Core Rotational Performance Lags Behind the Upper Body and Lower Body in Strength Development

Performance of rotational core movements showed a greater proportion of individuals that lacked baseline strength development as compared to the lower body and upper body in the same group.

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Abstract

Data collected on the Proteus Motion system was utilized to measure the difference in the performance of power and acceleration of athletes. Performance was categorized into 1 of 4 classifications: Low Strength, Strength Dominant, Speed Dominant, or High Strength and Speed. Movements were tested across 3 body regions and scores were averaged in order to assess the performance of the upper body, lower body, and core respectively. Results showed that the core shows a much larger percentage of individuals that need foundational strength training (63.0%) vs the upper body (55%) and lower body (58%). There are also much fewer that fall into the strength dominant classification for the core (13%) vs the upper body (22.5%) and lower body (22%) and a higher proportion of individuals that fall into the speed dominant classification (14%) vs the upper body (11.8%) and lower body (11%). This indicates a lack of foundational and high-level strength development in rotational core movements compared to the upper body and lower body. Training programs should include measurements of rotational core movements as well as an increase in training volume, load, and frequency to minimize the gaps in performance, reduce injury risk, and improve overall outcomes.

Introduction

Historically, strength and power testing have been limited by resistance technology requiring movements to be performed in one plane. This is primarily due to the overwhelming majority of implements creating resistance in only one plane in a single vector. Additionally, the majority of assessments are in the sagittal plane due to the ease of performing and proliferation of these testing methods.

You will find the majority of strength and power testing consisting of upper body horizontal pushing movements like the bench press, med ball chest toss, or push-ups. For the lower body,

vertical jump and broad jump testing is most common. Upper body pulling movements are not tested as frequently but are often assessed with horizontal movements like rows or vertical movements like pull-ups. It is rare to see coaches test rotational movements, but they will sometimes utilize med ball throws for distance.

Because testing is difficult and time-consuming, many coaches simply stick to simple tests of the upper body and lower body to assess athletic potential and performance. We wanted to compare performance in the presumably under-measured and under-trained rotational core movement pattern compared to more commonly tested and trained movements in the upper body and lower body to see if performance was equivalent or if there was a gap that should be addressed.

Methods

To investigate these differences across different body areas, Proteus analyzed all males from 20-30 years old across all of our locations who performed the same standardized test (Cressey Performance Test) from September 1, 2021, to Aug 31, 2022. This is an ideal test for evaluating performance of rotational sports. It was specifically designed for baseball players but is also used with Tennis, Golf, MMA, and other athletes.

The test consists of the following movements: (17 total), 5 reps each, at max effort, performed in the standing position, on the left and right unless otherwise noted:

- **Single Hand Horizontal Push**
- **Single Hand Horizontal Pull**
- **PNF D2 Flexion**
- **PNF D2 Extension**
- **Static Start Straight Arm Trunk Rotation**
- **Counter Movement/Plyo Straight Arm Trunk Rotation**
- **Lateral Bound**
- **Counter Movement Vertical Jump (not performed unilaterally)**
- **Full Body Rotational Shot Put**

We then grouped these movements into 3 body region groups:

Upper Body Movements

- **Single Hand Horizontal Push**
- **Single Hand Horizontal Pull**
- **PNF D2 Flexion**
- **PNF D2 Extension**

Lower Body Movements

- **Lateral Bound**
- **Counter Movement Vertical Jump**

Core Movements

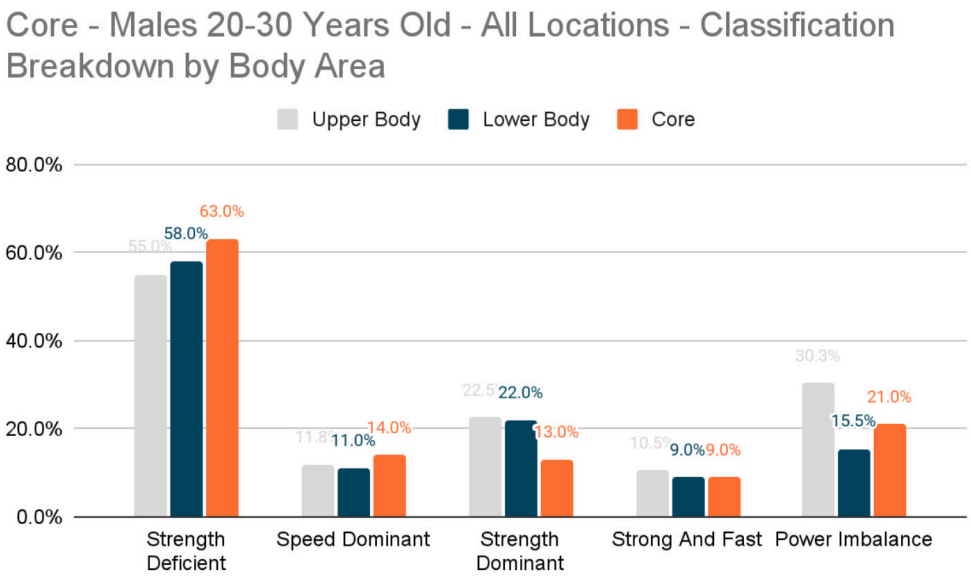
- **Static Start Straight Arm Trunk Rotation**
- **Counter Movement/Plyo Straight Arm Trunk Rotation**

Categorization

We then categorized athletes into 4 specific classifications based on their overall average percentile rankings for each body region in both power and acceleration among all males between 20-30 years old. Below are the criteria for these classifications:

LOW STRENGTH	SPEED DOMINANT	STRENGTH DOMINANT	STRENGTH & SPEED
Individuals that fall below the 50% baseline of power production	Individuals that possess baseline power (>50 percentile) but have a significantly higher amount of speed production over strength (>5 percentile points acceleration over power)	Individuals that possess baseline power (>50 percentile) but have a significantly higher amount of power production over speed (>5 percentile points power over acceleration)	Individuals that possess baseline power (>50 percentile) and have a balanced amount of speed and strength production (<5 percentile points difference between power and acceleration)

Results



The core shows the greatest number of individuals falling into the Strength Deficient classification at 63% while the lower body and upper body have 58% and 53% respectively. Simultaneously, the core has the lowest number of individuals falling into the Strength Dominant classification at 13%, while the upper body and lower body each have around 22%. All regions have roughly the same amount of individuals who fall into the High Strength and Speed classification, while in Speed Dominant the core displays a slightly higher proportion at 14% while the upper body and lower body each have 11.8% and 11% respectively.

Discussion

The core shows a much larger percentage of individuals that need foundational strength training, with 63.0% falling into this classification. In addition, for those that possess foundational strength (above 50th percentile in power), there are much fewer that fall into the Strength Dominant classification at only 13%. You also see a higher proportion of individuals fall into the speed dominant category at 14%, further indicating the lack of strength development. This highlights the inherent difficulty in developing foundational strength in rotational core movements as it is a very difficult movement to load with traditional equipment and techniques compared to the more uniplanar movements in the upper body and lower body.

This is an expected finding as it is very easy currently to train the upper and lower body regions with high orce, low-velocity exercise interventions such as squats, bench press, rows, etc. Doing that type of foundational loading on rotational core movements, particularly in a standing position, is difficult without 3D Resistance, which has only recently been introduced. This is primarily due to the limiting factor that most resistance training equipment cannot provide resistance across the entire ROM, but instead only loads at particular points in the range.

Proteus's 3D Resistance solves this problem, by providing resistance evenly across the entire ROM, perfectly mirroring the direction of movement with resistance. This allows Proteus to plug a major hole in the majority of athletes' training programs, something that this data supports.

Summary

A retrospective data analysis of power and acceleration metrics in males between 20-30 years old utilizing Proteus 3D Resistance shows that performance in rotational core movements lags behind the upper and lower body in foundational strength development. This is likely due to the difficulty in properly loading these movements with traditional equipment as compared to the lower body and upper body. Training programs should include measurements of rotational core movements as well as an increase in training volume, load, and frequency to minimize the gaps in performance, reduce injury risk, and improve overall outcomes.