EXAMINATION OF DIFFERENT FOOTWORK ON REACTIVE AGILITY: A SPLIT STEP INCREASES REACTIVE AGILITY IN A SPORT SIMULATED SITUATION

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ABSTRACT

In most sports, reactive agility is crucial, as athletes must cognitively respond to a stimulus, then organize a movement pattern to move the body quickly to a specific location. Critical components of reactive agility in athletics are response time and recognizing how to react to certain stimuli. PURPOSE: To investigate which footwork technique is optimal for reactive agility time (RA). Secondly, to determine if there is a correlation between countermovement jump height (CMJ) and (RA). METHODS: Sixteen current competitive NCAA Division III tennis players (5 females, 11 males) were recruited as participants. One testing session for each participant recorded RA time across two conditions: starting the run with a split-step (SS), where a small jump preceded movement, or a no-split-step (NSS) where no small prep step was allowed prior to movement. The order of each condition was randomized for each participant. Finally, each subject performed maximal countermovement jumps on a force plate to collect jumping metrics to use in correlations to RA performance. RESULTS: Analysis of variance revealed a significant difference in reaction time, with the SS being quicker than the NSS ($p < 0.0001$). Meanwhile, the NSS resulted in significantly faster movement time compared to the SS ($p < 0.001$). A significant predictive relationship was displayed between RA and CMJ height ($r^2 = 0.47$, $p < 0.01$). No significant differences were seen in total time between the SS and NSS. CONCLUSION: There was no significant difference in total movement time between the SS and NSS. Although reaction time was lower with the SS, movement time was lower with the NSS, making total time equal and indifferent. The footwork used when reacting to a stimulus should be based on preference and body anthropometrics. In addition, an athlete's CMJ height could be a predictive quality for RA time, so when profiling, the qualities needed for a high CMJ could parallel what is needed for RA, so training protocols could be properly administered to improve both.

INTRODUCTION

Attacking agility moves, like side steps, shuffle steps, crossover cutting, split steps, and fast turns are crucial in sports and are frequently connected to pivotal match winning moments. The objective of these agility techniques are to avoid separation from an opponent, produce high velocities, and most importantly produce a fast redirection (3).

Reaction time and anticipating ability are crucial perceptual skills in athletics (2). There are few studies that have examined players from sports where open skills predominate to date in terms of reaction time and speed in anticipatory skill (). Open skills entail a movement in reaction to a stimulus and are sporadic in nature (2), such as changing course quickly in response to a ball bounce or an opponent's side stepping, for example. Critical components of perceptual skills in athletics are response time, as well as recognizing how to react to certain stimuli (1). Analyzing the practice of these agility techniques will provide clarity on which footwork pattern is the most efficient.

PURPOSE & HYPOTHESIS

The purpose of this study was to evaluate which footwork style is ideal for reactive agility. A second purpose was to determine if countermovement jump height and reactive agility are correlated.

METHODS

Subjects
- 16 NCAA Division 3 tennis players
- 7 females (21.1 ± 1.2 years old; 163.6 ± 6.7 cm; 67.2 kg ± 17.0 kg)
- 9 males (21.8 ± 2.2 years old; 185.7 ± 6.1 cm; 80.0 ± 10 kg)
- Read and signed an informed consent approved by institution IRB prior to participation
- Approval of utilizing humans as subjects was approved by the IRB prior to any data collection

Warm-Up
- Five-minute, standardized dynamic movements including jogging, skipping, lateral shuffling, quad stretch, hamstring stretch, glute stretch, gastrocnemius stretch, and thoracic spine stretch.
- Familiarization period of jumping technique, and reactive agility test.

Instruments
- Hawkin Dynamics Force Plate (Westbrook, Maine)
- Witty SEM: Reactive and cognitive training system (Microgate, Bolzano, Italy)

Testing Procedures
- Countermovement Jump
  - Three maximal vertical jump with hands on hips
- Reactive Agility Test (RAT; See Figure 1)
  - Six total trials: 3 trials using the split step technique and 3 trials without the split step technique
  - Split Step (SS): a small jump preceded their movement forward
  - Non Split Step (NSS): no movement allowed prior to their movement forward
  - Technique order was randomized
  - Verbally instructed to run through the gate rather than to it

Data Analyses
- Jumping metrics included vertical jump height
- Witty SEM metrics included average reaction time (RT), movement time (MT), and total time (TT)
- Analysis of Variance (ANOVA) was used to evaluate differences between RAT footwork conditions (p-value ≤ 0.05)
- Bonferonni Post-Hoc Analyses to find specific differences
- Pearson correlation was used to measure relationship between CMJ jump height and RAT performance

Figure 1: Set-up and course for the reactive agility test (RAT)

RESULTS

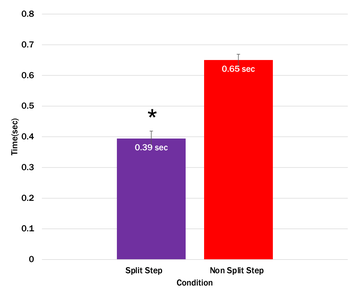

Figure 2: Reaction times for split step and no split step condition. * denotes significant difference (p-value < 0.05)

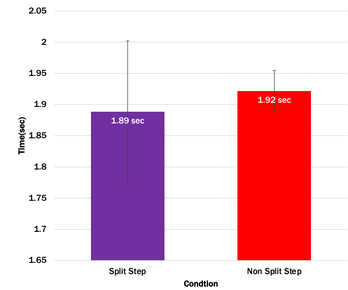

Figure 3: Average total time for split step and no split step condition

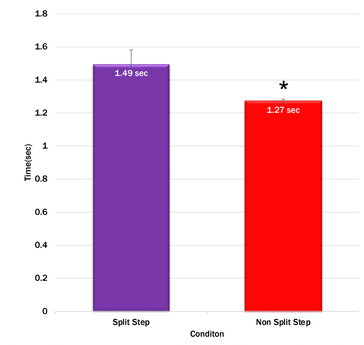

Figure 4: Average movement time for split step and no split step condition. * denotes significant difference (p-value < 0.05)

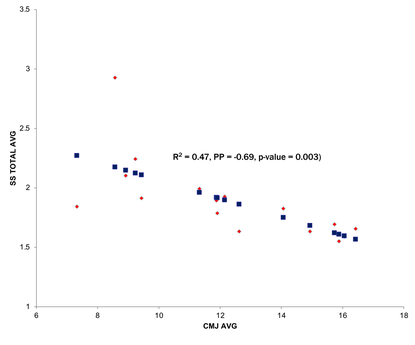

Figure 1: Regression and relationship between countermovement jump height (CMJ) and reactive agility performance (p-value = 0.003)

CONCLUSIONS & PRACTICAL APPLICATIONS

There was no significant differences between total time in the RAT between the split step and no split step. Although the split step reduced reaction time, the no split step reduced movement time, making the overall time equal and insignificant. When responding to stimuli, the footwork should be determined by preference and anthropometric measurements of the body. Additionally, an athlete's counter movement jump height may be a predictor of their reactive agility performance. As a result, when an athlete is profiled, the qualities required for a high counter movement jump may coincide with those required for reactive agility, allowing for the proper administration of training protocols to enhance both.

REFERENCES

1. Uzu, R. & Shinya, M. (2009). "A split-step shortens the time to perform a choice reaction step-and-reach movement in a simulated tennis task." *Journal of Sport Sciences*, (Vol.12 Issue: 12, 1233-1240
2. Young W & Farrow D. (2013). The importance of a sport specific stimulus for training agility. *Strength and Conditioning Journal* 35: 39-43.
3. Dos Santos, T. & McBurnie, A. (2019). "Biomechanical Comparison of Cutting Techniques: A Review and Practical Applications." *Journal of Sport Sciences* (vol 41)issue: 4, 40-54