

# A Comparative Study on the Effective Combination of High Voltage Microcurrent (Hvmc), Far Infradiation (Fir), And Pulsed Electromagnatic Field Therapy (Pemf) with Ankle Rehabilitation on Chronic Ankle Instability

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## ABSTRACT

**BACKGROUND**-Ankle ligament sprain is a common biomechanial injury and numerous cases of acute ankle sprain suffering from habitual ankle insecurity which affecting – Calcaneofibular ligament( CFL) ,Posterior talofibular ligament( PTFL) Anterior talofibular ligament( ATF)<sup>1</sup> . An acute ankle sprain following, poverties in postural control, proprioception, muscle response time and strength generally happens which can lead to habitual ankle insecurity( CAI). A cases incapability to complete jumping and wharf tasks within 2 weeks of a first- time ankle sprain( AS) and poorer dynamic postural control and lower tone- reported function 6 months after a first- time AS were prophetic of eventual CAI outgrowth includes mechanical insecurity( stir exceeds normal physiological limits) and Functional insecurity( objectively stable with private passions of insecurity related to sensorimotor or neuromuscular poverties). According to studies a high rate of disability and rush of CAI Clinically, the cases with history of CAI shows past intermittent ankle sprains with severe inversion/ eversion injury case have to take special preventives against weight bearing, emphatic conditioning, and walking on uneven surface. **PEMF** is like a " battery re-charger" for your depleted cells. PEMF remedy has several times of clinical success in relieving pain at the source by pulsing electromagnetic swells at precise frequentness. speeding the body's recovery at a cellular position. The electrical material exchange pets up the cell function, and, as a result, nutrition is completely absorbed by the cell and waste material is excluded. Metabolism is increased and the function of the cell is gradationally revived. Power of Natural Healing.**Far infrared radiation** - Far infrared swells can access up to three elevation deep to induce warmth that can give immense relief to muscles and internal organs Increased blood rotation carries down metabolic waste products and delivers oxygen-rich blood to depleted muscles so they recover

briskly. **High voltage micro current-** Low voltage in our cells is what causes them to malfunction, performing in illness and pain. High Voltage Micro Currents as a cells energizer. Our bodies use certain patterns of action capabilities to initiate the correct movements.

#### **AIM/OBJECTIVE –**

Chronic ankle instability happens to be the most common orthopedics affliction among adults between the age of 18 to 45 and most common cause of instability among the adults and make an important contribution to control the stability of the body biomechanics with researched rehabilitation. To analyse the efficacy of a particular set of ankle rehabilitation programme with therapeutic modality for fast recovery as the strategy – training programme as the exercise and electrotherapy intervention in chronic instability patients. Therefore the need arises to compare the effectiveness of specific ankle rehabilitation programme with combination of FIR / PEMF / HVMC modality with conventional ankle exercise programme in chronic ankle instability. The study objective is to establish and evaluate whether combination of PEMF/FIR/HVMC with ankle rehabilitation training in people with CAI will improve rehabilitation outcomes compared to standard rehabilitation. This study is also investigates the effect of electro combination unit on palpable ankle tenderness functional outcomes mechanical and functional properties of ligament.

**METHODOLOGY-**The study was conducted at department of physiotherapy, Ram krishna medical college hospital and research centre and private clinics and hospitals of BHOPAL (M.P) 40 subjects meeting the inclusion criteria were recruited for the study. They were allocated randomly into two groups, Group A and Group B respectively. Group 1 control group received standard ankle rehabilitation training which included strengthening, gentle stretches, coordination exercises, balance exercises and landing tasks of lower limb and the group 2 experimental group received above mentioned rehabilitation training with electromodality that is combination of PEMF/FIR/HVMC treatment was given for 6 days per week for 4 weeks.

**RESULTS –**The parametric test was used to examine both group Group A and Group B in this study. Paired t-tests were used to compare mean values within groups, while independent t-test were used to compare mean values between groups, i.e. Group A and Group B. A statistically significant difference was found in ankle instability and functional movements as CAI and all had a  $p =$  value 0.001 after treatment when compared to baseline.

**CONCLUSION -** The results of this study show that the standard ankle rehabilitation exercises combination with PEMF/HVMC/FIR modality, are equally beneficial in improving proprioception, range of motion and functional ankle stability. We accept the null hypothesis because the investigation yielded no meaningful results.

**KEYWORDS:-**Pulsed electromagnetic field therapy, far infrared radiation, high voltage micro current, chronic ankle instability, ankle rehabilitation, ankle sprain, star excursion balance test, Cumberland ankle instability questionnaire, Range of motion.

#### **INTRODUCTION**

Ankle ligament sprain is a common biomechanical injury and numerous cases of acute ankle sprain suffering from habitual ankle insecurity which affecting –Calcaneofibular ligament( CFL) ,Posterior talofibular ligament( PTFL) Anterior talofibular ligament ( ATFL) <sup>1 2 3</sup>. According to studies a high rate of disability and rush of CAI Clinically, the cases with history of CAI shows past intermittent ankle

sprains with severe inversion/ eversion injury case have to take special preventives against weight bearing, emphatic conditioning, and walking on uneven shells.

CAI is characterised by a range of poverties that can be estimated along a continuum of sensorimotor measures. It's apparent that conscious perception of sensational somatosensory information, kickback responses, and efferent motor control poverties are present with ankle insecurity. The specific origin of these poverties original to the ankle ligaments or at the spinal or supraspinal situations of motor control have yet to be completely illustrated that both feedback and feed forward mechanisms of motor control are altered with ankle insecurity. <sup>6</sup>The main causes of habitual ankle insecurity are dropped disabled proprioceptive capacities because of a loss of mechanoreceptors and dropped muscle strength of invertor and evertor muscles. The upper face, called the trochlear face, is kindly spherical and allows for dorsiflexion and plantarflexion of the ankle. The talus is wider antecedently and further narrow anteriorly It forms a wedge that fits between the medium and side malleoli making dorsiflexion the most stable position for the ankle. The ankle joint is important during ambulation because it adapts to the face on which one walks. The movements that do at the ankle joint are plantarflexion, dorsiflexion, inversion, and eversion. The muscles of the leg peak into anterior, posterior, and side chambers. The main stabilizing ligaments are deltoid ligament medially, anterior, posterior talofibular and calcaneofibular ligament indirectly. Medially The anterior and posterior tibiotalar ligaments connect the tibia to the talus and the tibionavicular ligament which attaches to the navicular antecedently and the tibio calcaneal ligament which attaches to the calcaneus inferiorly. The deltoid ligament, consists of four ligaments that form a triangle connecting the tibia to the navicular, the calcaneus, and the talus. It stabilises the ankle joint during eversion of the bottom and prevents subluxation of the ankle joint. Indirectly The anterior talofibular ligament connects the talus to the fibula, the weakest of the three side ligaments and therefore the most constantly injured. The posterior talofibular ligament connects the talus to the fibula and the calcaneofibular ligament connects the fibula to the calcaneus inferiorly. The ankle has stabilization from three separate ligaments, the anterior and posterior talofibular ligaments, and the calcaneofibular ligament. The side ligaments stabilize the ankle, and serve as a companion to direct ankle stir by attaching the side malleolus to the bones below the ankle joint. The reported normal available range for dorsiflexion varies in the literature between 0-16.5 o and 0- 25o This changes in weight-bearing. The normal range of Plantarflexion has been reported to be around 0 °- 50 ° where Closed Packed Position Is Maximum Dorsiflexion And Open Packed Position is 10 ° Plantarflexion. <sup>22</sup> PEMF stands for Pulsed Electro glamorous Field remedy using this particular process involves directing important, palpitated energy swells toward damaged or injured areas of the case's body. PEMF improves calcium transport for better immersion of calcium in bones, which enhances fracture mending and improves the cartilage in joints, dwindling pain dramatically. palpitating electromagnetic fields ameliorate supplemental rotation and have been scientifically proven to dramatically reduce inflammation and pain associated with all common, muscle, tendon and sports injuries. PEMF restores the positive and negative charges in the cell, enabling it to perform its natural function while speeding towel recovery. In substance. PEMF is like a" battery re-charger" for your depleted cells. PEMF remedy has several times of clinical success in relieving pain at the source by pulsing electromagnetic swells at precise frequentness. speeding the body's recovery at a cellular position. PEMF remedy was approved by the FDA in 1979 specifically for the mending of nonunion fractures. which came after a Columbia University study that was encouraged by NASA, and has lately gained attention in the U.S. PEMF technology was developed after WWII( though its origins go back much farther) and was delved and

espoused by NASA. PEMF remedy actually began from NASA's exploration involving the benefits of palpitated electromagnetic fields on astronauts for fatigue, depression, bone loss and other symptoms following indeed short passages to external space. Scientists discovered that the cause was due to astronauts being without this salutary natural field expiring from our Earth. PEMF technology has been FDA approved for 25 times for bone mending, post-surgical pain and mending, pain and inflammation, knee pain and indeed depression. PEMF technology efficacy is established in further than 20,000 well proved clinical studies, trials & Research carried out by hospitals, rheumatologists, physiotherapists, and neurologists.<sup>23</sup>

The mortal body requires electricity to shoot signals through the body and to the brain. This membrane eventuality decreases with the age, sedentary life, & a variety of adulterants. According to Dr. Tanaka, when- ionization is introduced, the ions in calcium and sodium (common swab) in the blood increases, and the blood is purified by increased blood alkalinity. Negative ions control the autonomic nervous system. Dr. Tanaka set up that negative ions control the balance in the Autonomic Nervous System between the insulin and adrenal functions. This provides strong resistance to conditions. Resting cells are negatively charged on the inside, while the outside of the cell is more appreciatively charged. The inflow of charges across the cell membrane is what generates electrical currents. When a cell is stimulated, it allows positive charges to enter the cell through open ion channels. The inside of the cell also becomes further appreciatively charged, which triggers farther electrical currents that can turn into electrical beats, called action capabilities. Our bodies use certain patterns of action capabilities to initiate the correct movements, studies and actions. Far Infrared are unnoticeable swells of thermal energy, which access the face of the skin where they gently and elevate the body's face temperature to 107.6 F/ 42C and over, whilst appreciatively cranking body systems and functions. The end result is an enhancement in the balance of blood pressure, blood sugar and nutrients in the cells performing in increased muscle strength, internal stability and bettered energy. assistances in Detoxification Far infrared remedy helps to detoxify the body in several important ways. Increased blood rotation stimulates the sweat glands, releasing erected- up poisons and waste. diurnal sweating can help detoxify the body as it rids itself of an accumulation of potentially carcinogenic heavy essence, alcohol, nicotine, sodium, sulfuric acid, cholesterol, and uric acid. In addition to causing the body to sweat, far infrared is able of removing poisons via several other fleshly systems<sup>23</sup>

#### **AIM –**

This study aims to investigate the clinical effectiveness of combination of PEMF /FAR INFRARED /HIGH VOLTAGE MICRO CURRENT (combination electrotherapy unit) as an adjunct to a program of standard ankle rehabilitation for the treatment of chronic ankle instability.

#### **OBJECTIVES-**

The study objective is to establish and evaluate whether combination of PEMF/FIR/HVMC with ankle rehabilitation training in people with CAI will improve rehabilitation outcomes compared to standard rehabilitation. This study is also investigates the effect of electro combination unit on palpable ankle tenderness functional outcomes mechanical and functional properties of ligament.

#### **HYPOTHESIS-**

**Experimental hypothesis:** The specific standard ankle rehabilitation strategy with combination of

pemf/fir/hvmc may have a significant faster recovering result in improving overall stability of ankle than the only standard ankle rehabilitation strategy.

**Null hypothesis :** The combination of standard ankle rehabilitation and selected electrotherapy unit may not have significant result in regaining overall stability of ankle in patients with chronic ankle instability.

## METHODOLOGY

- **Population**-There are 40 peoples are diagnosed where 3 are females and 4 are males which. falls under age of 20 years to 40 years WITH NO BIASING OF GENDER with chronic ankle instability
- **Source of data** - Ram Krishna medical college and hospital and research centre (RKMCH&RC), BHOPAL (MP) AND Private physiotherapy clinics and orthopedic hospitals from BHOPAL(mp)
- **Sampeling procedure**-Simple ramdom method
- **Type of study** - Experimental study
- Study design- Pre and post experimental study
- Sample size– 40
- Duration of study – 4 weeks
- **Sampeling criteria-**  
**Inclusion criteria-**
  - Aged 18 year old to 49 year old without gender biasing.
  - Unilateral ankle instability of individual patient.
  - Occurance of ankle sprain up to ( from 3 days up to 6 weeks ) prior to obtaining consent form.
  - Swelling or pain
  - Decrease of total or partial ankle motion.
- **Exclusion criteria-**
  - Bilateral ankle instability of Individual patient
  - Patient with post ankle joint fracture any level of articulating surface ad body
  - Fracture surgical history of foot and ankle.
  - Systematic disease (rheumatoid arthritis, systematic lupus erythematosus diabetes mellitus , osteoarthritis , inflammatory arthritis , disease causing ligamentous laxity )

## PROCEDURE-

In the conducted study following chronic ankle instability count of 40 patients were selected by using randomized controlled technique after fulfilling the criteria from the population and then divided into two groups each group consists of 20patients . A written consent was taken from the patient after explaining about the intervention procedure and ethical committee of career college bhopal (mp).The mean ages in both the group were 31 . the maximum number of patients (26.7% ) were in the age group 28- 42 . equal number of males (7) and females (8) were taken in both the experimental and control group.Group 1 control group received standard ankle rehabilitation training which included strengthening ,gentle stretches, coordination exercises , balance exercises and landing tasks of lower limb and the group 2 experinental group received above mentioned rehabilitation training with electromodality that is combination of PEMF/FIR/HVMC .

### CUMBERLAND ANKLE INSTABILITY

Using a numeric value, the CAIT has the ability to discriminate between stable and unstable ankles. The Cumberland Ankle Instability Tool (CAIT) is a 9-item 30-point scale that measures the severity of functional ankle instability. The CAIT is filled out for both the left and right ankle, making it possible to assess both ankles individually. The patient simply has to check one statement in each item that best describes the affected ankles. This self-report questionnaire allows patients to rate their perceived degree of difficulty in performing different physical activities. 10 11

The nine items of CAIT generate a total score of 30. Where 0 points indicates extreme functional ankle instability and 30 points indicate stable ankle.

### STAR EXCURSION BALANCE TEST-

The Star Excursion Balance Test (SEBT) is a dynamic test that requires strength, flexibility, and proprioception. It is a measure of dynamic balance that provides a significant challenge to athletes and physically active individuals. The test can be used to assess physical performance, but can also be used to screen deficits in dynamic [postural control](#) due to musculoskeletal injuries (e.g. chronic ankle instability), to identify athletes at greater risk for lower extremity injury, as well as during the rehabilitation of orthopedic injuries in healthy active adults. 16

The SEBT has been described in the literature and evaluated as a tool for measuring dynamic [postural control](#) in the lower limb, identifying functional deficits in the return to daily activity, and identifying high-risk individuals for suture injuries. 7

#### Technique

Before the SEBT can be performed, the limb length measurement can be recorded before limb length measurement patient positioned in supine lying and pelvis squaring should be done after that the limb length is taken from ASIS anterior superior iliac spine most prominent palpable bone to the most prominent tip of the medial malleolus through measurement tape in centimeters. A small amount of setup is required. Four strips of athletic tape will need to be cut to a length of 6-8 feet each. Two pieces will be used to form a '+', with the other two being placed over top to form an 'x' so that a star shape is formed. It is important that all lines are separated from each other by a 45° angle. The goal of the SEBT is to maintain single leg stance on one leg while reaching as far as possible with the contralateral leg. The person performing the test must maintain their balance on one leg, while using the other leg to reach as far as possible in 8 different directions. The person (standing on his/her left leg for example) must reach in 8 different positions, once in each of the following directions: anterior, anteromedial, medial, posteromedial, posterior, posterolateral, lateral and anterolateral. The anterior, posteromedial and posterolateral directions appear to be important to identify individuals with chronic ankle instability. When the person demonstrates a significantly decreased reach while standing on the injured limb compared to standing on the healthy limb, the Star Excursion Balance Test has highlighted his/her's loss of dynamic postural control. The test originally incorporated reaching in eight directions while standing on each foot, but factor analysis indicated that one reach direction in particular (posteromedial) was able to accurately identify individuals with [chronic ankle instability](#) as well as performing all eight directions Anterior Anteromedial. Medial. Posteromedial Posterior Posterolateral Lateral Anterolateral <sup>19</sup>

## PEMF UNIT

The AMWAVEWELLNES UNIT PEMF/FIR/HVMC combination unit is used for treatment the patient is positioned in supine lying then set up pemf unit over wooden bed and pre check the pemf unit with vibrating field checker whether unit is finely working or not then ask the patient to place the foot over pemf unit and set the parameters and explained the patient to not to move and do not touch any metal and ask patient for any discomfort and wait for treatment time over that is 20 minutes.

## ANKLE REHABILITATION-

In Ankle active range of motion exercisessubject is positioned supine lying and ask the patient to move ankle in planterflexion , dorsiflexion , inversion , eversion 20 repetition and than hold for 10 seconds each and progress repetition and sets accordingly.

In Ankle planterflexion/dorsiflexion exerciser Subject position in high sitting position and ask the subject to place ankle over ankle exerciser and do planterflexion to push down than dorsiflex the ankle to push up do same with required repetition maximum without any discomfort and painfree range progress progress repetition and sets accordingly.

In Ankle inversion/eversion exerciser Subject position in high sitting position and ask the subject to place ankle over ankle exerciser and evert the foot to push inner border foot line outside than invert the foot to push outer border of foot line inside do same with required repetition maximum withoutany discomfort and painfree range progress repetition and sets accordingly.

In Ankle manual resistive dorsiflexion with inversion – subject is positioned supine lying where manual resistance is applied over ankle againt dorsiflexion and inversion repetition maximum take withoutany discomfort and painfree range progress repetition and sets accordingly

In Ankle manual resisted planterflexion with eversionsubject is positioned supine lying where manual resistance is applied over ankle againt platerflexion and eversion repetition maximum take withoutany discomfort and painfree range progress repetition and sets accordingly

In Heel raisesubject is positioned standing over stairs with half foot outside the stairs boorder posteriorly in this position subject riase their heels at maximum effort than slowly lower down at stedy position repetition maximum take withoutany discomfort and painfree range progress repetition and sets accordingly

In Active Calf stretchingsubject is positioned standing over slant board with comfortable dorsiflexion and feel the stretch at calf area posteriorly and hold for 10 seconds than step back to initial position and repeat repetition maximum take without any discomfort and painfree range progress repetition and sets accordingly

In SEBT trainingstar excurtion balance test also used as exercise tool subject is positioned standing over centre of star figure with one leg stance with affected leg and ask subject to reach maximum with pointing toe at multidirectional levels and balance and focus over ankle repetition maximum take without any discomfort and painfree range progress repetition and sets accordingly.

In Resisted inversionsubject is positioned supine lying and banded the ankle with resistance band and ask subject to invert the foot against band with maximum pull at pain free range progress repetition and sets accordingly.

In Resisted eversionsubject is positioned supine lying and banded the ankle with resistance band and ask subject to evert the foot against band with maximum pull at pain free range progress repetition and sets

accordingly.

In Resisted dorsiflexion subject is positioned supine lying and banded the ankle with resistance band and ask subject to dorsiflex the foot against band with maximum pull up at pain free range progress repetition and sets accordingly. In Resisted planterflexion subject is positioned supine lying and banded the ankle with resistance band and ask subject to planterflex the foot against band with maximum pull down at pain free range progress repetition and sets accordingly.

In Single leg stance balancesubject is positioned standing with affected single leg over ground and flex the contralateral knee and try to balnce over single leg progress repetition and sets accordingly.

In Balance board training subject is positioned standing over balance board on ready to go position placed one leg at right corner and another leg on left corner at diagonal pattern and ask subject to planterflex and dorsiflex the foot with balance.

In perturbation trainingsubject is positioned standing with one leg stance and therapist pertuburate the subject multiple times at multidiectional level and ask patient to balance over stance leg repetition maximum take withoutany discomfort and painfree range progress repetition and sets accordingly

In Single leg vobel booard balance trainingsubject is positioned standing with one leg stance over vobble board and subject is balance stance leg subject is also take support initially for balance repetition maximum take withoutany discomfort and painfree range progress repetition and sets accordingly

In Gait traningsubject is positioned over treadmill and ask patient to walk and run according to gradually progressive speed and focus on gait pattern while training repetition maximum take withoutany discomfort and painfree range progress repetition and sets accordingly

### **Outcomes measures of Chronic Ankle Instability**

The combination of the SEBT as a predictor of dynamic balance in combination with the Cumberland ankle instabiity measure as a patient self reported outcome can predict the likelihood of CAI.The [Star Excursion Balance Test](#) (SEBT) (particularly the posteromedial reach) has very valuable predictive capacity for chronic ankle instability .

### **Outcome Measures**

- Subjective tool - Cumberland ankle istability Score(CAIS)
- Objective tool - Star excursion balance test (SEBT)

### **Variables**

- IndependentVariable–ankle rehabilitation exercises, PEMF/HVMC/FIR .
- DependentVariable–cumberland ankle instability test (CAIT),star excurtion balance test (SEBT)

### **DATA ANALYSIS AND RESULTS.**

In the present study, for data analysis SPSS v25 was used. Both the groupshad 20 subjects each and all the subject were assessed pre and post treatment byCumberland ankle instability test (CAI)forankle mechanical disabilityandstar excurtion balance test for ankle functional movements,proprioception and balance . As the no. of sample in one group was 20 (<100),thereforeShapiro-Wilk test was used in the study.

Age and Gender distribution comparison for Group A and B was doneusingdescriptivestatistics.To determine the significance of data of Group A and B normality test was donewhich showed non-



significant value i.e. less than 0.05. Therefore, in the present study both Group A and Group B were analyzed using parametric test. To compare the mean values within the groups Paired t-test was used while to compare the mean values between the groups i.e. Group A and Group B independent t-test was used.

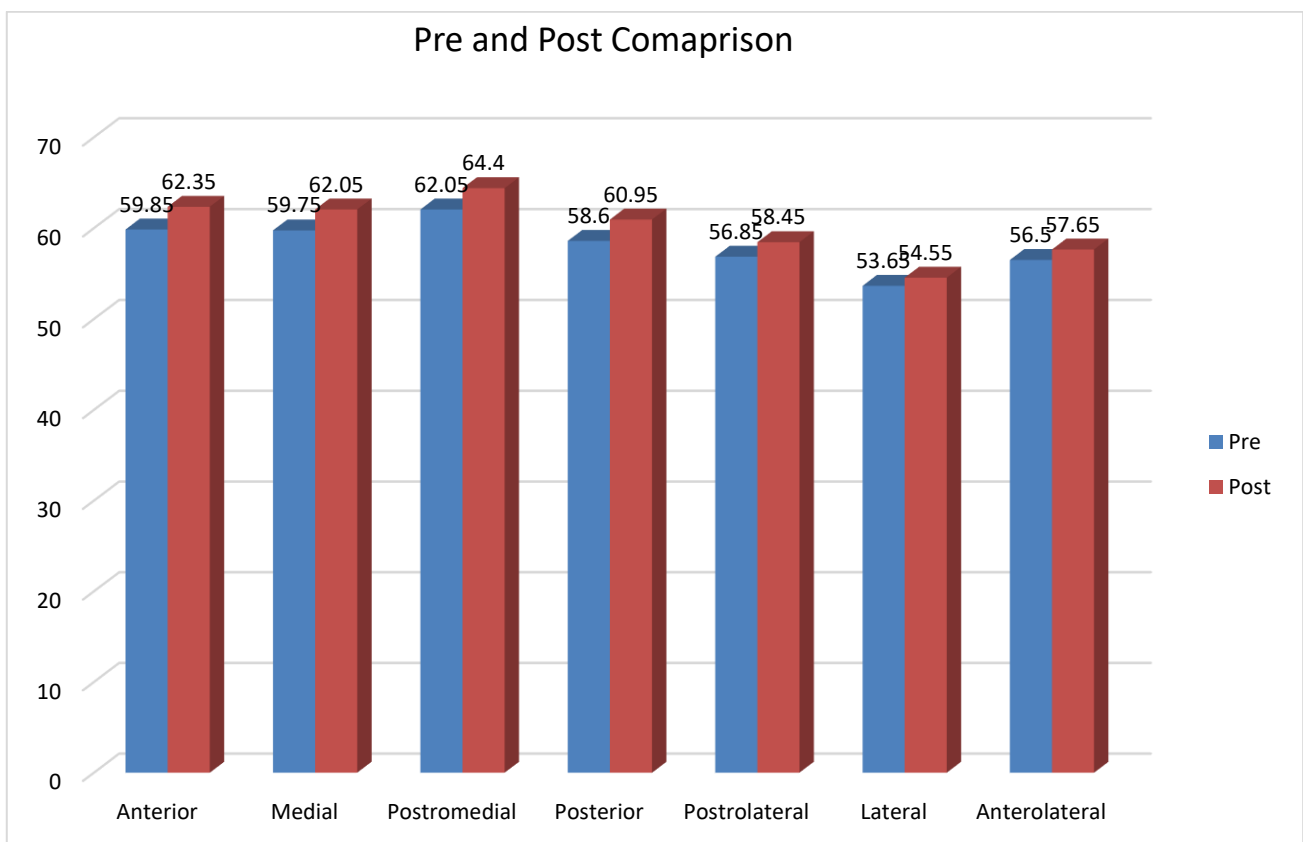
**TABLE 1. Comparison of Mean values of Pre & Post data of Cumberland ankle instability questionnaire & star excursion balance test in Group A using paired t-test.**

Variables		N	Mean	Std. Deviation	t value	P value	Significance
CAIT	Pre	20	69.35	5.39	13.31	.000	S
	Post	20	75.60	5.20			
Anterior	Pre Anterior	20	59.85	4.682	8.238	.000	S
	Post Anterior	20	62.35	5.029			
Medial	Pre Medial	20	59.75	4.700	3.899	.001	S
	Post Medial	20	62.05	4.893			
Postromedial	Pre Postromedial	20	62.05	5.835	6.443	.000	S
	Postromedial	20	64.40	5.698			
Posterior	Post Posterior	20	58.60	8.488	5.533	.000	S
	Posterior	20	60.95	8.935			
Postrolateral	Pre Postrolateral	20	56.85	8.299	3.816	.001	S
	Post Postrolateral	20	58.45	9.116			
Lateral	Pre Lateral	20	53.65	12.546	2.131	.046	S
	Post Lateral	20	54.55	12.841			
Anterolateral	Pre Anterolateral	20	56.50	7.564	3.286	.004	S
	Post Anterolateral	20	57.65	7.372			

The above table shows, baseline ankle functional and mechanical instability of subjects in Group A was  $69.35 \pm 5.39$  on CAIT. The ankle functional and mechanical instability of subjects following 4 week treatment session was  $75.60 \pm 5.20$  on CAIT. The base line anterior reach of Subject was  $59.85 \pm 4.682$  on SEBT. The anterior reach of subject following 4 weeks treatment session was  $62.35 \pm 5.029$  on SEBT. The base line medial reach of Subject was  $59.75 \pm 4.700$  on SEBT. The medial reach of subject following 4 week treatment session was  $62.05 \pm 4.893$  on SEBT. The base line postromedial reach of Subject was  $62.05 \pm 5.835$  on SEBT. The postromedial reach of subject following 4 week treatment session was  $64.40 \pm 5.698$  on SEBT. The base line posterior reach of Subject was  $58.60 \pm 8.488$  on SEBT. The posterior reach of subject following 4 week treatment session was  $60.95 \pm 8.935$  on SEBT..

The base line postrolateral reach of Subject was  $56.85 \pm 8.299$  on SEBT. The postrolateral reach of subject following 4 week treatment session was  $58.45 \pm 9.166$  on SEBT. The base line lateral reach of Subject was  $53.65 \pm 12.546$  on SEBT. The lateral reach of subject following 4 week treatment session was  $54.55 \pm 12.841$  on SEBT. The base line anterolateral reach of Subject was  $56.50 \pm 7.564$  on SEBT. The anterolateral reach of subject following 4 week treatment session was  $57.65 \pm 7.372$  on SEBT.

For analysis Paired t-test was applied and statistically significant difference was found in **CAIT and SEBT (anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral)** Post treatment as compared to baseline i.e. p-value for **CAIT and SEBT (anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral)** is 0.00



**Graph 1 - Graph showing the mean change of CAIT and SEBT (anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral) in group A**

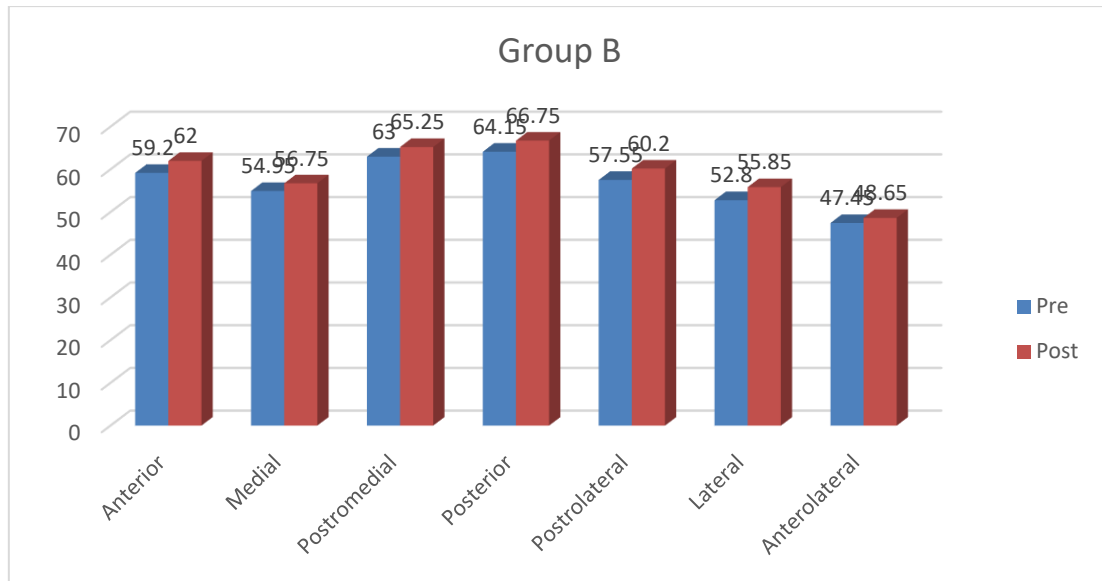
**TABLE 2. Comparison of Mean value Cumberland ankle instability questionnaire & star excursion balance test in Group B using Paired t-test**

		N	Mean	Std. Deviation	t	P value	Significance
CAIT	Pre	20	68.90	5.39	10.34	.000	S
	Post	20	77.15	5.20			
Anterior	Pre Anterior	20	59.20	5.755	9.772	.000	S
	Post Anterior	20	62.00	5.813			

Anterolateral	Pre Anterolateral	20	54.95	5.346	6.282	.000	S
	Post Anterolateral	20	56.75	5.711			
Medial	Pre Medial	20	63.00	6.000	5.039	.000	S
	Post Medial	20	65.25	6.781			
Postromedial	Pre Postromedial	20	64.15	7.429	5.940	.000	S
	Post Postromedial	20	66.75	6.927			
Posterior	Pre Posterior	20	57.55	5.000	4.958	.000	S
	Post Posterior	20	60.20	4.969			
Postrolateral	Pre Postrolateral	20	52.80	6.502	7.879	.000	S
	Post Postrolateral	20	55.85	6.953			
Lateral	Pre Lateral	20	47.45	5.491	.555	.585	NS
	Post Lateral	20	48.65	11.231			

The above table shows, baseline ankle functional and mechanical instability of subjects in Group A was  $68.90 \pm 5.39$  on CAIT. The ankle functional and mechanical instability of subjects following 4 week treatment session was  $77.15 \pm 5.20$  on CAIT. The base line anterior reach of Subject was  $59.20 \pm 5.755$  on SEBT. The anterior reach of subject following 4 weeks treatment session was  $62.00 \pm 5.813$  on SEBT. The base line medial reach of Subject was  $63.00 \pm 6.000$  on SEBT. The medial reach of subject following 4 week treatment session was  $65.25 \pm 6.781$  on SEBT. The base line postromedial reach of Subject was  $64.15 \pm 7.492$  on SEBT. The postromedial reach of subject following 4 week treatment session was  $66.75 \pm 6.927$  on SEBT. The base line posterior reach of Subject was  $57.55 \pm 5.000$  on SEBT. The posterior reach of subject following 4 week treatment session was  $66.20 \pm 4.969$  on SEBT. The base line postrolateral reach of Subject was  $52.80 \pm 6.502$  on SEBT. The postrolateral reach of subject following 4 week treatment session was  $55.85 \pm 6.953$  on SEBT. The base line lateral reach of Subject was  $47.45 \pm 5.491$  on SEBT. The lateral reach of subject following 4 week treatment session was  $48.65 \pm 11.231$  on SEBT. The base line anterolateral reach of Subject was  $54.95 \pm 5.346$  on SEBT. The anterolateral reach of subject following 4 week treatment session was  $56.75 \pm 5.711$  on SEBT.

For analysis Paired t-test was applied and statistically significant difference was found in **CAIT and SEBT (anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral)** Post treatment as compared to baseline i.e. p-value for **CAIT and SEBT (anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral)** is 0.00



**Graph 2 - Graph showing the mean change of CAIT and SEBT (anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral) in group B.**

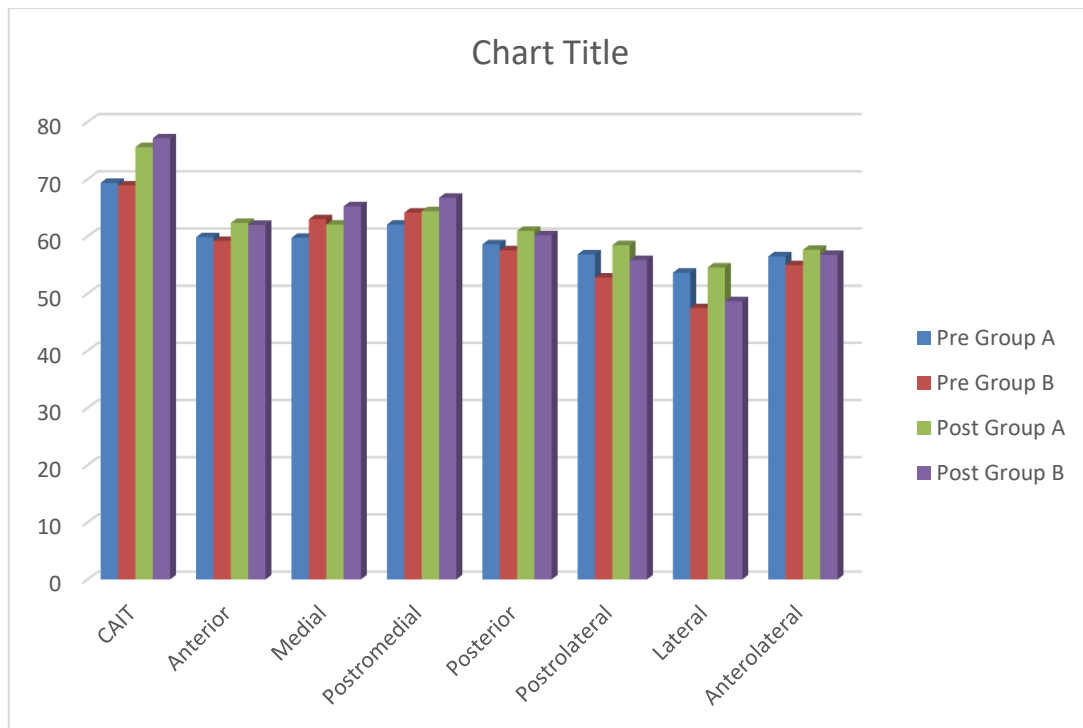
**TABLE 3. Comparison of Mean values of Pre-Pre & Post-Post data of Cumberland ankle instability questionnaire & star excursion balance test of Group A & Group B using Independent t-test**

		N	Mean	Std. Deviation	t test value	P value
Pre CAIT	Group A	20	69.35	5.39	.275	.297
Pre CAIT	Group B	20	68.90	4.64		
Post CAIT	Group A	20	75.60	5.20	.920	.703
Post CAIT	Group B	20	77.15	5.45		
Pre Anterior	Group A	20	59.85	4.682	.392	.697
	Group B	20	59.20	5.755		
Post Anterior	Group A	20	62.35	5.029	.204	.840
	Group B	20	62.00	5.813		
Pre Medial	Group A	20	59.75	4.700	-1.907	.064
	Group B	20	63.00	6.000		
post Medial	Group A	20	62.05	4.893	-1.711	.095
	Group B	20	65.25	6.781		
Pre Postromedial	Group A	20	62.05	5.835	-.994	.326
	Group B	20	64.15	7.429		
Post postromedial	Group A	20	64.40	5.698	-1.172	.249
	Group B	20	66.75	6.927		
Pre Posterior	Group A	20	58.60	8.488	.477	.636
	Group B	20	57.55	5.000		
Post posterior	Group A	20	60.95	8.935	.328	.745
	Group B	20	60.20	4.969		
Pre Postrolateral	Group A	20	56.85	8.299	1.718	.094

	Group B	20	52.80	6.502		
Post postrolateral	Group A	20	58.45	9.116	1.014	.317
	Group B	20	55.85	6.953		
Pre Lateral	Group A	20	53.65	12.546	2.025	.050
	Group B	20	47.45	5.491		
Post lateral	Group A	20	54.55	12.841	1.547	.130
	Group B	20	48.65	11.231		
Pre Anterolateral	Group A	20	56.50	7.564	.748	.459
	Group B	20	54.95	5.346		
Post anterolateral	Group A	20	57.65	7.372	.432	.668
	Group B	20	56.75	5.711		

The above table compare, baseline ankle functional and mechanical instability of subjects in Group A and B of subjects i.e.  $69.35 \pm 5.39$  and  $68.90 \pm 4.64$  respectively on CAIT. While following 4 week treatment session the ankle functional and mechanical instability of subjects of Group A and B was  $75.60 \pm 5.20$  and  $77.15 \pm 5.45$ . The comparison of baseline anterior reach showed that the subjects in Group A and B had  $59.85 \pm 4.682$  and  $59.20 \pm 5.755$ . While following 4 week treatment session anterior reach was  $62.35 \pm 5.029$  and  $62.00 \pm 5.813$ . The comparison of baseline medial reach showed that the subjects in Group A and B had  $59.75 \pm 4.700$  and  $63.00 \pm 6.000$ . While following 4 week treatment session medial reach was  $62.05 \pm 4.893$  and  $62.25 \pm 6.781$ . The comparison of baseline postromedial reach showed that the subjects in Group A and B had  $62.05 \pm 5.835$  and  $64.15 \pm 7.429$ . While following 4 week treatment session postromedial reach was  $64.40 \pm 5.698$  and  $66.75 \pm 6.927$ . The comparison of baseline posterior reach showed that the subjects in Group A and B had  $58.60 \pm 8.488$  and  $57.55 \pm 5.000$ . While following 4 week treatment session posterior reach was  $60.95 \pm 8.935$  and  $60.20 \pm 4.699$ . The comparison of baseline postrolateral reach showed that the subjects in Group A and B had  $56.85 \pm 8.299$  and  $52.80 \pm 6.502$ . While following 4 week treatment session postrolateral reach was  $58.45 \pm 9.116$  and  $55.85 \pm 6.953$ . The comparison of baseline lateral reach showed that the subjects in Group A and B had  $53.65 \pm 12.546$  and  $47.45 \pm 5.491$ . While following 4 week treatment session lateral reach was  $54.55 \pm 12.841$  and  $48.65 \pm 11.231$ . The comparison of baseline anterolateral reach showed that the subjects in Group A and B had  $56.50 \pm 7.564$  and  $54.95 \pm 5.346$ . While following 4 week treatment session anterolateral reach was  $57.65 \pm 7.372$  and  $56.75 \pm 5.711$ .

For between group comparison Independent t-test was used which showed insignificant difference in ankle functional and mechanical instability and reach balance and proprioception post treatment as compared to baseline i.e. p-value is 0.001. Also when post-test mean comparison was done of group A and B showed no difference.



**Graph3 :GraphShowingComparisonofmeanvaluesofPre-PreandPost-Postdata of CAIT and SEBT ( anterior, medial, postromedial, posterior, postrolateral, lateral, anterolateral) inGroupA and GroupB.**

## DISCUSSION-

In the present, total 40 patients of age 18-49 years that that were diagnosed withchronic ankle instability are included. These 40 patients were selected after pre-screeningdone usingCAIT for ankle functional and mechanical instability and SEBT for ankle balance and reach and they were randomly assigned into two groups i.e. Group A and B; where Group Aunderwent ankle rehabilitation exercisesand Group B underwent ankle rehabilitation along with PEMF/HVMC/FIR electrotherapy unit to improve flexibility , proprioception ,balance, and overall strength of the CAI patients.

After completing 4 weeks protocol, when mean values of post treatment data werecompared of both the group using Independent t test , it revealed non significant resultthat means both the groups had similar improvement in terms of ankle functional and mechanical stability.

## CONCLUSION

The present study concludes that application of ankle rehabilitation exercises with PEMF/HVMC/FIR is equally effective in improving ankle functional and mechanical instability. The study shows non significant result and thus weaccept thenull hypothesis.

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