

Comparison of a strengthening programme to a proprioceptive training in improving dynamic balance in athletes with chronic ankle instability (CAI)

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Abstract: Strength and proprioception are important to have a stable and functional ankle. Individuals with ankle injuries are bound to develop a loss of either or both of these during and after the phase of immobilization. Objectives: 1. To assess the effects of a 4 weeks strengthening programme on dynamic balance in CAI. 2. To assess the effects of a 4 weeks proprioceptive training on dynamic balance in CAI. 3. To compare the effects of a 4 weeks strengthening programme to a proprioceptive training on dynamic balance in CAI. Materials and methods: This was an interventional study done amongst athlete students at Deccan Education Society college campus, Pune during November 2013 to April 2014. Total 27 college students who were known athletes with chronic ankle instability were selected by convenient sampling. These 27 subjects were randomly allotted, 13 to the strengthening group and 14 to the proprioceptive group. Dynamic balance was assessed using the Functional reach test (FRT) prior to the intervention. Maximum three readings were collected and then an average of the best two was taken while the first was considered as the trial. This was considered as the pre intervention reading. These subjects then underwent a 4 week programme depending upon the group they were allotted. Post intervention readings were taken of the FRT scores in the two groups and statistical analysis was done. Results & Conclusion: Paired and Unpaired t tests were done to compare the Functional reach test (FRT) scores pre and post in both the strengthening and proprioceptive groups and also the post training FRT scores between the two groups. The differences in the pre and post FRT scores were found to be extremely significant in both the groups (p value < 0.0001). However there was no significant difference between the FRT scores post training between the two groups (p value > 0.0001). The study proves that both the strength training as well as proprioceptive training are equally effective in improving the dynamic balance in athletes with ankle instability. They should thus both be given to improve dynamic balance.

Keywords: Strength, Proprioceptive training, chronic ankle instability.

I. Introduction

A physically active body must achieve a stable balance around each active joint for top performance. The ligaments connect the bones to each other, and provide much of the joint's stability. Muscles are connected to bone by tendons, allowing movement. Although the ligaments connecting the bones in the ankle are necessary for proper function, there are several muscles that also help support the ankle during any type of activity [1]. Building strength and proprioception, or special awareness, in these muscles helps to prevent injury and improve performance. Ankle injuries are a common and recurrent problem around the world. International figures report that ankle sprains which are basically weight-bearing injuries represent 15-20% of all sporting injuries, and about 10% presentation to accident and emergency departments [2]. When an athlete performs any movement--whether running or jumping--the ankle and surrounding muscles are put under a great deal of stress. If the ankle musculature is strong, the athlete can withstand greater force before an injury is sustained. In addition to decreasing ankle injuries, strengthening lower leg muscles will help prevent injuries [3].

Until recently, clinicians thought that ankle sprains were primarily a matter of overstretched and traumatized ligaments. The taping or bracing approach ignored the role of the central nervous system, which is intimately tied in to every joint. Jay Hertel from the University of Virginia and an expert on the ankle said that when one damages the ligament, the neuro-receptors as well are affected. The brain no longer receives reliable signals from the ankle about the ankle and foot position in relation to the ground. The proprioception or the sense of one's body position in space is thus impaired [4].

Acute ankle sprains can cause a decreased participation in sporting activity and overall performance in an athlete by causing decreased muscle strength, short term ankle range of motion loss, functional instability, and decreased proprioceptive input. Proprioception describes the afferent signal that travels to the brain from receptors in the body that enables the brain to know where the body is in space. The proprioceptive input is provided to the brain via mechanoreceptors, vestibular receptors and visual receptors and are all integrated into the central nervous system. Together these receptors stimulate an efferent motor response resulting in proper

movement of the body [5]. Hertel and Freeman et al suggest that there are 2 main theories for recurrent ankle sprains in which any of the ideas of re-injury will fall under either the functional instability theory or the mechanical instability theory. Much of Freeman’s study is focused on post-injury functional instability where once the ligamentous structures are injured, the underlying physiology is affected by disrupting the function of the mechanoreceptors located in the joint capsule, thus resulting in decreased afferentation affecting the reflexes and proprioception that stabilizes the joint. Hertel states that both functional and mechanical instability play a major role in recurrent lateral ankle sprains [6].

In short, functional instability is the loss of function and stability of the ligaments and supporting structures of the ankle without finding any evidence of ligamentous laxity or joint compromise and the mechanical instability theory deals with the loss of integrity and the presence of laxity in the stabilizing ligamentous structures as the cause of instability. Thus apart from other medical treatments and rest, strength and proprioceptive exercises are very important to prevent the recurrence of ankle injury also to prevent ankle injuries at first place [7]. Very few studies were done on Indian population amongst athletes on dynamic balance and the effects of a strengthening and a proprioceptive training programme on it. Hence this study was undertaken to compare a strengthening programme to a proprioceptive training programme in improving the dynamic balance in athletes with chronic ankle instability.

II. Materials and Methodology

The study was a cross sectional study done amongst athletes at Deccan Education Society college campus, Pune during November 2013 to April 2014. 27 athletes between the age group of 20-25 years, both males and females were included in the study. These were the individuals having a history of chronic ankle instability in the past 6 months to 1 year. The exclusion criteria was an unstable ankle, other musculoskeletal and neurological conditions, obese individuals with a BMI of more than 29 and those receiving any form of physiotherapy or orthopaedic treatment for the ankle during that tenure. The materials used for the study were therabands, a stability trainer and wobble board, 1 meter ruler with centimetre measurement, Velcro or tape to fix ruler to wall at shoulder height, chair and a marker.

Ethical clearance was taken from the institutional ethical committee of DES Brijlal Jindal college of Physiotherapy, Pune, India. The dynamic balance was measured using the Functional reach test (FRT). The subjects were instructed to stand next to, but not touching, a wall and position the arm that is closer to the wall at 90 degrees of shoulder flexion with a closed fist. The assessor recorded the starting position at the 3rd metacarpal head on the yardstick. The instruction given to the subject was to “Reach as far as you can forward without taking a step.” The location of the 3rd metacarpal was then again recorded. Scores were determined by assessing the difference between the start and end position which was the reach distance, measured in inches. Three readings were done and the average of the last two was noted considering the first as the trial. This was the pre intervention FRT score. The subjects were then assigned to either of the two groups and underwent a 4 week programme. Post training, the FRT scores were taken by the similar method[8].

The strengthening group received four weeks of strength training exercises for the ankle using thera bands as per the athletes tolerance. The exercises consisted of 4 different exercises: front pull, back pull, crossover, and reverse crossover. The subjects made 3 visits per week, every alternate day for 4 weeks, to perform the thera band exercises. The subjects had a 30-second rest between each exercise and a 2-minute rest between sets [9]. The proprioceptive group took four weeks of ankle proprioceptive training using the stability trainer and wobble board. The subjects came for 3 sessions per week each on alternate days for 4 weeks.

III. Results

Table 1: Comparison of Pre & Post FRT scores in strengthening and proprioceptive groups

Group	Mean FRT (inches)		p value
	Pre	Post	
Strengthening group	15.25385	15.53077	<0.0001
Proprioceptive group	15.10714	15.56429	<0.0001

Table1 shows marked increase in functional reach test value after 4 weeks of strengthening exercises, the difference in the mean being 0.277. There is a significant difference between pre and post FRT scores (p value < 0.0001). It also shows marked improvement in functional reach test value after the four weeks of proprioceptive exercises, the difference in the mean being 0.5. Therefore there is improvement in dynamic balance and a significant difference between pre and post FRT scores (p value <0.0001).

Table 2: Comparison in post FRT scores of strengthening & proprioceptive groups

Group	Post Mean FRT (inches)	p value
Strengthening Group	15.53077	>0.0001
Proprioceptive Group	15.56429	

Table 2 shows that there is no significant difference in the post FRT scores between the strengthening and proprioceptive groups. (p value >0.0001)

IV. Discussion

In our study there was a significant change in post 4 weeks FRT scores signifying improvement in dynamic balance of the subjects in both the strength as well as proprioceptive groups (Table 1). This implies that strength and proprioceptive training are equally important to reduce risk of ankle instability.

In a study, performed by Emery et al (2007), a home-based proprioceptive balance training program using a wobble board was used. The participants performed the wobble board exercises daily for 6 weeks and once a week for the next 5 months. It was found that the use of a balance-training program, such as this one, could improve the dynamic balance and reduce the incidence of injury in its participants over a six month period[10].

Mohammandi et al (2011) in their study on comparison of three preventive methods to reduce the recurrence of ankle inversion sprains in male soccer players confirmed how important proprioception training was in the prevention of ankle injuries. They concluded that the wobble board balance training exercises effectively aided in stabilization of an injured unstable ankle and could reduce the risk of recurrent sprains [11, 12].

However there was no significant difference (Table 3) in the post intervention FRT scores between the strengthening group and the proprioceptive group (p value > 0.001). This shows that both strength and proprioception training are equally important. No previous studies comparing strengthening and proprioceptive training in CAI were found. One of the main limitations of the study was a small sample size. Subjects matching the inclusion criteria with chronic ankle instability (CAI) were necessarily not supposed to be undergoing any form of treatment including the RICE protocol (rest, ice, compression, elevation) or even therapeutic ultrasound. Taping and braces had to be excluded in order to correctly determine the efficiency of the strengthening and proprioceptive programme. Hence the small sample size was justified.

V. Conclusion

The study proves that both strengthening as well as proprioceptive training are equally useful in improving dynamic balance in athletes with ankle injuries. Individuals with chronic ankle instability need a rehabilitation programme incorporating both on strength and proprioceptive training as an integral component. This will improve the dynamic balance, hence reducing the risk of recurrence of ankle injuries.

Acknowledgements

We would like to thank all the subjects for their cooperation during the study. We also take this opportunity of expressing a sincere gratitude to Dr. Aparna Sadhale (PT), Principal of Deccan education society's Brijlal Jindal college of Physiotherapy, Pune for guiding us during and after completion of the study.

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