

Study of reliability of a software associated to a digital dynamometer for the measurement of hand grip isometric strength



C. Herrera-Ligero, S. Pitarch-Corresa^{*}, H. De-Rosario, F. Peydro-DeMoya, J. Sellés-Vizcaya, M.J. Vivas-Broseta

Instituto de Biomecánica de Valencia- Universitat Politècnica de València, Biomechanical Assessment, Valencia, Spain

1. Introduction

Grip strength is a commonly used parameter in clinical practice. Although the gold standard for its measurement is the hydraulic dynamometer Jamar, new modern software and digital devices have arisen, in many cases without published results about their reliability.

2. Research Question

The aim of this study was to evaluate the reliability of a software for the measurement of grip strength (NedMano/IBV) of which there are no published results on this matter to date.

3. Methods

Comparison of grip strength measurements from a sample of 23 healthy adult subjects in a test-retest study. Maximum grip isometric strength of the dominant hand was measured according to the standardized protocol of the American Society of Hand Therapists, as done by other authors [1], in two sessions performed in different days. We used the NedMano/IBV software [2], which allows the assessment of

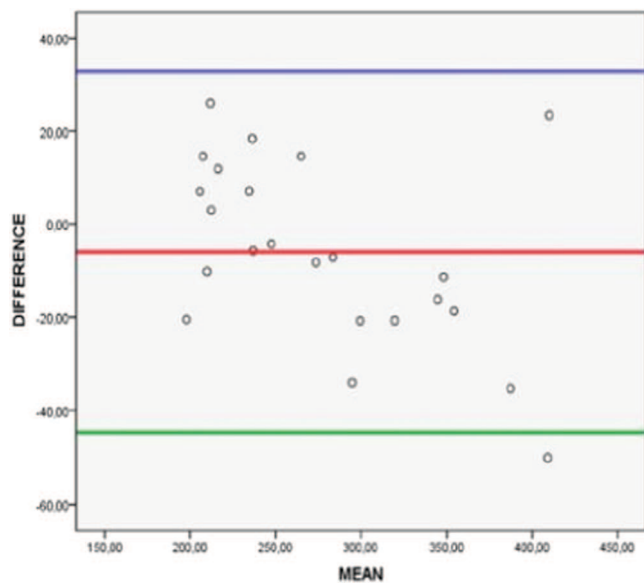
grip strength and digital pinches by means of a digital rigid dynamometer (NedVEP/IBV), showing the maximum forces reached and calculating the mean force, as well as estimating the Strength Loss Index compared to the opposite limb and to a normative database. In this study, we used the maximum and mean value of grip strength provided by this software. For the descriptive analysis, the mean and the standard deviation were used, and for the analysis of the reliability, we used the Intraclass Correlation Coefficient (ICC) and Bland-Altman Plots.

4. Results

The sample analyzed consisted of 11 women and 12 men, with an average age of 38.65 years. The average grip strength in the first session was 227.54 ± 26.52 Newtons (N) in women and 319.86 ± 56.39 N in men. In the second session, the average strength was 224.50 ± 26.99 N in women and 333.67 ± 64.75 N in men. A high reliability for NedMano/IBV was found, with an ICC of 0.95 and of 0.92 for the comparison of means and maximums respectively. Differences between both sessions were non-statistically significant, and stood within the Confidence Interval determined for the sample in all cases except for one (see [picture 1](#)).

^{*} Corresponding author.

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Picture 1. Blant-Altman Plot for the comparison of Means between sessions. All differences except for one gathered within the confidence interval(CI 95%: limits marked by upper and lower lines), with a balance distribution in both sides of 0,00 difference, indicating no systematic error.

5. Discussion

NedMano/IBV, by means of the dynamometer NedVEP/IBV, is a reliable instrument for the assessment of handgrip strength, also allowing the measurement of other gestures such as digital pinches. The reliability found for NedMano/IBV is either equal or even better than those found for other equivalent devices, including the Jamar, for which a Pearson correlation of 0.78 to 0.87 and of 0.88 was found in the past by Hamilton G.F. et al. [3] and Mathiowetz V. et al. [1], respectively.

References

- [1] V. Mathiowetz, K. Weber, G. Volland, N. Kashman, Reliability and validity of grip and pinch strength evaluations, *J Hand Surg 9A* (1984) 222–226, [https://doi.org/10.1016/S0363-5023\(84\)80146-X](https://doi.org/10.1016/S0363-5023(84)80146-X).
- [2] J. Montero Vilela, J.M. Baydal Bertomeu, J.D. Garrido Jaén, I. Bermejo Bosch, A. Page del Pozo, R. Porcar Seder, I. Morales Martín, R. Barberá Guillem, *Objetivamos los gestos característicos de la mano*, *Revista de Biomecánica* 58 (2012) 47–50.
- [3] G.F. Hamilton, C. McDonald, T.C. Chenier, Measurement of Grip Strength: Validity and Reliability of the Sphygmomanometer and Jamar Grip Dynamometer, *JOSPT* 16 (5) (1992 Jul), <https://doi.org/10.2519/jospt.1992.16.5.215>.