International
Journal of Medical and Exercise Science
(Multidisciplinary, Peer Reviewed and Indexed Journal)

ORIGINAL ARTICLE

EFFECTIVENESS OF TECHNICAL TRAINING Vs. PROPRIOCEPTIVE TRAINING TO PREVENT RECURRENCE OF ANKLE SPRAINS IN VOLLEYBALL PLAYERS- A COMPARATIVE STUDY	Search engine: www.ijmaes.org

Dr. Vivek Kumar Arora[1] and Dr.Jibi Paul[2]

Author: [1]Consultant Physiotherapist, Bharat Aluminum Company Limited Hospital, Korba, Chhattisgarh, India. Mail Id: vvkarora@gmail.com

Corresponding Author: [2]Associate professor, Department of physiotherapy, School of Health Sciences, KPJ Healthcare University College, Nilai, Negeri Sembilan, Malaysia, Mail id: jibipaul@rediffmail.com

Abstract

Background and objectives: *Ankle Sprain is one of the major cause of disability in professional volleyball players, which affects on their performance to a great extent, and a history of ankle sprain make the players more susceptible to recurrence of ankle sprain. Objectives of this study was to find out the effectiveness and to compare the effectiveness of the proprioceptive training and technical training immediately after the end of the treatment and after three months in prevention of recurrence of ankle sprain among volleyballers.* ***Methods:*** *30 subjects with previous history of grade I or grade II ankle sprain, within one year were selected for the study. They were divided into two groups equally,15 in each group A and group B. Group A received five minutes of warm-up, 20 minutes of unilateral balance board training . Group B received five minutes of warm-up, 20 minutes of unilateral vertical jumps.* ***Results:*** *Pre and post data were analyzed using Mann-Whitney test, Wilcoxon's sign rank test, paired 't' test. Intra group analysis showed that both groups have shown significant improvement after treatment. In, inter group analysis, the post scores of both groups were compare to find out the effectiveness of one training over other, there was no remarkable difference between the proprioceptive training and technical training.* ***Conclusion:*** *The study concluded that proprioceptive and technical training can be an effective treatment to prevent recurrence of ankle sprain in subjects with previous history of grade I or grade II ankle sprain.*

Keywords: *Ankle Sprain, Single Leg Balance test, Balance Board, Vertical Jumps, Visual Analogue Scale.*

INTRODUCTION

Ankle joint is one of the most stable joint of the human body. Its articulations are designed in such a way that it can transmit the whole body weight, besides providing adequate mobility. The ankle joint is made up of 3 articulations: The talocrural joint, the subtalar joint, and the distal tibiofibular syndesmosis. These 3 joints work together to allow coordinated movement of the rear foot[1].

Based on the severity sprains can be classified in to three: A mild sprain is a Grade 1. A moderate sprain is a Grade 2. A severe strain is a Grade 3. Grade 1 sprain is slight stretching and some damage to the fibres (fibrils) of the ligament. Grade 2 sprain is partial tear of the ligament. If the ankle joint is examined and moved in certain ways, abnormal looseness (laxity) of the ankle joint occurs. Grade 3 sprain is complete tear of the ligament. If sprain is present, then the joint is pulled or pushed during examination of ankle motion, gross instability occurs.

Stability of the ankle joint depends mainly on the three factors; they are congruity of the articular surfaces when the joints are loaded, static ligamentous restraints and the musculotendinous units, which allow for dynamic stabilization of the joints. Ligaments provide a continuous static force, which holds the joints in position and provide stability[2].

In the last 15 years volleyball has become popular all over the world. Competitions such as the world championship, the world league and the Olympic Games demand several exhaustive matches played very close to one another. It requires high level of repetitive performance by the players, which put great load over the joints and make them more susceptible for the injury. Because of this, players required to improve the quality and intensity of their physical and technical training significantly[2].

Volleyball is one of the most popular sports, in the world. Volleyball is becoming a more competitive sport every year. It produces sport specific muscle imbalances and ligament injury that, if not addressed, can lead to decreased performance and eventually injury. Epidemiological research has revealed that volleyball athletes are, in general, at greatest risk of acute ankle sprain. The ankle (54%) is the most commonly injured region. This indicates that a better injury prevention program should be developed for ankle sprain in volleyball[3,4].

Proprioceptive deficits have been identified in ankle sprain, and proprioception could play vital role in prevention of injury as well as in reducing symptoms of pathology. Acute ankle sprains are followed by immobilization, which leads to weakness of muscles, makes the subject more susceptible for the recurrence of ankle sprain. Technical training has proved its effects in preventing the reoccurrence of ankle sprain [5, 6].

Objeives of the study:

To find out the efficacy of proprioceptive training to prevent the recurrence of ankle sprain on professional volleyball players.

To find out the efficacy of technical training to prevent the recurrence of ankle sprain on professional volleyball players.

To follow up the individual efficacy of proprioceptive training and technical training on prevention of recurrence of ankle sprain on professional volleyball players after three months.

To compare the effectiveness of proprioceptive training and technical training

on the prevention of recurrence of ankle sprain on professional volleyball players after three months.

Hypothesis

Alternate hypothesis: Technical training or proprioceptive training may have a statistically significant effect in reducing the number of recurrence of ankle sprain with subjects having previous history of ankle sprain.

METHODOLOGY

Methodology is the most important part of any research study. Methodology of this study include the research approach, the setting, and population sampling technique, selection of tool, intervention, procedure, data collection and plan for analysis.

Research Approach: Research approach for this study was considered experimental comparative approach. Experimental approach is characterized by much greater control over the research environment. It is a quantitative approach that involves the generation of data in quantitative form that can be subjected to rigorous quantitative analysis in a formal and rigid fashion.

Population: A population is defined as the group of people to whom the research results are generalized. The subjects of volleyballers who full filled the selection criteria were the population of this study.

Research design: Comparative experimental design with pre, post and 3 month follow up test for both technical training and proprioceptive training.

Study Setting: The study setting was volleyball court of the district volleyball association, Korba, Chhattisgarh.

Inclusion Criteria:

•Male subjects who are professional volleyball players.

•Subjects with age group between 18 years to 30 years.

•Subjects with previous history of grade 1 or grade 2 ankle sprain within a period of one year.

Exclusion Criteria:

• All female subjects of any age.

•Subjects who are not professional volleyball players.

•Subjects below the age of 18 and above the age of 30.

•Subjects without previous history of ankle sprain.

•Subjects with history of ankle sprain within last three months.

•Subjects who have any other pathology or weakness in lower limbs or spine.

•Subjects who had recent fracture in any part of body.

Sample: Sample size was 30 and the samples who had at least one or more ankle sprain with in a year were selected for the study from the district volleyball association, Korba, Chattisgarh.

Sampling: Sampling method chosen for this study was simple random sampling by lottery method. Those subjects who full filled the inclusion criteria were equally divided to technical training and proprioceptive training group. Here 30 subjects were selected and 15 subjects were equally allotted randomly to technical training, proprioceptive training.

Data collection: Total 30 subjects with previous history of grade 1 or grade 2 ankle sprains were selected from district volleyball

association. These subjects were with age group between 18 and 30 years. They were selected by simple random sampling method and were divided into technical training and proprioceptive training group with 15 subjects in each group.

The data were collected before and immediately after the treatment and again after 3 months for both the groups. The pre score was obtained before the intervention applied to both the groups. The post score was obtained from subjects after 20 sessions of treatment. The follow up score was obtained after 3 months of the completion of the treatment.

Selection of tools

The Single Leg Balance Test: The single leg balance test is designed to measure the postural sway to predict the recurrence of ankle sprain. The test is defined as standing on foot without shoes with the contra lateral knee bent and not touching the weight bearing leg; the hips should be leveled to ground; the eyes open and fixed on a spot marked on the wall; and then eyes are closed for 10 seconds. Test results are recorded as positive or negative. Mostly the test is carried for two times; if the athlete had the positive test in first trail, second trail is carried out and second result is used for analysis to reach peak performance. If the athlete reports any sense of imbalance, athlete's leg touched each other, the feet moved on the floor, the foot touches down, the arms moved from their start position, or in other words, if the athlete failed to remain balanced the test is considered positive[7,8].

Visual Analog Scale: The visual Analog scale (VAS) is most commonly known and frequently used scale for measurement of pain. VAS measures the intensity of sensation and subjective feelings. Pain is a subjective sensation and therefore difficult to measure.

The VAS is a well studied method for measuring both acute and chronic pain[9].

It is however important to quantify it for several reasons; one of the most compelling reasons is assigning a measurement of pain, gives patient some sense of control over their condition, and has positive effect in their coping abilities. Pain measurement also provides a means of assessing the efficacy of response to treatment and prognosis.

The scale consists of a line with specified length. Descriptors are written at each end. The descriptors are short phrases that describe the variable being measured and easily understood[9].

Range of motion: The amount of motion that is available at a joint is called Range of Motion (ROM). The starting position for measuring plantar flexion and dorsi flexion is in the transverse plane, which is the anatomical position. Three notation systems have been used to define ROM: the 0-180 degree; the 180-0 degree system and the 360-degree system. 0-180 degree system of notations has been widely used throughout the world, in this System ROM begins at 0 degree and proceeds in arc toward 180 degree. Many authorities including Cave and Roberts, Moore have supported its use. In this study 0-180 degree system of notations has been used. The normal range of motion of ankle plantar flexion is considered 50 degree from neutral and ankle dorsiflexion is considered 20 degree from neutral[10,11,12,13].

Materials

Balance Board: A balance board is a piece of training equipment used to develop physical balance and coordination skills. It is made up of a wooden plateform with two hemispheric bars attached to the both ends of the plateform. The subject is made to stand on the plateform with both the legs placed on

each end of the plateform; and asked to shift his weight front and back. Due to unstable ground contact of the wooden plateform any movement of the board put challenge for the brain and mechanoreceptors present at the ankle joint, to maintain balance. With each additional degree of movement, the subject must exercises more skill to remain in control of the board.

Figure 1 Balance Board and Goniometre

Goniometer:

Goniometer refers to the measurement of angles created at human joints by the bones of the body. It is called goniometer because of its versatility. It may be constructed of metal or plastic. Parts of the goniometer are body, stationary arm and moveable arm.

Body: It represents a protractor which may form a full or half circle. Measurement scale is located on the both side of the body. The scale on a full circle instrument extends from 0-360 degree; and in half circle instrument scale extends from 0-180 degree.

Arms: 1. Stationary Arm: - It is a structural part of the body of the goniometre and can not be moved independently, 2. The moving Arm: - It is attached to the fulcrum in the center of the body by a screw that permits the arm to move freely on the body.

Goniometer is used to determine both, particular joint position and the total amount of motion available at the joint. Ekstrand J et al, 1982, stated that goniometer is a reliable instrument in measuring lower extremity range of motion[14].

Procedure:

Thirty male professional volleyball players volunteered them self for the study. After screening them for inclusion and exclusion criteria, the purpose and the rationale of the study was explained to the subjects and answers were given to their questions related to the study. After clearing all the doubts of the subject's, informed consent was taken.

In this study subject's age was 18-30 years. 30 subjects were equally divided into technical training (n=15); proprioceptive training (n=15). In technical training age group of 18-20 years were 4 (18.8) subjects; age group of 21-25 were 3 (21.5) subjects; age group of 26-30 were 8 (28.13) subjects. In proprioceptive training age group of 18-20 years were 3 (18.8) subjects; age group of 21-25 were 5 (23) subjects; age group of 26-30 were 7 (28.13) subjects. Before starting the treatment, the subject was positioned comfortably and was assessed thoroughly about his condition. Pre treatment assessment using single leg balance test, visual analog scale and range of motion was done for both the groups.

Assessment

Proprioception Assessment:

Proprioceptive assessment was done using the single leg balance test. Procedure of the test has been explained to the subject, in terms appropriate to his understanding. The subjects were made to wear comfortable clothing for assessment i.e. half paint and t-shirt to rule out the human error in concluding the result. The subjects were examined in the standing position with the face towards wall. The investigator was sitting

on behind the patient to visualize any sense of imbalance which occurs if the subject has the positive result.

The starting position for the test was, subject standing on the floor with the hands on the side, without shoes, with the contra lateral knee bent and not touching the weight bearing leg; the hips were leveled to the ground; the subject were asked to see a pointed mark at the level of his eyes on the wall; and then the subject was asked to close the eyes for ten seconds.

Figure 2 Subject doing Single Leg Balance Test

Test was considered positive if the athlete reports any sense of imbalance, athlete's leg touched each other, the feet moved on the floor, the foot touches down, the arms moved from their start position. If on first trail test result was positive for the subject, second trail was done and the result of second trail was used for the analysis to reach peak performance and to rule out human learning error.

Pain Assessment:

Pain assessment was done using the visual analog scale (VAS). It is very important to measure the pain subjectively to find out the prognosis of treatment. Subject was made to sit in a quite, comfortable room. Significance of the scale and complete description about the use of scale was given to the patient. Clear instructions were given to the subject about the use of scale. Subjects were

informed that the numbers written below to the scale indicates the intensity of pain; where 0 indicate "no pain" at all, and 10 indicate the "most severe pain". Then the subject was asked to mark a point or number in the line corresponding to the intensity of his pain.

Range of Motion (ROM):

Full circle goniometer was used to measure the ankle range of motion. Goniometer is a reliable tool to measure ankle plantar flexion and dorsi flexion. Rationale of the procedure was explained to the patient. Assessment was done in supine position with the ankle joint kept out of the end of the couch.

Figure 3 Range of Motion is being taken for Ankle Plantar Flexion

Fulcrum of goniometer was set over the lateral malleolus; stationary arm was parallel to the fibula and the moving arm was parallel to the fifth phalanges. Then the subject was first asked to do plantar flexion, and the total range available was recorded followed by dorsi flexion. Recording for both i.e. plantar flexion and dorsiflexion has been done three times; if the two recordings were same, then the same data were recorded, but if all three results were different then the average of the three were taken to ensure reliability.

Protocol

The subjects were divided into two groups; group A proprioceptive training), group B ((technical training). Group A was treated with

proprioceptive training and group B was treated with technical training for 20 minutes a day for 20 sessions. Frequency of the treatment was 5 days in a week. Exercise education leaflet specifically made for both the groups were given and appropriately explained to the subjects with emphasis on safety instructions. Subjects were asked to report any type of discomfort immediately to the researcher. Post test of treatment have been done after 20 sessions of treatment for both the groups. Follow up assessment have been done after 3 months of the completion of the treatment for both the groups.

Group A (Proprioceptive training): Before starting the treatment, demonstration about how to stand on the wobble board bilaterally and unilaterally was given to the subjects. Subjects were asked to warm up thoroughly by doing brisk walk on tread mill for 5 minutes followed by mild self stretching of the lower limb muscles with special emphasis to ankle plantar flexors and dorsi flexors to minimize the risk of muscle soreness. Then subjects were made to stand on the wobble board with the support of the investigator; and when the subject understood that how to perform the exercise, support was taken off. At the start subject were asked to perform the exercise bilaterally. After few plantar flexion and dorsi flexion movements, subject was asked to do the exercise with the affected leg only.

Treatment session of 20 minutes26 was divided into 4 parts with 5 minute in each part. Rest was given after every 5 minutes of treatment session; four intervals, which last for 2 minutes was given to the patient to avoid fatigue and over straining of the ankle. After 20 sessions of training program the subject's range of motion, balance, and pain were assessed using goniometre, single leg balance test and visual analog scale respectively.

Figure 4 Subject performing proprioceptive training

Group B (Technical training): Before starting the treatment, demonstration of the training was given to the subjects. Subjects were asked to warm up thoroughly by doing brisk walk on tread mill for 5 minutes followed by mild self stretching of the lower limb muscles with special emphasis to ankle plantar flexors and dorsi flexors to minimize the risk of muscle soreness. Then subjects were instructed to stand with leg apart; and were asked to perform vertical jumps for both the legs; and after performing few jumps subject was asked to do the jumps only with affected leg (leg which have the history of sprain) with counter movement for 5 minutes. The subjects were asked to jump to sub maximal level only to prevent force injuries.

Figure 5 Subject performing unilateral vertical jump.

Treatment session of 20 minutes was divided into 4 parts with 5 minute in each part. Rest was given after every 5 minutes of treatment session; four intervals, which last for 2 minutes was given to the patient to avoid fatigue and over straining of the ankle.

After 20 sessions of training program the subject's range of motion, balance, and pain were assessed using goniometre, single leg balance test and visual analog scale respectively.

Plan for Data analysis

This chapter deals with most important and crucial aspect of investigating the data, to answer the research question through suitable statistical treatment. Analysis is a method of rendering quantitative, meaningful and intelligible information.

The data collected in this study is analyzed statistically by computing percentages, descriptive statistics viz., mean and standard deviation. To examine the variation in the data within the group of ROM-DF and ROM-PF the paired t-test and to test between the Technical and Proprioceptive groups, independent sample t-test is applied. To test the difference in the variation of VAS within the group, Wilcoxon signed rank test and to test between the Technical and Proprioceptive groups, Mann-Whitney test is applied. The variation from pre-test, post-test and 3 months follow up is measured using the repeated measures of analysis of variance for ROM-DF and ROM-PF within the group.

The variation from pre-test, post-test and 3 months follow up in case of VAS is measured using Friedman's test for within the group. The changes within the time interval i.e., from pre-test to post-test and post-test to 3 months follow up of Single leg balance test and Grade of ankle sprain is tested using McNemar chi-square test. The independence

between the group is tested using the usually chi-square test. The difference is considered statistically significant whenever the p-value is less than or equal to 0.05.

RESULTS

The Range of Motion (ROM) - Dorsi Flexion (DF) (Table-1) in the present study was analyzed using paired t test. It has revealed that in the group A the Mean ROM-DF pre test was 18.73, which has got increased in the post to 19.93, which is found to be statistically highly significant (t= 2.276, p>0.039). It has also revealed that the Mean ROM-PF at 3-months follow up has been slightly increased to 20.00, which is not significant (t = 1, p > 0.334). These findings indicate that there was a significant improvement in the ROM-DF immediately after intervention but after 3 months follow up the effect of the intervention on ROM-PF was not so significant.

The Range of Motion (ROM) - Plantar Flexion (PF) (Table-2) in the present study was analyzed using paired t test. It has revealed that in the group A the Mean ROM-PF pre test was 47.40, which has got increased in the post to 49.73, which is found to be statistically highly significant (t= 3.704, p>0.002). It has also revealed that the Mean ROM-PF at 3-months follow up has been slightly increased to 50.00, which is not significant (t = 1.468, p > 0.164). These findings indicate that there was a highly significant improvement in the ROM-PF immediately after intervention but after 3 months follow up the effect of the intervention on ROM-PF was not so significant.

The Range of Motion (ROM) - Dorsi Flexion (DF) (Table-3) in the present study was analyzed using paired t test. It has revealed that in the group B the Mean ROM-DF pre test was 18.80, which has got increased in the post

to 20.00, which is found to be statistically significant (t= 2.316, p>0.036). It has also revealed that the Mean ROM-DF at 3- months follow up has been slightly reduced to 19.73, which is not significant (t = 1, p > 0.334).

These findings indicate that there was a significant improvement in the ROM-DF immediately after intervention but after 3 months follow up the effect of the intervention on ROM-DF was not maintained.

Pair	ROM-DF	N	Mean	SD	t-value	df	p-value (2-tailed)
1	Pre-test	15	18.73	2.22	2.276	14	**<0.039**
	Post-test	15	19.93	0.26			
2	Post-test	15	19.93	0.26	1	14	>0.334
	3 months follow up	15	20.00	0.00			

Table 1 Comparison of ROM-DF within Proprioceptive group.

Pair	ROM-PF	N	Mean	SD	t-value	df	p-value (2-tailed)
1	Pre-test	15	47.40	2.92	3.704	14	<0.002
	Post-test	15	49.73	0.70			
2	Post-test	15	49.73	0.70	1.468	14	>0.164
	3 months follow up	15	50.00	0.00			

Table 2 Comparison of ROM-PF within Proprioceptive group

Pair	ROM-DF	N	Mean	SD	t-value	Df	p-value (2-tailed)
1	Pre-test	15	18.80	2.01	2.316	14	**<0.036**
	Post-test	15	20.00	0.00			
2	Post-test	15	20.00	0.00	1	14	>0.334
	3 months follow up	15	19.73	1.03			

Table-3 Comparison of ROM-DF within Technical group

The Range of Motion (ROM) - Plantar Flexion (PF) (Table-4) in the present study was analyzed using paired t test. It has revealed that in the group B the Mean ROM-PF pre test was 46.47, which has got increased in the post to 49.60, which is found to be statistically highly significant (t= 3.445, p>0.004). It has also revealed that the Mean ROM-PF at 3-months follow up has been slightly increased to 49.67, which is not significant (t = 0.159, p > 0.876). These findings indicate that there was a significant improvement in the ROM-PF immediately after intervention but after 3 months follow up the effect of the intervention on ROM-PF was not so significant.

The Visual Analog Scale (VAS) score in this study (Table-5) was analyzed using Wilcoxon signed rank test. It has revealed that in the group A Mean VAS pre test was 1.60 which has got decreased to 0.13 post test, which is found to be statistically highly significant (z = 2.831, p = 0.005). The analysis has also revealed that at 3 months follow up the Mean

VAS has slightly decreased to 0.00 from post test, which indicates furthermore decrease in the intensity of pain (z = 1.414, p = 0.157) after 3 months. These findings indicate that the intervention given for the group B was very effective immediately after the treatment, and after 3 months intensity of pain has reduced al most to zero.

The Visual Analog Scale (VAS) score in this study (Table-6) was analyzed using Wilcoxon signed rank test. It has revealed that in the group B Mean VAS pre test was 1.53 which has got decreased to 0.13 post test, which is found to be statistically highly significant (z = 2.701, p = 0.007). The analysis has also revealed that at 3 months follow up the Mean VAS has slightly increased to 0.33, which indicates a slight increase in the intensity of pain (z = 0.447, p = 0.655) after 3 months. These findings indicate that the intervention given for the group A was very effective immediately after the treatment, but the effects of the training was not same after the 3 months.

Pair	ROM-PF	N	Mean	SD	t-value	Df	p-value (2-tailed)
1	Pre-test	15	46.47	3.87	3.445	14	<0.004
	Post-test	15	49.60	0.83			
2	Post-test	15	49.60	0.83	0.159	14	>0.876
	3 months follow up	15	49.67	1.29			

Table-4 Comparison of ROM-PF Within Technical group

		Mean Rank	Sum of Ranks	Mean	z- value*	p-value (2-tailed)
VAS (Post-test) - VAS (Pre-test)	Negative Ranks	5.50	55.00	1.60	2.831	<0.005
	Positive Ranks	.00	.00	0.13		
VAS (3 months follow up) - VAS (Post-test)	Negative Ranks	1.50	3.00	0.13	1.414	>0.157
	Positive Ranks	.00	.00	0.00		

Table-5 Ranks of VAS & within comparison of VAS of Proprioceptive group

		Mean Rank	Sum of Ranks	Mean	z- value*	p-value (2-tailed)
VAS (Post-test) - VAS (Pre-test)	Negative Ranks	5.00	45.00	1.53	2.701	<0.007
	Positive Ranks	.00	.00	0.13		
VAS (3 months follow up) -VAS (Post-test)	Negative Ranks	1.00	1.00	0.13	0.447	>0.655
	Positive Ranks	2.00	2.00	0.33		

Table-6 Ranks of VAS & within comparison of VAS of Technical group

The Single Leg Balance (SLB) pre test - post test (Graph-1) in the present study was analyzed using McNemar test. In pre test assessment total number of subjects found negative using SLB was 2 and positive was 13. After intervention given to group A, the subjects who found positive were reduced to 1. These findings indicate that statistically there was a highly significant (p=0.001) improvement in the SLB immediately after intervention.
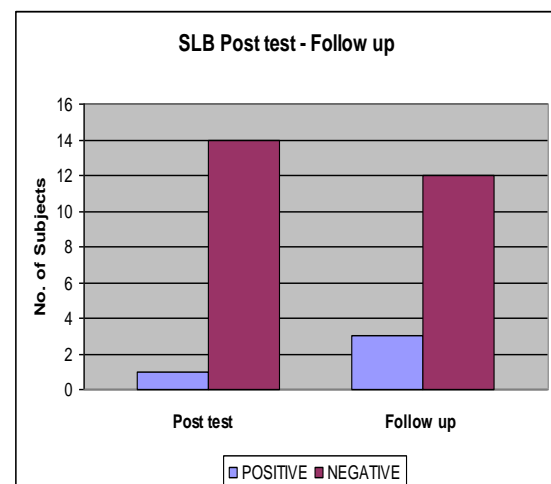
The Single Leg Balance (SLB) post test - 3 months follow up (Graph-2) in the present study was analyzed using McNemar test. In post test assessment total number of subjects found negative using SLB was 14 and positive was 1. After 3 months follow up of group A, the subjects who found positive were 3. These findings indicate that statistically there wasn't any significant (p=0.500) changes in the SLB after 3 months follow up.
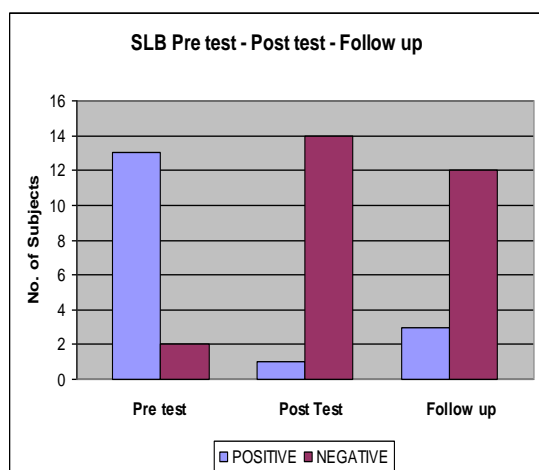
The Single Leg Balance (SLB) pre test - 3 months follow up (Graph-3) in the present study was analyzed using Chi-square test. Chi-square test has been used for this analysis because McNemar test could be done only in case of matched pair observation for a 2 X 2 table. The test has revealed that overall i.e. from pre test to 3 months follow up, the effect of intervention given to group A, on SLB was statistically highly significant (p=0.001).

The Single Leg Balance (SLB) pre test - post test (Graph-4)in the present study was analyzed using McNemar test. In pre test assessment total number of subjects found negative using SLB was 3 and positive was 12. After intervention given to group B, the subjects who found positive was reduced to 1.These findings indicate that statistically there was a highly significant (p=0.001) improvement in the SLB immediately after intervention.

The Single Leg Balance (SLB) post test - 3 months follow up (Graph-5) in the present study was analyzed using McNemar test. In post test assessment total number of subjects found negative using SLB was 14 and positive was 1. After 3 months follow up of group B,

the subjects who found positive were 2. These findings indicate that statistically there wasn't any significant (p=1.00) changes in the SLB after 3 months follow up.

The Single Leg Balance (SLB) pre test - 3 months follow up (Graph-6) in the present study was analyzed using Chi-square test. Chi-square test has been used for this analysis because McNemar test could be done only in case of matched pair observation for a 2 X 2 table. The test has revealed that overall i.e. from pre test to 3 months follow up, the effect of intervention given to group B, on SLB was statistically highly significant (p=0.001).
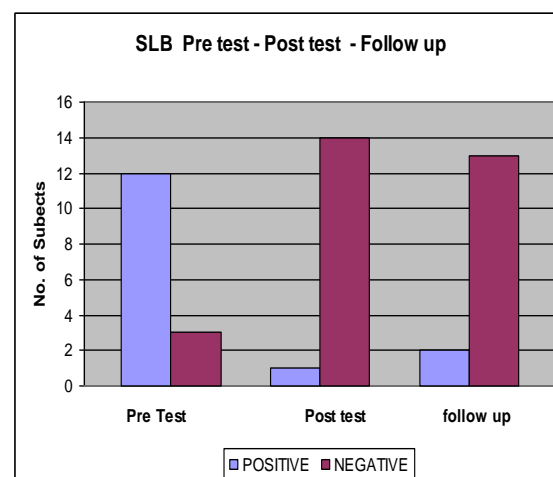

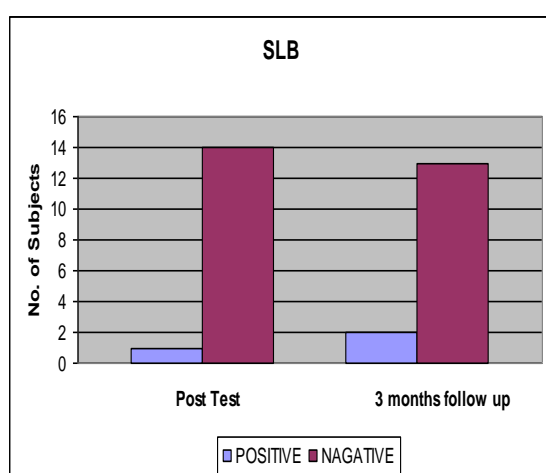**Graph 1** Comparison of SLB during pre test – post test of group A.

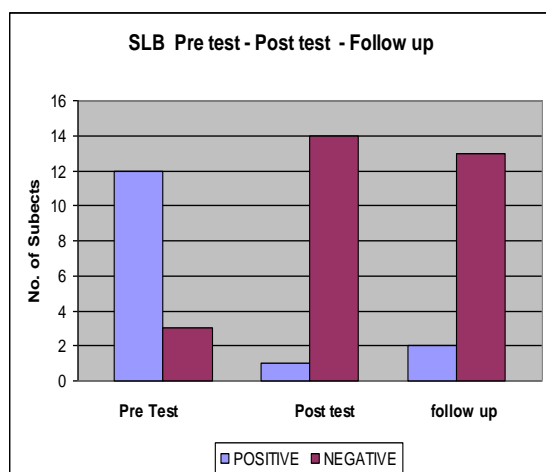**Graph 2** Comparison of SLB during post test – follow up of group A.

Graph3 Comparison of SLB during pre test - post test – follow up of group A.

Graph 4 Comparison of SLB during pre test – post test of group B

Graph 5 Comparison of SLB during post test – follow up of group B

Graph 6 Comparison of SLB during pre test - post test- follow up of group B

Between the groups analysis of Range of Motion (ROM) - Dorsi Flexion (DF) (Graph-7) in the present study was analyzed using paired t test. It has revealed that the Mean ROM-DF pre test was 18.73 and 18.80 for group A and group B respectively; Which indicates that there weren't significant difference (t = 0.086, p = 0.932) in the pre test ROM-DF between the groups. The mean ROM-DF post test was 19.93 and 20.00 for group A and group B respectively; which indicates that there weren't significant difference (t = 1, p = 0.326) in the post test ROM-DF between the groups, after the intervention also. After 3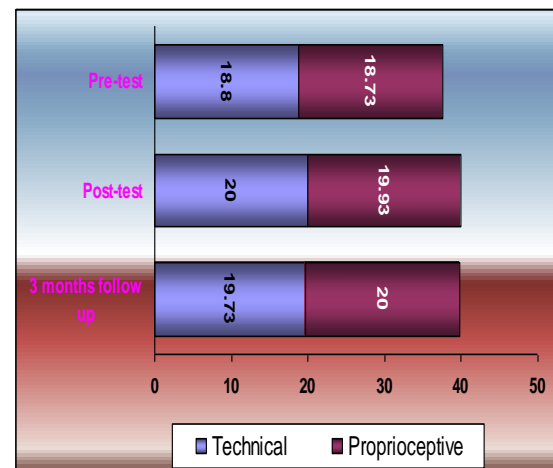 months follow up the mean ROM-DF were 20.00 and 19.73 for group A and group B respectively; which shows that there weren't significant difference (t = 1, p = 0.326) between the groups after 3 months.

Between the groups analysis of Range of Motion (ROM) - Plantar Flexion (PF) (Graph-8) in the present study was analyzed using paired t test. It has revealed that the Mean ROM-PF pre test was 47.40 and 46.47 for group A and group B respectively; Which indicates that there weren't significant difference (t = 0.745, p = 0.462) in the pre test ROM-PF between the groups. The mean ROM-PF post test was 49.73 and 49.60 for group A and group B respectively; which indicates that there weren't significant difference (t = 0.475, p = 0.638) in the post test ROM-PF between the groups, after the intervention also. After 3

months follow up the mean ROM-PF were 50.00 and 49.67 for group A and group B respectively; which shows that there weren't significant difference (t = 1, p = 0.326) between the groups after 3 months.

Between the groups analysis of Visual Analog Scale (VAS) (Graph-9) in the present study was analyzed using Mann-Whitney test. It has revealed that the Mean VAS pre test was 1.60 and 1.53 for group A and group B respectively; Which indicates that there weren't significant difference (Z = 0.236, p = 0.813) in the pre test VAS between the groups. The mean VAS post test was 0.13 and 0.13 for group A and group B respectively; which indicates that there weren't any difference in post test VAS (z = 0, p = 1) between the groups, after the intervention also. After 3 months follow up the mean VAS were 0.00 and 0.33 for group A and group B respectively; which shows that there weren't significant difference (t = 1, p = 0.326) in VAS between the groups after 3 months.
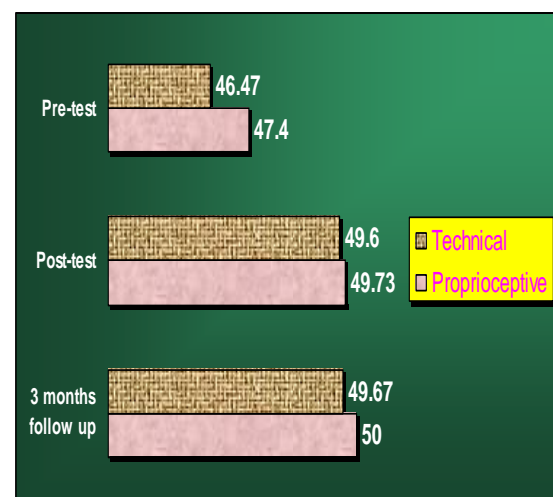
Between the groups analysis of pre test Single Leg Balance (SLB) Test (Graph-10) in the present study was analyzed using Chi-Square test. It has revealed that the Chi-Square value for SLB pre test is 0.24 and p value is 0.624. These results indicate that there weren't significant difference in SLB between the groups at pre test.

Between the groups analysis of post test Single Leg Balance (SLB) Test (Graph-11) in the present study was analyzed using Chi-Square test. It has revealed that the Chi-Square value for SLB post test is 0 and p value is 1. These results indicate that there weren't any difference in SLB between the groups at post test.
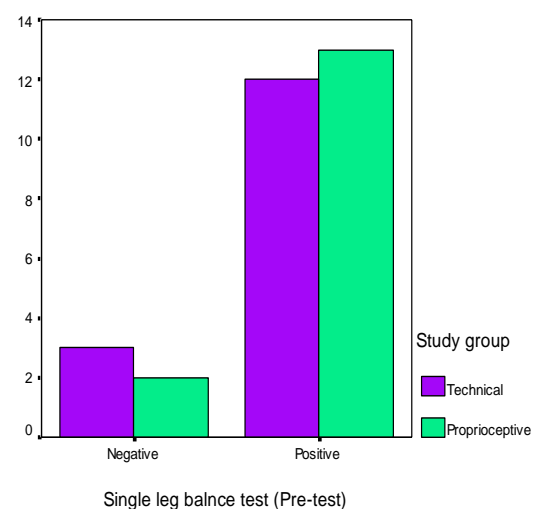
Between the groups analysis of Single Leg Balance (SLB) Test after 3 months follow up (Graph-12) in the present study was analyzed using Chi-Square test. It has revealed that the Chi-Square value for SLB after 3 months follow up is 0.24 and p value is 0.624. These results indicate that there weren't any difference in SLB between the groups after 3 months.
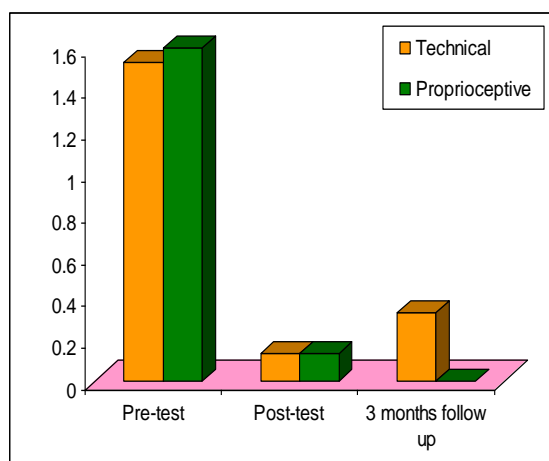

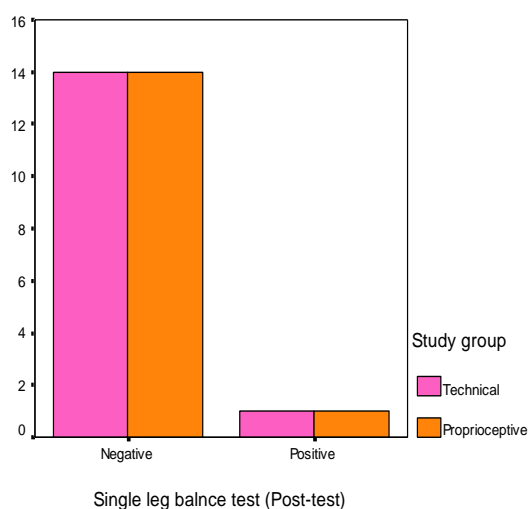**Graph 7** Comparison between group A and group B of ROM-DF

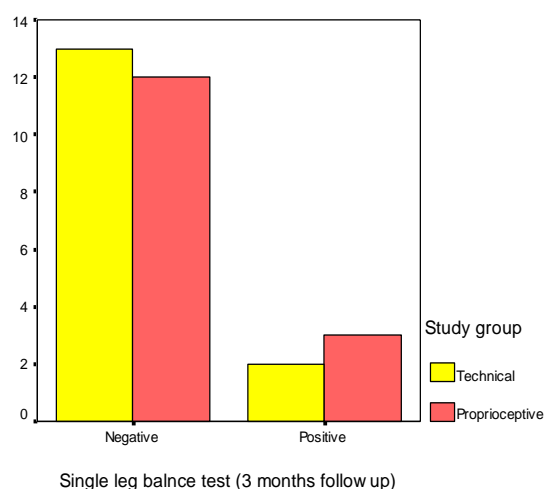**Graph 8** Comparison between group A and group B of ROM-PF

Graph 9 Comparison between group A and group B of VAS

Graph 10 Comparison of Pre test SLB between group A and group B

Single leg balnce test (Post-test)

Graph 11 Comparison of Post test SLB between group A and group B

Single leg balnce test (3 months follow up)

Graph 12 Comparison of SLB between group A and group B after 3 months

DISCUSSION

Recurrent ankle sprains are a major cause of disability and affect the player's performance to a great extent. In the field of health care system including pharmalogical and non-pharmological, have attended the different ways to find solution for prevention of recurrence and reducing pain and improving their physical function[15, 16].

This study was focused on finding out the effectiveness of proprioceptive training and technical training in order to prevent recurrence of ankle sprain, in subjects with previous history of grade I or grade II ankle sprain, and the objective of the study was to find out the efficacy of proprioceptive training and technical training individually, immediately after the end of training session and after three months, and also to compare the effectiveness of one training over another training immediately after the end of the trainings and after three months also; with alternate hypothesis stating that technical training or proprioceptive training may have a statistically significant effect in reducing the number of recurrence of ankle sprain with subjects having previous history of ankle sprain, and null hypothesis stating that technical training or proprioceptive training may not have a statistically significant effect in reducing the number of recurrence of ankle sprain with subjects having previous history of ankle sprain [17,18,19,20].

The present study found that proprioceptive training and technical training (a) improves the ROM PF / DF, (b) reduces pain (VAS), (c) improves proprioception when tested immediately after the treatment (P<0.001) significantly, so this study accepts the alternate hypothesis and rejects the null hypothesis.

Intragroup analysis of group A showed

1.There was significant improvement of ROM PF from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

2.There was significant improvement of ROM DF from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

3.There was significant improvement of VAS from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

4.There was significant improvement of SLB from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

Intragroup analysis of group B showed

1.There was significant improvement of ROM PF from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

2.There was significant improvement of ROM DF from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

3.There was significant improvement of VAS from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

4.There was significant improvement of SLB from pre test to post test at P < 0.001, but after post test to 3 months follow up there wasn't any significant improvement.

Intergroup analysis between group A and group B showed

1.There was no significant improvement of ROM PF from pre test to post test at P >

0.001, post test to 3 month follow up at P >0.001, between the group A and group B.

2.No Significant improvement found in ROM of DF from pre test to post test at P > 0.001, post test to 3 month follow up at P >0.001, between the group A and group B.

3.There was no significant improvement on VAS from pre test to post test at P > 0.001, post test to 3 month follow up at P >0.001, between the group A and group B.

4. In single leg balance test also no significant improvement found from pre test to post test at P > 0.001, post test to 3 month follow up at P >0.001, between the group A and group B.

Overall the intra group analysis of groups showed that there was remarkable improvement in range of motion, pain and proprioception, from pre test to post test but from post test to 3 months follow up there wasn't significant improvement.

Inter group analysis between group A and group B showed that there wasn't significant difference in improvement between groups.

These findings indicate that there is directs correlation between impaired proprioception and possibility of recurrence of ankle sprain; decrease ROM and recurrence of ankle sprain.

The study result is supported by many other investigators. Holme E et al, found that ankle injury resulted in decrease ankle strength and postural control. It was also supported by Tine Willems et al, suggested that the possible cause of chronic ankle instability is a combination of diminished proprioception weak evertor muscle[21, 22].

The study also suggested that proprioceptive training can be a effective in preventing the recurrence of ankle sprain, this was supported by Carl G Mattcola, Maureen K. Dwyer, stated that proprioception is use full in preventing

injury in slow, moderately or even rapid tasks. As the patient achieves full weight bearing with out pain, proprioceptive training should be started for the recovery of balance. Eils E, Rosenbaum D, concluded that proprioceptive exercise could be used in prevention and rehabilitation of recurrent ankle sprains [23, 24].

This study also recommended that proprioceptive training can also be used prophylactically to maintain proprioception. It was supported by Hans Tropp et al, found that proprioceptive training can be given prophylactically to the subjects with previous history of ankle sprain in order to break vicious circle of recurrent ankle sprain.

Johna Wills Lioyd, et al., examines the effect of 6-week proprioceptive and strength training program and concluded that the training produced improvements in the ability to balance. The balance assessment was done using single plane balance board[25].

CONCLUSION

In this study of male professional volleyball player's three parameters i.e. ROM PF / DF, SLB, and VAS have been taken to conclude the efficacy of individual training program and to compare the effectiveness of one training over training, immediately after the end of training and after three months.

The principal conclusion of this study is that both the trainings were equally affective immediately after the end of treatment even after three months follow up there wasn't remarkable difference between the proprioceptive training and technical training.

REFERENCES

1. Jay Hertel, (2002) Functional Anatomy, Patho-mechanics, and Pathophysiology of Lateral Ankle Instability. J Athl Train; 37(4): 364-375.

2. Brent Brotzman S; (2000). Clinical Ortho-paedics rehabilitation: Mosby; 6th edition,: 245-274.

3. Bahr R, Bahr IA. (1997).Incidence of acute volleyball injuries: A prospective cohort study of injury mechanism and risk factors. Scand J Med Sci Sports ; 7(3): 166-71.

4. Van der Beek AJ et al. A one-season prospective cohort study of volleyball injuries. Br J Sports Med 2004 Aug, 38(4): 477-481.

5. Stasinopoulos D. (2004). Comparison of three preventive methods in order to reduce the incidence of ankle inversion sprains among ankle sprains- a prospective controlled study: Br J Sports Med ; 30(2): 182-5.

6. Verhagen E et al. (2004).The effect of a proprioceptive balance board training program for the prevention of ankle sprain- a prospective controlled trial. Am J Sports Med ; 32(6): 1385-93.

7. Trojian T H, McKeag D B (2006). Single leg balance test to identify risk of ankle sprains- a prospective cohort study. British Journal of Sports Med; 40:610-613.

8. Victoria M. Clark, Adrian M. Burden. (2005) A 4-week wobble board exercise program improved muscle onset latency and perceived stability in individual wth a functionally unstable ankle. Physical Therapy in Sport; 6(4): 181-187.

9. Katz J, Melzack R., (1999).Measurement of pain. Surg Clin North Am; 79(2): 231-52.

10.Clopper Mp, Wolf Sl. (1988). Comparison of the reliability of the arthoranger and the standard goniometre for assessing active lower extremity range of motion. Physical therapy; 68(2): 214-8

11.Elveru RA, Rothstein J, Lamb R L.(1988). Goniometric Reliability in a clinical setting: subtalar and ankle joint measurement. Phys ther; 68: 672

12. Cynthia C Norkin., (1998). Measurement of Joint Motion: A guide to Goniometry. 2nd ed, New Delhi. Jaypee Brothers. 3-10 pp.

13. Youdas, J W Bogard, Suman, V j. (1992). Relaibility of goniometric measurement and visual estimates of Ankle Joint range of motion obtained in clinical setting. Phys Ther; 72 (suppl): 113.

14. Ekstrand J et al. (1982). Lower extremity goniometric measurement: A study to determine their reliability. Arch phys Med Rehabilitation; 63: 171.

15. Thacker SB, Stroup DF, Branche CM, Gilchrist J, Goodman RA, Weitman EA. (1999). The prevention of ankle sprains in sports: A systematic review of the literature. Am J Sports Med; 27(6): 753-760

16. Duncan Mason, Sean Kilmurray, (2003). Concepts in exercise rehabilitation, Tidy's Physiotherapy, 13TH Ed, Butter worth Heinemann, Manchester, , 484-85pp.

17. Kothari CR,(1990). Research Methodology Methods And Techniques. 2nd edition. New Delhi, New Age International publishers,233-341pp.

18. Pamela K. Levangie, Cynthia C. Norkin, (2001).Joint Structure and Function- A comprehensive analysis, 3rd edition. New Delhi, Jaypee Brothers, , 374pp.

19. Farshid Mohammadi, (2007). Comparison of 3 Preventive Methods to Reduce the recurrence of Ankle Inversion Sprains in Male Soccer Players. Am J Sports Med; 35: 922-926.

20. Jayant Joshi, Prakash Kotwal, (2002). Essentials of Orthopaedic and applied Physiotherapy; Churchill Livingstone Pvt Ltd; 4th edition; 552-564.

21. Holme E, Magnusson SP, Becher K, Bieler T, Aagaard P, Kjaer M., (1999).The effect of supervised rehabilitation on strength, postural sway, position sense and re-injury risk after acute ligament sprain. Scand J Med Sci Sports; 9(2): 104-9.

22. Tine Willems, Erik Witvrouw, Jan Verstuyft, Peter vaes, Dril De Clercq, (2002). Proprioception and Muscle Strength in Subjects With a History of Ankle Sprains and Chronic Instability. J Athl Train; 37(4): 487-493.

23. Carl G. Mattacola, Maureen K. Dwyer. (2002). Proprioceptive and Balance training. Athl Train; 37(4): 413-429.

24. Eils E, Rosenbaum D., (2001). A multi-station proprioceptive exercise program in patients with ankle instability. Med Sci Sports Exerc.; 33(12): 1991-1998.

25. John Wills Lloyd, Carl G. Mattacola, (1997). Effects of a 6-Week Strength and Proprioception Training Program on Measures of Dynamic Balance: A single-case Design. J Athl Train; 32(2): 127-135.