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Significance of Dorsiflexor Training Along with Balance Disc on Jumping Performance and Ankle Functional Ability Among Volleyball Players

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ABSTRACT

Background: Injuries in the volleyball players are more specific and ankle is one of the most common sites to get injured which is lateral ankle sprain which occur around the net during blocking and spiking. Decreased ROM in the dorsiflexors lead to imbalance and ankle injury this limits the further jumping performance of the volleyball players.
Purpose: To find out the significance of Dorsiflexor training along with balance disc on Jumping performance and Ankle functional ability among Volleyball players.
Methods: study design was an experimental study; A 30 volleyball players were selected from Indira Gandhi sports academy (Pondicherry). They were allocated into two group, group A(n=15) dorsiflexor training with balance disc, Group B (n=15) warm up exercise alone, 3 days/week for 4 weeks, the outcome measure was vertical jump test (VJT) and functional ankle ability measure (FAAM) were measured in pre and post-test for 4-week period.
Result: Data analysis was done by paired 't' test for within the group and unpaired 't' test for between the group analysis respectively, the statistical analysis done with unpaired 't' test between the group A and group B analysis shown significant ($p<0.0001$) which shows that the group A must be more significant than group B, it has been concluded that group A shows improvement in jumping performance and ankle functional ability with the outcome measure than group B.
Conclusion: This study concludes that the dorsiflexor training along with balance disc for group A shows more significant improvement in jumping performance than the conventional exercise in group B.

Keywords: Balance disc, vertical jump test, functional ankle ability measure, jumping performance.

INTRODUCTION

In India Volleyball is an Olympic sport that is practiced at all levels [1]. It is the one of the most popular sports in the world and it is played approximately by 200 million players worldwide. This game consists of sprinting for short distance, change in direction, jumping, diving, hitting[2] therefore these all the important thing among the volley ball players in current requirement. The risk of injury is reduced because volleyball is a non-contact sport in which players from opposing teams are kept apart by a net. Nevertheless, the rapid forceful movements of the body in two different directions which is horizontally and vertically in such movement it causes to get inevitable injuries among the players[3].

Ankle sprain is the most common type of ankle injury and 82 percent of ankle injury could be highly seen in volleyball players in these sprains 77% are lateral sprains and 73% involved rupture or tear to anterior tibiofibular ligament[4]. The researchers have been reported that the greatest injuries among the volleyball players is risk of acute ankle injury and overuse condition[5]. the maximum number of injuries that occur at the net[6] and more than half of the injuries that occurs in court which is during landing after blocking and the one third of injuries while during spiking[7].

One of the most crucial muscle groups for both dynamic and static movement, supporting the body as a whole, and participating in the majority of sporting activities are the ankle muscles. Ankle dorsiflexor muscles consist of musculus tibialis anterior, musculus extensor digitorum longus, musculus peroneus tertius and musculus extensor hallucis longus muscles and plays a major role in maintaining balance of the body. Additionally, dorsiflexors are useful for maintaining the swinging leg in a particular position while walking and running[8].

Lateral ankle sprains (LASs) are the most common lower limb musculoskeletal injuries most frequently it is been incurred for the individuals who participate in recreational physical activities and sports[9], These injuries can cause serious consequences for the person who got injured this can cause the individual to time lost from work or sports activity .This is an serious injury which can lead to development of long term symptoms which further develops into chronic ankle instability[9] .Physical activity is one of the one of the primary role for each and every individuals for day to day activity, injury to the musculoskeletal system can affect the individual's ability to participate in physical activity and this may trigger long

-term conditions such as early-onset posttraumatic osteoarthritis[10]. Lateral ankle sprain can be more commonly occurring to the young adult and adolescent population therefore to reduce the incidence of injury among the athletes the efforts should be taken among the sports medicine and sports physiotherapy communities[11-12].

Persons who went through the injury which is incur an acute lateral ankle sprain injury which develops a twofold increased risk of reinjures in the year following their initial injury[13]. Reinjures that progress a number of chronic injury-associated to pain, persistent swelling, feelings of ankle joint instability, ankle joint 'giving-way', recurrent injury and reduced functional capacity[14] These injury constitute the characteristic features of chronic ankle instability[15] in addition fall while walking, high occurrence of reinjures which must be due to inadequate rehabilitation on acute ankle injury[16], Hence, reducing the risk of reinjures and chronic ankle instability is a key priority after acute lateral ankle sprain injury occurrence[17].

Jumping ability is one of the most important performances in volleyball. In this game, vertical jumps (VJ) are one of the most frequently performed activity in each and every match, setting and attacking players performing at least one jumping movement during a 12 s rally. Moreover, frontcourt players nearly 22 jump landings for each game which is approximately four block jumps and three spike jumps were been performed.[18]

Two weeks after an acute ankle injury, patients who had static-stretching therapies with a home exercise regimen saw the greatest improvements in dorsiflexion. Exercises to promote ankle dorsiflexion as well as therapeutic methods include stretching, manual therapy, electrotherapy, and ultrasound. The most efficient course of action, they found, is a mix of interventions. The movement with mobilization on ankle dorsiflexion among individuals with recurrent ankle sprains. From this they concluded that the Static-stretching intervention as a part of standardized care yielded the strongest effects on dorsiflexion after acute ankle sprains[19].

A balancing disc is a rehabilitation tool made to increase balance, strength, and control of the lower extremities. Exercises with plates and the treatment of injuries to the lower extremities benefit most from their use. It can aid in lowering the risk of reinjury after beginning an activity or a sport. In physiotherapy therapeutic applications, these discs are frequently utilised for proprioceptive exercises, particularly in the final phases of rehabilitation following lower extremity injuries and surgical operations. Balance discs also enhance balance with common balance exercises on level surfaces like the ground.[20]

According to one study, the foot and ankle ability assessment is the best way to estimate the functional limits in people with different foot and ankle disorders[21]. the FAAM has the highest rating for its qualities which includes validity, reliability, interpretability. FAAM is the one of the best and useful tools which has evidence for evaluating purpose, and this tool able to measure the changes over time[22]. As it is a region specific instrument so that it can distinguish the levels of functional performance among the individual[23]. based on reliability and validity FAAM can be used in the population such as sprain, pain, orthopaedic condition fracture, plantar fasciitis, Achilles rupture. In addition, FAAM has been took as verified validity measure among the athletes with chronic ankle instability and individual with diabetes mellitus[23].

Therefore, this study focuses on significance of Dorsiflexor training on jumping performance and ankle functional ability among the volley ball players

MATERIALS AND METHODOLOGY

It is experimental study which includes the volleyball players. The interventions were planned for about 3 weeks, totally 30 volleyball players were included.

Selection Criteria: Subjects ages between 18-25 years, among male volleyball players with Previous history of ankle sprain and Vertical jump test greater than 30.

Outcome measures:

Vertical jump test

Vertical jump test was assessed with chalk piece holding it at their end of the finger tips and stands one side near the wall, keeping both feet remaining on the ground reach up as high as possible with one hand and mark the wall with the tip of the finger and makes another mark at the peak of the jump The vertical jump score is the difference between the two marks which is recorded in inches or centimetres.

Foot and ankle ability measure (FAAM)

The Foot and Ankle Ability Measure (FAAM) is a self-report outcome instrument which is been developed to assess physical function for individuals with the foot and ankle related impairments. The Foot and Ankle Ability Measure has 29-item questionnaire.

PROCEDURE

GROUP A: Dorsiflexor training in balance disc

GROUP B: Warm up

GROUP A -DORSIFLEXOR TRAINING PROTOCOL IN BALANCE DISC: The subjects in the experimental group are trained under Dorsiflexor training and Balance disc.

Table I: week 1 intervention on balance disc

BALANCE DISC EXERCISES	SET	REPETITIONS	TOTAL
WEEK 1			
Balance on both legs	3	30 rep	90 rep
Balance on right leg-hands on the waist	3	30 rep	90 rep
Balance on left leg-hands on the waist	3	30 rep	90 rep
WEEK - 2			
Passing to wall (hands at chest level)	3	20 rep	60 rep
Squat with proposal of hand	3	20 rep	60 rep
Standing on both legs, dorsiflexion and plantarflexion (right-left)	3	30 rep	90 rep

Standing on one leg-passing	3	20 rep	60 rep
WEEK – 3			
Ball thrown at the side -reception and passing while maintaining balance	3	20 rep	60 rep
Standing on one leg-passing	3	20 rep	60 rep
WEEK-4			
In pairs, passing while standing with legs astride	3	30 rep	90 rep
Standing on one leg-passing-standing on other leg-passing	3	20 rep	60 rep

GROUP –A (EXERCISE ON BALANCE DISC)

WEEK 1

Fig 1: Balance on both the leg

Fig 2: Balance on right leg

Fig 3: Balance on left leg

WEEK 2

Fig 4: Squat with proposal of hand

Fig 5: Standing on both legs, dorsiflexion

Fig 6: Standing on both legs,plantarflexion

WEEK 3

Fig 7: Ball thrown at the side -reception and passing while maintaining balance

Fig 8: Standing on one leg-passing

WEEK 4

Fig 9: Standing on one leg-passing-standing on other leg-passing

Fig 10: In pairs, passing while standing with legs astride

GROUP B - WARM UP EXERCISE

The subjects in the control group are trained under warm up exercise.

WARM UP EXERCISE	SETS	REPETITIONS	DAYS	WEEKS
TOE TOUCH	3	5	3	4
QUADRICEPS STRETCH	3	5	3	4
VERTICAL JUMP	4	10	3	4
HALF SQUAT	2	20	3	4
PUSH UP	3	10	3	4
LUNGE	3	10	3	4

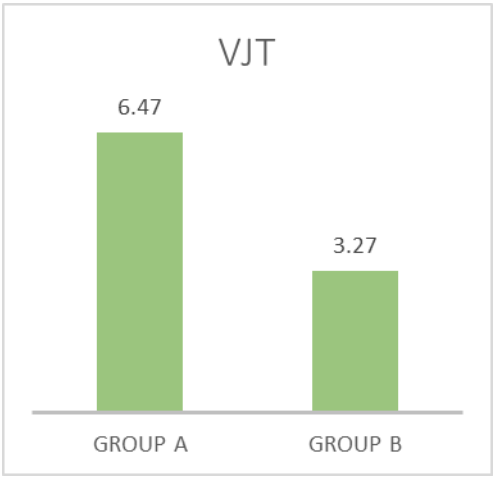
Table II: Intervention for control group

V. Data analysis

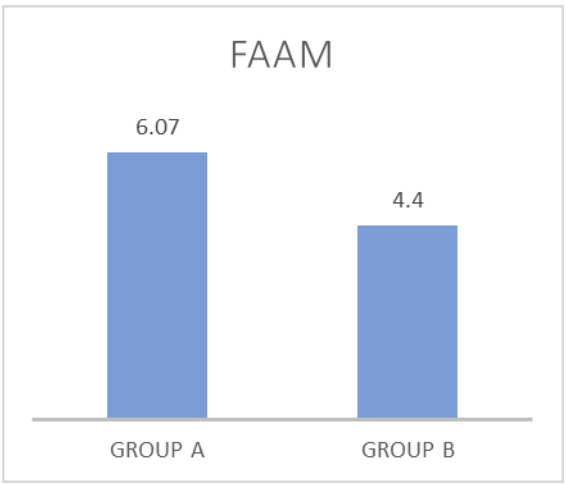
Pre and post interventional differences within the two groups were analyzed using paired 't' test and between the two groups were analyzed using unpaired 't' test for each of the outcome measures mentioned in the below tables. Statistical significance was set at p <0.0001.

TABLE III: Between the Group Analysis Of Group A And Group B For VJT & FAAM

Outcome Tools	Groups	Mean	SD	t- value	'p'- value
VJT	GROUP-A	6.07	1.94		
	GROUP-B	4.40	1.22	8.9610	<0.0001
FAAM	GROUP-A	6.07	1.94	8.9610	<0.0001
	GROUP-B	4.40	1.22		



Graph I: Between the group analysis of VJT of group A and B.



Graph II: Between the group analysis of FAAM of group A and B

RESULT

Between the group study inference the VJT and FAAM group analysis shows experimental group is very significant than control group with the t value of (VJT - 6.3899, FAAM– 8.9610) since p value is ($p<0.0001$)

DISCUSSION

The present study is the experimental study on Significance of dorsiflexor training along with balance disc on jumping performance and ankle functional ability among the volley ball players. the volley ball players were selected as study population as there is much established reports for high prevalence of ankle sprain that affecting the jumping performance. The age group chosen among volley ball players between 18 to 24 years.

In this study, there was 30 subjects selected on the basis of inclusion and exclusion criteria with age group between 18 to 24 years. they were randomly allocated into two groups which is group A and group B, each containing 15 subjects by improving the jumping performance which is the one of the main components for each and every volleyball player. Balance disc exercise was given to group A (n=15) and Warm up were given to group B (n=15). the outcome measures were assessed by using the VJT and FAAM scale for evaluating the jumping performance and ankle function ability before and after treatment.

BALANCE DISC EXERCISE ON JUMPING PERFORMANCE: The purpose of this specific balancing disc is to improve balance, strength, and control in the lower extremity. Multiple degrees of freedom in the sensorimotor system allow for the generation of a range of postural control maintenance strategies following balancing training. Thereby the balance disc improves the stability through strengthening the dorsiflexors muscle group. And also aids in lowering the risk of re-injury after beginning an activity or a sport.[19]

MOVEMENT WITH MOBILIZATION ON RECURRENT ANKLE SPRAIN: Individuals with recurrent ankle sprains may benefit from movement-based mobilisation of the ankle dorsiflexors because it increases muscle spindle sensitivity, activates joint proprioception, and enhances the efficacy of dorsiflexor range expansion. Although there is debate about the exact mechanisms causing ranges of motion to increase following stretching, the rise is frequently linked to lessened Muscle Tendon Unit (MTU) stiffness**.**

It concludes that the Static-stretching intervention as a part of standardized care yielded the strongest effects on dorsiflexion after acute ankle sprains[18]

BALANCE TRAINING ON CHRONIC ANKLE INSTABILITY: The balance training program aided the sensorimotor system in freeing up degrees of freedom that were not available to these individuals previously due to the constraints of CAI. Automatic postural and voluntary motor commands of the trunk and limb musculature interact to create balance. the CNS may suppress anticipatory postural adjustments as defence against their potential destabilising effects. The CNS performs anticipatory postural adjustments when anticipating self-inflicted postural perturbations Therefore, the voluntary responses of the trunk and limb muscles to postural demands would be crucial this causes increased balance. these individuals experienced a significant improvement in the SD.[22]

The result of this study demonstrated that four weeks of balance disc exercise showed an improvement in jumping performance and ankle functional ability for volleyball players. But finally it concluded that the balance disc exercise (experimental group) is more effective than warm up (control group).

LIMITATIONS AND RECOMMENDATIONS

Limitation of this study were condensed sample size and treatment duration were really short (4 week). Subjects were selected from same training academy. Regular follow-ups are challenging due to tournaments of the subjects. Only male Gender was studied in this study for jumping performance. Recommendations of this study is long term follows ups has to be done. Dorsiflexor training can also be studied in other players who requiring jumping ability. Multicomponent training can be given to the players. Other quantitative outcome measures could be used for the evaluation of Jumping performance.

CONCLUSION

This study concluded that the balance disc exercise (GROUP A) shows significant improvement on jumping performance and ankle functional ability than the control group (GROUP B) among the volleyball for 4 weeks of intervention.

Declaration by Authors

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