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Review Research Article

Effectiveness strengthening exercises and Mulligan's mobilization in patients with unilateral ankle sprain

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ABSTRACT

The ankle sprain is defined "An ankle injury that occurs when a person stumbles and the supporting foot twists, resulting in damage to the ligament". 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 purpose of the study is comparing mulligan, strengthening methods versus conventional methods to treating LAP. 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 include PRICE (Protection, rest, ice, Compression and Elevation) protocol and strengthening exercises is used. In group B along with PRICE protocol, strengthening exercises and mulligan's mobilizations are used to the affected ankle joint. After the 6 weeks of the treatment, measured the pain, ROM, and ankle functional status, it will be measuring by VAS (visual analogue scale), GONIOMETER and AJFAT (ankle joint functional assessment tool). In this study mulligan's mobilization combined with strengthening exercises used to improve ankle dorsiflexion and functional activity in subjects with acute (grade 1) unilateral ankle sprain. Group A is given PRICE protocol, ROM exercises, strengthening exercises and Group B is given with PRICE, strengthening exercises and mulligan's mobilization. By statistical analysis our study demonstrates that significant difference for VAS with values of (-17.33) and (-2.145) ($p < 0.05$) pre and post intervention and it is less than 0.05 suggest that significant difference for pain between group A and group B. 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); GONIOMETER; Mulligan's mobilizations; strengthening exercises; VAS.

INTRODUCTION

In activities of daily living lateral ankle sprains is the most common musculoskeletal injuries (Han K, Ricard MD et al., 2009). The ankle joint is the most frequently affecting in athletes (Friel et al., 2006). The ankle sprain defined as "An ankle injury that occurs when a person lose the balance and the base of foot twists, resulting in damage to the ligament (Seah R, et al., 2010).

In athletic persons 70% to 85% are the inversion type of sprains are present (Van der Wees et al., 2006). Acute lateral sprains individuals 74% develop residual symptoms defined as "chronic ankle instability" (Wikstrom EA et al., 2010). Acute inversion type of sprain

develops chronic mechanical instabilities and approximately 80% of ankle sprains reoccur in 10% to 30% of population (Van der Wees PJ, Lencsen AF, Hendriks EJ et al., 2006).

The re-injury may be greater in high risk of basketball players an injury rate of 73% were rate reported (McKay GD, et al., 2001). Inversion ankle sprain is the most common type of sprain, it's a excessive plantar flexion and supination it resulting the anterior talofibular ligament to be injured. Inversion type of ankle sprains accounted for 85% of all ankle sprains. (Collins N, et al., 2007).

Individuals with repeated sprained ankle may have the symptoms like pain during the activity, weakness, swelling, and functional disability. Functional disability includes a feeling of giving away 'or' a feeling of Ap-prehension (Han K, Ricard MD et al., 2009). Functional instability of the foot is nearly 40% of injuries to the lateral ligament of the ankle (Mohammadi F et al., 2007).

Ankle sprains have been classified into three grades.

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Grade 1: Mild swelling, or tenderness, and no mechanical instability of the joint. Injury (mild) involves stretching of the ligament without macroscopic tearing.

Grade 2: Moderate pain, swelling, and tenderness, but no instability of the joint. Injury (moderate) involves a macroscopic tear of the ligament.

Grade 3: Involves a complete rupture of the ligaments with severe swelling and tenderness. The joint is unstable (Collins N, *et al.*, 2007).

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).

Acute ankle sprains having reduction in dorsiflexion range of motion and frequently in full weight bearing and walking is aggravating the pain, in these activities are not advisable in clinically. And also in 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).

Early management of acute ankle sprain includes RICE (rest, ice, compression and Elevation). Immediately after the injury cryotherapy should be used. For acute injury of ankle joint heat should not be applied it cause encourages swelling and inflammation through hyperemia. Applying cryotherapy, exercises should be initiated to maintain range of motion and assist lymphatic drainage (Alburquerque-Sendín F *et al.*, 2016).

Manual therapy is used by a physiotherapist for the treatment of musculoskeletal joint dysfunction (Reid SA, *et al.*, 2014). The key component to MWM is that pain should always be reduced or eliminated during the application (Marrón-Gómez D, Rodríguez-Fernández ÁL *et al.*, 2015).

METHODOLOGY

The study was conducted on 30 participants with acute unilateral ankle pain who recruited from PPG College of physiotherapy, Coimbatore, India after obtaining intuitional ethical approval and written informed concern. Both men and women with symptoms of first degree of ankle pain between 25 to 40 years of age group 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.

PROCEDURE

Total thirty participants were further assigned into 2 groups consisting of 15 subjects each, Group A (control) and Group B (experimental). Group A include PRICE (Protection, Rest, Ice, Compression and Elevation) protocol and strengthening exercises is used. In group B along with PRICE protocol, functional therapy and mulligan's mobilizations are used to the effected ankle.

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 stand 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 off with a foam cushioning to achilies 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 decrease pain and to facilitate normal function. Cryotherapy treatment given for 10 minutes. After 6 weeks of treatment pain, ROM and ankle joint functional status are measured VAS (visual analogue scale), Goniometer, AJFAT (ankle joint functional assessment tool) measured.

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 functional therapy used to improve ankle dorsiflexion and functional activity in subjects with acute (grade 1) unilateral ankle sprain. Group A is given PRICE protocol ,ROM exercises ,strengthening exercises and Group B is given with PRICE, strengthening exercises and mulligan's mobilization. By statistical analysis our study demonstrate that significant difference for VAS with values of (-17.33) and (-2.145) ($p < 0.05$) pre and post intervention and it is less than 0.05 suggest that significant difference for pain between group A and group B .

Table 1: Strengthening exercises for unilateral ankle sprain

Component	Procedure	Duration and frequency
Achilles tendon stretch with weight bearing	Stand with heel support on floor and bend at knees	Pain free stretch for 15 to 30 seconds, perform five repetitions, repeat five times a day.
Isometric exercises	Resistance applied by immovable object like wall or floor in contra lateral foot	For each exercise hold 5 seconds do 10 repetitions; repeat three times a day
Isometric type	Push foot downward	For each exercise, hold 1 second for concentric component and perform eccentric component over 4 seconds; do three sets of 10 repetitions; repeat two times a day Two sets of 10 repetitions, repeat two times a day
Plantar flexion,	Pull foot upward	
Dorsiflexion,	Push foot inward	
Inversion	Push foot outward, away from mid-line of body.	
Eversion	Resistance can be provided by contra lateral foot, rubber tubing or weights	
Isotonic exercises type	Push foot downward, away from head.	
Plantar flexion	Push foot outward, away from mid-line of body.	
Dorsiflexion	Pull foot upward, toward head. Inversion Push foot inward toward midline of body.	
Eversion	Push foot outward, away from mid-line of body.	
Toe curls and marble pick ups	Place foot on a towel, then curl toes, moving the towel toward the body, use toes to pick up marbles or other small object	

Table 2: Visual analogue scale component comparison of groups a and b post-test values

POST TEST	Mean	SD	Mean difference	Wilcoxon- signed rank value
Group A	2.933	0.798	2.067	0.033
Group B	0.866	0.743		

Table 3: 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	15.53	1.552	3.0	6.92
2	Group B	18.53	0.63		

Table 4: AJFAT component comparison of group a and b post-test values

Post test	Mean	Sd	Mean difference	Mann-whitney u value
Group A	21	2.104	18.73	7.5
Group B	39.73	1.709		

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. 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 rehabilitation 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 instabilities

(Tsirakis V, Perry J Carl *et al.*, 2006). Mattacola *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 nociperception 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 nociperception 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.

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