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Number of Trials Necessary to Achieve Performance Stability of Selected Ground Reaction Force Variables During Landing

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ABSTRACT

The objectives were to determine the number of trials necessary to achieve performance stability of selected ground reaction force (GRF) variables during landing and to compare two methods of determining stability. Ten subjects divided into two groups each completed a minimum of 20 drop or step-off landings from 0.60 or 0.61 m onto a force platform (1000 Hz). Five vertical GRF variables (first and second peaks, average loading rates to these peaks, and impulse) were quantified during the initial 100 ms post-contact period. Test-retest reliability (stability) was determined using two methods: (1) intra-class correlation coefficient (ICC) analysis, and (2) sequential averaging analysis. Results of the ICC analysis indicated that an average of four trials (mean 3.8 ± 2.7 Group 1; 3.6 ± 1.7 Group 2) were necessary to achieve maximum ICC values. Maximum ICC values ranged from 0.55 to 0.99 and all were significantly ($p < 0.05$) different from zero. Results of the sequential averaging analysis revealed that an average of 12 trials (mean 11.7 ± 3.1 Group 1; 11.5 ± 4.5 Group 2) were necessary to achieve performance stability using criteria previously reported in the literature. Using 10 reference trials, the sequential averaging technique required standard deviation criterion values of 0.60 and 0.49 for Groups 1 and 2, respectively, in order to approximate the ICC results. The results of the study suggest that the ICC might be a less conservative, but more objective method for determining stability, especially when compared to previous applications of the sequential averaging technique. Moreover, criteria for implementing the sequential averaging technique can be adjusted so that results closely approximate the results from ICC. In conclusion, subjects in landing experiments should perform a minimum of four and possibly as many as eight trials to achieve performance stability of selected GRF variables. Researchers should use this information to plan future studies and to report the stability of GRF data in landing experiments.

Key words: Reliability, variability, sequential averaging, intra-class correlation coefficient.

Key Points