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The ten to five repeated jump test: A new test for evaluation of lower body reactive strength.

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Reactive strength is generating sharp interest with research and applied practitioners as a measure to monitor an individual's ability to change quickly (<0.25 s) from an eccentric to a concentric contraction (Young, 1995: *New Studies in Athletics*, *10*, 88-96). In order to further replicate the rebound qualities exhibited in many sporting activities Lloyd et al. (2009: *Journal of Sports Sciences*, *27*, 1565-1573) used a maximal bi-lateral hopping test performed over five repeated repetitions. However, the ability of this test to detect training induced changes in performance was poor. Analysis of covariance (CV) for the average height obtained was 15%. The authors acknowledged that this greater variability was likely due to difficulties in postural control. The purpose of this study therefore was to refine and develop a methodology for assessment of lower body reactive strength, examine it for test-retest reliability, determine the internal consistency of the test across five trials and, in addition, validate measures using contact mat against those acquired from ground-fixed force plate measures. Sixteen male Super League rugby league players (age, 19.7 $\pm$ 0.8 years; body mass 88.5 $\pm$ 12.0 kg; height 177.3 $\pm$ 6.1 m) volunteered to participate in the reliability study. An additional group of seven male college academy level rugby league players (age 17.4 $\pm$ 0.6 years; body mass 81.6 $\pm$ 16.3 kg) participated in the internal consistency and validity study. All jumps were performed on a mobile contact mat (Smart-jump, Fusion Sport, Australia) with instantaneous feedback on contact time (CT), flight time (FT), peak power output (PPO), impulse (IMP) and the reactive strength index (RSI) collected and displayed via a hand-held PDA (iPAQ, Hewlett Packard, USA). For the validity and internal consistency study the mobile contact mat was positioned directly over a 900 x 600 mm ground-fixed force plate. The ten to five repeated jump test (RJT) involved participants performing optimal vertical rebounds (i.e. maximal elevation at each jump) with minimal ground contact (<0.25 s) performed for a series of eleven jumps. Participants were instructed to keep their hands on the hips to ensure no contribution from the arms. Further instructions were given to (a) "minimize ground contact time", (b) "maximize jump height", (c) "imagine the ground as a hot surface", and (d) "legs like a stiff spring" (Flanaghan & Comyns, 2008: *Strength and Conditioning Journal*, *30*, 32-38). From the eleven jumps that were recorded the first jump was discarded from the analysis since this did not involve a fast stretch-shortening cycle. From the remaining ten jumps the five jumps with greatest height exhibiting ground contact of less than 0.25s was used for further analysis. The height of these five jumps was then added together to provide a repeated reactive strength score. For the validity study participants performed five trials and for the reliability study two trials were performed on each testing session which was separated by one week. All participants in both studies were given a minimum of one minutes rest between successive trials. Pearson's correlation coefficient revealed a significant (r=0.897; P=<0.01) level of agreement between the mobile contact mat and force plate for ground contact time. There was a 14.25% change in the mean height from trial 1 to trial 5, however after an 11.55% change between trial 1 and 2 the change between trial 2 to 5 varied from only 0.33 to 1.25%. The average CV across all seven participants in the validity study was 9%. The test-retest reliability results displayed a significant (r=0.782; P=<0.01) relationship between trial 1 and 2. The main finding of the present study was that the CV of the ten to five RJT was found to be 9%. The higher levels of sensitivity in the present protocol compared to Lloyd *et al.* (2009: *Journal of Sports Sciences*, *27*, 1565-1573) can be attributed to the elimination of the lowest 5 jump heights that are likely to have been a result of deficiencies in postural control. Another important finding was that the ten to five RJT was found to gain consistent scores after just 2 trials. Furthermore, the mobile contact mat used in the present study was shown to have a high level of criterion validity in agreement with Lloyd *et al.* (2009: *Journal of Sports Sciences*, *27*, 1565-1573). Consequently, for coaches working with large groups of athletes the ten to five RJT can provide a quick and reliable means of monitoring individual progress and evaluating the success of interventions aimed at developing the reactive strength capabilities of their athletes.