

# Kinesio taping versus Mulligan's mobilization with movement in sub-acute lateral ankle sprain in secondary school Hockey players - Comparative study

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## ABSTRACT:

**Background:** The effectiveness of taping and bracing in the treatment of ankle injuries in hockey has not been investigated, although it has been shown effective in reducing the incidence of Sub-acute ankle injuries in other sports (basketball and US football). The effectiveness of application Mulligan's Mobilization with movement technique for talocrural dorsiflexion to sub acute lateral ankle sprains produces an initial dorsiflexion gain, and simultaneously produces a mechanical but not thermal hypoalgesia, so need to be proved the effectiveness in sub-acute lateral ankle sprain in secondary Hockey players. **Methods:** Thirty Subjects who have fulfilled inclusion and exclusion criteria have been selected from the population and divided into two Groups (A=Kinesiotaping technique & B=Mulligan's Mobilization with movement technique.). Ultrasound was given to both groups. Groups were evaluated with Qualitative outcome: Numerical pain Rating Scale and Quantitative outcome: Dorsiflexion range of motion (Knee-to- wall principal). **Results:** Both the Kinesiotaping and Mulligan's Mobilization with movement technique are effective in sub-acute lateral ankle sprain to reduce pain and improve the dorsiflexion range of motion. In Numerical pain rating scale Group B show 74.90% (p=0.01) of reduction as compare to Group A there is 55.69% (p=0.01) of reduction. In Dorsiflexion range of motion Group B there is 71.07% (p=0.000) of improvement as compare to Group A there is 27.64% (p=0.000) of improvement. **Conclusions:** This study demonstrated an effect of Mulligan's Mobilization with movement technique on sub-acute lateral ankle sprain in secondary hockey players. These results suggest that this technique should be considered in rehabilitation program following sub-acute lateral ankle sprain. This study provides justification for follow-up research of the long-term effect of Mulligan's Mobilization with movement on sub-acute lateral ankle sprain and proposes further work be conducted on the weight-bearing posteroanterior tibial glide Mobilization with movement.

**Keywords:** Kinesiotaping, Mobilization with movement (MWM), Ankle sprain, Hockey players, and Ultrasound Therapy.

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**INTRODUCTION:** Field Hockey is an ancient game thought to be the forerunners of all 'stick and ball' games. This game is being played on natural grass, gravel, or in any artificial turf that can either be sand-based or water-based. Using a small, hard ball and a J-shaped hockey stick made of composite of wood, glass and carbon fiber. Two opposing teams of 11 players try to outdo and outsmart each other to get the ball into the opponents' goal.<sup>1</sup>

Most serious injuries result from being struck by the stick or the ball. Epidemiological studies have consistently shown that injuries in hockey are numerous and can be serious. Players aged between 10 and 19 years account for 50% of hockey injuries.<sup>2</sup> A major factor in the etiology of lower limb injuries can be the playing surface.<sup>1</sup> Kawaldeep Kaur et.al. reported 64.87% injuries occurred while playing on natural grass and 35.13% occurred while playing on artificial turf.<sup>3</sup>

The Anterior Talo fibular Ligament - ATFL provides stability against excessive inversion of the talus; the Posterior Talo fibular Ligament PTFL resists ankle dorsiflexion, adduction ("tilt"), medial rotation, and medial translation of the talus and the Calcaneo fibular Ligament - CFL provides stability against maximum inversion at the ankle and Subtalar joints. The ATFL is the ligament most commonly injured by a lateral ankle sprain, followed by the CFL.<sup>4</sup>

Grade 1 or Mild ankle sprain, is a stretch of the ligament with no macroscopic tear, little swelling or tenderness, minimal or no functional impairment, and no joint instability. Grade 2 or Moderate ankle sprain, involves a partial tear of the ligament with moderate swelling and tenderness, some loss of joint function, and mild joint instability. A Grade 3 or Severe sprain, involves a complete tear of the ligaments (ATFL and CFL) with severe swelling, ecchymosis and tenderness, inability to bear weight on the extremity, and mechanical joint instability. Generally, acute conditions are those that have been present for 7 to 10 days, sub-acute conditions have been present for 10 days to 7 weeks, and chronic conditions or symptoms have been present for longer than 7 weeks.<sup>6</sup>

The classic ankle sprain occurs with inversion of the plantar flexed ankle when the forefoot is bearing weight. Maximum elongation and tension of the ATFL occurs in plantar flexion. Forced inversion while in plantar flexion can increase ligament stress and strain beyond the yield point (stretch or partial tear) or even the ultimate failure strain (complete tear). The force may be sufficient to also injure the CFL. More commonly, failure of the ATFL causes rebound dorsiflexion of the ankle as the heel comes back into contact with the ground. Continued inversion force with the ankle neutral or dorsiflexion leads to yield point or ultimate failure strain of the CFL.<sup>7-8</sup>

The athlete 'going over on' the ankle, so the sole of the foot faces inwards and results in pain, swelling, and limitation of movement. While injury to the ligaments may result in decreased mechanical stability of the ankle, neuromuscular deficits are also likely to occur as a result of injury to the nervous and musculo-tendinous tissue.<sup>10-11</sup>

The inability to dorsiflexion is thought to be indicative of a severe injury and is often a complication of these injuries on follow-up. Restriction of dorsiflexion would normally be expected to limit gait and other functional activities. At least 10 degrees of dorsiflexion is required for normal walking, descending stairs, and kneeling, whereas running requires 20 to 30 degrees of dorsiflexion. Gait limitations have been reported, People with acute ankle sprains walk slowly and take smaller steps. Subjects were less symmetrical for single support time when less than 4 degrees of dorsiflexion was available than when more than this range of movement was available. Thus, it would be expected that a treatment resulting in reducing pain and improving dorsiflexion range of movement should also result in more rapid improvement of gait variables.<sup>9</sup>

If Significant pain and disability persist despite appropriate treatment four to six weeks after an apparent 'routine' ankle sprain, a radioisotopic bone scan, CT or MRI is

indicated to exclude an osteochondral lesion.<sup>7, 12</sup> If MRI is not available and the bone scan gives a positive result, a CT scan should be ordered to image the site of abnormality.

Therapy for ankle sprains focuses on controlling pain and swelling. PRICE (Protection, Rest, Ice, Compression, and Elevation) is a well-established protocol for the treatment of ankle injury. There is some evidence that applying ice and using non-steroidal anti-inflammatory drugs improves healing and speeds recovery. Ultrasound is used in physical therapy to relieve pain, reduce swelling, and improve joint immobility in ankle sprains.<sup>13</sup> Early manipulative therapy and therapeutic exercise techniques to address impairments of movement and strength. The Mobilization with movement (MWM) treatment approach for improving dorsiflexion post-ankle sprain combines a relative postero anterior glide of the tibia on talus (or a relative antero posterior glide of the talus on the tibia) with active dorsiflexion movements, preferentially in weight bearing. MWM technique produced significant gains in dorsiflexion range.<sup>14</sup> The effectiveness of taping in the prevention of sports injuries has only been studied in detail with regard to the lateral ligaments of the ankle. It appears that taping can protect against injury.<sup>15</sup> Kinesiotaping is currently being used by therapists.<sup>16</sup> Functional rehabilitation is preferred over immobilization.<sup>11</sup>

There is increasing interest in prophylactic taping and bracing as a means of protecting players against ankle sprains which probably account for the greatest loss of playing time of any injury. The effectiveness of taping and bracing in the treatment of ankle injuries in hockey players has not been investigated, although it has been shown effective in reducing the incidence of sub-acute ankle injuries in other sports (basketball and US football).<sup>2</sup> The effectiveness of application Mulligan's mobilization with movement (MWM) for talocrural dorsiflexion to sub-acute lateral ankle sprains produces an initial dorsiflexion gain, and simultaneously produces a mechanical but not thermal hypoalgesia, so need to be prove the effectiveness in sub-acute lateral ankle sprain in secondary school hockey players.

There is a lack of evidence for the management strategies of patients with sub-acutely injured lateral ankle ligament complex.

Thus, the purpose of this study is to examine the effectiveness of Kinesiotaping versus Mulligan's mobilization with movement (MWM) in the treatment of sub-acute lateral ankle sprain in secondary school hockey players.

## METHODS

A Experimental Design [Comparative study] was conducted with Convenient sampling method. Study was done on players who have sub-acute lateral ankle sprain while playing hockey game. Thirty (n=30) subjects were included who fitted in inclusion and exclusion criteria and they were divided into two groups, Group A (Kinesiotaping technique, n=15) and Group B (Mulligan's Mobilization with Movement (MWM) technique n=15) and treated for 3 sessions/ week; 1 week.<sup>12, 16</sup> Study is done in Out Patient Department of Physiotherapy, C. U. Shah Physiotherapy College, Surendranagar, Gujarat. Study has been approved by the institutional scientific committee and Institutional Ethical committee affiliated by Saurashtra university, Rajkot, Gujarat, India.

Subjects for the study were selected based on the following inclusion criteria, Minimum Age-13 Years,<sup>2</sup> Maximum Age-17 Years,<sup>2</sup> Both Gender,<sup>35</sup> After 10 days to 7 weeks of injury,<sup>23</sup> Tenderness restricted to the lateral ligament.<sup>23</sup> Subject were not included with Current assisted ambulation (e.g., cane or crutches),<sup>5</sup> Acute ankle or foot trauma occurring within 7 days of injury incident,<sup>35</sup> Positive anterior drawer or inversion stress maneuver

suggesting ligamentous laxity,<sup>5</sup> Acute or healing fracture and Medial ankle instability,<sup>35</sup> Gross ligamentous mechanical instability (grade III ankle sprains),<sup>26</sup> Syndesmosis injury and Inflammatory arthritis,<sup>35</sup> A sprain sustained in the previous 12 months,<sup>24</sup> Benign joint hypermobility syndrome,<sup>35</sup> Connective tissue disorder,<sup>35</sup> Inability to bear weight through the affected extremity immediately after injury<sup>5</sup> and An altered mental status,<sup>36</sup> Presence of severe vascular disease,<sup>23</sup> Use of anticoagulant or anti-inflammatory medications,<sup>36</sup> A history of previous injury (e.g., fracture, talipes equinovarus),<sup>23</sup> Chronic ankle injury on the contralateral side.<sup>36</sup> Inform consent form was signed by the subject, who fulfilled inclusion criteria before the treatment started.

Material used for study are Kinesio Tex tape (Color : Blue, Size:1.5"×5.4 yard),<sup>16</sup> Mulligan's Mobilization Belt,<sup>24</sup> Ultrasound machine (Electroson 709; Sl. No.: TU3-706.),<sup>29</sup> Electrode care Gel (Mfg. By: Arihant care, Ahmadabad.) Cotton, Scissor, Bench, Measuring tape,<sup>24,31</sup> Inform consent form, Assessment form and Pen.

Numeric Pain Rating Scale [NPRS]<sup>37</sup> (Qualitative Outcome) and Dorsiflexion Range of Motion<sup>6,19</sup> (Quantitative Outcome) as outcome measurements were taken before and after the Program Schedule. The NPRS was used to measure the Subject's current level of pain intensity. Subject was sitting on chair and he/she was asked to mark the severity of resting pain ranging from 0 as "no pain" to 10 as "worst imaginable pain" on a 10 cm line. NPRS measurements are reliable and valid tool for used in Sub-acute lateral ankle sprain. Using the knee-to-wall principle, Weight-bearing lunge was measured for ankle Dorsiflexion, which was found to have excellent inter- and intra-rater reliability. Subject was standing in front of a wall, with the test foot's second toe and midline of the heel and knee maintained in a plane perpendicular to the wall. The subject slowly lunged forward into talocrural dorsiflexion until the knee contacted the wall, and progressively moved the foot back to the point where the knee could just touch the wall with the heel sustained on the ground. This represented end of range dorsiflexion, and the distance between the wall and second toe was measured in "centimeters" using a tape measure. The examiner ensured maintenance of heel contact via verbal instructions and manual contact with the calcaneum.

Kinesiotaping technique: <sup>16</sup> (3 sessions/ week)

The proposed mechanisms by which Kinesio tape works are different than those underlying traditional ankle taping. Rather than being structurally supportive, like white athletic tape, Kinesio tape is therapeutic in nature. According to Kenzo Kase, the creator of Kinesio tape, these proposed mechanisms may include:

1. Correcting muscle function by strengthening weakened muscles,
2. Improving circulation of blood and lymph by eliminating tissue fluid or bleeding beneath the skin by moving the muscle,
3. Decreasing pain through neurological suppression, and
4. Repositioning subluxed joints by relieving abnormal muscle tension, helping to return the function of fascia and muscle (Kase et al., 1996).

In Acute lateral Ankle sprain condition lymphatic corrective technique to the anterior, posterior, medial and lateral aspects of the lower leg is given.

In Sub-acute lateral ankle sprain(When acute treatment symptoms subsides) apply lymphatic corrective technique to lateral aspect of the ankle, application for gastrocnemius

muscle to assist in plantar flexion range of motion and limit muscle weakness. As the patient progresses, a tendon correction may be applied over the Achilles tendon to assist in movement. Application for tibialis anterior muscle to assist in ankle dorsiflexion and limits in muscle weakness. Application for peroneus longus and/or brevis muscle to assist in ankle eversion and limits in muscle weakness.

### 1<sup>st</sup> Session:

#### *1.Lymphatic correction technique to lateral aspect of the ankle:*

Requirement: 1 Kinesio Fan strip (5-Strip cut)

Subject position: Supine lying or long sitting position with the lower leg out of the plinth, ankle is in plantar flexion (Stretch position).

Procedure: Place base of fan cut slightly above the lymph node of the lateral side of ankle joint area to which lymph drainage is being directed. Apply the tail of the fan with none to very little tension, (0-15% of available) over area of edema.

#### *2.Application for Tendon correction for Achille tendon:*

Requirement: 1 Kinesio Y strip

Subject position: Prone lying with lower leg out side the Plinth.

Procedure: Apply end of tape with no tension at heel. Hold the tape end to ensure that no tension will be placed on the base of the tape. Apply moderate to severe tension, (50-75% of available) along the length of the tendon, with patient in a stretched position. Remember to reduce tension over belly of muscle. Slide the hand that was holding the base up to the end of tension position. Lay down the base or tails of the tape with appropriate tension for Insertion to origin application.

### 2<sup>nd</sup> and 3<sup>rd</sup> Session:

#### *1.Application for tibialis anterior muscle:*

Requirement: 1 Kinesio Y strip

Patient position: Supine lying with the affected lower leg out of the plinth.

Procedure: Base of the Y strip is applied over the plantar surface of little toe. Both the tail then crosses over the lateral malleolus are applied along the route of the muscle till head of fibula. This is insertion to origin technique using very light to light tension (15-25% of available) or paper off tension.

#### *2.Application for peroneus longus and brevis muscle:*

Requirement: 1 Kinesio Y strip.

Patient position: Supine lying with the affected lower leg out of the plinth.

Procedure: Base of the Y strip is applied over the base of heel. Both the tail are passing anteriorly to lateral malleolus and along the route of the muscle and ends at the lateral aspect of tibia. This is insertion to origin technique using very light to light tension (15-25% of available) or paper off tension.



**Mulligan's mobilization with movement (MWM):<sup>24</sup> (3 sessions/ week)**

The mobilization with movement (MWM) treatment approach for improving dorsiflexion post-ankle sprain. However, weight-bearing treatment techniques are widely believed to be superior to non-weight-bearing techniques, as they replicate aspects of functional activities. Acute ankle sprains, whilst having marked reduction in dorsiflexion range of motion, are frequently painful in full weight bearing, and weight bearing techniques are not clinically indicated. The sub-acute ankle sprain is characterized by significant residual deficits in dorsiflexion and the capacity to fully weight bear, making it a good model on which to study the initial effects of weight bearing MWM on dorsiflexion range of motion.

**Subject position:** Subject in relaxed stance on a bench, a Mulligan's mobilization belt (nonelastic seatbelt) will be placed around the distal tibia and fibula and the therapist's pelvis, with foam cushioning the Achilles tendon.

**Hand placement:** The talus and forefoot will be fixated with the web space of one hand close to the anterior joint line. The other hand will be positioned anteriorly over the proximal tibia and fibula to direct the knee over the second and third toes to maintain a consistent alignment of the distal leg and foot.

**Technique applied:** A backward translation by the therapist imparted tension on the seatbelt and a posteroanterior tibial glide, was sustained during slow active dorsiflexion to end of pain-free range, with the seatbelt kept perpendicular to the long axis of the tibia throughout movement, and released after return to the starting position.

**No. of Glide:** 10 Repetition/Set; 3 sets/session; 3 sessions/week, with 1 minute rest between sets.

**Ultrasound Therapy:<sup>29</sup>**

Acute soft tissue injuries of the ankle (simple stretching, partial rupture or complete rupture of at least one ligament) are extremely common. Ankle sprains may be associated with long-term complaints of pain, functional disability and absence from work. Based on these experimental findings, Frequency: 1 MHz, Intensity :1.5W/cm<sup>2</sup>, Time: 4 minutes, Mode: Continuous. No. of sessions : 3 sessions.

## RESULTS

**Gender Distribution:** The Gender distribution among 30 subjects who Participated in the study is 5 females (33.33%) and 10 males (66.66%) in Group A and 3 females (20%) and 12 males (80%) in Group B. There are more males in both the group compare to Females.

**Age Distribution:** There are more males in both the groups. There are more males in age group of 17 yrs in both groups as compare to other categories.

**Inter-group comparison of Pre NPRS of Group A and B:** After analyzing the data with Mann-Whitney Test, the calculated U-value is 112.5 and table U-value is 64 for Numerical pain rating scales. The results shows that calculated U-value is greater than table U-value and p-value is 1.000, showing that there is no significant difference between pre values of Numerical pain rating scales of Group A and B. It shows that baseline data are homogenous.

**Inter-group comparison of Post NPRS of Group A and B:** After analyzing the data with Mann-Whitney Test, the calculated U-value is 15.00 and table U-value is 64 for Numerical

pain rating scales. The result shows that calculated U-value is lesser than table U-value and p-value is 0.000, showing that there is significant difference between post values of Numerical pain rating scales of Group A and B. Statistical analysis shows 55.69% improvement in Group A, where as 75.90% improvement in Group B. When comparing the percentage of reduction of Numerical pain rating scale between Group A and B, shows that there is more reduction in pain in Group B at the end of the treatment (after 1 week) compare to Group A.

**Pre and Post Values of NPRS of Group A:** The mean and standard deviation of Numerical pain rating scale of affected ankle of Group A measured before the treatment (Pre), and at the end of the treatment (after 1 week). The Mean of base line of Numerical pain rating scale is 6.93 and after 1 week are 3.07. The Standard deviation of baseline of Numerical pain rating scale is 0.884 and after 1 week id 0.704. According to Wilcoxon Signed Ranks Test in Group A calculated Z-value is -3.458 and table Z-value is 25. The result shows that calculated Z-value is lesser than table Z-value and p-value is 0.01, showing that there is significant difference between pre and post values of Numerical Pain Rating Scales of Group A. Statistical analysis shows 55.69% of reduction in Group A for Numerical pain rating scale.

**Pre and Post Values of NPRS of Group B:** The mean and standard deviation of Numerical pain rating scale of affected ankle of Group B measured before the treatment (Pre), and at the end of the treatment (after 1 week). The Mean of base line of Numerical pain rating scale is 6.93 and after 1 week is 1.67. The Standard deviation of baseline of Numerical pain rating scale is 0.884 and after 1 week id 0.488. According to Wilcoxon Signed Ranks Test in Group B calculated Z-value is -3.448 and table Z-value is 25. The result shows that calculated Z-value is lesser than table Z-value and p-value is 0.01, showing that there is significant difference between pre and post values of Numerical pain rating scales of Group B. Statistical analysis shows 75.90% of reduction in Group B for Numerical pain rating scale.

**Inter- group comparison of Pre Dorsiflexion ROM of Group A and B:** After analyzing the data with Mann-Whitney Test, the calculated U-value is 112.5 and table U-value is 64 for dorsiflexion range of motion. The results show that calculated U-value is greater than table U-value and p-value is 1.000, showing that there is no significant difference between pre values of dorsiflexion range of motion of Group A and B. It shows that baseline data are homogenous.

**Inter- group comparison of Post Dorsiflexion ROM of Group A and B:** After analyzing the data with Mann-Whitney Test, the calculated U-value is 0.000 and table U-value is 64 for dorsiflexion range of motion. The result shows that calculated U-value is lesser than table U-value and p-value is 0.000, showing that there is significant difference between post values of dorsiflexion range of motion of Group A and B. Statistical analysis shows 27.64% improvement in Group A, where as 71.07% improvement in Group B. When comparing the percentage of improvement of Dorsiflexion range of motion between Group A and B, shows that there is more improvement in dorsiflexion range of motion in Group B at the end of the treatment (after 1 week) compare to Group A.

**Pre and Post Values of Dorsiflexion Range of Group A:** The mean and standard deviation of dorsiflexion range of motion of affected ankle of Group A measured before: the treatment (Pre), and at the end of the treatment (after 1 week). The Mean of base line of dorsiflexion range of motion is 7.87 and after 1 week are 10.67. The Standard deviation of baseline of dorsiflexion range of motion is 0.834 and after 1 week id 0.617. According to Wilcoxon Signed Ranks Test in Group A calculated Z-value is -3.458 and table Z-value is 25. The result shows that calculated Z-value is lesser than table Z-value and p-value is 0.000, showing

that there is significant difference between pre and post values of Dorsiflexion range of motion of Group A. Statistical analysis shows 27.67% of reduction in Group A for Dorsiflexion range of motion.

**Pre and Post Values of Dorsiflexion ROM of Group B:** The mean and standard deviation of dorsiflexion range of motion of affected ankle of Group A measured before the treatment (Pre), and at the end of the treatment (after 1 week). The Mean of base line of dorsiflexion range of motion is 7.87 and after 1 week are 15.07. The Standard deviation of baseline of dorsiflexion range of motion is 0.834 and after 1 week is 0.799. According to Wilcoxon Signed Ranks Test in Group A calculated Z-value is -3.432 and table Z-value is 25. The result shows that calculated Z-value is lesser than table Z-value and p-value is 0.000, showing that there is significant difference between pre and post values of Dorsiflexion range of motion of Group A. Statistical analysis shows 71.07% of reduction in Group A for Dorsiflexion range of motion.

## DISCUSSION

The ankle is one of the most common sites of injury in sports, with ankle sprains accounting for 85% of all ankle injuries. It is estimated that 70% of all high school players have a history of an ankle sprain, with an 80% recurrence rate. The high rate of injury and especially reinjury seen with ankle sprains has challenged the clinical community to provide better rehabilitative as well as prophylactic strategies to reduce the incidence rate.<sup>20</sup>

Ankle sprain results in pain, swelling and limitation of movement.<sup>23</sup> Therapy for ankle sprains focuses on controlling pain and swelling. PRICE is well-established protocols for the treatment of ankle injury.<sup>13</sup> Electrotherapy and Exercise therapy has also shown good results in sub-acute lateral ankle sprain.

The study was conducted on 30 patients with two groups of 15 each. Group A was intervened with kinesiotaping and ultrasound whereas Group B was intervened with Mulligan's mobilization with movement (MWM) and ultrasound. Outcome measures included pain intensity by Numerical pain rating scale (NPRS) and dorsiflexion range of motion by knee-to wall principle were measured prior to treatment and at the end of 1 week of treatment.

1<sup>st</sup> Objective of this study was to find the effectiveness of kinesiotaping in sub-acute lateral ankle sprain in secondary school hockey players in terms of pain and range of motion. In Group A who received kinesiotaping and ultrasound shows overall effectiveness after 1 week on Numerical pain rating scale is  $p = 0.000$  and dorsiflexion range of motion is  $p = 0.000$  using Wilcoxon Signed Ranks Test is significant. This means that Kinesiotaping is effective in reducing pain and improving dorsiflexion range of motion. So Null hypotheses-  $H_{01}$  and  $H_{02}$  is rejected and Alternative hypotheses-  $H_{11}$  and  $H_{12}$  is accepted.

2<sup>nd</sup> Objective of this study was to find the effectiveness of Mulligan's mobilization with movement (MWM) in sub-acute lateral ankle sprain in secondary school hockey players in terms of pain and range of motion. In Group B who received Mulligan's mobilization with movement (MWM) and ultrasound shows overall effectiveness after 1 week on Numerical pain rating scale is  $p = 0.000$  and dorsiflexion range of motion is  $p = 0.000$  using Wilcoxon Signed Ranks Test is significant. This means that Mulligan's mobilization with movement (MWM) is effective in reducing pain and improving dorsiflexion range of motion. So Null hypotheses-  $H_{021}$  and  $H_{022}$  is rejected and Alternative hypotheses-  $H_{121}$  and  $H_{122}$  is accepted.



3<sup>rd</sup> Objective of the study was to compare the effectiveness of Kinesiotaping versus Mulligan's mobilization with movement (MWM) in sub-acute lateral ankle sprain in secondary school hockey players. The intergroup comparison after 1 week of treatment of Numerical pain rating scale is  $p = 0.000$  and dorsiflexion range of motion is  $p = 0.000$  using Mann-Whitney Test is significant. So Null hypotheses-  $H_{031}$  and  $H_{032}$  is rejected and Alternative hypotheses-  $H_{131}$  and  $H_{132}$  is accepted.

Statistical analysis shows the percentage of reduction in Numerical pain rating scale between Group A and B. In Group B there is 74.90% of reduction as compare to Group A there is 55.69% of reduction in pain. Statistical analysis shows the percentage of improvement in dorsiflexion range of motion between Group A and B. In Group B there is 71.07% of improvement as compare to Group A there is 27.64% of improvement in dorsiflexion range of motion.

The results of this study supported the alternative hypothesis-  $H_{131}$  and  $H_{132}$  that there is significant difference between the Kinesiotaping versus Mulligan's mobilization with movement (MWM) in sub-acute lateral ankle sprain in secondary school hockey players in reducing pain and improving dorsiflexion range of motion.

Our Study Support the study of Natalie Collins et. al. who conducted a study on "The initial effects of a Mulligan's mobilization with movement technique on dorsiflexion and pain in sub-acute ankle sprains." at the university of Queensland, Australia; over subjects with sub-acute grade II lateral ankle sprains ( $n=14$ ), with help of the Mulligan's mobilization with movement (MWM) treatment on weight bearing dorsiflexion and concluded that Mulligan's mobilization with movement (MWM) Treatment for ankle dorsiflexion has a mechanical rather than hypoalgesic effect in sub-acute ankle sprains. The mechanism by which this occurs requires investigation if we are to better understand the role of manipulative therapy in ankle sprain management.<sup>24</sup>

Bill Vicenzino et. al. has conducted a study on "Initial changes in posterior Talar Glide and Dorsiflexion of the Ankle After Mobilization with Movement in Individuals with recurrent ankle Sprain." at the university of Queensland; Australia, over 16 subjects to evaluate the effect of 2 independent variables: treatment conditions and time on the dependent variable of posterior talar glide and weight-bearing dorsiflexion. They concluded that an initial ameliorative effect of Mulligan's mobilization with movement treatment techniques on posterior talar glide and dorsiflexion range of motion in individuals with recurrent lateral ankle sprain.<sup>22</sup>

Increase in ankle dorsiflexion range after Mulligan's mobilization with movement (MWM) is seen clinically in injured and asymptomatic populations. Previous research finding suggest that the predominant mechanism of action for the dorsiflexion Milligan's mobilization with movement is most likely mechanism, rather than other mechanisms such as motor control effect. Due to design of this study, we did not investigate the effect beyond three sessions. However, we suggest further investigations to determine the long term effects of Mulligan's mobilization with movement (MWM) are warranted.<sup>38</sup>

From this study it can be said that Mulligan's mobilization with movement (MWM) and ultrasound can be used as choice of treatment for patient with sub-acute lateral ankle sprain in secondary school hockey players. An increase in participant numbers may be required to further validate this innovative therapeutic technique for lateral ankle pain.

Limitations of the study are sample size was limited, Male participants are more comparing to female participant, no long-term follow-up of the patients, no control group present. So the further recommendations for future studies need to be done with large group and longer follow-up. The same study can be done on female participants and with control group.

## CONCLUSIONS

The results indicate that both the treatments are effective in sub-acute lateral ankle sprain to reduce pain and improve the dorsiflexion range of motion. However, the subjects in experimental Group B, who received Mulligan's mobilization with movement and ultrasound showed better improvement in reducing pain and improving the dorsiflexion range of motion than experimental Group A.

In conclusion the treatment program consisting of Mulligan's mobilization with movement and ultrasound may be more effective in sub-acute lateral ankle sprain to reduce pain and improve the dorsiflexion range of motion in secondary school hockey players.

### List of Abbreviations:

1. MWM : Movement with Mobilization
2. MCL : Medial collateral Ligament
3. LCL : Lateral collateral Ligament
4. ATFL : Anterior Talo fibular Ligament
5. PTFL : Posterior Talo fibular Ligament
6. CFL : Calcaneo fibular Ligament

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Table: 1 Pre and Post Mean of Numerical Pain Rating Scale score of Group A and B.

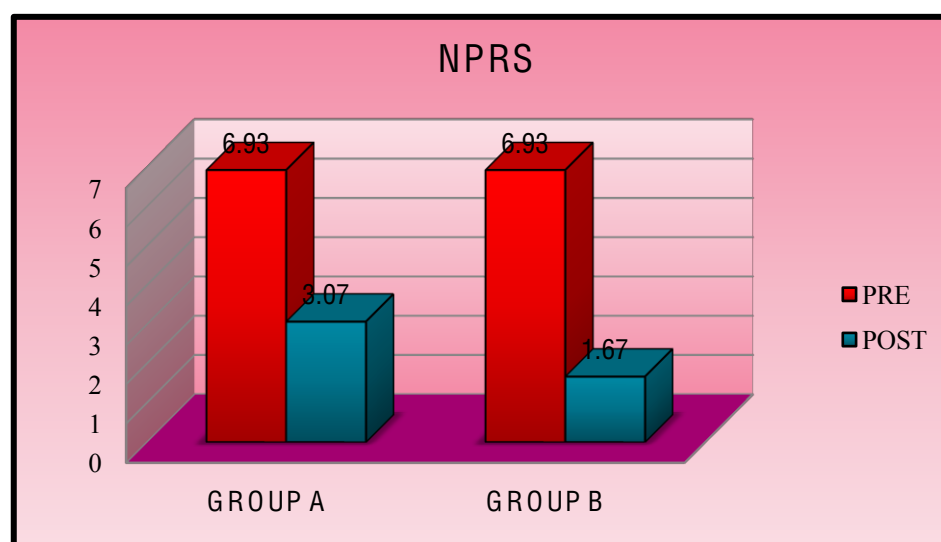
Group	Pre Test Score	U– Score (Inter Group) 64	Post Test Score	F – Score (Inter Group) 64	Z – Score (Intra Group) 25	% of Improvement
Group-A	6.93	112.5	3.07	15	- 3.458	55.69 %
Group-B	6.93		1.67		-3.448	75.90 %



Table: 2 Pre and Post Mean of Dorsi flexion range of Group A and B.

Group	Pre Test Score	U – Score (Inter Group) 64	Post Test Score	F – Score (Inter Group) 64	Z – Score (Intra Group) 25	% of Improvement
Group-A	7.87	112.5	10.67	0.00	- 3.482	27.64 %
Group-B	7.87		15.07		-3.432	71.07 %

Graph: 1 Pre and Post Mean of Numerical Pain Rating Scale score of Group A and B.



Graph: 2 Pre and Post Mean of Dorsi flexion range of Group A and B.

