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"CHANGE OF DIRECTION DEFICIT" MEASUREMENT IN DIVISION I AMERICAN FOOTBALL PLAYERS

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INTRODUCTION

Change of direction (COD) ability is an important physical fitness capacity required in conjunction with cognitive-perceptual ability to perform effective and efficient agility manoeuvres in many sports (4). Although, the physical capacity to change direction is often measured by strength and conditioning professionals, the ability of these common COD tests (presented as time to complete a running task) to truly measure one's ability to decelerate and subsequently reaccelerate in a new direction is often tangled within one's ability to perform straight line running. This has been demonstrated with large to very large correlations found between COD tests and straight-line sprint speed in various studies (1, 3, 5). The reason for continuing to use these common COD tests, such as the T-test, 505 and pro-agility is often due to existing data to compare athlete performances and ease of data collection. Some researchers have used the velocity of the centre of mass as a true measure of COD ability (6). Although assessing COD ability by measuring athlete COM out of a COD step provides a direct measure of COD ability, the scope for strength and conditioning professionals to be able to use this type of assessment is small due to time and equipment constraints. A proposed method, termed "change of direction deficit", to assess COD ability was calculated to assess if this measure could better isolate COD ability independent of one's straight-line sprint ability.

METHODS

Participants

Sixty-six Collegiate Division I American football players (n = 66) between the ages of 18 and 22; body mass: 107.7 ± 20.5; relative 1-RM Squat: 2.0 ± 0.3; relative 1-RM Hang Clean: 1.2 ± 0.2) performed the pro-agility COD test and 40 yard (36.6. metre) sprint test (with 10 yard split times) as part of their standard testing for sport performance athlete profiling at their University. Athletes were cleared for physical performance testing and an ethics declaration for use of the collected data was obtained.

Experimental Design

Participants performed a 40-yard sprint test through timing gates (Speedlight Timing System; Swift, Australia) with a 10-yard split. Further, pro-agility COD performance was assessed with timing lights, allowing for a split time during the first 10 yards of the test which includes a single 180 degree COD (Figure 1). "Change of direction deficit" was calculated as the difference between the 10-yard split time during the 40-yard sprint and the 10-yard split with a 180-degree COD (as assessed during the first half of the pro-agility).

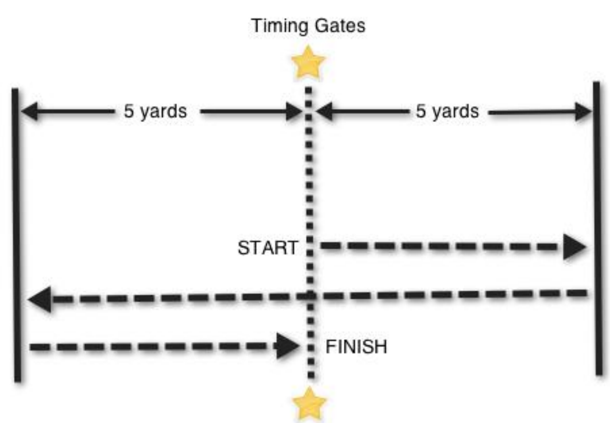

Figure 2 - Pro-Agility COD test.

Statistical Analysis

SPSS Version 21.0 (SPSS Inc., Chicago, USA) was used to assess the relationship between pro-agility COD performance, straight-line sprint speed (10 yd split) and COD deficit using Pearson product-moment correlations (r) with explained variance (r^2). Significance set at an alpha level of 0.05. Magnitude of the effect was based on the following scale: trivial: <0.10, small ≤0.10-0.29, moderate 0.30-0.49, large 0.50-0.69, very large: 0.70-0.89, and nearly perfect ≥0.90 (2). Further, to ensure the COD deficit is actually a different measure than total time to perform pro-agility and is a separate quality than straight-line sprint speed, partial correlation was assessed with sprint time over 10 yards as the controlled (removed) variable. All data is presented as means ± SD.

RESULTS

The mean ± SD of pro-agility, 10 yard sprint time and COD deficit are presented in Table 1. Further, the correlations between pro-agility time (including the pro-agility 10 yd split time), sprint time and COD deficit are presented in Table 2. Finally, in Table 3, the relationship between pro-agility and COD deficit is presented when the variable of sprint time is controlled for using a partial correlation analysis.

Table 1 - Mean ± SD values for all variables.

	Mean		SD
Pro-agility (s)	4.53	±	0.33
Pro-agility (10 yd split) (s)	2.29	±	0.17
10 yd Sprint time (s)	1.57	±	0.15
COD Deficit (s)	0.72	±	0.08

Table 2 - Correlation and (explained variance) between COD deficit, Pro-agility time, Pro-agility 10 yd split and 10 yd sprint time with and without sprint speed controlled.

	COD Deficit	Pro Agility	Pro Agility (10 yd)
Pro Agility (s)	0.54 (29%) **		
Pro Agility (10 yd) (s)	0.61 (37%) **	0.98 (96%) **	
Sprint time (10 yd) (s)	0.19 (4%)	0.91 (83%) **	0.89 (79%) **

*** p ≤ 0.001*

Table 3 - Correlation and (explained variance) between COD deficit, Pro-agility time and Pro-agility 10 yd split when sprint time (10 yd) variable is controlled.

	COD Deficit
Pro Agility (s)	0.89 (79%) **
Pro Agility (10 yd) (s)	0.89 (79%) **

*** p ≤ 0.001*

DISCUSSION

When assessing the COD ability of an athlete, it is important understand the implications of the design of the test on ability to isolate COD ability when using “time” to complete the entire test. The calculation of COD deficit (0.72 ± 0.08 s) during the first half of a pro-agility test (2.29 ± 0.17 s) revealed that approximately 31% of the time spent during that test is actually spent changing direction or is the amount of time required to add a single change of direction within a 10 yard distance in comparison to a straight line 10 yard sprint. With this understood, it is logical the results demonstrate a relationship between COD deficit and pro-agility time and pro-agility time (10 yd), that although significant, only explains 29% and 37% of the score respectively. The other percentage of this explained variance would be a function of one’s straight-line sprint ability and underpinning physical attributes such as strength and explosiveness. The small and non-significant relationship between COD deficit and sprint time indicates that COD deficit represents a unique measure of physical performance. This differs from the typical large to very large significant correlations between COD tests and sprint time in this study (Table 2) and those reported in previous studies (1, 3, 5). Therefore, it would appear that COD deficit relates significantly to COD times measured by a typical COD test such as pro-agility, but with the explained variance only being between 29-37% is representing possibly a more specific isolation of just COD ability, independent of straight-line sprint ability. To confirm that COD deficit is a function of COD ability as measured by the pro-agility test, the relationship between pro-agility time and COD deficit was assessed with sprint time controlled for using a partial correlation. The result was a significant and very large relationship between COD deficit and pro-agility time (Table 2) that explained 79% of the variance. This ensures that this measure reflects the intention of the COD test, to measure only COD capacity independent of straight-line sprint ability.

PRACTICAL APPLICATIONS

The results of this research were intended for and directly applicable to strength and conditioning professionals interested in isolating COD ability in athletes using tests the are probably already using in their current athlete performance profiling. The potential to use the COD deficit to assess COD ability independent of sprint speed could allow practitioners to more effectively identify if COD ability is lacking in an athlete independent of their need to merely improve sprint ability. Therefore, with additional testing, normative data and a standardised protocol the COD deficit has potential to improve specificity of COD ability characterisation without need for additional testing, time or equipment.

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