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Effects of Ultrasound Therapy Ultrasound Therapy with Taping PNF Training and PNF Training with Taping in Treatment and Rehabilitation of Sports Injuries of Inversion Ankle Sprain

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Abstract

Ankle sprains are a very common injury (making up 15%–20% of all sports injuries),The aim of this study was to find out effects of Ultrasound therapy, Ultrasound therapy with Taping, PNF training, PNF training with Taping in treatment and rehabilitation of Inversion ankle sprain injury in improving Range of Motion at Ankle Joint. 50 subjects suffering from high ankle sprain were randomly selected and divided into five groups consisting of 10 in each. Group I underwent ultrasound therapy (UT), Group II underwent ultrasound therapy with taping (UT&T), Group III underwent PNF training (PNF), Group IV underwent PNF training with taping (PNFT&T) and Group V was considered as control group which was managed with RICE protocol and did not receive any specialized treatment. The range of motion of ankle was measured through Goniometry and scores recorded in degrees. The experimental treatments were given to the subjects as per description and supervision of the experienced physiotherapist for fifteen days continuously. All the subjects were tested prior to treatment and after completion of fifteen days of treatment on selected dependent variable, range of motion. The results indicated that the adjusted mean on inversion injury Range of Motion on UT group was 36.59, UT & T group was 36.05, PNFT was 31.32 PNFT&T was 41.32 and control group was 15.22. The obtained F ratio of 1.17 on pre test means of the groups was not significant at 0.05 level. F ratio of 31.06 on post test means of the groups was significant at 0.05 level. F value on adjusted means 31.52 was significant at 0.05 level. The post hoc analysis of obtained ordered adjusted means proved that the following paired mean differences were greater than required confidence interval of 8.1. The treatments UT, UT & T, PNFT and PNFT&T treatments were significantly better than control group in improving range of motion of high ankle sprain injured subjects. Comparing the treatments, it was found that PNFT & T was significantly better than PNFT. And other comparisons were found to be not significant. It was concluded that combining Ultrasound with Taping, PNF training with Taping were found to be more beneficial to the ankle ligament injured treatment and rehabilitation. The combined effect of UT, PNF training and Taping may be explored by future researchers.

Keywords: Ultrasound therapy, PNF Training, Taping, Inversion Ankle Sprain, Range of Motion.

Introduction

Approximately 14% of all Sport Injuries are sprains to the ankle, representing one ankle injury each season for every 17 participants. In high risk sports, such as jumping and running this percentage is even higher, at 25% of all lost time injuries. Ankle Sprain has been shown to be 24 times more common in the dominant leg, and to have a high (73.5%) prevalence of recurrence. (Churchill RS, Donley BG, (1998) Ligamentous injuries around the ankle joint are among the most common sporting injuries especially in jumping sports (e.g., basketball, volleyball). They are not always well managed. Associated injuries are frequently not diagnosed and the rehabilitation of ligamentous injuries is often inadequate leading to a high rate of recurrence (Khan, K., & Bruker, P. 1998) . The Physiotherapist identifies the problems of the joints, muscles, ligaments and does the management with the manual adjustments of joints, muscles and ligaments specifically. The managements are done also with taping techniques, ultrasound therapy, Transcutaneous Electrical nerve stimulation, PNF training, Theraband /tube trainings, shoe modifications and core stability trainings as per the requirement of the sports person. Early management includes RICE (rest, ice, compression and elevation). Cryotherapy should be used immediately after the injury (Knight KL 1995). Heat should not be applied to an acutely injured ankle joint because it encourages swelling and inflammation through hyperemia.

The two types of therapeutic ultrasound effects are: thermal and non thermal effects. Thermal effects are due to the absorption of the sound waves. Non thermal effects are from cavitation, microstreaming and acoustic

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streaming (Steven Mo et al 2012) . Cavitational effects result from the vibration of the tissue causing microscopic bubbles to form, which transmit the vibrations in a way that directly stimulates cell membranes. This physical stimulation appears to enhance the cell-repair effects of the inflammatory response (Wilkin, H. D., et al. 2004) . Effectiveness of therapeutic ultrasound for pain, musculoskeletal injuries, and soft tissue lesions remains questionable. Study has proven that Ultrasound helps in enhancing the metabolic activities of cells. Thus, ultrasound treatment helps in tissue repair, especially in soft tissue injuries (Kerry G Baker, et al.2001) .

The literature regarding PNF training has made the technique, the optimal stretching method when the aim is to increase range of motion, especially in short-term changes. Generally an active PNF stretch involves a shortening contraction of the opposing muscle to place the target muscle on stretch. This is followed by an isometric contraction of the target muscle. PNF can be used to supplement daily stretching and is employed to make quick gains in range of motion to help athletes improve performance (Westwater-Wood S et al.2010) . Aside from being safe and time efficient, the dramatic gains in range of motion seen in a short period of time may also promote compliance with the exercise and rehabilitation program (Kisner et al.2012) . PNF stretching was originally developed as a form of rehabilitation, and to that effect it is very effective. It is also excellent for targeting specific muscle groups, and as well as increasing flexibility, it also improves muscular strength. Pain reduction is essential, but improvement of any loss of motion, strength, and/or proprioception is equally important (DeLee Jc et al. 1994, Singer KM et al 1995 ,Windsor RE.1994) .

Tape is often applied to manage symptoms of chronic injuries such as medial tibial stress syndrome (or shin splints), patella-femoral syndrome, and turf-toe (McConnell J 2000 , Specchiulli F et al.2001 , Ugalde V et al.2001). Athletic tape can be applied to ease pain symptoms as well. Taping along the nerve tract of irritated or inflamed tissue can shorten the inflamed region and reduce pain (Heidt RS et al.1996 , McConnell J 2002). Ankle taping can increase ankle stability by at least 2 mechanisms: limitation of motion and proprioception (Lephart SM et al. 1998) .For a single treatment, ankle taping is less expensive than either a brace or an athletic shoe. Initially, the effectiveness of ankle taping is similar to bracing (Quinn K, Parker P et al.2000 , Arnold BL et al.2004) However, studies have demonstrated a significant loss of effectiveness after 24 minutes of activity (Lohrer H et al.1999) ; moreover, ankle taping becomes virtually ineffective after periods as short as 40 minutes(Manfroy PP et al.1997) .

Thus, there is different physiotherapy methods are being used to treat the ankle ligament injuries of the players. They are ultrasound therapy, cryotherapy, massage, proprioceptive neuromuscular facilitation (PNF) training, taping, electrotherapy such as short wave diathermy, transcutaneous electrical stimulation (TENS), etc. To felicitate for speedy recovery from the injury, it is much essential to select the right treatment. In this research the researcher is interested to find out effects of ultrasound therapy, ultrasound therapy with taping, PNF training, PNF training with taping in treatment and rehabilitation of ligament injuries in ankle. Even though there are different ankle injuries, the investigator selected high ankle sprain for this study. To test the effect of these different treatments on the injured players, the researcher selected range of motion.

Methodology

The experimental design used in this study was random group design. Of the total population with ligament injuries of ankle 50 suffering from high ankle sprain were randomly selected. The selected subjects 50 injured were further randomly divided into five groups consisting of 10 in each. Group I underwent ultrasound therapy (UT), Group II underwent ultrasound therapy with taping (UT&T), Group III underwent PNF training (PNF), Group IV underwent PNF training with taping (PNFT&T) and Group V was considered as control group which was managed with RICE protocol and did not receive any specialized treatment. The range of motion of ankle was measured through Goniometry and scores recorded in degrees. The experimental treatments were given to the subjects as per description and supervision of the experienced physiotherapist and medical doctor, for fifteen days continuously. All the subjects were tested prior to treatment and after completion of fifteen days of treatment on selected dependent variable, range of motion. The differences between initial and final means of range of motion were considered as the effect of selected treatment on selected injury. To find out the significance of the difference among the five different treatments on a particular dependent variable, Analysis of Covariance (ANCOVA) was used. In all the cases 0.05 level was fixed to test the hypothesis.

Results

The statistical analysis comparing the initial and final means of HAS Iy Range of Motion due to ultrasound therapy (UT), ultrasound therapy with taping (UT&T), PNF training (PNFT), PNF training with taping (PNFT&T) and control group (CG) of ligament injured is presented in Table I.

Table I. Computation of analysis of covariance due to ultrasound therapy, ultrasound therapy with taping, pnf training, pnf training with taping on inversion injury range of motion

	SOV	Sum of Squares	df	Mean Squares	Obtained F
Pre Test Mean	B	30.2	4	7.55	1.17
	W	289.8	45	6.44	
Post Test Mean	B	4258.2	4	1064.55	31.06*
	W	1542.3	45	34.27	
Adjusted Post Test Mean	B	4011.14	4	1002.78	31.52*
	W	1399.96	44	31.82	

* Significant at 0.05 level of confidence
SOV: Source of Variance; B: Between W: Within Required $F_{(0.05),\,(df\ 4,45)} = 2.58$

Since significant improvements were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table II.

Table II. Multiple comparisons between ultrasound therapy, ultrasound therapy with taping, pnf training, pnf training with taping and control groups and scheffe's post hoc analysis on inversion injury range of motion

UT Group	UT & T Group	PNFT Group	PNFT & T Group	Control Group	Mean Diff	C.I
36.59	36.05				0.54	8.1
36.59		31.32			5.27	8.1
36.59			41.32		4.73	8.1
36.59				15.22	21.37*	8.1
	36.05	31.32			4.73	8.1
	36.05		41.32		5.27	8.1
	36.05			15.22	20.83*	8.1
		31.32	41.32		10.00*	8.1
		31.32		15.22	16.1*	8.1
			41.32	15.22	26.1*	8.1

***** Significant at 0.05 level.

Discussions

The results proved that the pre test mean on inversion injury Range of Motion of UT group was 10.1 with standard deviation ± 1.73 pre test mean of UT&T group was 10.9 with standard deviation ± 1.79, the pre test mean of PNTS was 12 with standard deviation ± 2.94, the pre test mean of PNFT&T was 12 with standard deviation ± 2.94 the pre test mean of control group was 12 with standard deviation ± 2.94. The post test mean on inversion injury Range of Motion of UT group was 37.5 with standard deviation ± 6.95 post test mean of UT & T group was 36.4 with standard deviation ± 5.52, the post test mean of PNFS group was 30.9 with standard deviation ± 5.52, the post test mean of PNFS & T group was 40.9 with standard deviation ± 8.06 and control group was 14.8 with standard deviation ± 2.66.The adjusted post test means were determined and analysis of covariance was done. The adjusted mean on inversion injury Range of Motion on UT group was 36.59, UT & T group was 36.05, PNFS was 31.32 PNFS&T was 41.32 and control group was 15.22.The obtained F ratio of 1.17 on pre test means of the groups was not significant at 0.05 level. F ratio of 31.06 on post test means of the groups was significant at 0.05 level. F value on adjusted

means 31.52 was significant at 0.05 level.

The post hoc analysis of obtained ordered adjusted means proved that the following paired mean differences were greater than required confidence interval of 8.1. The treatments UT, UT & T, PNFT and PNFT&T treatments were significantly better than control group in improving range of motion of inversion ankle sprain injured subjects. Comparing the treatments, it was found that PNFT & T was significantly better than PNFT. And other comparisons were found to be no significant.

The findings of this study are in agreement with the findings of Steven Mo et al 2012 who found therapeutic ultrasound effects are due to the absorption of the sound waves and Wilkin, H. D., et al. 2004 who found cavitational effects result from the vibration of the tissue causing microscopic bubbles to form, which transmit the vibrations in a way that directly stimulates cell membranes. This physical stimulation appears to enhance the cell-repair effects of the inflammatory response. Kerry G Baker et al.2001 found effectiveness of therapeutic ultrasound for pain, musculoskeletal injuries, and soft tissue lesions remains questionable. Study has proven that Ultrasound helps in enhancing the metabolic activities of cells. Thus, ultrasound treatment helps in tissue repair, especially in soft tissue injuries which resulted in improved range of motion as found in this study compared to control group..

Westwater-Wood S et al.2010 reported that PNF can be used to supplement daily stretching and is employed to make quick gains in range of motion to help athletes improve performance Kisner et al.2012 found aside from being safe and time efficient, the dramatic gains in range of motion seen in a short period of time may also promote compliance with the exercise and rehabilitation program. de Vries JS et al. 2011 reported based on a meta-analysis found that neuromuscular rehabilitation results in more rapid improvements in function. And the findings of this study are in agreement with these findings.

McConnell J (2002) found athletic tape can be applied to ease pain symptoms as well. Lephart SM et al. (1998) found ankle taping can increase ankle stability by at least 2 mechanisms: limitation of motion and proprioception. And the findings of this study proved range of motion has been increased significantly compared to control group while applying taping with ultrasound therapy and PNF training.

Conclusions

It was concluded that combining Ultrasound Therapy with Taping, PNF training with Taping were found to be more beneficial to the sports injuries of Inversion ankle injury treatment and rehabilitation. The combined effect of UT, PNF training and Taping may be explored by future researchers.

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