Perineal Muscle Stiffness in Women with and without Vulvodynia: Reliability of Measurement and Differences in Muscle Stiffness

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BACKGROUND

- Studies report an increase in muscle stiffness - also described as tension, tone or overactivity - in the pelvic floor and perineal muscles in women with vulvodynia.
- However, due to the lack of objective or standardised measures of perineal muscle stiffness to date, these findings are unconfirmed.

OBJECTIVES

- The first aim of this study was:
  - To determine the inter-rater and intra-rater reliability of a myotonometer (MyotonPro™) to measure the stiffness of the perineal muscles in asymptomatic and symptomatic (vulvodynia) cohorts.
- The hypothesis was that the reliability values would be good (Intra-class correlation coefficient [ICC]: 0.61 – 0.80) or very good (ICC: 0.81 – 1.00)2,3.
- The second aim was:
  - To determine if differences existed in perineal muscle stiffness in the resting state between the two cohorts.
  - The hypothesis was that there would be increased muscle stiffness in the symptomatic cohort.

METHODS

- Cross-sectional observational study involving:
  - (i) Reliability testing of the MyotonPro™ to measure muscle stiffness (Newton metre) in the perineal muscles.
  - (ii) A cross-sectional comparison of muscle stiffness in two cohorts – asymptomatic and symptomatic (vulvodynia).
- Participants:
  - Women aged 18 – 50 years, asymptomatic of pelvic floor dysfunction (asymptomatic) and symptomatic of vulvodynia (symptomatic).
- Sample Size Calculations:
  - (i) Reliability Study:
    - To obtain an ICC value of 0.85 with 95% confidence interval for muscle stiffness, n = 15 (intra- and inter-rater).
    - Sample sizes were increased a priori to include all participants.
  - (ii) Comparison of cohorts:
    - An a priori power analysis (B = 0.2, a = 0.05) was conducted to obtain a moderate effect size of 0.7 (n = 30 each cohort).
    - Sample sizes were increased a priori to include all participants.
    - Post hoc analysis of muscle stiffness data confirmed power (large effect size 1.03 – 1.30).2,3
- Measurement Methods:
  - Perineal muscle stiffness values were taken at rest and measured on both sides.
  - Measures were taken on two occasions, one hour apart, using standardised positions, instructions and measurement protocols.
- Statistical Analysis:
  - (i) Reliability:
    - Intra-rater and inter-rater reliability measures were tested using the two way mixed model, averaged measures, ICC with 95% confidence intervals.
  - (ii) Comparison of cohorts:
    - Two tailed, independent sample t-tests (p < 0.05) were conducted to determine differences between cohorts.
    - The study received local institutional ethics approval.

RESULTS

- Participant Characteristics
  - All symptomatic participants presented with localized provoked vulvodynia with a average pain duration of 10.39 years (range 0.42–30 years).
- Table 1: Summary of demographic variables of all participants

<table>
<thead>
<tr>
<th>Variable</th>
<th>Asymptomatic</th>
<th>Symptomatic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years, mean (SD)</td>
<td>30.9 (3.2)</td>
<td>29.25 (7.3)</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²),</td>
<td>23.76 (3.62)</td>
<td>22.72 (2.84)</td>
</tr>
<tr>
<td>mean (SD)</td>
<td>n = 43</td>
<td>n = 32</td>
</tr>
<tr>
<td>Parity (nulliparous/parous) n (%)</td>
<td>32 (74) / 11 (26)</td>
<td>24 (75) / 8 (25)</td>
</tr>
<tr>
<td>Ethnicity:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>European-Caucasian n (%)</td>
<td>37 (87)</td>
<td>26 (82)</td>
</tr>
<tr>
<td>Asian n (%)</td>
<td>4 (9)</td>
<td>2 (6)</td>
</tr>
<tr>
<td>Indian n (%)</td>
<td>1 (2)</td>
<td>3 (9)</td>
</tr>
<tr>
<td>African n (%)</td>
<td>1 (2)</td>
<td>1 (3)</td>
</tr>
</tbody>
</table>

(i) Reliability:
- The MyotonPro™ demonstrated good to very good intra-rater and inter-rater (Table 2).

<table>
<thead>
<tr>
<th>Cohort Perineal Muscle Side</th>
<th>Intra-rater ICC (95% CI)</th>
<th>Inter-rater ICC (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asymptomatic; n = 43</td>
<td>0.70 (0.73, 0.92)</td>
<td>0.70 (0.23, 0.88)</td>
</tr>
<tr>
<td>Leber; n = 32</td>
<td>0.77 (0.62, 0.89)</td>
<td>0.41 (0.19, 0.61)</td>
</tr>
<tr>
<td>Symptomatic</td>
<td>0.91 (0.81, 0.96)</td>
<td>0.46 (0.34, 0.54)</td>
</tr>
<tr>
<td>Left</td>
<td>0.86 (0.75, 0.94)</td>
<td>0.57 (0.50, 0.64)</td>
</tr>
<tr>
<td>Right</td>
<td>0.85 (0.73, 0.92)</td>
<td>0.70 (0.23, 0.88)</td>
</tr>
</tbody>
</table>

(ii) Comparison of cohorts:
- A significant difference in muscle stiffness between the cohorts was measured (Table 3).
- The symptomatic cohort demonstrated significantly higher values than the asymptomatic cohort.
- In the symptomatic cohort, right hand dominant participants exhibited significantly increased muscle stiffness on the left side as compared to right side (p = 0.000). There were no missing data.

Table 3: Comparison of Muscle Stiffness of Perineal Muscles in Asymptomatic and Symptomatic Cohorts

<table>
<thead>
<tr>
<th>Muscle Side</th>
<th>Asymptomatic Stiffness (N/m)</th>
<th>Mean (SD)</th>
<th>Symptomatic Stiffness (N/m)</th>
<th>Mean (SD)</th>
<th>p Value</th>
<th>Magnitude of Difference (Cohen’s d)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right</td>
<td>118.25 (22.57)</td>
<td>142.85 (25.65)</td>
<td>24.61 (13.47)</td>
<td>35.74</td>
<td>&lt;0.001</td>
<td>1.03</td>
</tr>
<tr>
<td>Left</td>
<td>122.27 (19.98)</td>
<td>155.05 (28.99)</td>
<td>32.77 (21.50)</td>
<td>44.04</td>
<td>&lt;0.001</td>
<td>1.30</td>
</tr>
</tbody>
</table>

CONCLUSIONS

- It is possible that the difference in muscle stiffness in the perineal muscles between symptomatic and asymptomatic women could be detected via digital palpation.
- Future research to develop a digital palpation scale using the MyotonPro™ as a reference standard would facilitate accurate diagnosis of increased, reduced, or normal muscle stiffness.
- This would assist with the clinical management of perineal muscle - and potentially levator ani - muscle dysfunction.
- Further studies are required to investigate the cause of the increased muscle stiffness in women with vulvodynia, as well as research to provide further confirmation of the construct validity of the MyotonPro™ in measuring small, centrally located perineal muscles using 4D ultrasound imaging in combination with fine wire EMG and Myoton measurements.

ACKNOWLEDGEMENTS

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- No financial relationship exists between the author and the manufacturer of the MyotonPro™
- For additional information please contact Melissa Davidson, Remarkable Physios Ltd, Queenstown, New Zealand. Email: melissa@remarkablephysios.com

REFERENCES