

# Interest of the Upper Quarter Y-Balance Test for Assessing Upper-Extremity Force Capacity in Multisport Athletes

Thomas De Sousa<sup>a, b\*</sup>, Isabelle Rogowski<sup>b</sup>, Yoann Blache<sup>b</sup>

<sup>a</sup> TRINOMA, Villefort, France

<sup>b</sup> Univ Lyon, Université Claude Bernard Lyon 1, Laboratoire Interuniversitaire de Biologie de la Motricité, EA 7424, F-69622 Villeurbanne, France

\* Corresponding author: thomas@trinoma.fr

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## 1. Introduction

Proposed to assess joint stability and mobility of the entire upper quarter and trunk at the limit of stability (Gorman et al., 2012), the Upper Quarter Y-Balance Test (UQYBT) is a physical performance test used in performance and return to sport contexts to improve athlete management (Schwank et al., 2022). While it is suggested that similar performance are reached by the dominant and non-dominant upper extremities (Steele & Valentin, 2024), these performances may result from different motor strategies. Consequently, assessing the biomechanical strategies of the dominant and non-dominant upper extremities may improve understanding of the role of dominance during the test.

To perform the UQYBT, participant must be able to sustain a large portion of his body weight on the support Upper Extremity (UE) (Gorman et al., 2012). However, the role of the forces sustained by the support UE in UQYBT performance remains to be investigated. Therefore, examining the relationship between the force produced by the support UE may improve athlete management by enhancing understanding of the factors influencing UQYBT performance. This study aimed to assess the influence of the dominance and ground reaction forces level on the UQYBT performances.

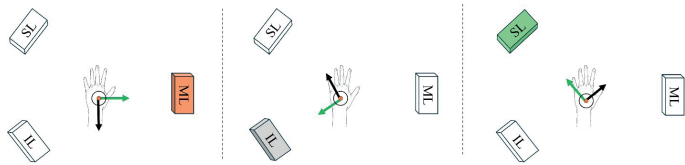
## 2. Methods

Twenty-five male athletes (age:  $26.0 \pm 11.3$  yrs; height:  $179.0 \pm 6.5$  cm; mass:  $77.8 \pm 23$ ; right-handed: 22;

dominant limb length:  $91.0 \pm 3.9$ ; non-dominant limb length:  $91.0 \pm 3.8$ ) participated in the study (ethical committee #2022-10-13-002). Inclusion criteria were being aged from 18 to 35 years and practicing sport activity involving at least one UE. Exclusion criteria were injured in the 6-months before the study or undergone surgery at one UE.

Ground reaction force signals of the support UE were collected using a force plate (2000 Hz, Kistler, Switzerland). Four reflective markers were fitted on each participant's hand to compute the hand barycenter, calculated as the average of the 3D positions of the markers, using an optoelectronic system (200 Hz, Qualisys, Gothenburg, Sweden). For the UQYBT, three graduated pipes were placed beyond the force plate, to define the medial (ML), inferolateral (IL), and superolateral (SL) directions (Gorman et al., 2012). From a unilateral push-up position, the task consisted of pushing boxes as far as possible in the ML, IL and SL directions, successively. After completing one familiarization trial, three maximal trials were performed per UE, with 30-s recovery between trials.

UQYBT performances were normalized to the moving limb length (MLL). For each UQYBT direction, local reference systems were computed with the origin defined as the barycenter of the support hand with the x-axis pointing towards the box direction, z-axis orthogonal to the box direction and y-axis vertical (Figure 1). Ground reaction force signals were normalized to body



**Figure 1.** Local reference systems used for the mediolateral direction (ML) (left), inferolateral (IL) direction (center) and superolateral (SL) direction (right). Green arrow: propulsive force; black arrow: orthogonal force; circle: vertical force.

weight and the propulsive force (x-axis), orthogonal force (y-axis) and the body weight supported (vertical axis) were averaged for each direction. Linear mixed models were used to determine the effect of dominance and the force produced by the support hand on the UQYBT performance.

### 3. Results and discussion

For the ML direction, similar performances were observed (DOM:  $106.1 \pm 5.9$  %MLL *vs.* NDOM:  $106.8 \pm 5.6$  %MLL). In the IL direction, performances were lower on the dominant UE (DOM:  $82.3 \pm 7.0$  %MLL *vs.* NDOM:  $90.2 \pm 7.7$  %MLL) which may highlight diminished mobility of the dominant upper quarter side due to its involvement in the activity. In the SL direction, performances were higher on the dominant UE (DOM:  $90.2 \pm 7.7$  %MLL *vs.* NDOM:  $82.3 \pm 7.0$  %MLL).

For all UQYBT directions, the performance was explained by the participant capacity to produce propulsive force (Table 1). These results highlight that UQYBT is a useful test to assess participant ability to produce propulsive force in different directions. Surprisingly, none of the orthogonal force were discriminating for UQYBT performances. Executing the UQYBT require to sustain higher proportion of the body weight in the SL direction (Degot et al., 2020) Our results confirmed that for the SL direction by showing that being able to increase the amount of body weight sustained on the support UE was associated with increased performance. Therefore, the SL performance may be an indicator of the stability level of the support UE. Overall, these results highlighted that moderate-to-high variation of the UQYBT performances were explained by the force applied by the stance UE (Table 1).

**Table 1.**  $b_i$  and  $\beta_i$  coefficients of optimized mixed models explaining the mediolateral, inferolateral and superolateral performances of the UQYBT by the average forces of the support upper extremity in the direction of movement (FDM), vertical (FDV) and orthogonal (FDO) and Dominance.  $R^2$  for conditional coefficient of determination; AIC for Akaike information criterion.

	Mediolateral		Inferolateral		Superolateral	
	$b_i$	$\beta_i$	$b_i$	$\beta_i$	$b_i$	$\beta_i$
Intercept	102.14	107.97	77.96	83.76	18.96	73.47
FDM	1.03	5.14	1.40	9.47	1.23	9.32
FDV					0.95	8.43
FDO						
DOM			-3.80	-3.80		
$R^2$	0.70		0.57		0.71	
AIC	305.03		331.60		338.97	

### 4. Conclusions

In conclusion, this work has shown that the UQYBT assesses the ability of the support UE to produce propulsive forces to move the boxes, but also to sustain high proportion of the body weight in the superolateral direction. Further work is needed to better understand the role of the lower limb on the upper quarter motor strategies.

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### Conflict of Interest Statement

The authors report no conflict of interest.

### Contributor Roles

TDS performed data collection, data analysis and wrote the manuscript.

YB participated in the study design and data analysis and contributed to manuscript writing.

IR contributed to the data analysis, study design and manuscript writing.

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## References

- Degot, M., Rogowski, I., & Blache, Y. (2020). Ground reaction force during the Upper Quarter Y-Balance Test. *Computer Methods in Biomechanics and Biomedical Engineering*, 23, S69–S70. <https://doi.org/10.1080/10255842.2020.1812162>
- Gorman, P. P., Butler, R. J., Plisky, P. J., & Kiesel, K. B. (2012). Upper Quarter Y Balance Test : Reliability and performance comparison between genders in active adults. *Journal of Strength and Conditioning Research*, 26(11), 3043–3048. <https://doi.org/10.1519/JSC.0b013e3182472fdb>
- Schwank, et al. (2022). 2022 Bern consensus statement on shoulder Injury prevention, rehabilitation, and return to sport for athletes at all participation levels. *The Journal of Orthopaedic and Sports Physical Therapy*, 52(1), 11–28. <https://doi.org/10.2519/jospt.2022.10952>
- Steele, C., & Valentin, S. (2024). Intrinsic and extrinsic variables impacting upper quarter Y-balance test scores in sporting cohorts : A systematic review. *Journal of Bodywork and Movement Therapies*, 39, 183–194. <https://doi.org/10.1016/j.jbmt.2024.02.043>