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D1.P20. Effect of elbow position on grip strength in children: validity and reliability of TKK 5101 and DynX dynamometers

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One of the most widely used methods to assess upper-body isometric strength in children is the handgrip strength test. Owing to inconsistent findings, however, it is not clear which elbow position and which dynamometer type are most appropriate for achieving the maximal grip strength. Similar studies have been conducted on adolescents, whereas, studies in children are scarce. Therefore, the purpose of this study was to investigate whether elbow position and the type of dynamometer affect the handgrip strength in children. A total of 60 children, 6 to 11 years old (30 boys and 30 girls), from London participated in this study, and an ethics approval was obtained prior to the tests. Grip strength was measured by two different dynamometers: TKK digital hand dynamometer (TKK 5101 Grip-D, Takey, Tokyo, Japan) and DynX electronic hand dynamometer (MD System, Inc., Westerville, OH, USA). Every child performed two different tests with each type of dynamometer. The first test was with the elbow fully extended, and the second with flexed elbow at 90°. While using the TKK dynamometer, grip strength was significantly higher when the test was performed with elbow extended, in contrast to those obtained with flexed elbow (14.58 ± 3.04 kg vs 12.97 ± 2.99 kg, $P < 0.001$ for right hand, and 14.25 ± 3.05 kg vs 12.61 ± 2.99 kg, $P < 0.001$ for left hand). Furthermore, Cohen's effect size values ($d = 0.87$ for right hand, and $d = 0.91$ for left hand) suggested high practical significance. When using the DynX dynamometer, the difference between the two elbow positions was smaller (13.84 ± 3.22 kg vs 13.35 ± 3.01 kg, $P = 0.035$ for right and, and 13.35 ± 2.95 kg vs 12.77 ± 2.96 kg, $P = 0.003$ for left hand), and the effect sizes were small to moderate ($d = 0.28$ and $d = 0.41$, respectively). The validity and reliability of the TKK and DynX dynamometers were analysed by using known weights within the range of the children's strength (5–30 kg). The criterion-related validity analyses showed a systematic bias of -0.20 kg ($P < 0.05$) for the TKK, and -0.42 kg ($P < 0.001$) for the DynX dynamometer. The reliability analyses revealed a systematic bias of -0.07 kg in the TKK, and 0.10 kg in the DynX dynamometer ($P > 0.05$ for both dynamometers). Both dynamometers provided sufficient results in terms of their validity and reliability, and can, therefore, be used when assessing handgrip strength in children. Performing the handgrip strength test with elbow extended appears to be the most appropriate protocol in order to evaluate maximal handgrip strength in children.