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Wobble Board and Theraband Exercise for Dynamic Stabilization in Chronic Ankle Instability

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Keywords

Chronic Ankle Instability; Wobble Board Exercise; Theraband Exercise; Dynamic Stabilization; Y Balance Test

Abstract

Dynamic stabilization disorders frequently occur among athletes as a consequence of Chronic Ankle Instability (CAI), which arises from recurrent ankle sprains resulting in ligament damage and diminished ankle function. Effective management is therefore required to enhance proprioception through wobble board exercise and to improve muscular strength through theraband exercise, thereby increasing overall ankle stabilization. This case study investigated the physiotherapy management of dynamic stabilization disorders attributable to CAI using combined wobble board exercise and theraband exercise interventions conducted at Monsphysio Handil Bakti Clinic. Dynamic stabilization was measured using the Y Balance Test over a four-week treatment period. The results demonstrated a progressive improvement in dynamic stabilization, with the Y Balance Test composite score increasing from 86.7% at baseline (Week I) to 93.7% after four weeks of intervention (Week IV), representing an absolute improvement of 7.0 percentage points. These findings suggest that the combined intervention of wobble board exercise and theraband exercise yields weekly improvements in dynamic stabilization among patients with CAI. Future researchers are recommended to conduct studies with longer treatment durations and to control for patient activity levels, which may influence treatment outcomes.

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INTRODUCTION

Participation in physical activities, particularly in sporting contexts, inherently carries the risk of injury. As noted by Mahfud et al. (2018), athletic performance may be substantially impeded by injury. The occurrence of sports-related injuries is frequently precipitated by inadequate warm-up and stretching protocols prior to physical exertion.

Excessive physical loading, overexertion, and body-contact sports constitute principal risk factors for injury. Among the most prevalent injuries afflicting athletes is Chronic Ankle Instability (CAI), a condition that develops from recurrent ankle sprains. These sprains typically result from sudden movements involving inversion or eversion of the ankle joint, leading to damage to the ligamentous structures. Approximately 85% of ankle sprains are attributable to inversion injuries, which occur when excessive rotational or lateral movements are performed during running or upon landing from a jump (Syafrianto et al., 2017). Ankle sprains may cause damage to the lateral ligament complex, comprising the calcaneofibular ligament, the anterior talofibular ligament, and the posterior talofibular ligament, and may even extend to the interosseous talocalcaneal ligament, resulting in ligamentous stretching or tearing (Kim et al., 2017).

In Indonesia, ankle sprains represent one of the most commonly reported injuries among athletes. Data from the DKI Jakarta Regional Training Center in 2012 indicated that ankle sprains accounted for 41.1% of all reported injuries. Furthermore, cases in which ankle sprains progressed to CAI at Monsphysio Handil Bakti Clinic in Banjarmasin constituted 30% of all patients treated between 2019 and 2020. The consequences of this condition include residual symptoms and functional impairments, typically manifesting as pain and instability during physical activity, attributed to ligamentous damage and diminished physiological function, including sensorimotor deficits. These deficits may lead to muscular weakness, resulting in reduced postural tone, diminished muscular strength, impaired proprioception, decreased flexibility, and compromised stability and balance. Athletes with a history of ankle sprain are at heightened risk of recurrent ankle injuries. When mobilization is premature and rehabilitation inadequate, residual symptoms may develop and ultimately progress to Chronic Ankle Instability (Prasada et al., 2020).

Recurrent ankle sprain episodes may culminate in a condition recognized as Chronic Ankle Instability (CAI), which is diagnosed when symptoms persist for more than six months. The chronic nature of CAI leads to joint destabilization, rendering surrounding structures susceptible to recurrent injury (Wiharja & Nilawati, 2018). CAI is defined as a clinical condition characterized by recurrent episodes of ankle sprain (Parra-Téllez et al., 2019). The management of ankle injuries necessitates relevant and evidence-based therapeutic interventions. Contemporary rehabilitation programs for CAI incorporate balance and coordination training designed to minimize proprioceptive deficits, reduce the sensation of “giving way,” lower the potential for recurrent injury, and improve balance control (Maulida, 2018).

Stabilization disorders are highly prevalent among athletes with CAI, as recurrent sprains cause ligamentous damage and functional decline, including sensorimotor deficits. These deficits may precipitate muscular weakness, reducing postural tone and muscular strength while diminishing proprioception, flexibility, stabilization, and balance (Najizah et al., 2017). The decline in stabilization may impede ankle mobility and function. Such disturbances are commonly observed during ambulation on uneven surfaces, where slight inversion movements become apparent, and a reduction in jumping performance is noted. Ankle stabilization is governed by both active (dynamic) and passive (static) stabilizing mechanisms. Active stabilization is mediated by contractile structures, including muscles and tendons, whereas passive stabilization is provided by bony, articular, and ligamentous structures. The reduction in stabilization resulting from ligamentous damage at the ankle leads to muscular weakness and diminished proprioception, necessitating interventions to enhance proprioception through wobble board exercise and muscular strength through theraband exercise to improve ankle stabilization (Anggita & Ramadani, 2018).

Wobble board exercise has been shown to enhance motor unit recruitment, which activates the Golgi tendon organ and improves the coordination of intrafusal and extrafusal muscle fibers via afferent nerve fibers located within the muscle spindle, thereby stimulating

proprioceptive function (Helmi et al., 2020). Research conducted by Swandari et al. (2016) demonstrated that wobble board training is effective in improving dynamic stability through proprioceptive training of the ankle. Proprioceptive training stimulates mechanoreceptors through activation of the Golgi tendon organ (GTO) and muscle spindle, resulting in improved proprioceptive information. This enhancement enables more accurate information regarding body position relative to the external environment and the positional relationship between body segments to be transmitted to the cerebellum, which the body utilizes to maintain stabilization.

According to Destya et al. (2020), theraband exercise in the form of isotonic training can assist in ameliorating muscular weakness caused by lateral complex ligament damage. Theraband serves as a resistance medium for strengthening ankle musculature; strengthening weakened muscles is essential for prompt recovery and plays a critical role in preventing recurrent injury (Hakiki, 2016). Isotonic exercise involves contraction against a constant load or resistance, during which changes in muscle length occur throughout the range of motion. Improvements in muscular strength are achieved through consistent training, enabling ankle muscles, which are classified as tonic (antagonist) muscles, to enhance capillary blood circulation, thereby increasing muscular strength. Conversely, in agonist muscles, strength improvement results in increased motor unit recruitment, which activates the Golgi tendon organ, enabling muscles to function optimally through depolarization during exercise. As more motor units undergo depolarization, greater force is generated, ultimately establishing effective ankle stabilization (Destya et al., 2020; Haryoko & Juliastuti, 2016).

Research by Muawanah et al. (2016) demonstrated that the combination of proprioceptive training and theraband exercise over a six-week therapy period was effective in improving stabilization in Chronic Ankle Instability. However, in South Kalimantan, specifically in Banjarmasin, no prior study has investigated the combined application of wobble board exercise and theraband exercise for the management of Chronic Ankle Instability. Accordingly, the present study was undertaken to examine the physiotherapy management of CAI using wobble board exercise and theraband exercise at Monsphysio Handil Bakti Clinic. Previous studies have demonstrated the effectiveness of proprioceptive training combined with theraband exercise in improving ankle stability. However, most studies employed experimental designs with larger samples and different intervention protocols. The novelty of the present study lies in the detailed documentation of physiotherapy management through a case study using a combination of wobble board exercise and theraband exercise in a patient with Chronic Ankle Instability treated at Monsphysio Handil Bakti Clinic, South Kalimantan. Furthermore, weekly changes in dynamic stabilization were monitored using repeated Y Balance Test assessments, providing a detailed description of the patient's recovery process during the four-week intervention.

METHODS

This study employed a case study research design. A case study is an investigative approach involving in-depth examination of a single research unit, such as an individual patient, family, group, community, or institution. The distinguishing characteristic of a case study is that, although the number of subjects is limited, the aspects investigated are comprehensive and multifaceted (Kuntjojo, 2009). The study was conducted at Monsphysio Physiotherapy Clinic, located at Jl. Trans Kalimantan 2 Jalur Utama Tahap 1 No. 89, Handil Bakti Village, Barito Kuala Regency, South Kalimantan.

Data collection was performed through the following procedures:

Vital sign measurement: A sphygmomanometer, thermometer, and stethoscope were used to measure vital signs, including blood pressure, pulse rate, respiratory rate, and body temperature. These measurements served as clinical guidelines prior to the administration of therapeutic exercises.

Primary and secondary data: Primary data were obtained through direct patient assessment using the Y Balance Test instrument, conducted twice weekly over four weeks, yielding a total of eight data points. Secondary data were collected through review of supporting examination results, including magnetic resonance imaging (MRI) and laboratory findings. This study

employed a single-subject case study design involving one patient diagnosed with Chronic Ankle Instability (CAI). The participant was selected purposively from patients receiving physiotherapy treatment at Monsphysio Handil Bakti Clinic based on the diagnosis of CAI and the presence of dynamic stabilization deficits. The outcome measure used was the Y Balance Test, which was administered twice weekly for four weeks to evaluate changes in dynamic stabilization.

According to Wibowo (2020), the wobble board exercise was performed as follows:
Front-to-back exercise*:* The patient stood upright with both feet positioned shoulder-width apart on the wobble board, with both hands placed on the hips. The patient then rocked the wobble board forward and backward.
Side-to-side exercise*:* The patient stood upright with both feet positioned shoulder-width apart on the wobble board, with both hands placed on the hips. The patient then rocked the wobble board from the right side to the left side and vice versa.
Circular rotation exercise*:* The patient stood upright with both feet positioned shoulder-width apart on the wobble board, with both hands placed on the hips. The patient then rocked the wobble board in all directions in a circular motion.
The exercise dosage, as prescribed by Muawanah et al. (2016), was as follows: frequency of 3 times per week; intensity of 3 sets per exercise type; duration of 1 minute per set, with 30 seconds of rest between each exercise type.

According to Muawanah et al. (2016), the theraband exercise intervention was administered as follows: 1) Prior to exercise commencement, the patient received an explanation regarding the proper technique for performing strengthening exercises with elastic resistance bands; 2) The patient was positioned in a relaxed seated posture on the treatment table with the lower extremities extended; 3) The therapist instructed the patient to resist the elastic band tension in the directions of dorsiflexion-plantarflexion and inversion-eversion, followed by relaxation.

The exercise dosage was as follows: frequency of 3 times per week; intensity of 3 sets with 10 repetitions per set; duration of 30 minutes, with 30 seconds of rest between sets.

The Y Balance Test procedure, as described by Bulow et al. (2019) and Neves et al. (2017), was conducted as follows: 1) The length of both lower extremities was measured from the anterior superior iliac spine (ASIS) to the medial malleolus; 2) The patient wore lightweight clothing and was barefoot during the test; 3) The starting position required the patient to stand on one leg on the platform, with the affected extremity as the stance limb and the toes positioned on the designated red line; 4) The arms were held at the hips throughout the testing procedure; 5) The heel maintained contact with the platform at all times; 6) The reach indicator was pushed continuously in three directions: anterior, posterolateral, and posteromedial; 7) The patient returned to the starting position in a controlled manner without touching the ground during the test; 8) Following three trials in each direction (anterior, posterolateral, posteromedial), the examiner evaluated whether the patient achieved at least one successful trial. If unsuccessful, the patient was requested to repeat the trial until performed correctly. If the patient was unable to complete the test according to the established criteria within six attempts, the patient was deemed to have failed the test; 9) The average of the three directional reaches was calculated and expressed as a percentage of limb length using the following composite score formula: Lower Quarter Y Balance Test Score = [(Anterior + Posteromedial + Posterolateral) / (3 × Limb Length)] × 100; 10) A composite score below 94% was interpreted as indicative of a dynamic stabilization deficit. The improvement in dynamic stabilization was analyzed descriptively by comparing the composite Y Balance Test scores obtained at baseline and at the end of each treatment week. Weekly improvement was calculated by subtracting the previous week's composite score from the current week's score. Overall improvement was determined by subtracting the baseline score (86.7%) from the final score (93.7%), resulting in an absolute increase of 7.0 percentage points. No inferential statistical analysis was performed because this study employed a single-case study design.

The criteria for a successful trial were: (a) the participant maintained balance throughout the entire trial; (b) the participant maximally reached to push the reach indicator;

and (c) the participant did not shift the foot or hand position on the platform to achieve a greater reach distance.

RESULTS AND DISCUSSION

The patient, a 20-year-old male (Mr. R), underwent physiotherapy assessment and was evaluated using the Y Balance Test. On March 28, 2021, the initial dynamic stabilization measurement revealed a physiotherapy problem of dynamic stabilization disorder due to Chronic Ankle Instability. Based on this diagnosis, the patient received wobble board exercise and theraband exercise interventions to improve dynamic stabilization. The patient underwent physiotherapy intervention over a period of four weeks, comprising 12 treatment sessions. The evaluation results following therapy are presented in **Table 1.**

Table 1. Y Balance Test Results Across Four Weeks of Intervention

Measurement Period	Y Balance Test Score (%)	Weekly Improvement (%)
Week I (Initial)	86.7	—
Week II	88.5	1.8
Week III	92.9	4.4
Week IV (Final)	93.7	0.8

Table 1 presents the results of the Y Balance Test measurements, which were conducted at the beginning and end of each treatment week over a four-week period. A progressive improvement in dynamic stabilization was observed throughout the study, influenced by several factors.

During Week I, the initial measurement yielded a score of 86.7%, with no discernible improvement from baseline. This result was likely influenced by the patient's daily occupational activities as a vendor, which resulted in insufficient rest, as the patient commenced vending activities from 6:00 PM to 1:00 AM and infrequently performed the home exercise program prescribed by the researchers. In Week II, the measurement score increased to 88.5%, representing a 1.8% improvement from the preceding week. This improvement was attributed to the patient's improved compliance with the home exercise program and greater attention to rest periods.

In Week III, the dynamic stabilization score reached 92.9%, reflecting a 4.4% improvement from Week II. The most substantial improvement was observed during this week, primarily because the patient consistently adhered to the home exercise program and did not engage in vending activities, resulting in the patient being in favorable physical condition. In Week IV, the final measurement yielded a score of 93.7%, with a 0.8% improvement from Week III. The relatively modest improvement during this period was attributable to the patient having commenced employment at a new workplace and still adapting to the new activity demands. This occupation required prolonged standing, which caused the recurrence of symptomatic complaints. Additionally, the patient did not perform the home exercise program during this week, resulting in a less pronounced improvement in stabilization.

The cumulative weekly improvements were as follows: 1.8% from Week I to Week II, 4.4% from Week II to Week III, and 0.8% from Week III to Week IV. The overall improvement in dynamic stabilization from Week I to Week IV was 7.0%.

The first intervention administered was wobble board exercise, which, according to Muawanah et al. (2016), trains proprioception by simultaneously engaging lower extremity musculature from the pelvis to the foot and ankle, thereby enhancing muscular strength, proprioception, and stability, leading to a reduction in ankle instability and normalization of daily activities. Furthermore, research conducted by Swandari et al. (2016) demonstrated that wobble board training is effective in improving dynamic stability through proprioceptive training of the ankle. Proprioceptive training stimulates mechanoreceptors through activation of the Golgi tendon organ (GTO) and muscle spindle, resulting in enhanced proprioceptive information. When proprioception improves, the information regarding body position relative to the external environment and the positional relationships between body segments that is

received by the cerebellum becomes more accurate, and this information is utilized by the body to maintain stabilization.

In addition to wobble board exercise, the researchers also administered theraband exercise. According to Destya et al. (2020), theraband exercise in the form of isotonic training can assist in ameliorating muscular weakness caused by lateral complex ligament damage. Theraband serves as a resistance medium for strengthening ankle musculature, and strengthening weakened muscles is essential for prompt recovery and plays a critical role in preventing recurrent injury (Hakiki, 2016). Through consistent training, muscular strength improves because ankle muscles, which are classified as tonic (antagonist) muscles, enhance capillary blood circulation, thereby increasing muscular strength. In agonist muscles, strength improvement results in increased motor unit recruitment, which activates the Golgi tendon organ, enabling muscles to function optimally through depolarization during exercise. As more motor units undergo depolarization, greater force is generated, ultimately establishing effective ankle stabilization (Destya et al., 2020; Haryoko & Juliastuti, 2016).

The selection of therapeutic exercises significantly determines the degree of treatment success. Patient compliance with the prescribed therapy protocol contributed substantially to achieving outcomes aligned with clinical expectations. The findings of this study are consistent with those reported in several published studies, which demonstrated that patients with dynamic stabilization disorders attributable to Chronic Ankle Instability benefited from wobble board exercise and theraband exercise interventions in improving dynamic stabilization. Notably, the fluctuation in weekly improvement rates, particularly the substantial gain in Week III followed by a more modest increase in Week IV, underscores the importance of patient adherence to home exercise programs and the influence of occupational demands on recovery trajectories. These findings highlight the need for clinicians to consider patient-specific lifestyle factors when designing rehabilitation protocols. The present findings are consistent with those reported by Muawanah et al. (2016), who found that proprioceptive training combined with theraband exercise significantly improved ankle stability in individuals with Chronic Ankle Instability after six weeks of intervention. Similarly, Swandari et al. (2016) reported that wobble board training effectively enhanced dynamic balance by improving proprioceptive function. Although the present study was conducted over a shorter intervention period of four weeks and involved only a single patient, the observed improvement in the Y Balance Test score from 86.7% to 93.7% supports previous evidence that combined proprioceptive and strengthening exercises contribute to improved dynamic stabilization in patients with CAI. The slightly smaller improvement observed during the fourth week may have been influenced by reduced adherence to the home exercise program and increased occupational demands, indicating that patient compliance is an important determinant of rehabilitation outcomes.

CONCLUSION

Based on the physiotherapy assessment and examination findings, the physiotherapy diagnosis was established as “dynamic stabilization disorder secondary to Chronic Ankle Instability.” The principal findings and conclusions of this study. The primary physiotherapy problem identified was dynamic stabilization disorder attributable to Chronic Ankle Instability. He physiotherapy management objectives, derived from the assessment and diagnosis, were to improve dynamic stabilization in Chronic Ankle Instability. The combined application of wobble board exercise and theraband exercise demonstrated therapeutic efficacy in enhancing dynamic stabilization among patients with Chronic Ankle Instability.

The results of this study indicated a progressive improvement in dynamic stabilization following the administration of wobble board exercise and theraband exercise interventions. Evaluation outcomes demonstrated weekly improvements in dynamic stabilization attributable to Chronic Ankle Instability when managed with combined wobble board exercise and theraband exercise interventions. The overall improvement across the four-week treatment period was 7.0%.

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