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A COMPARISON OF VERTICAL JUMP DISPLACEMENTS BETWEEN A VERTEC™ AND A FORCEPLATE

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The purpose of this study was to compare vertical jump displacements between a Vertec™ and a forceplate. Thirty-two Army Reserve Officers' Training Corps (ROTC) cadets completed three countermovement vertical jumps on a forceplate while simultaneously touching the highest vane they could reach on a Vertec™ placed immediately next to the forceplate. The means between the methods were found to be significantly correlated (r=.91, p<.001). However, significant differences were found between the means (t=13.6, p<.001). With-in method analysis results showed no significant differences between the three jumps as estimated by the forceplate (F<.001, p=.985), however, significant differences were found between displacements as measured by the Vertec™ (F=17.0, p<.001).

KEY WORDS: countermovement vertical jump, force platform, lower body power.

INTRODUCTION: The vertical jump is commonly used as a method to evaluate athletes' power in the lower body. Using a Vertec™ has been a long standing method of evaluating vertical jumping ability. A Vertec™ is an apparatus that has an adjustable vertical pole with horizontal movable vanes on the top at every 1.3 cm. The participant jumps and moves the highest vane they can reach during the jump. Use of a forceplate to measure vertical jump is a more recent and less common method to assess vertical jumping ability, primarily due to the cost and lack of availability to many practitioners. It is important for coaches to measure vertical jumps accurately because they may use the results to assess an athlete's lower-body power. It is also important for researchers to have accurate methods for drawing conclusions between research studies examining vertical jump height. Recent studies have shown a difference in vertical jump displacement across different methods, making comparisons dubious (Ferreira et al., 2010; Leard et al., 2007; Slinde et al., 2008). The purpose of this study was to compare vertical jump displacements between a Vertec™ and a forceplate.

METHOD: Thirty-two Army Reserve Officers' Training Corps (ROTC) cadets (24 males, 8 females) from North Dakota State University volunteered for this study (age 21.2±2.9 years, height 174.7±9.6 cm, body mass 77.4±14.6 kg). Each participant completed three vertical jumps while standing on a forceplate (Advanced Mechanical Technology Incorporated, Accupower) set at a six channel sample rate of 1200 data sets per second. A Vertec™ was placed immediately next to the forceplate on the side of the participant's dominant reaching hand. A standing reach height was used with the participant standing flat footed and reaching as high as they could with their dominate hand. The standing reach height was considered zero. The participants used the countermovement vertical jump technique using their arms to aid in each jump. With each jump, participants were instructed to jump as high as they could and move the highest vane they could reach on the Vertec™. No familiarization or practice jumps were completed. The vertical jump displacement was the difference between the highest vane touched on the Vertec™ and the zero standing reach height. Both the Vertec™ displacements and the estimated vertical jump displacements from the forceplate were recorded.

Mean displacements from the Vertec™ and the forceplate were calculated and used for statistical analyses. A Pearson correlation was computed to examine the linear relationship between the two methods. A paired-samples t-test was used to test for significant differences in vertical jump displacement between the Vertec™ and forceplate. To examine consistency,

a with-in methods repeated ANOVA was computed for each method comparing the mean vertical jump displacements across jumps one, two, and three. If the ANOVA results were significant, Bonferroni-adjusted pairwise comparisons were used to determine the location of significant differences between jump trials. Statistical signifiance was set at α=0.05.

RESULTS: The mean displacements for the three jumps were found to be 37.6±7.98 cm for the forceplate and 47.6±9.74 cm for the Vertec.™ Displacements between both methods were found to be significantly correlated (r=.91, p<.001); however, significant differences were also found between the means (t=13.6, p<.001). Repeated measures ANOVA revealed no significant differences between the three estimated displacements from the forceplate (F<.001, p=.985). However, there were significant differences between the three Vertec™ displacements (F=17.0, p<.001). The mean displacements were found to increase each jump. Follow-up pairwise comparisons revealed significant differences between jumps one and two (p<.001) and jumps one and three (p<.001).

DISCUSSION: The results of this study indicate that although the two methods were highly correlated, the significant differences may be more noteworthy. Vertec™ displacements were 10 cm higher on average than the displacements from the forceplate. This difference in means was slightly lower than discovered by Ferreira et al. (2010), who found a mean difference of approximately 13 cm. However, the mean differences in displacements found in this study were greater than those reported by Leard et al. (2007) between the Vertec™ and a Just Jump mat (approximately 5 cm) and between the Vertec™ and a 3-camera motion analysis system (approximately 4 cm). It is likely that the differences in means between this study and the others that used the same countermovement jumping technique were due to using a flat foot position to measure the initial Vertec™ reach height. Forceplates estimate vertical jump displacements starting when the toes leave the forceplate, therefore, using the flat foot method may falsely increase Vertec™ displacement scores by a significant amount. The consistency across the three forceplate scores, however, confirms the reliability of this method. The significant difference between the three displacements with the Vertec™ suggests there may also be a learning effect when using this method. The learning effect was probably due to the participants becoming more comfortable with the coordination of jumping while simultaneously reaching for the Vertec™ vanes.

CONCLUSION: The results of this study displayed significant differences between the two methods of measuring vertical jump displacements. While this study did show an overestimation of maximal vertical jump height when using the Vertec™ method, it may have been due to using the flat-foot method for the standing reach height. Therefore, consistency needs to be established across studies with respect to initial reach measurement, and caution should be used when comparing study results if the initial reach method is not known.

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