# Assessing Risk of Lower Extremity Injury: Y-Balance Test™ Lower Quadrant

Donald D. Shrump Jr., CSCS
University of Bridgeport College of Chiropractic
University of Bridgeport, Bridgeport, CT

## Background and Purpose

**Background –**

- Utility of functional testing has become increasingly popular by clinicians in an effort to assess injury risk, baseline deficits from injury, and improvement after treatment. [1, 2,3,4,5]
- Previous injuries may lead to subtle deficits in neuromuscular control, dynamic posture control, strength, and flexibility. [3,4]
- Y-Balance Test™ lower quadrant (YBT-LQ) provides quantitative data for the effectiveness rehabilitative modalities.[6]
- Evidence supporting YBT-LQ has provided many clinicians with criterion for decision making in treatment modalities.

**Purpose –**

- The purpose of this presentation was to demonstrate the usefulness of employing YBT-LQ into chiropractic rehabilitation practice.

## Methods

- Prior to balance testing, lower extremity length is measured from the anterior superior iliac spine (ASIS) to the medial malleolus on all patients to standardize reach distances.
- Following familiarization with the YBT-LQ protocols, dynamic standing balance can be quantified by measuring lower extremity reach distances anteriorly (A), posteromedially (PM), and posterolaterally (PL) from 3 successful attempts.
- Initial results of the reach distances may be compared for left to right asymmetries.
- Composite score (CS) can be calculated by the sum of three reach directions divided by three times lower limb length (cm), then multiplied by 100.

$$\frac{(A + PM + PL)}{(3 \times \text{Limb Length})} \times 100 = CS$$

- Using the composite score, a clinician could utilize the injury risk algorithm by Move2Perform for pre-participation physical screenings and to assist with return to sport decisions.[5]
- Various treatment modalities can be tested for effectiveness.[7,8]

## Methods


**Fig. 1 – Anterior Reach**


**Fig. 2 – Posteromedial Reach**


**Fig. 3 – Posterolateral Reach**

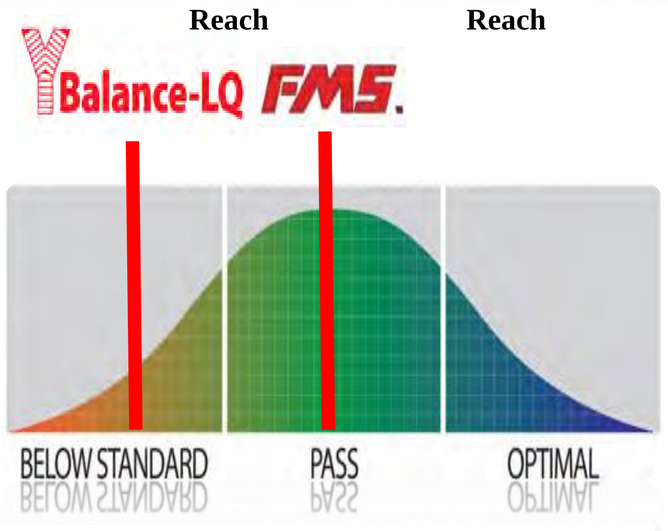


**Fig. 4 – Move2Perform algorithm creates cut off points for age, gender, and sport.**

## Treatments

**Table 1. Sample neuromuscular exercise progressions from the balance and hip/pelvis/trunk strengthening protocol for single leg stability.[7]**

| Initial Phase (Weeks 1-2) | Intermediate Phase (Weeks 3-4) | Late Phase (Weeks 5-6) |
|---|---|---|
| Stable surface progression: | | |
| • Broad jump, stick landing<br>• Box drop, stick landing | • Single-leg, stick landing<br>• Box drop medicine ball catch | • Single-leg crossover, stick landing<br>• Box drop 180° medicine ball catch |
| Unstable surface (BOSU) progression: | | |
| • Double-leg balance<br>• Double-knee balance | • Single-leg balance<br>• Single-knee balance (Fig. 6) | • Single-leg balance (perturbation/ sport-specific)<br>• Hip-side balance |
| Targeted hip/pelvis/trunk strengthening: | | |
| • Abdominal crunch BOSU abdominal crunch<br>• Lower back superman's | • BOSU abdominal crunch<br>• BOSU lower back superman's | • BOSU abdominal V-sit/toe touch<br>• Back hyperextensions |


**Fig. 6 - Neuromuscular training[7]**


**Fig. 7 - Rearfoot Distraction Manipulation[8]**

## Results

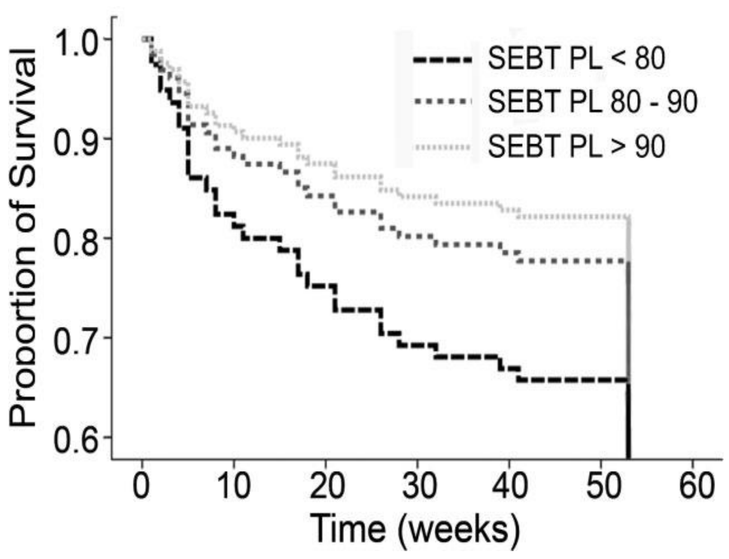


**Fig. 5 - Survival curves for Star Excursion Balance Test posterolateral direction (SEBT PL) according to Cox regression model. [6]**

## Results and Conclusions

- Composite scores below cut off points (i.e. college football = 89%) increased probability of injury by 37.7% to 68.1 %.[4]
- Subjects with anterior asymmetry > 4 cm were 2.5 times more likely to sustain a injury. Additionally, females in the bottom1/3 of the composite score cut off had a 6 times risk of injury.[1]
- Subjects with a composite score under 80 for PL have 48% greater risk of suffering an ankle sprain. In contrast, participants who were able to reach a distance equivalent to 90% of their limb length or higher, had a significantly lower incidence of sprains.[5]
- Neuromuscular training and rearfoot distraction manipulation significantly improve YBT-QL scores.[7,8]
- Future studies using YBT-LQ should evaluate effectiveness of various chiropractic manipulation treatments.

## References

1. Plisky P, Rauh M, Kaminski T, Underwood F. Star Excursion Balance Test as a predictor of lower extremity injury in high school basketball players. J Orthop Sports Phys Ther. 2006;36:911-919.
2. Plisky PJ, Gorman PP, Butler RJ, Kiesel KB, Underwood FB, Elkins B. The reliability of an instrumented device for measuring components of the star excursion balance test. North Am J Sports Phys Ther 2009;4(2):92.
3. Nadler SF, Malanga GA, Feinberg JH, Rubanni M, Moley P, Foye P. Functional performance deficits in athletes with previous lower extremity injury. Clin J Sport Med. 2002;12(2):73-78.
4. Lehr ME, Plisky PJ, Kiesel KB, Butler RJ, Fink M, Underwood FB. Y Balance Test Predicts Non-Contact Lower Extremity Injury in Collegiate Football Players. Sports Health. (In Review)
5. Lehr ME, Plisky PJ, Butler RJ, Fink ML, Kiesel KB, Underwood FB. Field-expedient screening and injury risk algorithm categories as predictors of noncontact lower extremity injury. Scand J Med Sci Sports. 2013 Aug;23(4):e225-32.
6. de Noronha M, França LC, Haupenthal A, Nunes GS. Intrinsic predictive factors for ankle sprain in active university students: A prospective study. Scand J Med Sci Sports. 2012.
7. Paterno MV, Myer GD, Ford KR, Hewett TE. Neuromuscular training improves single-limb stability in young female athletes. J Orthop Sports Phys Ther. 2004 Jun;34(6):305-16.
8. Wassinger CA, Rockett A, Pitman L, Murphy MM, Peters C. Acute effects of rearfoot manipulation on dynamic standing balance in healthy individuals. Man Ther. 2013 Nov 10.