

# Accuracy of a motorized sprint resistance device for measuring 5-10-5 change of direction performance in elite female volleyball players

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## Abstract

**INTRODUCTION:** Change of direction (COD) ability is a critical component of agility and many movement patterns required for various sports, such as volleyball. Therefore, the evaluation of COD performance with accurate testing procedures is critical. The purpose of this study was to compare a motorized sprint resistance device (MSRD) to timing gates for measuring time to complete the 5-10-5 COD test in elite female volleyball players. **METHODS:** Sixteen Division I female volleyball players (age = 19.4 ± 1.5 years, height = 176.2 ± 10.6 cm, weight = 71.5 ± 11.1 kg) participated in this study. Following a series of dynamic warm-up drills and a 5-minute rest period, the participants performed two 5-10-5 familiarization attempts, followed by three recorded trials that were separated by 1-minute rest periods. The time to complete each 5-10-5 was simultaneously recorded by an MSRD and timing gate system. The MSRD was set up at 3.0 m to the right of the 3-cone set-up of the 5-10-5 drill. The tether of the MSRD remained secured to a waist belt worn by each participant while they performed the test. The fastest time from the three recorded attempts obtained via the timing gates (as the criterion) was compared to the MSRD. **RESULTS:** The mean ± SD values of the recorded time to complete the 5-10-5 was 5.36 ± 0.23 seconds from the MSRD and 5.31 ± 0.17 seconds from the timing gates, which was significantly different ( $p < 0.001$ ). The recorded time from MSRD was significantly correlated ( $r = 0.87$ ,  $p < 0.001$ ) to the timing gates and showed a standard error of estimate (SEE) of ± 0.09 seconds. Limits of agreement procedures showed a 95% confidence interval (constant error ± 1.96 SD) of 0.23 ± 0.24 seconds. **CONCLUSION:** The time to complete the 5-10-5 COD test was significantly greater when recorded from the MSRD than the timing gate system. However, the MSRD demonstrated a strong correlation with the timing gate system, along with a small SEE and tight LOA. **PRACTICAL APPLICATIONS:** Despite the observed mean difference, time to completion of the 5-10-5 COD drill when recorded by the MSRD demonstrated a small range of individual error. Therefore, practitioners can consider using the MSRD system for recording time to completion of the 5-10-5 COD drill in female volleyball players.

## Introduction

- Change of direction (COD) ability is a foundational skill in volleyball, requiring athletes to accelerate, decelerate, and reaccelerate quickly in response to game-specific demands (1,3).
- Effective assessment of COD ability is essential for monitoring performance, guiding training adaptations, and reducing injury risk (4).
- One of the most widely used field-based COD assessments is the 5-10-5 shuttle test, traditionally measured using electronic timing gates due to their accuracy and ease of use (2).
- However, recent advancements in wearable technology, such as motorized sprint resistance devices (MSRDs), offer new opportunities for performance testing by capturing both movement timing and resistance-based data simultaneously.
- These devices may allow for more comprehensive movement analysis and practical integration in both training and testing environments.
- The purpose of this study was to compare the measurement accuracy of an MSRD to a traditional timing gate system for assessing time to completion of the 5-10-5 COD test in Division I female volleyball players.

## Methods

- Sixteen Division I female volleyball players (age = 19.4 ± 1.5 years, height = 176.2 ± 10.6 cm, weight = 71.5 ± 11.1 kg) participated in this study.
- The time to complete each 5-10-5 was simultaneously recorded by an MSRD and timing gate system.
- The MSRD was set up at 3.0 m to the right of the 3-cone set-up of the 5-10-5 drill (Figure 1).
- The tether of the MSRD remained secured to a waist belt worn by each participant while they performed the test.
- The fastest time from the three recorded attempts obtained via the timing gates (as the criterion) was compared to the MSRD.

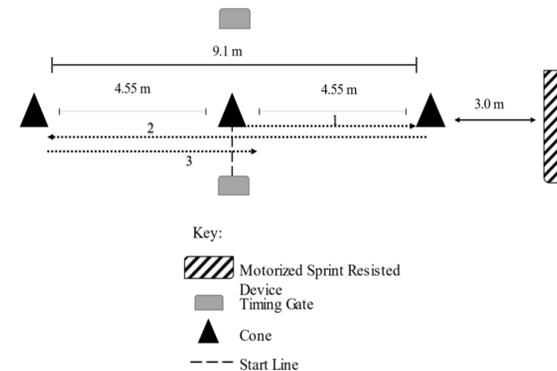


Figure 1. Cone and equipment set-up for the 5-10-5 Drill.

## Results

Table 1. Agreement statistics comparing 5-10-5 time between MSRD and Timing Gates

	Mean ± SD	p	ES	r	SEE	CE ± 1.96 SD	Upper	Lower
Timing Gates	5.13 ± 0.17							
MSRD	5.36 ± 0.23	<0.01	1.14	0.87*	0.09	0.23 ± 0.24	0.47	-0.01

SD = standard deviation, p = probability, ES = Effect size, r = correlation coefficient, SEE = standard error of the estimate, CE = constant error. \*Indicates statistical significance for correlation ( $p < 0.05$ )

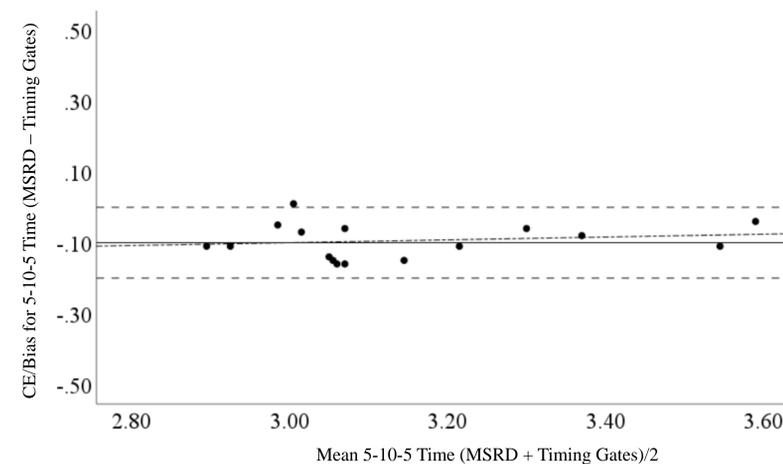


Figure 2. Bland-Altman plot comparing 5-10-5 time (sec) between the MSRD and Timing Gates. The solid line represents the mean error. The dashed lines represent the upper and lower 95% limits of agreement. The dashed-dotted line represents the trend between the difference and mean of the two methods ( $r = 0.48$ ,  $p = 0.09$ ).

## Conclusions

- The findings of this study demonstrated that the MSRD recorded significantly slower 5-10-5 COD completion times compared to the timing gate system.
- Despite this difference, a very strong correlation was observed between the two systems, with a low SEE and narrow limits of agreement.
- These results suggest that the MSRD provides consistent and relatively accurate timing data, albeit with a slight positive bias.
- The fixed tether resistance or lateral placement of the MSRD may contribute to the slightly inflated time readings.
- Nevertheless, the small individual error range indicates the MSRD could serve as a valid alternative to traditional timing gates when direct comparison of absolute time values is not required.
- Overall, the MSRD appears to be a valid tool for measuring COD performance trends over time in elite female volleyball players.

## Practical Applications

- For practitioners or sport scientists working with volleyball players, the use of an MSRD offers a convenient and valid method for assessing COD performance.
- The added benefit of real-time resistance and velocity feedback may also enhance training integration, allowing for dual use during both performance monitoring and COD-focused drills.
- This expands the utility of MSRDs beyond resistance training into performance testing, providing a versatile tool for both evaluation and athlete development in court-based sports.

## References

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