial of a passive accessory joint mobilization on acute ankle sprains. *Phys Ther*. 2001; 81:984-994.
- Eisenhart AW, Gaeta TJ, Yens DP. Osteopathic manipulative treatment in the emergency department for patients with acute ankle injuries. *J Am Osteopath Assoc*. 2003;103 (9):417-421.
- Kaminski T, Hertel J, Amendola N, et al. National Athletic Trainers' Association Position Statement: Reid SA, Rivett DA, Katekar MG, Callister R. Comparison of mulligan sustained natural apophyseal glides and maitland mobilizations for treatment of cervicogenic dizziness: a randomized controlled trial. *Physical therapy*. 2014 Apr 1;94 (4):466-76.
- Marrón-Gómez D, Rodríguez-Fernández ÁL, Martín-Urrialde JA. The effect of two mobilization techniques on dorsiflexion in people with chronic ankle instability. *Physical Therapy in Sport*. 2015 Feb 28;16 (1):10-5.
- Hopper D, Samsson K, Hulenik T, Ng C, Hall T, Robinson K. The influence of Mulligan ankle taping during balance performance in subjects with unilateral chronic ankle instability. *Physical Therapy in Sport*. 2009 Nov 30;10 (4):125-30.
- Ghadi P, Verma C. Study of the efficacy of the Mulligan's Movement with Mobilization and Taping Technique as an Adjunct to the Conventional Therapy for Lateral Ankle Sprain. *Indian Journal of Physiotherapy and Occupational Therapy*. 2013 Jul 1;7 (3):167.
- Vicenzino B, Branjerdporn M, Teys P, Jordan K. Initial changes in posterior talar glide and dorsiflexion of the ankle after mobilization with movement in individuals with recurrent ankle sprain. *Journal of Orthopaedic & Sports Physical Therapy*. 2006 Jul;36 (7):464-71.
- Tsirakis V, Perry J. The effects of a modified spinal mobilisation with leg movement (SMWLM) technique on sympathetic outflow to the lower limbs. *Manual therapy*. 2015 Feb 28;20 (1):103-8.
- Marrón-Gómez D, Rodríguez-Fernández ÁL, Martín-Urrialde JA. The effect of two mobilization techniques on dorsiflexion in people with chronic ankle instability. *Physical Therapy in Sport*. 2015 Feb 28;16 (1):10-5.
- Hubbard T, Hertel J, Sherbondy P. Fibular position in individuals with self-reported chronic ankle instability. *J Orthop Sports Phys Ther*. 2006;36 (1):3-9.
- Hubbard T, Hertel J. Anterior positional fault of the fibula after sub-acute lateral ankle sprains. *Man Ther*. 2008;13 (1):63-67.
- Fukuhara T, Sakamoto M, Nakazawa R, Kato K. Anterior positional fault of the fibula after sub-acute anterior talofibular ligament injury. *J Phys Ther Sci*. 2012;24 (1):115-117.
- Wikstrom E, Hubbard-Turner T, McKeon P. Understanding and treating lateral ankle sprains and their consequences. *Sports Med*. 2013;43 (6):385-393.
- Hetherington B. Lateral ligament strains of the ankle, do they exist? *Man Ther*. 1996; 1 (5):274-275.
- Stubbs E, Baker RT, Ramos, C. Utilizing Mulligan's concept for correcting an anterior positional fault of the fibula following a lateral ankle sprain: A case report. Paper presented at: 2012 Far West Athletic Trainers' Association Annual Meeting and Clinical Symposium; April 12-15, 2012, San Diego, CA.