A STUDY TO COMPARE THE EFFECTIVENESS OF MOBILIZATION WITH MOVEMENT VERSUS ULTRASOUND IN FOOTBALL PLAYERS WITH ANKLE SPRAIN.

Register No: 271350222

Guide : Mr. V.K. Jayaseelan. MPT., MIAP.,

A Dissertation Submitted to
THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY,
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In partial fulfillment of requirement for the Post Graduate Degree of
Masters of Physiotherapy (Sports Physiotherapy)
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GUIDE

Mr. V.K. Jayaseelan. *MPT., MIAP.,*
Associate Professor
Jaya College of Paramedical Sciences, College of Physiotherapy,
MTH Road, Thiruninravur – 602 024.
Thiruvallur District, Tamilnadu.

EXAMINERS

1.

2.

A Dissertation Submitted to
THE TAMIL NADU Dr. M.G.R. MEDICAL UNIVERSITY
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APRIL -2016

CERTIFICATE

This is to certify that the dissertatioIn titled **"A STUDY TO COMPARE THE EFFECTIVENESS OF MULLIGANS MOBILIZATION WITH MOVEMENT VERSUS ULTRASOUND IN FOOTBALL PLAYERS WITH ANKLE SPRAIN"** is a bonafide record of work done under my guidance and supervision in partial fulfilment for the Post Graduate Degree of Master of Physiotherapy (MPT II YEAR, APRIL - 2016) by *Mr. Ganesh Chandar. M.R.*. (Register No. **271350222**) Post Graduate (MPT) student of Jaya College of Paramedical Sciences, College of Physiotherapy, Thiruninravur - 602024.

GUIDE

Mr. V.K. JAYASEELAN. *MPT., MIAP.,*
Associate Professor,
Jaya College of Paramedical Sciences,
College of Physiotherapy,
MTH Road, Thiruninravur – 602 024.
Thiruvallur District, Tamilnadu.

PRINCIPAL

Mr. V. BALCHANDAR.
MPT., MIAP., MBA., PGDHM.,
Professor / Principal,
Jaya College of Paramedical Sciences,
College of Physiotherapy,
MTH Road, Thiruninravur – 602 024.
Thiruvallur District, Tamilnadu.

DECLARATION BY THE CANDIDATE

I hereby declare that the Dissertation entitled **"*A Study To Compare The Effectiveness Of Mulligans Mobilization with Movement Versus Ultrasound In Football Players With Ankle Sprain*"** was done by me for partial fulfillment of the requirement of **Master of Physiotherapy** degree. The dissertation had been done under the direct supervision and guidance of my Guide Mr. V.K. Jayaseelan, Associate Professor at **Jaya College of Paramedical Sciences, College of Physiotherapy**, Thiruninravur, and submitted the same during the year April 2016 to **The Tamilnadu Dr. M.G.R Medical University**.

Date:

Place: Thiruninravur.

…..…….

Signature of the Candidate

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LIST OF ABBREVIATIONS USED

1. LAS : Lateral Ligament Sprain
2. AP : Antero-posterior
3. PA : Postero- anterior.
4. FAAM : Foot & Ankle Ability Measure.
5. UST : Ultrasound Therapy.
6. DF : Dorsi flexion.
7. PF : Plantar flexion .
8. MWM : Mulligans Mobilization with Movement.
9. NPRS : Numerical Pain Rating Scale.
10. N : No. of Subjects.
11. SD : Standard Deviation.
12. M : Mean.
13. MD : Mean Deviation.
14. ROM : Range of Motion.

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A STUDY TO COMPARE THE EFFECT OF MULLIGAN MOBILISATION WITH MOVEMENT (MWM) VS ULTRASOUND THERAPY IN FOOTBALL PLAYERS WITH ANKLE SPRAIN.

AIM :

Study to compare the effect of mulligan mobilization with movement (MWM) VS ultrasound therapy in lateral ligament sprain of ankle

INCIDENCE :

Foot ball is one of the most popular sports throughout the World. . Most football injuries occur to the Lower extremities, especially the ankle sprain.

Ankle sprain injuries in amateur Football players are primarily contact injuries, occurring mainly in defenders and during both games and practice. It appears that more injuries occur in players with previous ankle injury. Injury rates are higher toward the end of a game and chiefly occur during the first 2 months of the season.

Common sites for acute musculoskeletal injuries and sprains accounts for 75 percent of ankle injuries. Acute ankle trauma is responsible for 10 to 30 percent of sports-related injuries in young athletes.[1] More than 23,000 ankle sprains have been estimated to occur per day in the United States, which equates to one sprain per 10,000 people daily

Hypothesis :
Alternate Hypothesis:

There is significant difference between the ROM, swelling and pain in Mulligan's Mobilization with movement (MWM) technique vs ultrasound therpy in acute lateral ankle sprain in sports players

Null Hypothesis :

There is no significant difference between ROM, swelling and pain in Mulligan's Mobilization with movement (MWM) vs ultrasound therapy technique in acute lateral ankle sprain in sports players

Inclusion Criteria:

- Age group : 15to 30 years
- Gender : Both females and males.
- Enter the trial within 72 hours of injury.

Exclusion Criteria:

- Current assisted ambulation (eg, cane or crutches)
- All kind of other ankle injuries.
- Presence of severe vascular disease
- Grade III ankle sprain

Outcome measurement :

1. ROM- Goniometry
2. Pain - numerical pain rating scale
3. Functional activity – Foot & Ankle Ability measure (FAAM) Scale

METHODS

30 subjects selecting from population were clinically diagnosed. They divided into two groups

[Group-A: Mulligan mobilization with movement technique – 15 subjects]

[Group – B : Ultrasound therapy – 15 subjects]

GROUP – A : MULLIGAN MOBILISATION WITH MOVEMENT (MWM) TECHNIQUE:

Subject stance on bench. The mulligan mobilization belt will be placed around the distal tibia and fibula & therapist pelvis

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 positioned anteriorly over proximal tibia & fibula to direct the knee over the 2 & 3 toes to maintain a consistent alignment of distal leg & foot

APPLICATION OF TECHNIQUE : A backward translation by the therapist imparted tension on the MWM Belt & a postero-anterior tibial glide was sustained during active dorsiflexion to end of free range.

PARAMETERS OF MWM TECHNIQUE :

1 week : 3 session

1 session : 3 sets

Repitition : 10/ sets

Rest time : 1 min

GROUP – B : ULTRASOUND THERAPY

PARAMETERS OF ULTRASOUND THERAPY :

Intensity : 1.5 W/cm2

Frequency : 1 MHz

Mode : pulsed mode

Session : 1 week

Duration : 10 min

REVIEW OF LITERATURE :

Joshua C. Dubin DC. et al (2010) have discussed normal anatomy and biomechanics of the foot and ankle, mechanisms that may result in a lateral ankle sprain or syndesmotic “high ankle” sprain, assessment and diagnostic procedures, and presents a treatment algorithm based on normal ligament healing principles

Toni Green. et al (2001) have conducted a study to investigate the effect of a specific joint mobilization, the anteroposterior glide on the talus, on increasing pain-free dorsiflexion and 3 gait variables: stride speed (gait speed), step length, and single support time. Subjects. Forty-one subjects with acute ankle inversion sprains (<72 hours) and no other injury to the lower limb entered the trial

Natalie Collins, Pamela Teys, Bill Vicenzino (2004)

Physiotherapists frequently use manipulative therapy techniques to treat dysfunction and pain resulting from ankle sprain. This study investigated whether a Mulligan's mobilization with movement (MWM) technique improves talocrural dorsiflexion, a major impairment following ankle sprain, and relieves pain in subacute populations. Fourteen subjects with subacute grade II lateral ankle sprains served as their own control in a repeated measures, double-blind randomized controlled trial that measured the initial effects of the MWM treatment on weight bearing dorsiflexion and pressure and thermal pain threshold

Tracey O'Brien (2005)A single case study design was used to investigate the effects of Mulligan's mobilization with movement treatment technique for lateral ankle sprains. The technique involved the physiotherapist sustaining a posterior glide to the distal fibula, while the patient actively inverted the ankle several times. Passive overpressure at end of range was then applied by the therapist.

Dr. Jeremy Sibold (1996) Therapeutic ultrasound is a commonly used treatment for a variety of musculoskeletal conditions. Ankle sprains are among the most commonly seen sport-related injuries and proper acute management can significantly improve the rate of healing and return to activity. A major goal during the acute stage of healing is to control pain and inflammation. The delivery of therapeutic ultrasound to an acutely sprained ankle can reduce pain and swelling while facilitating tissue healing

Van der Windt DAWM, Van der Heijden GJMG,et al.(2006) has conducted a study on "Therapeutic ultrasound for acute ankle sprains."A Systemic review concluded that the effects of ultrasound therapy for acute ankle sprains is limited. Only few trials are available and no conclusions can be made regarding any optimal dosage schedule for ultrasound therapy, and whether such a schedule would improve the reported lack of effectiveness of ultrasound for ankle sprains

INTRODUCTION

1. INTRODUCTION

Ankle sprain are one of the most common soft tissue injuries and are especially prevalent at all levels of sports, with lateral sprains accounting for 85% of all ankle sprains. [(1)] The most common injury with an incidence of 30,000 per day in the United States. 40% of all athletic injury involves the ankle.[(2)]

Foot ball is one of the most popular sports throughout the World. . Most football injuries occur to the Lower extremities, especially the ankle sprain.

Ankle sprain injuries in amateur Football players are primarily contact injuries, occurring mainly in defenders and during both games and practice. It appears that more injuries occur in players with previous ankle injury. Injury rates are higher toward the end of a game and chiefly occur during the first 2 months of the season.

Accounting for about 67.3% of football players and 70% of their Basketball players had multiple sprains.[(3)] Most ankle sprain involve the lateral ligament complex consists of an anterior talo-fibular ligament (ATFL), the calcaneofibular ligament (CFL) and posterior talo-fibular ligament (PTFL) are caused by an inversion force on a plantar flexed foot.[(4)]The ATFL which is the weakest of the three lateral ligament ; CFL is involved in 50% to 75% of such injuries and the PTFL is <10%14

The ATFL is the first ligament to be damaged during a lateral ankle sprain, followed most often by the CFL.[37,38] Cadaveric-sectioning studies have demonstrated that after the ATFL is ruptured, the amount of transverse-plane motion (internal rotation) of the rearfoot increases substantially, thus further stressing the remaining intact ligaments.[43] This phenomenon has been described as “rotational instability” of the ankle and is often overlooked when considering laxity patterns in the sprained ankle [38]. Concurrent damage to the talocrural joint capsule and the ligamentous stabilizers of the subtalar joint is also common with lateral ankle sprains. Martin et al[40] demonstrated significantly greater strain in the cervical ligament after complete disruption to the CFL. The incidence of subtalar joint injury has been reported to be as high as 80% among patients suffering acute lateral ankle sprains.[41] Injury to the PTFL is typical only in severe ankle sprains and is often accompanied by fractures or dislocations or both.[42]

A pathomechanical model described by Fuller[35] suggested that the cause of lateral ankle sprain is an increased supination moment at the subtalar joint. The increased supination moment is caused by the position and magnitude of the vertically projected ground-reaction force at initial foot contact. Fuller hypothesized that a foot with its center of pressure (COP) medial to the subtalar-joint axis has a greater supination moment from the vertical ground-reaction force than a foot with a more lateral relationship between the COP and the joint axis.[43] This increased supination moment could thus cause excessive inversion and internal rotation of the rearfoot in the closed kinetic chain and potentially lead to injury of the lateral ligaments. Individuals with a rigid supinated foot would be expected to have a more laterally deviated subtalar axis of rotation and a calcaneal varus (inverted rear foot) malalignment, which could predispose those with a rigid supinated foot to lateral ankle sprain

Ultrasound therapy has been used in the treatment of musculo-skeletal conditions for many years. Ultrasound is used in physical therapy to relieve pain, reduce swelling, and improve joint mobility in a wide variety of musculoskeletal disorders.(5) Laboratory research has demonstrated that the application of ultrasound results in the promotion of metabolic rate and increased viscoelastic properties of collagen [Maxwell 1992](4

Physiotherapists frequently use manipulative therapy techniques to heal dysfunction and pain resulting from ankle sprain. Mobilization with movement (MWM) technique widely used and developed by "Brian Mulligan" for peripheral joints. It is also referred to as a manipulative technique.(6) The mobilization with movement (MWM) treatment approach for improving dorsiflexion post ankle sprain combines a relative postero-anterior glide or a relative antero-posterior glide of the talus on the tibia] with active dorsiflexion movements. Rapid restoration of pain free movement are associated with Mulligan mobilization with movement (MWM) technique generally [Mulligan 1993, 1999 ;Exelby 1996](7

Foot and Ankle Ability Measure (FAAM) is most appropriate outcome instrument to quantify functional limitations in patients with varying leg, foot and ankle disorders in sports.(8) Numerical Pain Rating Scale (NPRS) is reliable and valid scale will be used as an outcome measure within this program of care. This is a subjective pain measure that is widely used in clinical practice and research. (10)

Goniometer is a universally acceptable most reliable & valid measurement tool used joint Range of motion. It can be used to measure both active and passive Range of motion.[12] Goniometer is most commonly used instrument in clinical practice. It depends on the point of reference utilized as standard for positioning the arms of goniometer and that varies according to the tested joint It is inexpensive, but also requires the greatest degree of technical proficiency.[13] The purpose of the study to compare the efficacy of conventional ultrasound with that of Mulligans Mobilization with Movement a hand on technique for ankle sprain in football players. This can also help to plan an effective on field treatment for one of the most common sports injuries in football players.

OBJECTIVES

OF

THE STUDY

2. OBJECTIVES OF THE STUDY:

1. To evaluate the efficacy of mulligan mobilization with movement (MWM) in Football Players with Ankle Sprain.

2. To evaluate the efficacy of Ultrasound therapy in Football Players with Ankle Sprain.

3. *To compare the efficacy of mulligan mobilization with movement (MWM) vs. ultrasound* therapy in Football Players with Ankle Sprain.

HYPOTHESIS

3. HYPOTHESIS

1, NULL Hypothesis:

There is no significant difference between the Mulligan's Mobilization with movement (MWM) technique vs. ultrasound therapy in acute lateral ankle sprain in Football players in terms of pain, range of motion & functional activities

2, ALTERNATIVE Hypothesis:

There is significant difference between the Mulligan's Mobilization with movement (MWM) vs. ultrasound therapy technique in acute lateral ankle sprain in Football players in terms of pain, range of motion & functional activities.

OPERATIONAL DEFINITIONS

4. OPERATIONAL DEFINITIONS

1. ANKLE SPRAIN :

- Ankle Sprain is a common musculoskeletal injury in which ligaments of the ankle partially (or) completely tear due to sudden stretching.
    - Grade I - mild tear of ligament , minimal pain, little or no joint instability.
    - Grade II - moderate tear of ligament, moderate to severe pain, moderate instability of joint.
    - Grade III – complete tear of ligament, severe pain, and gross instability of joint.

2. ULTRASOUND THERAPY :

- Ultrasound therapy is a treatment modality used in physical therapy that utilize high frequency sound waves ranging between 1 MHz to 3 MHz therapy.

3. MULLIGAN MOBILIZATION WITH MOVEMENT (MWM):

- "Brian Mulligan "developed manual therapy technique widely used for peripheral joint pain. It is a treatment for musculoskeletal dysfunction in which the therapist applies a passive glide mobilization to a joint while the patient performs physical activity using the limbs.

4. NUMERICAL PAIN RATING SCALE :

❖ The NPRS (NRS – 11) is an 11- point scale for patients self reporting pain. It is for adults and children 10 years old (or) older.

RATING	PAIN LEVEL
0	No pain
1-3	Mild pain (nagging, annoying, interfering little with ADL's)
4-6	Moderate pain (interferes significantly with ADL's)
7-10	Severe pain (disability, unable to perform ADL's)

5. FOOT AND ANKLE ABILITY MEASURE (FAAM) :

❖ FAAM is a self report outcome instrument has been developed by researcher to provide information about functional limitations and disabilities experienced by foot and ankle disorders. Four steps are followed to develop a self reported evaluative instrument :

- Generation of potential items
- Initial item reduction
- Final item reduction
- Acquisition of validity evidence to support interpretation of the score.

6. GONIOMETRY :

❖ Goniometer is the instrument which is used for measuring the Range of Motion of joint.

REVIEW OF LITERATURE

5. REVIEW OF LITERATURE:

1. **Christopher W. Digivonni et al (2006)** They conducted study as, *Current concepts; Lateral ankle Instability*. This study concluded, the ankle sprains are the most common musculo-skeletal injury. [2]

2. **I.C. Wright et al (2000**) They concluded study as, *the influence of foot positioning of ankle sprain.* This study suggested to, examine the influence of changes in foot positioning to touch down on ankle sprain occurrence. [14]

3. **Bruce D. Beynnon et al (2002)** They conducted study as, *Predictive factors for Lateral ankle sprain. A Literature review. A Journal of Athletic training.* This study concluded with regard to height, weight, limb dominance, ankle-joint laxity, anatomical alignment, muscle strength, muscle-reaction time, and postural sway are risk factors for ankle sprains.

4. **C. Woods et al (2003)** The study as, *the football association medical research program me an audit of Injuries in professional football an analysis of ankle sprain*. This study suggested that, ankle sprain are most common in football involving lateral ligament complex. [4]

5. **Daniel. TP .Fong et al (2009)** The study as, *Understanding acute ankle ligamentous sprain injury in sports.* This study concluded that, among 80% are ligamentous sprains caused by explosive inversion or supination. The injury motion often happens at the subtalar joint and tears the anterior talofibular ligament (ATFL) which possesses the lowest ultimate load among the lateral ligaments at the ankle.[17]

6. **Vander Windt DAWN et al (2006)**They conducted study as, *Therapeutic ultrasound for acute ankle sprain.* The goal of the study is, Ultrasound is used in treatment of wide variety of musculo-skeletal disorders.[5]

7. **Geert . J .Vander Heijden et al (2010)** They conducted study as, *Therapeutic Ultrasound for acute ankle sprain.* This study suggested, the effect of Ultrasound therapy for acute ankle sprain is limited.[16]

8. **Makuloluwe (1977)** They conducted study as, *Compare the effectiveness of Ultrasound therapy with immobilization.* The goal of the study is, that Ultrasound treatment to reduce swelling.[18]

9. **Van Laniveld (1979)** The study as, *Compare the effectiveness of Ultrasound therapy with sham ultrasound and with electrotherapy.* The study concluded that, Ultrasound reduce swelling, Range Of Motion, Pain.[19]

10. **Wayne Hing et al -** They conducted study as, *Mulligan mobilization with movement : A Systemic Review.* The goal of the study is Mulligan mobilization with movement is used for treatment of musculo-skeletal joint dysfunction.[6]

11. **Natalie Collins et al (2003)** They concluded study as, *The initial effect of Mulligan mobilization with movement technique in dorsiflexion and pain in sub-acute ankle sprain*. This study indicated that, Mulligan mobilization with movement treatment for ankle dorsiflexion has a mechanical rather than hypoalgesic effect in sub-acute ankle sprain.[7]

12. **B.Vicenzio et al.** They conducted study as, *The initial effect of two mulligan mobilization with movement technique on ankle dorsiflexion.* The goal of the study is, Manipulative therapy is an integral part of best clinical practice management of restricted joint motion.[20]

13. **Atit Paungmali et al (2006)** The study as, *Mulligan mobilization with movement, positional faults, pain relief, current concepts from a critical view of literature.* This study concluded that, Mulligan mobilization with movement more frequent reported effects and putative mechanisms of action of the MWM approach in the treatment of musculoskeletal conditions.[21]

14. **Dr. Gopal Nambi S, et al.** The study as, *Kinesiotaping versus Mulligan's mobilization with movement in sub-acute lateral ankle sprain in secondary school Hockey players-Comparative study.* This study concluded that, provides justification for follow-up research of the long term effect of Mulligan's mobilization with movement on sub-acute ankle sprain and purposes further work be conducted on weight- bearing postero-anterior tibial glide Mobilization with movement [22]

15. **Stephane borloz et al (2011)**They conducted study as, *Evidence of validity and reliability of a French version of the FAAM.* This study concluded that, FAAM is valid and Reliable for the self-assessment of physical function patients with wide range of chronic foot and ankle disorders.[9]

16. **Robroy L. Martin et al (2005)** They concluded study as, *Evidence of Validity for the Foot and Ankle Ability Measure [FAAM].* This study suggested that, FAAM is reliable, responsive, and valid measure of physical function for individual with a broad range of musculoskeletal disorders of lower leg, foot and ankle.[23]

17. **M. Mazaheri et al (2010)** The study as, *Reliability of the Persian version of FAAM to measure functional limitation in patient*s *withfoot and ankle Disorders*. This study concluded that, the Persian version of FAAM is reliable and valid measure to Quantify physical functioning.[8]

18. **Megan N. Houston et al (2013)** They conducted study as, *FAAM scores in patients with chronic ankle instability following Joint Mobilization.* The finding suggest talocrural Joint mobilization may address specific mechanical and functional impairments associated with the task during physical activity.[24]

19. **Nicole L. Cosby et al (2011)** The study as, *Clinical Assessment of Ankle injury Outcomes: Case Scenario using the Foot & Ankle Ability Measure.* They suggested as, the tool can be used to assess function and disability through our patients self-reported responses.[30]

20. **M.Gabrielle Page et al (2012)** They conducted study as, *Validation of Numerical Rating Scale for pain Intensity and Unpleasantness in pediatric Acute post-operative pain; sensitivity to change over time.* The study conducted as NRS could be used by clinician to assess these two different dimension of children's pain experience in acute pain setting.[10]

21. **Erin K. Krebs et al.** The study as, *Accuracy of pain Numeric Rating scale as a screening Test in primary care.* The goal of study is, most commonly used measure for pain screening may have only modest accuracy for identifying patients with clinically important pain in primary care.[11]

22. **Gillian A. Hawker et al (2011)** The study conducted as, *Measures of Adult pain.* The study concluded as, the pain NRS is easy to administer and score.[25]

23. **Ellen Flaherty et al (2012).** The study as, *Pain Assessment for older Adults.* This study concluded as, the most popular tool NRS ask the patient to rate their pain.[26]

24. **Colletle Menadue et al.** This study conducted as, *Reliability of two goniometric methods of measuring active inversion and eversion ROM at the ankle.* This study concluded that, the reliability of measures made by the same observes between session varies depends on the directions.[27]

25. **Megan M . Konor et al.** The study as, *Reliability of three measures of Ankle Dorsiflexion Range of motion.* This study concluded that, weight bearing dorsiflexion ROM is the most reliable measure of ankle dorsiflexion can be obtained.[28]

26. **Claudia Venturni et al.** They study conducted as, *Reliability of two evaluation methods of Active ROM in the ankle of healthy individuals.* This study concluded that, the intrasession reliability was high for measurement obtained from both digital inclinometer and goniometer.[29]

27. **Julio. E. Pardave et al (2005)** The study as, *The Effects of Ankle Manipulations.* This study concluded as, a treatment program that manages the symptoms of inflammation, restores normal joint motion and gradually apply stress to healing tissues can be offered as a viable alternative to current practices. [31]

28. **Christopher et al (2008)** The study as Validity of the Foot and Ankle Ability Measure in Athletes with Chronic Ankle Instability. This study concluded the FAAM may be used to deduct self- reported functional deficits related to CAI.

29. **Andrea Reid et al (2007)** They conducted study as, Efficacy of Mobilization with Movement for Patients with Limited Dorsiflexion after Ankle sprain. They concluded Talocrural MWM improves ankle dorsiflexion immediately following treatment.

30. **MauH et al** (2014) The study as modified MWM to treat a lateral ankle sprain. They suggested as recent evidence has been presented to support the use of mobilization techniques to treat patient limitations following ankle injury; however, the majority of evidence is associated with addressing the talar & dorsiflexion limitations .currently, little evidence is available regarding the use of the MWM technique designed for LASs and the expected outcomes.

31. **Joshua et al (2013)** They conducted as Manual physical therapy & exercise vs. supervised home exercise in the management of patient with inversion ankle sprain. They suggested an Manual physical therapy & exercise approach is superior to Home exercise program in the treatment of inversion ankle sprain.

32. **Nijhawan A.Megha et al(2014)** The study " Efficacy of weight bearing distal talofibular joint Movement with Mobilization in improving pain ,dorsiflexion range & function in patients with post acute lateral ankle sprain .They suggested MWM is worth considering for further exploration in lateral ankle sprain patients.

33. **A.H.Engebretsen et al (2009)** The study about "Intrinsic Risk factors for acute ankle injuries among soccer players. A prospective cohort study " They suggested the history of previous injury proved to be only significant risk factor for new ankle sprain

DESIGN

&

METHODOLOGY

6. DESIGN AND METHODOLOGY

6.1 STUDY DESIGN :

Experimental Design

TYPE OF SAMPLING :

Simple random sampling

6.2 STUDY SETTING :

The study was conducted in the Department of physiotherapy, Jaya college of physiotherapy, Chennai.

6.3SAMPLE SIZE :

A Total of 30 subjects fulfilled the inclusion criteria are randomly assigned as

Group A (n= 15) receive Mulligans Mobilization with Movement

Group B (n=15) receive Ultrasound Therapy.

STUDY DURATION : 1 week

6.4 SAMPLING CRITERIA:

INCLUSION CRITERIA:

A) Age group: 15to 30 years

B) Gender: Both female and male football players.

C) Enter the trial within 72 hours of injury.

D) Diagnosed cases of grade II lateral ligament injury of ankle.

EXCLUSION CRITERIA:

A) Currently on assisted ambulation (eg, cane or crutches)

B) All kind of other ankle injuries.

C) Presence of severe vascular disease

D) Grade III ankle sprain

E) Deformities of ankle and foot.

6.5 MATERIALS

Couch

Goniometer

Ultrasound

Mulligan belt

Ultrasound gel

cotton


GONIOMETER

MULLIGANS BELT

ULTRASOUND


COTTON


TOWEL


ULTRASONIC GEL

6.6 METHODOLOGY

PROCEDURE

A comparative study is done among the football players to determine the effect of Mulligans mobilization with movement and ultrasound therapy in acute lateral ligament sprain of ankle reducing pain and improving range of motion & function. 48 subjects from 7 different colleges participated in the study who were between the ages of 17-30 yrs and were football players. The subjective history was taken from each subject and then objective examination is done. The objective examination involved ankle joint range of motion testing. After the completion of the general assessment 32 subjects fit into the inclusion criteria. An informed consent was received and signed by the subjects.

The subjects are given the FAAM questionnaire and the numerical pain rating scale for indicating their pain intensity & Ankle ROM is measured. These scores were recorded as pretest values. The subjects were randomly allocated in each group. The subjects were explained about Mulligans Mobilization with movement technique & ultrasound its effects and the possible outcomes of the study.

Group A received Mobilization with movement for a duration of 1 week (3 session). MWM technique were performed with the subject placed in forward stance on the couch. The mulligan mobilization belt were placed around the distal tibia and fibula & therapist pelvis.

The talus and forefoot were fixated with the web space of one hand of the therapist close to the anterior joint line. The other hand were positioned anteriorly over proximal tibia & fibula to direct the knee over the 2 & 3 toes to maintain a consistent alignment of distal leg & foot.

A backward translation by the therapist imparted tension on the MWM Belt & a postero-anterior tibial glide was sustained during active dorsiflexion to end of free range for one session with three sets . one sets consists of ten repetition with rest time of one minute.

FIG 1 INTIAL POSITION OF MULLIGAN MOBILIZATION WITH MOVEMENT

FIG 2 END STAGE OF MULLIGAN MOBILIZATION WITH MOVEMENT

Group –B received Ultrasound therapy by placing the subject with side lying and pillow were placed under the leg for stabilizing the foot. Ultrasound was turned on with the pulsed mode with the frequency of 1MHZ and 1.5W/cm intensity .the treatment time was ten minutes for one week.

FIG 3 position of the patient in ultrasound

FIG 4 ultrasound therapy

DATA ANALYSIS

&

STATISTICS

7. DATA ANALYSIS & STATISTICS:

7.1 STATISTICAL METHODOLOGY:

In this study, the sample data includes both categorical (or nominal) and scale (or quantitative) variables. Both descriptive statistics and inferential statistics (i.e., hypothesis tests) have been performed to analyze the sample data.

In this study, two hypothesis tests have been conducted to test our hypothesis and those tests are:

(i) Paired Samples t-test, and

(ii) Independent Samples t-test

These two tests are performed at 5% level of significance. That is, $\alpha = 5\%$ or 0.05

Paired Samples t-test:

Hypotheses:

Null hypothesis, H_0: $\mu_d = 0$

(That is, there is no significant mean change in a standard measure between two treatments

Alternative hypothesis, H_1: $\mu_d \neq 0$) (Two-tailed test)

(That is, there is significant mean change in a standard measure (such as NPRS) due to Treatment 1 or due to Treatment 2)

Let the level of significance be $\alpha = 0.05$

Test Statistic:

In order to test the above hypothesis, it is appropriate to use Paired Samples t-test and the corresponding test statistic is given below:

$$t = \frac{\bar{d} - \mu_d}{s_d / \sqrt{n}}, \quad \text{where } \bar{d} = \frac{\sum d}{n}, \; s_d = \sqrt{\frac{\sum (d - \bar{d})^2}{n-1}}$$

Where, $\bar{d}$ = Mean of the differences of sample; $d = X_2 - X_1$ = Post Test Score – Pre Test Score; S_d = Standard error of the difference; and μ_d = Population Mean difference to be tested

In order to test the effectiveness of each treatment separately, the Pre-test and Post-test scores for each standard measures have been considered and then a Paired t-test has been performed with these Pre and Post-test scores separately for each treatment.

1 Descriptive Statistics for all Measures by Treatment Groups

Table.1

Descriptive Statistics						
Treatment		N	Minimum	Maximum	Mean	Std. Deviation
MWM	DF1	15	8.00	16.00	12.0667	2.54858
	PF1	15	10.00	34.00	22.8000	6.36059
	NPRS1	15	3.00	8.00	6.0000	1.36277
	FAAM1	15	24.13	65.51	41.2020	11.12735
	DF2	15	14.00	20.00	18.2667	1.66762
	PF2	15	40.00	44.00	42.5333	1.24595
	NPRS2	15	.00	2.00	.6667	.61721
	FAAM2	15	91.37	98.27	96.2593	1.86377
	Valid N (listwise)	15				
UST	DF1	15	6.00	14.00	11.0000	2.00000
	PF1	15	13.00	33.00	22.5333	4.98378
	NPRS1	15	4.00	7.00	5.8667	1.06010
	FAAM1	15	18.10	65.51	39.2580	15.91591
	DF2	15	12.00	17.00	13.9333	1.66762
	PF2	15	20.00	40.00	31.6000	4.38830
	NPRS2	15	2.00	5.00	3.4000	.91026
	FAAM2	15	51.72	79.31	63.7900	8.14832
	Valid N (list wise)	15				

The frequency distribution tables shows that majority of the subjects involved in this study are male (57%) and only 43% are female. The sample of 30 subjects have been randomized into two treatments in 1:1 ratio - that is, 50% of the subjects received Mulligan Mobilization with Movement (MWM) and the remaining 50% received Ultrasound therapy (UT). In addition, the descriptive statistics for all the four measures (before and after treatment) have been calculated separately for each treatment group and the corresponding table is shown in Table 2.1 respectively.

7.2. Statistical Test :

Independent Samples t-test:

Hypotheses:

Null hypothesis, H_0: $\mu_1 = \mu_2$

(That is, there is no significant difference between two groups (*such as Group A and Group B*) with respect to the changes in corresponding mean scores of standard measures (such as NPRS)

Alternative hypothesis, H_1: $\mu_1 \neq \mu_2$ (*Two-tailed test*)

(That is, there is significant difference between two groups (*such as Group A and Group B*) with respect to the changes in corresponding mean scores of standard measures (such as NPRS)

2. Analysis:

7.3. Statistical Test :

2.2.1 Testing the Effectiveness of Mulligan Mobilization with Movement (MWM) and Ultrasound therapy individually

2.1 Testing the Reduction in NPRS (NPRS2 – NPRS1) due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Paired Samples t-test

The **output** of this test is presented below:

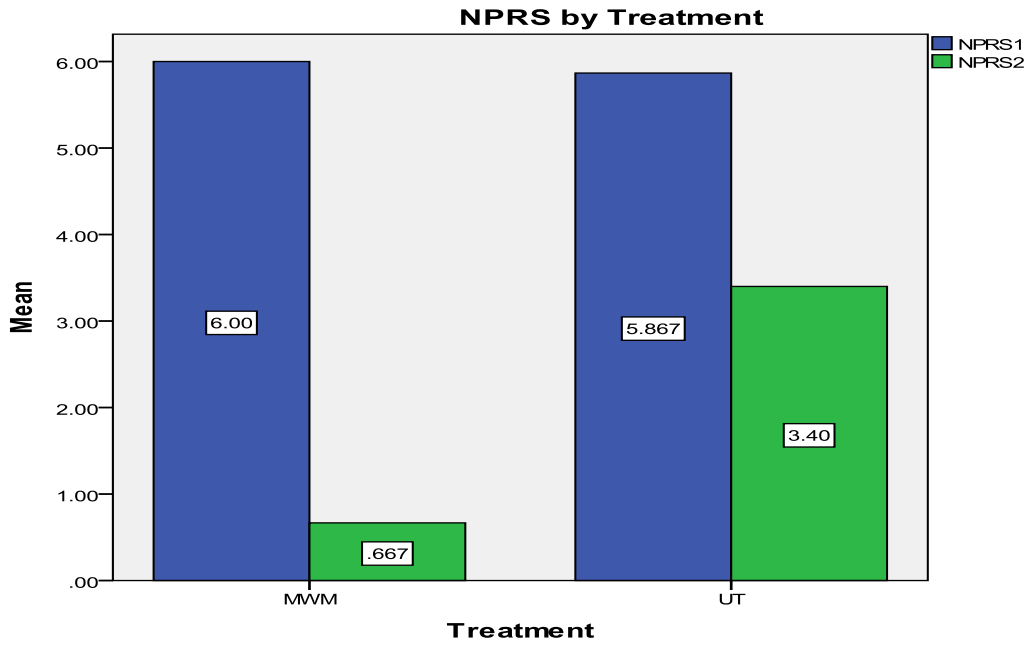
TABLE : 2

Paired Samples Statistics					
Treatment			Mean	N	Std. Deviation
MWM	Pair 1	NPRS2	.6667	15	.61721
		NPRS1	6.0000	15	1.36277
UT	Pair 1	NPRS2	3.4000	15	.91026
		NPRS1	5.8667	15	1.06010

Paired Samples Test				
			Paired Differences	
Treatment			Mean	Std. Deviation
MWM	Pair 1	NPRS2 - NPRS1	-5.33333	1.63299
UT	Pair 1	NPRS2 - NPRS1	-2.46667	.91548

GRAPH :1

Reduction in NPRS due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that there is **significant mean reduction** in NPRS scores due to Mulligan Mobilization with Movement (MWM) (*t(14) = –12.649, p = 0.000 < 0.05*). The mean reduction in NPRS score due to (*MWM)* is 5.33 with the standard deviation of 1.63. Similarly, there is **significant mean reduction** in NPRS scores due to Ultrasound therapy (UT) (*t(14) = –10.435, p = 0.000 < 0.05*). The mean reduction in NPRS score due to *UT* is 2.47 with the standard deviation of 0.915.

.2 Testing the Difference in Dorsi Flexion (DF2 – DF1) due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Paired Samples t-test

The **output** of this test is presented below:

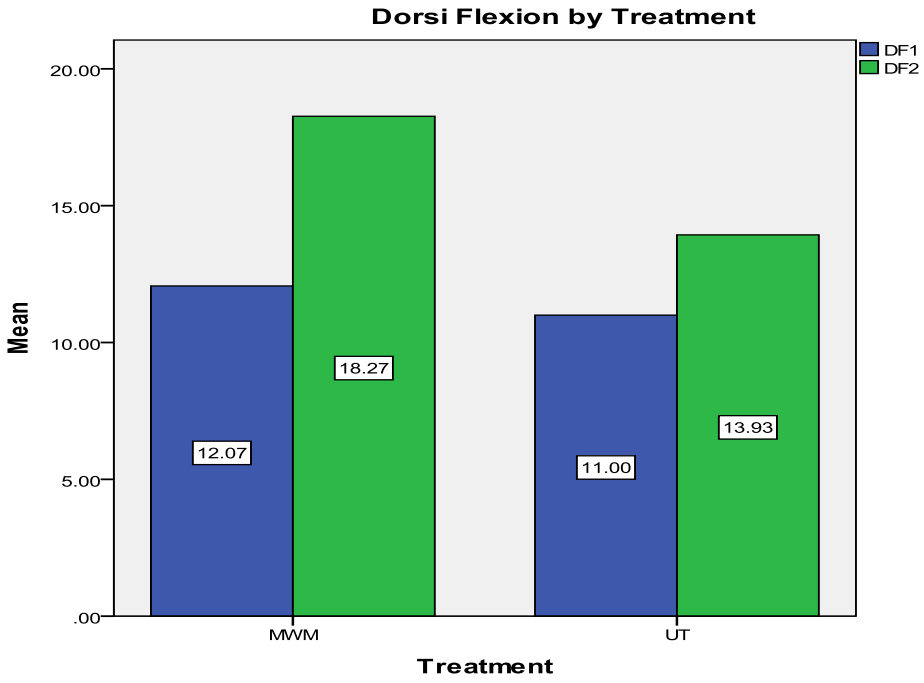
TABLE : 3

Paired Samples Statistics					
Treatment			Mean	N	Std. Deviation
MWM	Pair 1	DF2	18.2667	15	1.66762
		DF1	12.0667	15	2.54858
UT	Pair 1	DF2	13.9333	15	1.66762
		DF1	11.0000	15	2.00000

Paired Samples Test				
Treatment			Paired Differences	
			Mean	Std. Deviation
MWM	Pair 1	DF2 - DF1	6.20000	2.07709
UT	Pair 1	DF2 - DF1	2.93333	1.62422

GRAPH : 2

Difference in Dorsiflexion due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that there is **significant mean increase** in DF scores due to Mulligan Mobilization with Movement (MWM) (*t(14) = 11.561, p = 0.000 < 0.05*). The mean increase in NPRS score due to (*MWM*) is 6.20 with the standard deviation of 2.08. Similarly, there is **significant mean increase** in DF scores due to Ultrasound therapy(UT) (*t(14) = 6.995, p = 0.000 < 0.05*). The mean increase in DF score due to (*UT*) is 2.93 with the standard deviation of 1.62.

2..3 Testing the difference in Plantar Flexion (PF2 – PF1) due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Paired Samples t-test

The **output** of this test is presented below:

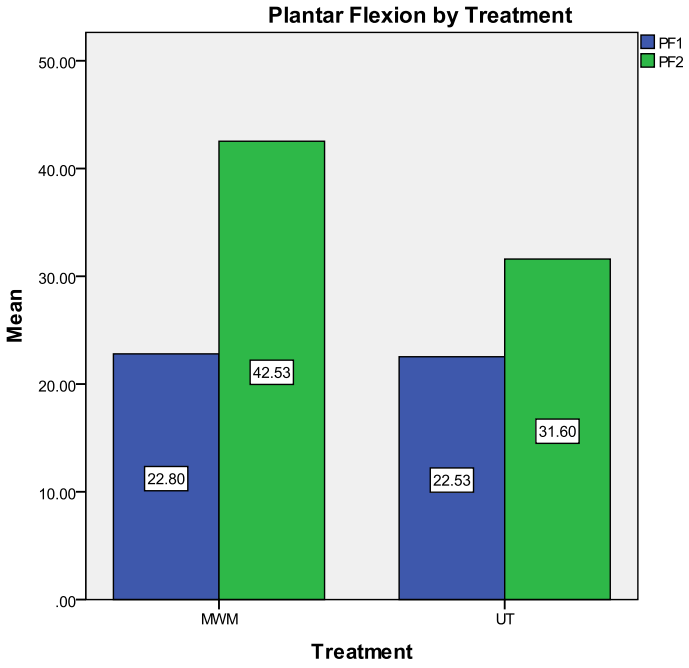
TABLE : 4

Paired Samples Statistics					
Treatment			Mean	N	Std. Deviation
MWM	Pair 1	PF2	42.5333	15	1.24595
		PF1	22.8000	15	6.36059
UT	Pair 1	PF2	31.6000	15	4.38830
		PF1	22.5333	15	4.98378

Paired Samples Test				
Treatment			Paired Differences	
			Mean	Std. Deviation
MWM	Pair 1	PF2 - PF1	19.73333	6.31853
UT	Pair 1	PF2 - PF1	9.06667	4.43149

GRAPH : 3

Difference of Plantarflexion due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that there is significant mean increase in PF scores due to Mulligan Mobilization with Movement (MWM) (*t(14) = 12.096, p = 0.000 < 0.05*). The mean increase in PF score due to (*MWM*) is 19.73 with the standard deviation of 6.32.Similarly, there is significant mean increase in PF scores due to Ultrasound therapy(UT) (*t(14) = 7.924, p = 0.000 < 0.05*). The mean increase in PF score due to (*UT*) is 9.07 with the standard deviation of 4.43.

2.4 Testing the difference in FAAM (FAAM2 – FAAM1) due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Paired Samples t-test

The **output** of this test is presented below:

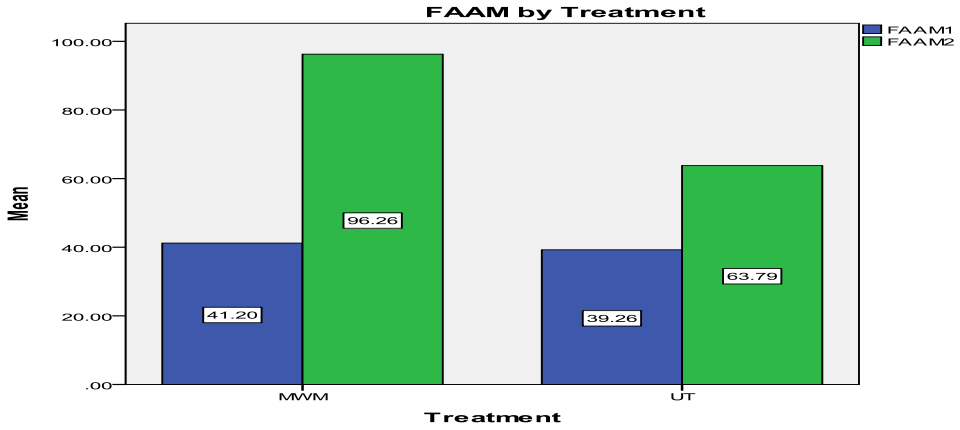
TABLE : 5

Paired Samples Statistics					
Treatment			Mean	N	Std. Deviation
MWM	Pair 1	FAAM2	96.2593	15	1.86377
		FAAM1	41.2020	15	11.12735
UT	Pair 1	FAAM2	63.7900	15	8.14832
		FAAM1	39.2580	15	15.91591

Paired Samples Test				
Treatment			Paired Differences	
			Mean	Std. Deviation
MWM	Pair 1	FAAM2 - FAAM1	55.05733	10.91845
UT	Pair 1	FAAM2 - FAAM1	24.53200	14.90087

GRAPH : 4

difference of FAAM due to Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that there is **significant mean increment** in FAAM scores due to Mulligan Mobilization with Movement (MWM) ($t(14) = 19.530, p = 0.000 < 0.05$). The mean increment in FAAM score due to (*MWM*) is 55.06 with the standard deviation of 10.92. Similarly, there is **significant mean increment** in FAAM scores due to Ultrasound therapy(UT) ($t(14) = 6.376, p = 0.000 < 0.05$). The mean increment in FAAM score due to (*UT*) is 24.53 with the standard deviation of 14.90.

2.2 Comparing the effectiveness of Mulligan Mobilization with Movement (MWM) and Ultrasound therapy with respect to Standard Measures

2.1 Testing the difference in Reduction in NPRS (NPRS2 – NPRS1) between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Independent Samples t-test

The **output** of this test is presented below:

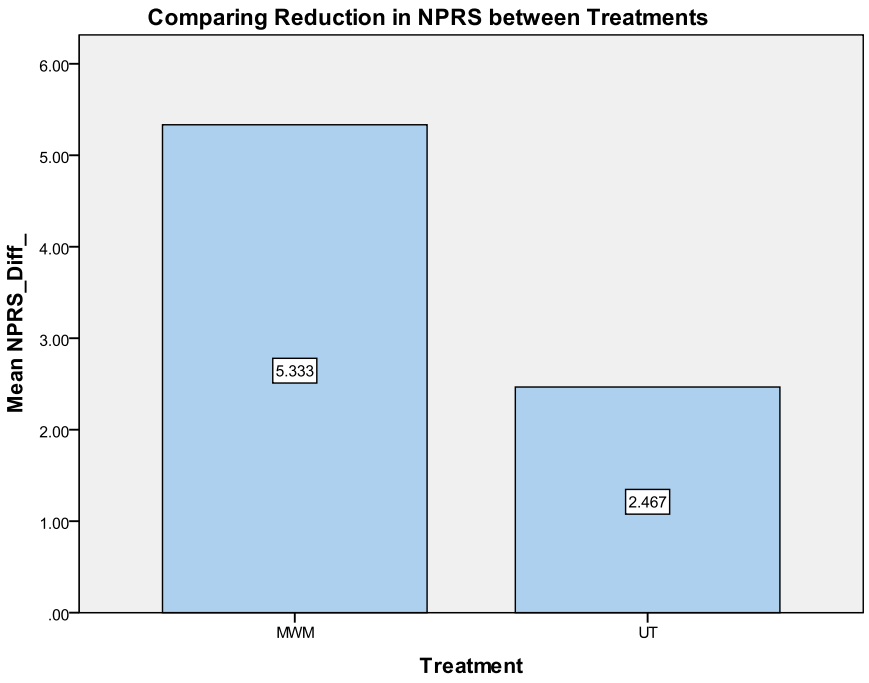
TABLE : 6

Group Statistics				
	Treatment	N	Mean	Std. Deviation
NPRS_diff	MWM	15	-5.3333	1.63299
	UT	15	-2.4667	.91548

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	**T**	**Df**	**Sig. (2-tailed)**	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
NPRS_diff	Equal variances assumed	3.424	.075	**-5.931**	**28**	**.000**	-2.86667	.48337	-3.85681	-1.87652
	Equal variances not assumed			-5.931	22.009	.000	-2.86667	.48337	-3.86910	-1.86423

GRAPH :5

Reduction in NPRS between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that the difference in average reduction in **NPRS** scores between Mulligan Mobilization with Movement (MWM) and Ultrasound therapy(UT) is **statistically significant** at 5% level (*t(28) = –5.931, p = 0.000 < 0.05*). That is, the evidence is sufficient to conclude that there is significant difference in average reduction in **NPRS** scores between (**MWM**) and (**UT**). Going by these average values, we conclude that the average reduction in NPRS scores due to Mulligan Mobilization with Movement (MWM) (Mean = 5.33 & SD = 1.63) is significantly **greater** than that of Ultrasound therapy(UT) (Mean = 2.47 & SD = 0.915).

2.2.2.2 Testing the difference in improvement in Dorsi Flexion (DF2 – DF1) between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Independent Samples t-test

The **output** of this test is presented below:

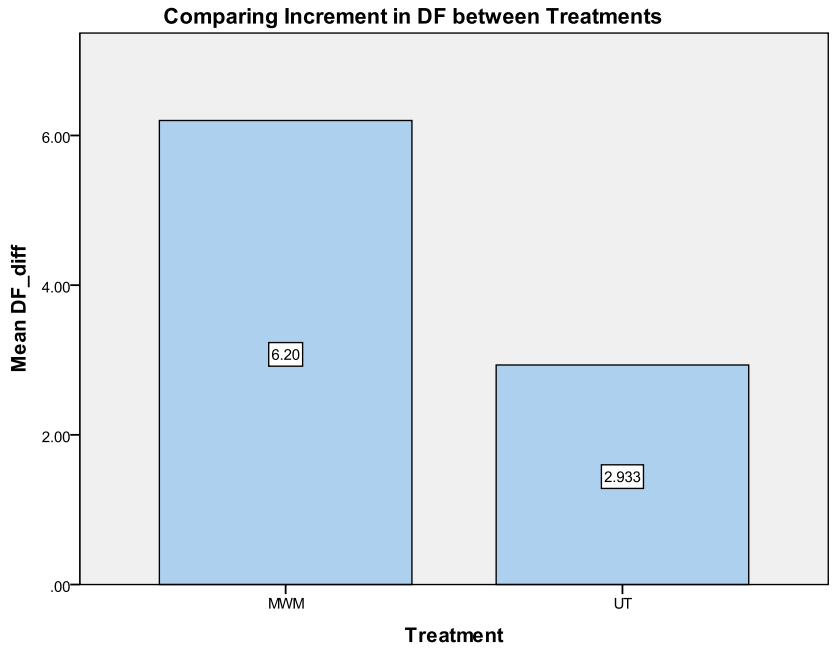
TABLE : 7

Group Statistics				
	Treatment	N	Mean	Std. Deviation
DF_diff	MWM	15	6.2000	2.07709
	UT	15	2.9333	1.62422

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
DF_diff	Equal variances assumed	2.645	.115	**4.798**	**28**	**.000**	3.26667	.68080	1.87211	4.66123
	Equal variances not assumed			4.798	26.462	.000	3.26667	.68080	1.86844	4.66489

GRAPH : 6

Difference in Dorsi Flexion between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



6

Result: The above output shows that the difference in average increment in **Dorsi Flexion** scores between Mulligan Mobilization with Movement (MWM) and Ultrasound therapy(UT) is **statistically significant** at 5% level (*t(28) = 4.798, p = 0.000 < 0.05*). That is, the evidence is sufficient to conclude that there is significant difference in average increment in **Dorsi Flexion** scores between **(MWM)** and **(UT)**. Going by these average values, we conclude that the average increment in DF scores due to Mulligan Mobilization with Movement (MWM) (Mean = 6.20 & SD = 2.08) is significantly **greater** than that of Ultrasound therapy(UT) (Mean = 2.93 & SD = 1.62).

2.3 Testing the difference in Plantar Flexion (PF2 – PF1) between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Independent Samples t-test

The **output** of this test is presented below:

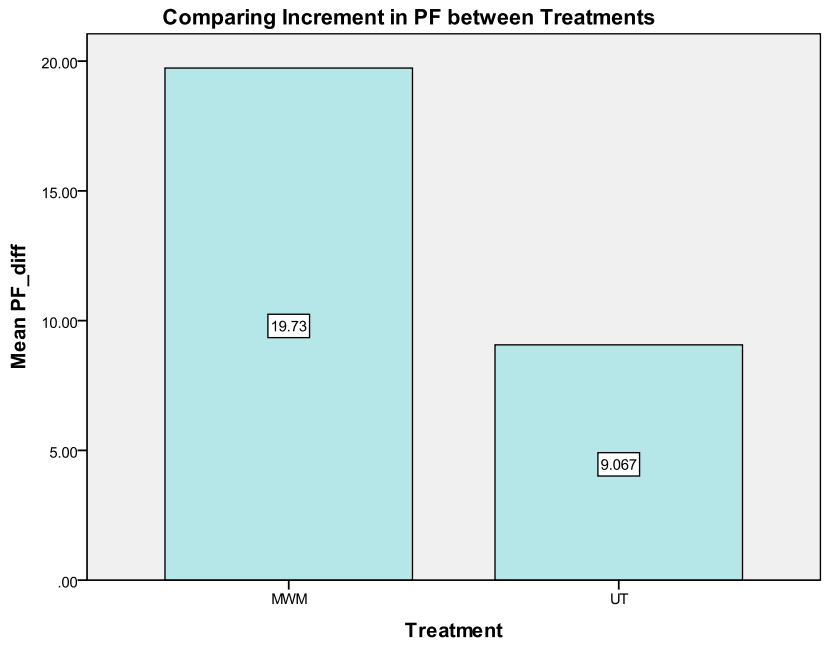
TABLE : 8

Group Statistics				
	Treatment	N	Mean	Std. Deviation
PF_diff	MWM	15	19.7333	6.31853
	UT	15	9.0667	4.43149

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
PF_diff	Equal variances assumed	1.187	.285	**5.353**	**28**	**.000**	10.66667	1.99269	6.58484	14.74850
	Equal variances not assumed			**5.353**	**25.090**	**.000**	10.66667	1.99269	6.56340	14.76993

GRAPH : 7

Difference in Plantar Flexion between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that the difference in average increment in **Plantar Flexion** scores between Mulligan Mobilization with Movement (MWM) and Ultrasound therapy(UT) is **statistically significant** at 5% level ($t(28) = 5.353$, $p = 0.000 < 0.05$). That is, the evidence is sufficient to conclude that there is significant difference in average increment in **Plantar Flexion** scores between (**MWM**) and (**UT**). Going by these average values, we conclude that the average increment in PF scores due to Mulligan Mobilization with Movement (MWM) (Mean = 19.73 & SD = 9.32) is significantly **greater** than that of Ultrasound therapy(UT) (Mean = 9.07 & SD = 4.43).

2.4 Testing the difference in FAAM (FAAM2 – FAAM1) between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy

Let the level of significance be $\alpha = 0.05$

Test to be applied: Independent Samples t-test

The **output** of this test is presented below:

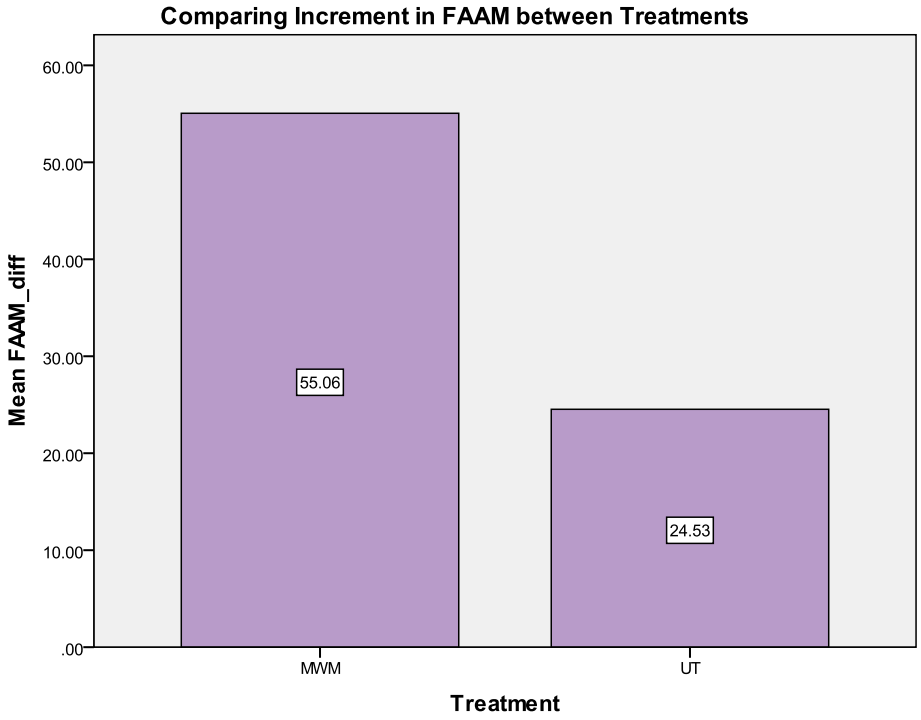
TABLE : 9

Group Statistics				
	Treatment	N	Mean	Std. Deviation
FAAM_diff	MWM	15	55.0573	10.91845
	UT	15	24.5320	14.90087

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
FAAM_diff	Equal variances assumes	1.436	.241	**6.400**	**28**	**.000**	30.52533	4.76969	20.75507	40.29559
	Equal variances not assumes			6.400	25.669	.000	30.52533	4.76969	20.71496	40.33571

GRAPH : 8

Difference in FAAM between Group A Mulligan Mobilization with Movement (MWM) and Group B Ultrasound therapy



Result: The above output shows that the difference in average increment in **FAAM** scores between Mulligan Mobilization with Movement (MWM) and Ultrasound therapy(UT) is **statistically significant** at 5% level (*t(28) = 6.40, p = 0.000 < 0.05*). That is, the evidence is sufficient to conclude that there is significant difference in average increment in **FAAM** scores between**(MWM)** and **(UT).** Going by these average values, we conclude that the average increment in FAAM scores due to Mulligan Mobilization with Movement (MWM) (Mean = 55.06 & SD = 10.92) is significantly **greater** than that of Ultrasound therapy(UT) (Mean = 24.53 & SD = 14.90).

7.4. Results :

Going by the results of the analysis, it is observed that

- There is no significant difference between Mulligan Mobilization with Movement (MWM) and Ultrasound therapy (UT) in terms of all the four measures at baseline (i.e., DF1, PF1, NPRS1, and FAAM).

- On average, there is significant mean reduction in NPRS score due to Mulligan Mobilization with Movement (MWM) and also due to Ultrasound therapy (UT). Also, the average reduction in NPRS scores due to Mulligan Mobilization with Movement (Mean = 5.33 & SD = 1.63) is significantly **greater** than that of Ultrasound therapy (Mean = 2.47 & SD = 0.915).

- On average, there is significant mean increase in DF score due to Mulligan Mobilization with Movement (MWM) and also due to Ultrasound therapy (UT). Also, the average increment in DF scores due to Mulligan Mobilization with Movement (Mean = 6.20 & SD = 2.08) is significantly **greater** than that of Ultrasound therapy (Mean = 2.93 & SD = 1.62).

- On average, there is significant mean increase in PF score due to Mulligan Mobilization with Movement (MWM) and also due to Ultrasound therapy (UT). Also, the average increment in PF scores due to Mulligan Mobilization with Movement (Mean = 19.73 & SD = 9.32) is significantly **greater** than that of Ultrasound therapy (Mean = 9.07 & SD = 4.43).

- There is significant mean increase in FAAM score due to Mulligan Mobilization with Movement (MWM) and due to Ultrasound therapy (UT). Also, the average increment in FAAM scores due to Mulligan Mobilization with Movement (Mean = 55.06 & SD = 10.92) is significantly **greater** than that of Ultrasound therapy (Mean = 24.53 & SD = 14.90).

On the whole, we conclude that both the treatments are effective in reducing NPRS scores and in increasing Dorsi Flexion, Plantar Flexion, and FAAM scores. However, *Mulligan Mobilization with Movement*s *significantly* ***more effective*** than *Ultrasound Therapy* in terms of reducing NPRS scores and increasing Dorsi Flexion, Plantar Flexion, and FAAM scores. From these findings, we conclude that the "*Mulligan Mobilization with Movement* " is relatively more effective treatment than "*Ultrasound Therapy*" in lateral ligament sprain of ankle.

DISCUSSION

8.DISCUSSION :

The ankle is one of the most common sites of injury in sports; with ankle sprains accounting for about 85% of all ankle injuries. It is estimated, that 67.3% of Football players and 70% of their Basketball players. The high rate of injury and especially reinjures seen in ankle sprains has challenged the clinical community to provide better rehabilitative as well as prophylactic strategies to reduce the incidence rate.[1] [3

Ankle sprain results in pain, swelling and limitation of movement. Therapy on ankle sprain focuses on controlling pain improve Range Of Motion and function.

This study investigate the effectiveness of MWM and Ultrasound in Ankle sprain in football players in terms of NPRS, ROM ,FAAM for Ankle joint.

The Objective of this study of **Group A** was to find the effectiveness of Mulligan Mobilization with Movement (MWM) in lateral ligament sprain of ankle in terms of pain, Range Of Motion and functional activity. In Group A who received Mulligan Mobilization with Movement (MWM) shows overall effectiveness after 1 week.

From the value of table 2 & graph 2 NPRS Mean= 5.33,SD= 1.63 and p=0.000 <0.05, the value of table 3 & graph 3 dorsiflexion range of motion Mean= 6.20 SD= 2.08 and p= 0.000<0.05, the value of table 4 & graph 4 plantarflexion range of motion Mean= 19.73,SD= 6.32 and p= 0.000<0.05, the value of table 5 & graph 5 Foot and Ankle Ability Measure (FAAM) Mean= 55.06,SD= 10.92 and p= 0.000 < 0.05. This means that Mobilization with Movement (MWM) is effective in reducing pain, improve ROM and functional activity. So, Null hypothesis (H_0) is rejected and alternate hypothesis (H_1) is accepted.

Joint mobilization can relieve pain and Improve ROM by neurophysiological and Mechanical mechanism (or) some combination of neurophysiological and mechanical mechanism.Trauma, either (or) chronic, rupture cell walls. Enzymes such as cyclo-oxygenase then breakdown the spilled Intracellular contents into prostaglandins, leukotrienes, and other component of the body inflammatory process. The enzymatic activity mobilizes WBC and triggers other aspects of the innate healing response. Prostaglandins also sensitizers nerve ending which make nerve fibers fire more aggressively, and at a lower stimulus than would normally cause firing. Passive joint mobilization is also used to reduce pain by modulation of nervous tissue and to increase range of motion. Adjustive therapy is a procedure that may induce Quick

distraction and Break the intra-articular adhesion. Early intervention for soft tissue Injury by means of manual therapy will promote better healing, pain and inflammation. Restoring the ROM and arthrokinematics, there is evidence to suggest that it mobilization may enhance sensorimotor system function by stimulating articular afferent receptors located in the ligaments and it capsule surrounding the ankle [31]

Our study support the study of Natalie Collins et. al (2003) who conducted study on, "The initial effects of a Mobilization with Movement (MWM) 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 Mobilization with Movement MWM) treatment on weight bearing dorsiflexion and concluded that Mobilization with Movement (MWM) treatment for ankle dorsiflexion has a mechanical rather than the 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 [7]

Our study support the study of O"Brein et.al (1998) in their study "A study to find the effects of Mulligans Mobilization with Movement in treatment of LAS using a case study design" the intervention included a sustain posterior glide to the fibular while the patient actively inverted the ankle. They suggested benefits of treatment included reduced pain & increase ROM.44

Our study supports the study of Andrea Reid et.al.(2007) in their "Efficacy of Mobilization with Movement for patient with Limited Dorsiflexion after Ankle Sprain :A Crossover Trial" at the university of Western Ontario, Canada; subjects with help of Mobilization with Movement treatment for ankle Dorsiflexion. They suggest that talocrural MWM improves range of motion of ankle immediately following treatment. 45

Ultrasound therapy has been used in the treatment of musculo-skeletal conditions for many years. Ultrasound is used in physical therapy to relieve pain, reduce swelling, and improve joint mobility in a wide variety of musculoskeletal disorders. Ultrasound therapy is a treatment modality used in physical therapies that utilize high frequency sound waves ranging between 1 MHz to 3 MHz therapy.[4][5]

The Objective of this study of **Group B** was to find the effectiveness of ultrasound therapy in lateral ligament sprain of ankle in terms of pain, Range Of Motion, and functional activity. In group B, who received Ultrasound therapy shows overall effectiveness after 1 week. From 0.000<0.05 , the value of table 5 & graph 5 Foot and Ankle Ability Measure (FAAM) Mean= 24.53 SD= 14.90 and p= 0.000<0.05.This means that Ultrasound therapy is effective in reducing pain, improve ROM and function. So, Null hypothesis (H_0) is rejected and alternate hypothesis (H_1) is accepted.

Ultrasound has been used in treatment of Musculo-skeletal conditions for many years Laboratory Research has demonstrated, that the application of ultrasound results in the promotion of cellular metabolic rate and increased visco-elastic properties of collagen.This rise in temperature is assumed to be the mediating mechanism for tissue Repair, the enhancement of soft tissue extensibility, promotion of muscle Relaxation, augmentation of Blood flow, and alleviation of Inflammatory treatments of soft tissue. The compression and rarefaction of ultrasonic waves producing form of micro massage effect this helps to reduce edema [(5)]

Our study support the study of van der Windt DAWN et al (2010) who conducted study on,"Therapeutic ultrasound for acute ankle sprain" with treatment of the Ultrasound therapy concluded that, Ultrasound therapy has magnitude of treatment effects are generally small and limited clinical importance such a schedule would improve the reported lack of effectiveness of Ultrasound for ankle sprain [(5)]

Statistical analysis shows the percentage of reduction in NPRS between Group A and Group B. From the value of table 5 & graph 5 In group A there is 5.33 % reduction to compare Group B 2.46% of reduction of pain. Statistical analysis shows the percentage of improvement in dorsiflexion range of motion between Group A and B. From the value of table 6 & graph 6 In Group A, there is 6.20% of improvement as to compare to Group B 2.93% improvement Dorsiflexion. Statistical analysis shows the percentage of improvement in Plantarflexion between Group A and Group B. From the value of table 7 & graph 7 In Group A, there is 19.73% of improvement as to compare to Group B 9.0% improvement Plantarflexion . Statistical analysis of shows the percentage of improvement in FAAM between Group A and Group B. From the value of table 8 & graph 8 In Group A, there is 55.06 % of improvement as to compare Group B 24.53 % improvement of FAAM.

Our study support the study of Akre Ambarish et.al(2008) the study "Comparative Effectiveness of MWM in weight bearing & Non weight bearing in the treatment of Ankle sprain- A Randomized clinical trail. They concluded the weight bearing MWM were significant to that of Non weight bearing with ultrasound.46

According to data interpretation, from this study both the techniques are significant to reduce the NPRS and improving Range Of Motion, Foot and Ankle Ability Measure (FAAM) scale. But, among these two techniques, Mulligan Mobilization with Movement is ***more effective*** than Ultrasound therapy

LIMITATIONS

&

RECOMMENDATIONS

9.LIMITATION :

- The sample size is limited
- Male participants are more, compare with female participants
- No control group present
- No long term follow up of patients

RECOMENTATION :

- The future studies need to done with large group
- Long term follow-up
- The study can be done as equal sex ratio
- Future study can be done in either males & females, sports players and dancers.

CONCLUSION

10. CONCLUSION

Based on the outcome measure, this study although both Mulligan Mobilization with Movement and Ultrasound therapy shows significant improvement while comparing post-test results of these two groups, Mulligan Mobilization with Movement are more effective in reducing pain, improving ROM and functional activity in lateral ligament sprain of ankle joint. This study recommends that Mulligan Mobilization with Movement is effective treatment for lateral ligament of ankle sprain in football players .

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ANNEXURE

12.ANNEXURE :

12.1 CONSENT FORM

Informed Consent for Participants in Research study Involving Human Subjects

Title of Project :A Study To Compare The Effects Of Mulligan Mobilization with Movement [MWM] Technique Vs Ultrasound therapy in Lateral ligament Sprain of ankle join in football players..

Investigator : Ganesh Chander

Purpose of This Research: You are invited to participate in a study on the effects of Mulligan Mobilization with Movement [MWM] Technique Vs Ultrasound therapy in Lateral ligament Sprain of ankle joint in football players. From the information collected and studied in this project we hope to learn more about the effects of Mulligan Mobilization with Movement [MWM] Technique Vs Ultrasound therapy in Lateral ligament Sprain of ankle joint in football players.

Procedures: With your permission we would like to collect health information about you, including information about your general health and then we will evaluate your ankle.

Only researchers will have access to the final data, and you can refuse to be part of the study. You can also stop at any point during the study. Your results will never be shared with anyone other than the researchers.

Benefits: You may receive direct benefit from this study. We cannot guarantee that you will receive any benefits from this study.

Extent of Anonymity and Confidentiality: At no time will the researchers release the results of this study to anyone other than individuals working on this study without your written consent.

It is possible that the Institutional Review Board (IRB) may view this study's collected data for auditing purposes. The IRB is responsible for the oversight of the protection of human subject's involved in research.

Compensation: You will not be paid to participate in this study.

Freedom to Withdraw: Your decision whether or not to participate in this study will not affect medical care. If you read this form and have decided to participate in this project, please understand your participation is voluntary and you have the right to withdraw your consent or discontinue your participation at any time without penalty. Your identity will not be disclosed in any published and written material resulting from the study.

Subject's Responsibilities:

I voluntarily agree to participate in this study. I have the following responsibilities:

- Report to my test sessions on time.
- Report to each test session as scheduled.
- Complete the testing as described to me to by the investigator the best of my ability.
- Be honest about my pain scale to the investigators at the time of testing.
- To be honest about my medical history.

Subject's Permission:

I have read the Consent Form and the conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent.

_____ Date_____

Subject signature :

Should I have any pertinent questions about this research or its conduct, and research subjects' rights, and whom to contact in the event of a research related injury to the subject, I may contact:

Investigators:

MR. Ganesh chander

Co-ordinator:

Dr.V.K.Jayaseelan jayaseelanvkmpt@gmail.com

IRB Chair:

*Dr.V. Balchandar*jayacpt202@gmail.com

12.2EVALUATION FORM

3

NAME :

AGE :

SEX :

OCCUPATION :

ADDRESS :

CHIEF COMPLAINTS :

GAME POSITION :

HISTORY :

PAST MEDICAL HISTORY :

- History of any disease like diabetes, hypertension yes /no
- History of any previous fracture in ankle yes/no
- History of any injury in ankle yes /no
- History of previous surgery in ankle yes /no
- History of any physiotherapy taken previously yes /no
- History of medication taken previously yes /no

PRESENT MEDICAL HISTORY :

- Any present medical/physiotherapy treatment yes /no
- Duration of treatment taken yes /no
- History of sprain occurs within 72 hours yes/no

PERSONAL HISTORY :

- Habit of smoking yes /no
- Habit of intake of alcohol yes /no
- Habit of tobacco chewing yes /no

OCCUPATIONAL HISTORY :

- Any sports related activity yes /no
- Duration of work yes /no

VITAL SIGNS :

✍BP :

✍Heart rate :

✍Respiratory rate :

✍Temperature :

OBJECTIVE EVALUATION :

ON OBSERVATION :

✍Built of the patient

- Ectomorph yes /no
- Endomorph yes /no
- Mesomorph yes /no

✍Attitude of the limb

✍Any marked swelling around the ankle yes /no

✍Any marked muscle spasm around the ankle yes /no

✍Any marked bony deformities around the ankle yes /no

✍Any marked bony prominence around the ankle yes /no

✍Any marked bony angulation around the ankle yes /no

✍Using any assistive devices yes/no

✍Any marked open wounds yes /no

✍Any marked surgical scar yes /no

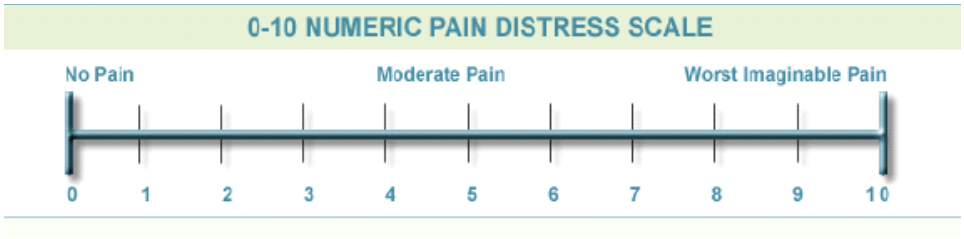
ON PALPATION :

☝Any marked swelling around the ankle yes /no

- Any marked tenderness around the ankle yes /no
- Any marked crepitation around the ankle yes /no
- Any marked edematous formation around the ankle yes /no

PAIN EVALUATION :

NPRS SCALE



Onset of pain :

- Sudden onset yes /no
- Gradual onset yes /no

Type of pain :

- Sharp pain yes /no
- Stabbing pain yes /no
- Shouting pain yes /no

Nature of pain :

- Constant pain yes /no
- Intermittent pain yes /no
- Site of pain
- Pain at rest
- Severity of pain

Aggravating factors :

- Walking yes /no
- Running yes /no
- Jumping yes /no
- Landing yes /no
- Standing yes /no

Relieving factors :

- Rest yes /no
- Medication yes /no

Deformities :

- Equinus yes /no
- Valgus yes /no
- Clawing toes yes /no
- Hallus valgus yes /no
- Hallusvarus yes /no
- Pescavus yes /no
- Pesplanus yes /no

Gait :

- Walking on heel yes /no
- Walking on toes yes /no
- Unable to walk yes /no
- Any abnormal gait yes /no

Balance :

- Double limb stance yes /no
- Single limb stance yes /no

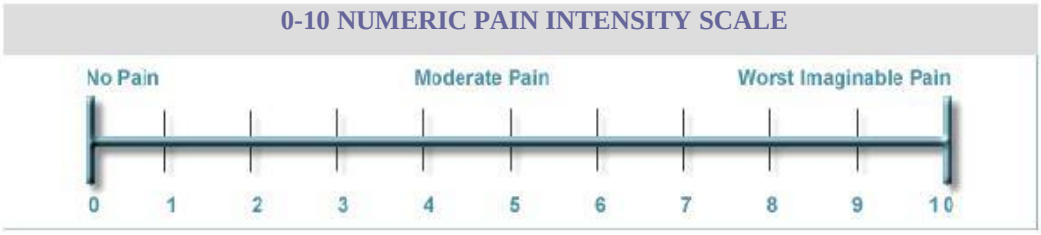
Proprioception :

- Balance on one leg yes /no
- Balance opposite leg behind 90^0 yes /no
    - Eyes open

12.3 NUMERIC PAIN RATING SCALE

Pain Assessment with the "0—10 Numeric"
Pain Intensity Scale

The 0 to 10 pain scale is commonly and successfully used with hospitalized and nursing home patients, even those with mild to moderate dementia. The scale is often displayed as a line numbered from zero to ten as shown below.



This scale asks the person in pain to assign a number, from zero to ten, to the severity of their pain.

It is important to properly instruct the person in how to rate their pain. Use the following statements to ask the person to rate their pain.

1. I would like you to rate your pain on a scale from zero to ten.
2. 'Zero' means you have no pain at all.
3. 'Ten' means the worst possible pain you can image.
4. What number would you give to your pain?

A common administration error is to describe "10" as "the worst pain you ever had." For some people, the worst pain they ever had may have been something minor like a toothache; and remember, persons with dementia may not be able to remember their worst pain.

A variation of this technique is to provide the instructions, then ask the person to point to the number that represents their pain.

The values on the pain scale correspond to pain levels as follows: 1 1– 3 = mild pain
4 – 6 = moderate pain
7 – 10 = severe pain

12.4 Foot and Ankle Ability Measure (FAAM)

Please answer **every question** with one response that most closely describes to your condition within the past week.
If the activity in question is limited by something other than your foot or ankle mark not applicable (N/A).

	No difficulty	Slight difficulty	Moderate difficulty	Extreme difficulty	Unable to do	N/A
Standing						
Walking on even ground						
Walking on even ground without shoes						
Walking up hills						
Walking down hills						
Going up stairs						
Going down stairs						
Walking on uneven ground						

Stepping up and down curbs

Squatting

Coming up on your toes

Walking initially

Walking 5 minutes or less

Walking approximately 10 minutes

Walking 15 minutes or greater

1

Because of your **foot and ankle** how much difficulty do you have with:

	No difficulty at all	Slight difficulty	Moderate difficulty	Extreme difficulty	Unable to do	N/A
Home Responsibilities						
Activities of daily living						
Personal care						
Light to moderate work (standing, walking)						
Heavy work (push/pulling, climbing, carrying)						
Recreational activities						

How would you rate your current level of function during your usual activities of daily living from 0 to 100 with 100 being your level of function prior to your foot or ankle problem and 0 being the inability to perform any of your usual daily activities?

.0 %

FAAM Sports Scale

Because of your **foot and ankle** how much difficulty do you have with:

	No difficulty at all	Slight difficulty	Moderate difficulty	Extreme difficulty	Unable to do	N/A
Running						
Jumping						
Landing						
Starting and stopping quickly						
Cutting/lateral movements						
Low impact activities						
Ability to perform activity with your normal technique						
Ability to participate in your desired sport as long as you would like						

How would you rate your current level of function during your sports related activities from 0 to 100 with 100 being your level of function prior to your foot or ankle problem and 0 being the inability to perform any of your usual daily activities?

.0 %

Overall, how would you rate your current level of function?

Normal Nearly normal Abnormal Severely abnormal

12.5 **MULLIGAN MOBILIZATION WITH MOVEMENT**

	PRE - TEST							**POST - TEST**						
S.NO	**RANGE OF MOTION**				***NPRS***	**FAAM**		**RANGE OF MOTION**				***NPRS***	**FAAM**	
	Dorsi flexion	*Plantar flexion*	*Inversion*	*Eversion*		*ADL*	*SPORTS*	*Dorsi flexion*	*Plantar flexion*	*Inversion*	*Eversion*		*ADL*	*SPORTS*
						84	32						*84*	*32*
1	14^0	14^0	15^0	10^0	4	43	16	13^0	35^0	30^0	11^0	2	77	29
2	11^0	25^0	23^0	9^0	6	33	14	14^0	40^0	38^0	13^0	1	82	30
3	15^0	34^0	15^0	12^0	8	32	14	12^0	30^0	25^0	11^0	0	82	31
4	10^0	21^0	22^0	9^0	7	18	11	14^0	34^0	14^0	11^0	1	81	31
5	10^0	25^0	16^0	10^0	6	35	10	15^0	20^0	35^0	10^0	1	83	31
6	11^0	24^0	21^0	10^0	7	28	13	12^0	31^0	34^0	11^0	0	78	32
7	8^0	25^0	23^0	7^0	6	43	15	17^0	33^0	35^0	12^0	1	82	30
8	15^0	30^0	21^0	21^0	3	38	15	16^0	35^0	33^0	12^0	0	83	31
9	9^0	20^0	22^0	6^0	7	30	7	16^0	32^0	34^0	12^0	0	80	29
10	16^0	10^0	19^0	10^0	7	18	10	15^0	28^0	31^0	12^0	1	80	30
11	10^0	23^0	21^0	9^0	6	25	13	15^0	28^0	25^0	11^0	0	81	30
12	11^0	29^0	10^0	9^0	6	46	18	12^0	31^0	29^0	13^0	1	82	31
13	12^0	23^0	20^0	11^0	4	55	21	13^0	33^0	31^0	11^0	1	82	31
14	11^O	14^0	15^0	10^0	7	33	16	13^0	31^0	30^0	14^0	1	82	31
15	15^0	25^0	23^0	90^0	6	32	14	12^0	33^0	29^0	11^0	0	81	32

ULTRASOUND THERAPY

	PRE -TEST							POST - TEST						
S.NO	**RANGE OF MOTION**				***NPRS***	**FAAM**		**RANGE OF MOTION**				***NPRS***	**FAAM**	
	Dorsi flexion	*Plantar flexion*	*Inversion*	*Eversion*		*ADL*	*SPORTS*	*Dorsi flexion*	*Plantar flexion*	*Inversion*	*Eversion*		*ADL*	*SPORTS*
						84	32						84	*32*
1	60	$_{0}^{20}$	6^{0}	7^{0}	7	13	9	13^{0}	35^{0}	30^{0}	11^{0}	4	74	18
2	$_{0}^{10}$	$_{0}^{33}$	36^{0}	12^{0}	6	38	3	14^{0}	40^{0}	38^{0}	13^{0}	3	57	18
3	$_{0}^{10}$	$_{0}^{22}$	20^{0}	7^{0}	5	56	20	12^{0}	30^{0}	25^{0}	11^{0}	2	60	28
4	10^{0}	$_{0}^{15}$	10^{0}	5^{0}	7	18	3	14^{0}	34^{0}	14^{0}	11^{0}	2	50	24
5	14^{0}	13^{0}	14^{0}	12^{0}	5	17	4	15^{0}	20^{0}	35^{0}	10^{0}	3	51	18
6	10^{0}	$_{0}^{20}$	23^{0}	9^{0}	5	31	14	12^{0}	31^{0}	34^{0}	11^{0}	3	54	21
7	12^{0}	$_{0}^{30}$	31^{0}	11^{0}	4	45	20	17^{0}	33^{0}	35^{0}	12^{0}	3	55	22
8	14^{0}	$_{0}^{24}$	21^{0}	10^{0}	7	30	8	16^{0}	35^{0}	33^{0}	12^{0}	4	45	20
9	12^{0}	$_{0}^{21}$	23^{0}	10^{0}	7	30	14	16^{0}	32^{0}	34^{0}	12^{0}	4	52	24
10	12^{0}	$_{0}^{25}$	29^{0}	10^{0}	7	49	19	15^{0}	28^{0}	31^{0}	12^{0}	5	63	24
11	13^{0}	$_{o}^{25}$	23^{0}	9^{0}	7	16	7	15^{0}	28^{0}	25^{0}	11^{0}	5	43	17
12	11^{0}	$_{0}^{21}$	23^{0}	12^{0}	^{5}	47	15	12^{0}	31^{0}	29^{0}	13^{0}	3	54	19
13	11^{0}	$_{0}^{22}$	25^{0}	5^{0}	5	37	20	13^{0}	33^{0}	31^{0}	11^{0}	3	58	15
14	10^{0}	$_{0}^{24}$	21^{0}	9^{0}	6	25	15	13^{0}	31^{0}	30^{0}	14^{0}	4	44	19
15	10^{0}	23^{0}	21^{0}	9^{0}	5	38	7	12^{0}	33^{0}	29^{0}	11^{0}	3	50	19