Comparative assessment of pelvic floor strength using a perineometer and digital examination

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Objective To determine whether digital assessment of pelvic floor contraction strength is as reliable as vaginal perineometry and to assess the practice of pelvic floor exercises by women.

Design A blinded, two-assessor protocol, prospectively testing a volunteer sample of women.

Population Two hundred and sixty-three women (from a total of 278), aged 16–75 years, attending a general gynaecological clinic with nonurinary symptoms.

Methods Participants answered a questionnaire regarding urinary symptoms and practice of pelvic floor exercises. History and examination was carried out by the clinician, and pelvic floor strength scored digitally using the Oxford Scale. Pelvic floor strength was then assessed by the physiotherapist, using a PFX perineometer. The physiotherapist was blinded to the woman’s history, examination findings and digital assessment score. Both the clinician and physiotherapist were blinded to the questionnaire responses.

Main outcome measures Digital pelvic floor contraction assessment, according to the Oxford Scale, was compared with perineometric assessment as the gold standard — examined against the background of the questionnaire findings.

Results Of 263 patients, 53 were nulliparous (20%), and 210 parous (80%). Only 49 women carried out regular pelvic floor exercises (19%), and all were parous and admitted to troublesome urinary symptoms. Stress urinary incontinence was reported by 28% of all women (38.1% of parous women and 10.5% of nulliparous women). For both methods, there was no difference in the range of results when parity was taken into account. Concordance studies showed good agreement between digital and perineometric assessment of pelvic floor strength. The kappa value of 0.73 (95% confidence interval 0.67–0.79) indicated substantial agreement between the two methods.

Conclusion There is good agreement between digital assessment of pelvic floor contraction strength and vaginal perineometry. Assessment during gynaecological examination may help to identify women with fascial defects of the pelvic floor, as well as those at risk of genital prolapse or urinary symptoms.

INTRODUCTION

Urinary incontinence is an important component of health care expenditure, and an important and neglected cause of morbidity in women. Studies evaluating management of this condition show that the majority of women respond to simple measures such as pelvic floor exercises and weight loss. In 1948, Kegel reported that pelvic floor training produced a cure rate of 84% for women with various types of urinary incontinence. In our experience, few women have pelvic floor strength assessed during vaginal examination. This prospective study was designed to measure the degree of concordance between digital and perineometric scoring of pelvic floor contraction strength. Perineometry, which gives a measured value for contraction strength, was taken as the gold standard. There is no standard recommendation for the minimum desirable perineometric reading when assessing the strength of a pelvic floor contraction.

The aim was to determine the value of digital assessment, so that health care workers can use this as an opportunistic screening and assessment tool without needing to purchase specialised equipment. There are no published studies (to date) which directly compare these two methods of assessment. In addition, the presence of urinary symptoms and the regularity with which this group of women carried out pelvic floor exercises was assessed by questionnaire.

METHODS

The study was carried out following approval from the hospital ethical committee. Two hundred and sixty-three women referred to a general gynaecological clinic with nonurinary symptoms agreed to participate after being...
given details of the study. They were drawn from a cohort of 278 consecutive new patients after excluding women referred with urinary symptoms.

Each woman first answered a questionnaire, which included age, parity, urinary symptoms and an assessment of the regularity of pelvic floor exercises (Table 1). All women were interviewed by the same clinician and instructed on pelvic floor 'squeeze'. After emptying the bladder, a 'best-of-three' assessment of pelvic floor contraction was carried out during routine bimanual examination. A score from 0–5 was given according to the previously validated Oxford Scale (Table 2). Examination was carried out in the dorsal position, with the knees semi-flexed. The woman was not told the result. Vaginal pressure was then measured using a silicone sensor perineometer (PFX 9100 C, Cardio-Design Pty. Ltd, Baulkham Hills, Australia, 2153). This perineometer uses an arbitrary scale of 0–12 (rather than cms/H₂O).

Perineometry was carried out with the woman in the same dorsal position. To ensure uniformity, the probe was inserted until the blue marker band was level with the hymenal ring. All measurements were carried out by the same physiotherapist, who also observed the woman to ensure she wasn’t ‘straining’ the pelvic floor during the procedure. The physiotherapist did not have access to the questionnaire responses, history and examination findings or digital score. The final score was the 'best-of-three', measured on the 0–12 scale.

Prior to commencing the study we grouped the perineometer results into six categories (Fig. 1) according to usual clinical management, ranging from pelvic floor exercises plus faradism to no treatment.

**Statistical analysis**

Agreement between digital assessment of pelvic floor strength and the perineometric score was investigated using weighted kappa values (k) to show the index of concordance. Kappa is a chance-corrected index that measures observer agreement for categorised data. Results are given with 95% confidence intervals.

<table>
<thead>
<tr>
<th>Score</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>nil</td>
</tr>
<tr>
<td>1</td>
<td>flicker of muscle contraction</td>
</tr>
<tr>
<td>2</td>
<td>weak contraction</td>
</tr>
<tr>
<td>3</td>
<td>medium: slight lift of examiner’s finger, no resistance</td>
</tr>
<tr>
<td>4</td>
<td>strong: elevation of examiner’s finger against light resistance</td>
</tr>
<tr>
<td>5</td>
<td>very strong: elevation of examiner’s finger against strong resistance</td>
</tr>
</tbody>
</table>

Log-linear modelling was used to investigate the structure of agreement in more detail. Two log-linear models were formulated:

1. A model of independence, which assumed that there was no relationship between the two sets of results, and was used as a baseline.
2. A model using diagonal agreement. The deviance or ‘goodness-of-fit’ of this model was directly compared with the fit of the model of independence. Deviance is a χ² statistic indicating a good ‘fit’ if a small value is obtained relative to the degrees of freedom.

Statistical analysis was carried out using SPSS for windows, 6-1-3 and BMDP-PC. Values of P < 0.05 were considered statistically significant.

**RESULTS**

Of 278 consecutive potential subjects, 263 women agreed to participate. The youngest was aged 16 and the oldest aged 75. The median age was 41 years. There were 53 nulliparous women (20%) and 210 parous women (80%). Median parity was two, and maximum parity six. Hormone replacement therapy was being used by 10.6% of all patients.

The results from the patient questionnaire are shown in Table 3. None of the nulliparous women performed pelvic floor exercises, regardless of age or the presence of urinary symptoms. In the parous group, 119 women (57%) performed pelvic floor exercises for a short time after childbirth, but only 49 women performed pelvic floor exercises regularly (23% of parous women, 19% of all women). All these women had urinary symptoms (in particular, more than one episode of stress incontinence per week).

Digital assessment of contraction strength gave a median score of 3/5. Perineometry gave a median score of 6/12. Using both methods, there was little difference in the distribution of results for nulliparous and parous women when grouped separately. The range of results for nulliparous women was 2–4 (Oxford Scale).
Comparative Assessment of Pelvic Floor Strength

Fig. 1. Distribution of results obtained when comparing perineometry and digital assessment of pelvic floor contraction strength. Numbers above markers indicate number of women. Vertical lines indicate grouping of perineometry scores into six categories.

and 3–9 (perineometer), while that for parous women was 1–4 (Oxford Scale) and 1–10 (perineometer). Both methods of assessment showed an association between increasing frequency of pelvic floor exercises and increased contraction strength. This did not reach statistical significance.

The distribution and comparison of results following the two methods of assessment is shown in Fig. 1, while agreement is shown in Table 4. The kappa value was 0.72 (95% confidence interval 0.67–0.79), indicating substantial agreement between both methods.

Log-linear modelling using diagonal agreement showed that concordance between the two methods was highly significant ($P < 0.0001$).

DISCUSSION

Urinary incontinence is an important health problem in women. It is age-related, affecting 10%–20% of younger women, and up to 30%–40% of the elderly female population. The most common type of urinary incontinence in women is stress incontinence. It may arise during pregnancy but is usually the result of neuromuscular damage to the pelvic floor during vaginal delivery, particularly the first.

Transperineal ultrasound scanning and magnetic resonance studies show that pelvic floor contraction produces elevation of the urethrovaginal junction. There is a strong correlation between contraction strength and the ability to control urine flow, and defective pelvic floor function is an important component of stress urinary incontinence and uterine prolapse.

The questionnaire responses showed that women are unlikely to carry out regular pelvic floor exercises except for a short time after childbirth or when prompted by urinary symptoms. Women who carried out regular pelvic floor exercises tended to score higher with both methods of assessment, despite the majority having troublesome stress urinary incontinence (>1 episode/week). These women may represent a subgroup whose urinary symptoms relate to fascial defects of the pelvic floor rather than neuromuscular dysfunction.

A high proportion of nulliparous women admitted to urinary symptoms and urinary leakage, confirming the
findings of other authors\textsuperscript{15}. Underlying differences in connective tissue collagen content and function may go some way towards explaining this\textsuperscript{16}. It may also be related to lack of exposure of nulliparous women (of all ages) to the concept and practice of pelvic floor exercises.

The nature of this study meant that there was potential for measurement bias. This was resolved by using the same clinician to assess all 263 women, by keeping the women blinded to their results, by using the same physiotherapist for all perineometric measurements and by blinding the physiotherapist to the woman's questionnaire responses, history and examination findings and digital assessment score.

The standardisation committee of the International Continence Society has commented that there are no published data directly comparing different methods of measuring pelvic floor contraction strength\textsuperscript{17}, therefore there is no validated method for clinically assessing pelvic floor strength. However, testing this large sample of 263 women, we found good agreement between digital and perineometric scoring of contraction strength.

Other authors have shown that test-retest and interobserver scores for digital assessment of pelvic floor contraction strength are reliable in both women\textsuperscript{6} and men\textsuperscript{18}. Hahn \textit{et al.}\textsuperscript{14} used vaginal cones, vaginal digital palpation and vaginal pressure measurements to compare women with genuine stress urinary incontinence to a group of continent women. Contreras Ortiz and Coya Nunez\textsuperscript{19} showed acceptable correlation of pelvic floor contraction strength (0.75) when indirectly comparing digital palpation with the ability to retain a weighted intravaginal device in a group of women with genital prolapse and in a control group. Their study took the digital test as the gold standard against which the intravaginal devices were assessed. Other authors have used similar methods to ours for evaluating pelvic floor strength but have compared results in groups of women (e.g. antenatally and postnatally\textsuperscript{20}) rather than comparing the methods used.

Primary care physicians are poor at eliciting urinary symptoms\textsuperscript{21}, and often lack the knowledge and confidence to manage those women who present with such symptoms\textsuperscript{22}. Measures to prevent and treat urinary incontinence not only have the potential to produce major health savings, but can reduce the physical, psychological, social and sexual problems for the woman involved. Most women will respond to simple, conservative measures, such as regular pelvic floor exercises and weight loss, and there is some evidence that symptomatic improvement remains for at least five years following a structured pelvic floor exercise programme\textsuperscript{23}.

Rather than intervening when urinary symptoms become significant, our aim should be to prevent or minimise these problems by encouraging all women to carry out regular pelvic floor exercises, thereby protecting pelvic floor integrity\textsuperscript{20,24}. We advocate that health care workers, particularly primary care physicians and gynaecologists, should include digital evaluation of pelvic floor strength as part of their routine gynaecological assessment for all women including nulliparae and those who are pregnant. This can be done opportunistically when performing a cervical smear, carrying out antenatal or postnatal assessment.

This comparative study shows that digital evaluation of pelvic floor strength compares favourably with perineometric results. Therefore clinicians can utilise this method of assessment in their everyday practice to reinforce the importance of carrying out regular pelvic floor exercises and to assess the results of this practice at a later date without the expense of purchasing specialised equipment.

The results showed a similar range for both nulliparous and parous women, but parous women were over three times more likely to be troubled with urinary symptoms. This may be because parous women are more likely to have fascial defects of the pelvic floor (related to vaginal delivery), despite demonstrating good pelvic floor contraction strength. It suggests that digital assessment of pelvic floor muscle strength can

<table>
<thead>
<tr>
<th>Table 3. Results of questionnaire. Values are given as n (%)</th>
<th>All women</th>
<th>Nulliparous women</th>
<th>Parous women</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvic floor exercises</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>95 (36)</td>
<td>53 (100)</td>
<td>42 (20)</td>
</tr>
<tr>
<td>Only after childbirth</td>
<td>119 (45)</td>
<td>0 (0)</td>
<td>119 (57)</td>
</tr>
<tr>
<td>Regularly</td>
<td>49 (19)</td>
<td>0 (0)</td>
<td>49 (23)</td>
</tr>
<tr>
<td>Stress incontinence</td>
<td>86 (32.7)</td>
<td>6 (11.3)</td>
<td>80 (38.1)</td>
</tr>
<tr>
<td>Urge incontinence</td>
<td>69 (26.2)</td>
<td>8 (14.9)</td>
<td>61 (29)</td>
</tr>
<tr>
<td>Frequency</td>
<td>58 (22)</td>
<td>7 (13.2)</td>
<td>51 (24.3)</td>
</tr>
<tr>
<td>Nocturia</td>
<td>14 (5.3)</td>
<td>2 (3.7)</td>
<td>12 (5.7)</td>
</tr>
</tbody>
</table>

Table 4. Agreement between perineometry and digital assessment of pelvic floor muscle strength.

<table>
<thead>
<tr>
<th>Digital score</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>-</td>
<td>19</td>
<td>11</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td>15</td>
<td>10</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
<td>-</td>
<td>119</td>
<td>36</td>
<td>-</td>
<td>161</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>47</td>
<td>-</td>
<td>-</td>
<td>47</td>
</tr>
<tr>
<td>5</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>0</td>
<td>19</td>
<td>32</td>
<td>129</td>
<td>83</td>
<td>0</td>
<td>300</td>
</tr>
</tbody>
</table>

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help to identify women with urinary symptoms who have an underlying fascial defect(s). These women may require surgical repair, rather than conservative measures alone.

In conclusion, this study shows that women do not usually carry out regular pelvic floor exercises, unless prompted by unwanted symptoms such as urinary stress incontinence. There is good agreement between digital evaluation of pelvic floor contraction strength and vaginal perineometry when compared directly.

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References

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