

Combined Effectiveness of Ebbets Foot Drills and Wobble Board Training on Proprioception and Balance in a Patient with Chronic Ankle Instability: A Case Study

Chaithanya P¹, Sreejisha PK², Tanmay K³

¹Lecturer, ²Assistant Professor, ³BPT Intern,
Laxmi Memorial College of Physiotherapy, Mangalore, Karnataka, India

Corresponding Author: Tanmay K

DOI: <https://doi.org/10.52403/ijhsr.20240747>

ABSTRACT

Introduction: The most prevalent lower limb injury, a lateral ankle sprain, is associated with impaired proprioception, balance, and strength, and it occurs often. Chronic Ankle Instability (CAI) is characterized by a lack of function and recurrent episodes. The six movements that make up Ebbets foot drills work to develop the muscles like Tibialis Anterior, Tibialis Posterior, and Peroneus Longus. Sensorimotor re-education may be facilitated by wobble board training (WBT).

Objective: This research seeks to determine the efficacy of combining Wobble board training with Ebbets foot exercises in improving balance and proprioception in a patient suffering from chronic ankle instability.

Materials and Method: With the use of inclusion and exclusion criteria, a person with chronic ankle instability was chosen. We used the Y balance test and an iPhone inclinometer to measure balance and proprioception as part of our pre-test. The patient participated in Ebbets foot exercises and Wobble board training for four weeks, with three 30-minute sessions each week. Using the same instrument as the pre-test, the impact of both components was evaluated after four weeks.

Results: Ankle proprioception angles and Y balance test composite scores both showed improvement, indicating an improvement in proprioception and balance.

Conclusion: The results of this research indicated that a patient with Chronic Ankle Instability shown higher improvements in proprioception and balance when the Ebbets foot exercise and Wobble board training were performed together.

Keywords: Ankle sprains, Balance, Chronic ankle instability, Ebbets foot drills, Proprioception, Wobble board training.

INTRODUCTION

Ankle sprains, especially lateral ones, are the most common and often recurring injuries affecting the lower extremities. After a lateral ankle sprain, your strength, balance, and sense of proprioception are all negatively impacted. Chronic Ankle Instability (CAI) is

characterized by a lack of function and recurrent episodes. Chronic ankle instability (CAI) develops in 32% of people after their first sprain. The anterior talofibular and calcaneofibular ligaments, as well as other external ankle muscles and nerves, are especially vulnerable to stresses and injuries

caused by mechanical and functional causes, leading to this syndrome¹.

The proprioceptive ability comes from the skin, joints, and muscles that constantly feed responses to the brain. Acute injuries to the ligaments such as ligament sprains or muscle strains depreciate the ability to gather this response. This leads to the reoccurrence of these injuries. Chronic conditions can also lead to a proprioceptive deficit in individuals. Proprioception plays a crucial role in maintaining stable joints. Chronic ankle instability can arise from weakened muscles and reduced proprioceptive abilities. Following an injury, these deficits often manifest as decreased awareness of joint position. The capacity to perceive foot movements and adjust accordingly is critical for preventing ankle injuries.⁴

The capacity to keep one's weight distributed evenly over one's body's supporting structures is the definition of balance. However, when all competing forces are balanced, a stable system is achieved equilibrium. Due to their association with ankle sprains and the onset of chronic ankle instability, balance deficits need urgent rehabilitation². The capacity to detect one's own location and motions in space, known as proprioception, is essential for maintaining one's balance. This perception is derived from the transmission of impulses from mechanoreceptors. All of the body's proprioceptive input helps keep you balanced, at least in theory¹.

Various forms of sensory deficits are associated with ankle damage in the form of visual, cutaneous, etc. Among these, the proprioception sense is the one that processes information through the sensorimotor system. Which is divided into Kinesthesia i.e. movement sense of limbs and Joint Position Sense (JPS) i.e. static position of limbs⁴.

Wobbleboard exercises consist of standing and weight-bearing routines performed on an unstable surface. Their purpose is to strengthen the muscles surrounding the ankles and enhance balance. Widely used in both rehabilitation and athlete training

programs, wobble boards can also be utilized to enhance upper body stability and core strength. You can go "around the world" on a round balancing board, which allows you to go in a full circle, and you can also go side to side and front to rear. An inexpensive and widely used tool for improving balance and posture control is the wobbling board. It helps with the re-education of the sensorimotor system and improves balance rapidly and effectively. Scientific research has shown that wobble board training (WBT) may increase the function of mechanoreceptors and restore the normal neuromuscular feedback loop¹.

According to Ebbets (2011), "eliminate lower leg ailments and lessen the risk and severity of ankle sprains when practiced daily" (the Ebbets foot drills are a series of gait exercises. People do Ebbets foot exercises by walking in an unusual way. The primary goal of rehabilitation for patients suffering from Chronic Ankle Instability (CAI) is to strengthen the muscles of the lower leg. A possible advantage of Ebbets foot exercises for strengthening the Peroneus Longus, Tibialis Anterior, and Tibialis Posterior muscles is the increased muscular activity compared to typical walking².

Objective:

This research seeks to determine the efficacy of combining Wobble board training with Ebbets foot exercises in improving balance and proprioception in a patient suffering from chronic ankle instability.

MATERIALS AND METHODS

The purpose of this case study was to examine how a person with persistent ankle instability fared after undergoing wobble board and Ebbets foot workouts. A subject, a 23-year-old physiotherapy student from a Mangalore college, was evaluated according to inclusion and exclusion criteria; the results indicated chronic ankle instability. She attended the outpatient Physiotherapy department of AJIMS. Inclusion criteria comprised of subjects who scored < 25 points in Cumberland Ankle Instability Tool

(CAIT), who experienced more than 3 recurrent lateral ankle sprains in the last 6 months, and ankle sprains from more than 1 year. Subjects with ankle fracture-related problems, road traffic accidents, vestibular or neuromuscular disorders, musculoskeletal deformities, and individuals who have taken Physiotherapy for their ankle over the last 3 months were excluded. Materials used for assessment included a CAIT scoring sheet, a wobble board, a smartphone with an inclinometer, and a measuring tape. Outcome measures include an iPhone inclinometer for Proprioception and a Y balance test for Balance. The subject underwent pre-intervention measurements before engaging in a four-week treatment regimen consisting of supervised exercises conducted for 4 weeks for three days a week, totaling 12 sessions which lasted for 25-30 minutes per session. Patient education remained integral

throughout the treatment process. Post-intervention measurements were taken after the completion of the 12 sessions to assess the study outcomes.

Outcome Measure: Ankle proprioception

The inclinometer app on the iPhone was used to measure proprioception. One way to measure proprioception is by looking at the JPS. After the patient closes their eyes, the therapist will set the ankle at an angle and then release it. The patient must align their ankle with the therapist-adjusted angle. In these test results, an undershoot (less angle) or an overshoot (more angle) may be defined as the difference between the subject's obtained angle and the angle corrected by the therapist. After then, the results are recorded¹¹.



Figure 1: Ankle proprioception

Y Balance Test

To determine equilibrium, the Y balance test (YBT) was administered. Using the anterior, posteromedial, and posterolateral planes, the YBT determines the subject's dynamic balance. To determine the maximum reach distance in each of these three directions, we balanced the subject on one foot at the intersection of the lines, had them reach in a

certain direction, and then had them return to their starting position. Along with the individual's maximum reach lengths in the anterior, posteromedial, and posterolateral directions, a composite score is also calculated by dividing the total by the leg length and then multiplying by 100. After then, the results are recorded¹³.

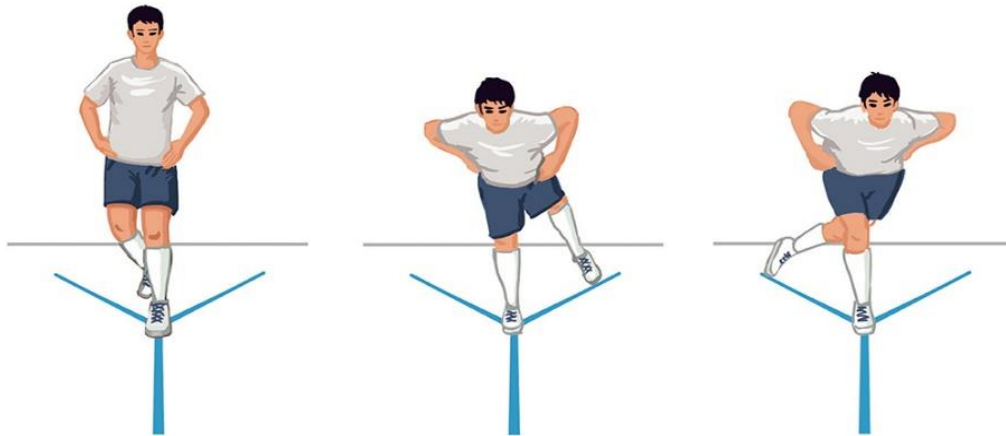


Figure 2: Y balance test

Intervention:

Intervention no.1: Ebbets foot drills-The subject was made to do the drills on a plain surface. The therapist stood at the side to supervise the treatment. The foot drills consist of 6 types of foot positions [table no 1] and the patient has to walk for 25 meters in each of these positions.

Table no. 1

Exercise	Dosage
Toe in walk	25 meters once
Toe out walk	25 meters once
Inversion walk	25 meters once
Eversion walk	25 meters once
Toe walk	25 meters once
Heel walk	25 meters once



Figure 3: Ebbets foot drills

Intervention no.2: Wobbleboard training- The patient was made to do four types of exercises on the wobble board [table no.2] and the patient has to do these exercises for 10 repetitions. The therapist stood at the side to supervise the treatment.

Table no. 2

Exercise	Dosage
Side to side	10 Reps on each side
Front and back	10 Reps on each side
Clockwise	10 Reps
Anticlockwise	10 Reps



Figure 4: Wobble board training

RESULT

TABLE 3:

Outcome measure	Pre-intervention		Post-intervention	
	Right	Left	Right	Left
Ankle Proprioception	5°	4°	1°	1°
Y Balance test	70.411	76.136	84.644	87.5

This study shows improvement in proprioception and balance, as indicated by improved ankle proprioception angles and composite scores of the Y balance test [Table 3].

DISCUSSION

This research aimed to determine if individuals with persistent ankle instability

may improve their proprioception and balance by combining wobble board training with Ebbets foot exercises. Recurring ankle sprains that continue more than a year after the original injury, persistent symptoms like pain, weakness, or limited range of motion (ROM), decreased self-reported functionality, and the sensation of the ankle giving way are all signs of chronic ankle

instability (CAI).¹⁴

Reduced proprioception and balance impact the functional aspect the most in CAI¹⁴. Current research found that Ebbets foot workouts increased proprioception and balance. These exercises are designed to strengthen the tibialis posterior, peroneus longus, and anterior muscles of the leg. Quentin A. Archuleta et al. (2024) found that Ebbets foot exercises might help with chronic ankle instability, which is validated by the current investigation³.

This research found that wobble board training improved balance and proprioception in people with CAI. Restoring normal neuromuscular feedback loop and enhancing mechanoreceptor function are two ways in which wobble board training (WBT) helps rehabilitate the sensorimotor system¹. Supporting the findings of the present research, Singh Amrinder et al. (2012) demonstrated that participants' balance and proprioception significantly improved after six weeks of proprioceptive training¹⁵.

Both balance and proprioception were shown to be enhanced by a program that included both strength training and proprioceptive exercises. According to Khalid A. Alahmiri et al. (2020), research has shown that people of all ages who suffer from chronic ankle instability benefit from a combination of strengthening and proprioceptive training in terms of their stability, balance, and proprioception¹⁶.

In this research, the participants' proprioception was measured using an app on their smartphones called an iPhone inclinometer. Carlos Balsalobre et al. (2018) found that measuring ankle proprioception using a mobile phone is a viable and reliable way to diagnose chronic ankle instability¹⁷. A Y balance test was administered to determine the participant's level of stability. The test measured the participant's maximum reach distance in three different directions, and the results were shown alongside their limb lengths to provide a composite score. According to Scott w. Shaffer et al. (2013), who found an acceptable degree of measurement error across many raters and

strong inter-rater and test-retest reliability for the Y balance test, this is supported¹⁸.

There were certain restrictions on this research. First, there is a lack of diversity in the sample, which might be addressed by doing the study again with a larger sample size and focusing on the causes of chronic ankle instability (CAI). Secondly, although strength training was included of the intervention, it was not used to evaluate success. Furthermore, because the trial only lasted for four weeks, the long-term consequences are still a mystery.

Extensive research on chronic ankle instability has shown that some activities may alleviate the condition. Nevertheless, there has been a lack of comprehensive research on the efficacy of combining Wobble board training with Ebbets foot exercises for chronic ankle instability over a four-week period. The outcomes of this research indicate that both treatments were beneficial for those suffering from Chronic Ankle Instability.

CONCLUSION

This research found that patients with Chronic Ankle Instability benefited more from a combination of the Ebbets foot drill and wobble board training when it came to improving their proprioception and balance.

Declaration by Authors

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

REFERENCES

1. Taghavi Asl A, Shojaedin SS, Hadadnezhad M. Comparison of effect of wobble board training with and without cognitive intervention on balance, ankle proprioception and jump landing kinetic parameters of men with chronic ankle instability: a randomized control trial. BMC Musculoskelet Disord. 2022 Sep 30;23(1):888.
2. Kaminski TW, Hartsell HD. Factors contributing to chronic ankle instability: a strength perspective. J Ath Train. 2002

- Oct;37(4):394.
3. Archuleta QA, McIlvain G, Leigh S, Timmons MK. Lower leg muscle activation during the ebbets foot drills. *J of Bodyw Mov Ther.* 2024 Jul 1; 39:279-84.
 4. Docherty CL, Moore JH, Arnold BL. Effects of strength training on strength development and joint position sense in functionally unstable ankles. *J Athl Train.* 1998 Oct;33(4):310.
 5. Wright CJ, Linens SW. Patient-reported efficacy 6 months after a 4-week rehabilitation intervention in individuals with chronic ankle instability. *J Sport Rehabil.* 2017 Jul 1;26(4):250-6.
 6. Feger MA, Donovan L, Hart JM, Hertel J. Lower extremity muscle activation in patients with or without chronic ankle instability during walking. *J Ath Train.* 2015 Apr 1;50(4):350-7.
 7. Cruz-Diaz D, Lomas-Vega R, Osuna-Pérez MC, Contreras FH, Martínez-Amat A. Effects of 6 weeks of balance training on chronic ankle instability in athletes: a randomized controlled trial. *Int J Sports Med.* 2015 May 13;754-60.
 8. Herzog MM, Kerr ZY, Marshall SW, Wikstrom EA. Epidemiology of ankle sprains and chronic ankle instability. *J Ath Train.* 2019 Jun 1;54(6):603-10.
 9. Ha SY, Han JH, Sung YH. Effects of ankle strengthening exercise program on an unstable supporting surface on proprioception and balance in adults with functional ankle instability. *J Exerc Rehabil.* 2018 Apr;14(2):301.
 10. Jain TK, Wauneka CN, Liu W. The effect of balance training on ankle proprioception in patients with functional ankle instability. *J Foot Ankle Res.* 2014 Apr 8;7(Suppl 1):A37.
 11. Mourcou Q, Fleury A, Diot B, Franco C, Vuillerme N. Mobile phone-based joint angle measurement for functional assessment and rehabilitation of proprioception. *Biomed Res Int.* 2015 Oct 25;2015.
 12. Vuurberg G, Kluit L, van Dijk CN. The Cumberland Ankle Instability Tool (CAIT) in the Dutch population with and without complaints of ankle instability. *Knee Surg Sports Traumatol Arthrosc.* 2018 Mar; 26:882-91.
 13. Foldager FN, Aslerin S, BÆ S, Tønning LU, Mechlenburg I. Interrater, test-retest reliability of the Y balance test: A reliability study including 51 healthy participants. *Int J Exerc.* 2023;16(4):182.
 14. Gribble PA, Delahunt E, Bleakley C, Caulfield B, Docherty C, Fourchet F, Fong D, Hertel J, Hiller C, Kaminski T, McKeon P. Selection criteria for patients with chronic ankle instability in controlled research: a position statement of the International Ankle Consortium. *J Orthop Sports Phys Ther.* 2013 Aug;43(8):585-91.
 15. Amrinder S, Deepinder S, Singh SJ. Effect of proprioceptive exercises on balance and center of pressure in athletes with functional ankle instability. *Sports Med J/Med Sport.* 2012 Sep 1;8(3).
 16. Alahmari KA, Kakaraparathi VN, Reddy RS, Silvian P, Tedla JS, Rengaramanujam K, Ahmad I. Combined effects of strengthening and proprioceptive training on stability, balance, and proprioception among subjects with chronic ankle instability in different age groups: Evaluation of clinical outcome measures. *Indian J Orthop.* 2021 May; 55:199-208.
 17. Balsalobre-Fernández C, Romero-Franco N, Jiménez-Reyes P. Concurrent validity and reliability of an iPhone app for the measurement of ankle dorsiflexion and inter-limb asymmetries. *J Sports Sci.* 2019 Feb 1;37(3):249-53.
 18. Shaffer SW, Teyhen DS, Lorenson CL, Warren RL, Koreerat CM, Straseske CA, Childs JD. Y-balance test: a reliability study involving multiple raters. *Mil Med.* 2013 Nov 1;178(11):1264-70
- How to cite this article: Chaithanya P, Sreejisha PK, Tanmay K. combined effectiveness of Ebbets foot drills and wobble board training on proprioception and balance in a patient with chronic ankle instability: a case study. *Int J Health Sci Res.* 2024; 14(7):361-367. DOI: <https://doi.org/10.52403/ijhsr.20240747>
