

# The Y balance test—how and why to do it?

## Abstract

Neuromuscular control of the lower limbs has been explored in the liturgy in an attempt to elucidate possible causes and mechanisms of lower limb injuries. Among other instruments, the Y Balance Test has been used to evaluate neuromuscular control, mobility and stability of lower limbs and hip. The device used to perform the test uses the anterior posteromedial and posterolateral components of the Star Excursion Balance Test, the test that gave rise to the Y Balance Test. During the test, the individual needs a maximum distance in each direction in a stable way without leaving the posture indicated by the evaluator. To express a reach distance as a division of the length, are calculated as normalized distances of each direction for each lower limb, asymmetry between the limbs, and a composite score of the whole test. Asymmetries with a value equal to or higher than 4 cm and/or composite score below 94% are related to neuromotor deficit suggesting a greater probability of injuries in the lower limbs.

**Keywords:** y balance test, dynamic stability, neuromotor deficit

Volume 2 Issue 4 - 2017

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**Received:** September 01, 2017 | **Published:** December 15, 2017

## Introduction

The Y Balance Test is a dynamic stability test that has been considered efficient and clinically applicable to provide an accurate assessment of the lower limb neuromuscular control.<sup>1</sup> Originally this test was called the Star Excursion Balance Test (SEBT) and it was called that way because the athlete had to perform the range in eight different directions when performing it. The aim of this review is to describe the Y Balance Test, as well as its use in clinical practice.

## Methods

A search was made for articles describing the history of the Y Balance Test, its objectives, protocol and analyzes. During the data collection, we used studies without language restriction and year of publication, and using as descriptors “Y Balance Test” and “physiotherapy”.

## Results

Publications about Y Balance Test are relatively recent, so their method has been constantly improved and standardized. However, its application has been an important tool in clinical practice, especially in sports, since the literature brings several studies using Y Balance Test as predictive of injury. Recently, researchers have suggested using SEBT as a sports practice screening method, to identify athletes at higher risk for lower limb injuries and as a test for high post-rehabilitation, to check for dynamic functional symmetry, thus, the return to the sport practice.<sup>2</sup> However, due to the redundancy in data between the eight directions, it was suggested to simplify the test using only three directions. This new way to perform the SEBT, was titled Y Balance Test.<sup>3,4</sup> and only the anterior, posteromedial and posterolateral directions are used in this case. Dynamic stability which is tested by Y Balance Test depends on factors such as muscle strength, co-contraction, flexibility, passive stiffness of the lower limbs and lumbopelvic stability.<sup>4</sup> There is evidence of the relation between the anterior reach and flexor and extensor hip strength, as well as posterolateral reach and flexor, extensor and abductor strength.<sup>5</sup>

The device used to perform the test uses the anterior, posteromedial and posterolateral components of the SEBT.<sup>2</sup> The Y Test kit consists

of a position platform, through which three pieces of PVC pipe are attached, duly marked in centimeters forming the directions of anterior posteromedial and posterolateral reach. The posterior directions are each positioned 135 degrees from the previous and 90 degrees between them. The subject should push the reach indicator along the standardized tube. Then, the height reached, and the indicator remain on the tape measure glued to the tube after the test making the determination of the range more precisely. However, when there is no instrument of the test it can be replaced by tapes fixed to the ground with the same measurements but this requires more attention of the evaluator due to the absence of a reach indicator with which the individual touches quickly in the tape.

The individual performing the test must first watch a video demonstrating the test and the test procedure or be instructed and visualize a demonstration by the evaluator. The individual should practice six times on each lower limb in each of the three reach directions before the formal test. The individual must be barefoot or wear athletic shoes during the test and must be with the support foot positioned in the center of the platform, leaning against the starting line. At the same time that it needs to maintain the unipodal posture the individual is asked to reach the free limb in the anterior posteromedial and posterolateral directions in relation to the static foot.<sup>2</sup>

The individual should be instructed by an assessor to stand on the platform with his fingers behind the line and to push the reach indicator on the target area in the direction being tested. After three attempts in each direction with each member, the evaluator checks if the individual has at least one successful test. Otherwise, the evaluator requests that an additional test be performed until the range is correct. If the individual is unable to perform the test according to the above criteria in six attempts, it means that he failed in the direction.<sup>2</sup>

The maximum reach distance is measured by reading the tape measure at the edge of the reach indicator, at the point where the most distal part of the foot has reached. The test is discarded if the individual: cannot maintain the unipodal posture on the platform; cannot maintain firm and smooth contact with the reach indicator; uses the scope indicator as a support for body weight discharge because it cannot maintain the position; and when the reach foot cannot return to the starting position and keep the position under control.<sup>2</sup>

To express the reached distance as a percentage of limb length, the normalized value is calculated as the range distance divided by limb length (distance between the anterior superior iliac spine and the medial malleolus) then multiplied by one hundred. The composite reach distance is the sum of the three reach directions divided by three times the limb length, this all multiplied by one hundred.<sup>2</sup> The asymmetry between the limbs is calculated by the absolute difference of the distances for each direction, that is, one must subtract the value of the dominant leg from the non-dominant one.<sup>4</sup>

Asymmetry between limbs equal to or greater than 4 centimeters for the anterior direction and/or composite score less than 94% is related to neuromuscular control deficits and a higher probability of lower limb injuries.<sup>2</sup> When athletes or patients in general presents this results preventive exercise strategies should be considered. The Y Balance Test also can offer an assessment of injury risk for some athletes which is very important to minimize costs and time spent in rehabilitation.<sup>6</sup>

In sum, this functional test has a high level of reliability as a predictor of injuries in the lower limbs, especially in the ankle joint, since results considered below the expected show the following changes: chronic ankle instability due to lack of dorsiflexion range of motion (normalized anterior distance) strength and neuromuscular control deficits for inverters (normalized posteromedial distance) and ankle everters (normalized posterolateral distance).

## Acknowledgements

None.

## Conflict of interest

The authors declares no conflict of interest.

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