Comparison of a New Digital Device to Measure Grip Strength and the Jamar Dynamometer

Principal Investigator: Edwin Myers, OTR, OTR/L, ATP
David Dominguez, OTR/L, Melissa Guigliano, OTS, Joanna Pijau, OTS
Marieb College of Health & Human Services, Occupational Therapy Program
Florida Gulf Coast University, Ft. Myers, FL

PURPOSE
Use of a dynamometer to measure handgrip strength is widely accepted due to its simple, non-invasive marker of muscle strength of the upper extremities (Norman et al., 2010). In addition to its evaluative usefulness in rehabilitation, deficits in grip strength may be an indicator of impairments in the upper extremities and occupational performance skills. Studies also indicate a correlation between a person’s grip strength and nutrition, fragility, diabetes, length of hospital stay, mobility, mortality and other risk factors (Bohannon, 2008; Fain & Weatherford, 2016; Kilgour et al, 2013; Massy-Westropp, 2011; Vaz 2002).

The gold standard of grip strength measurement is the Jamar dynamometer with repeated studies indicating a high level of inter-rater validity and reliability (Mathiowetz, 2002; Myers & Triscari, 2015). BTE Technologies, Inc. is developing a new digital handheld dynamometer to be used in physical function and industrial rehab settings. To ensure that their product meets user requirements, the device must go through a field testing process and that usability issues are identified prior to manufacturing (Soares, Jacobs, Woodcock, Fielden, & Bartlett, 2012).

The purpose of this study is to determine if the digital handgrip dynamometer developed by BTE Technologies, Inc. is comparable and reproducible to the performance of the Jamar dynamometer. By following the ASHT protocol throughout data collection, similar results between the two devices may suggest reproducibility of the BTE Device as compared to a precisely calibrated Jamar dynamometer.

METHODS
Design: Comparison of handgrip strength using the Jamar dynamometer and BTE device

- Descriptive research design
- Coefficient of variation (CV) calculated for each participant
- Bland-Altman plot and Intraclass Correlation Coefficient (ICC) used to compare performance

Subjects: Convenience population of participants aged 20-50 years drawn from Southwest Florida. Exclusion criteria: Age < 20 or > 50 years old. Individuals with a history of upper extremity pathology and/or currently pregnant

Comparison Trials: 337 participants: Men (N=138) and women (N=199)

Reproducibility Trials: 68 participants: Men (N=23) and women (N=45)

PROCEDURE
The BTE Technologies, Inc. handgrip device is compared to the Jamar Hydraulic Hand Dynamometer. The Jamar devices were calibrated through an independent laboratory

- Determine if participant met study criteria and consent acquired
- Participant randomly assigned to begin study with either BTE or Jamar device
- Testing conducted following protocol established by the American Society of Hand Therapists (Myers & Triscari, 2015)
- Average grip strengths for gender and age were calculated manually for the Jamar device while the BTE device recorded data automatically
- Participants were given the opportunity to return for a repeat of the protocol to assist in determining reproducibility

RESULTS

COMPARISON

<table>
<thead>
<tr>
<th></th>
<th>BTE Device</th>
<th>Jamar Device</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Right</td>
<td>94% of data within 2 SD (130/138)</td>
<td>91% of data within 2 SD (187/199)</td>
</tr>
<tr>
<td>Female Right</td>
<td>93% of data within 2 SD (187/199)</td>
<td></td>
</tr>
</tbody>
</table>

Reproducibility

<table>
<thead>
<tr>
<th></th>
<th>ICC</th>
<th>Lower</th>
<th>Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Right</td>
<td>906</td>
<td>728</td>
<td>756</td>
</tr>
<tr>
<td>Female Right</td>
<td>435</td>
<td>751</td>
<td>887</td>
</tr>
</tbody>
</table>

REFERENCES


