560

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THE ASSESSMENT OF PELVIC FLOOR MUSCLE FUNCTION USING A NOVEL AND DIRECTIONALLY SENSITIVE INTRA-VAGINAL SENSOR PROBE

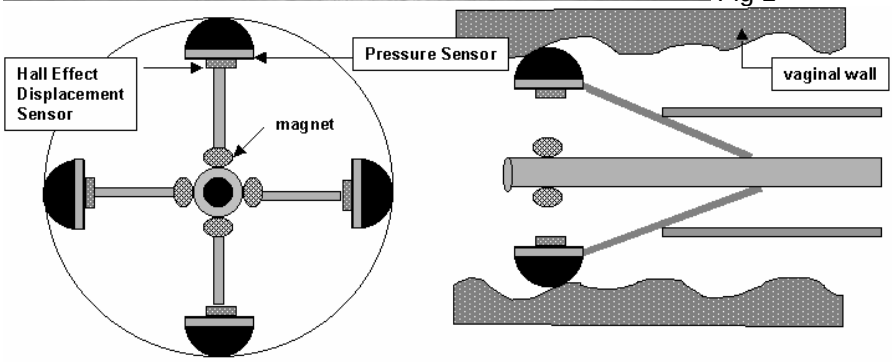
Hypothesis / aims of study

Evaluation of pelvic floor muscle (PFM) function is essential for the clinical management of women with urinary incontinence and/or pelvic organ prolapse. Currently available approaches, designed to measure PFM strength objectively, such as surface EMG or pressure measurement, have been claimed that they were not able to localize pelvic floor muscle activity. Digital palpation is a reliable examination but it is operator dependent and a subjective observation. To address the need for the objective measurement of PFM, we developed a novel sensor probe, which is directionally sensitive and is capable of measuring PFM strength.

Study design, materials and methods

12 incontinent patients (mean age 63.2) were recruited to the study. The PFM strength was measured in the lithotomy position first by palpation and then using the new sensor probe. Palpation was performed by a trained physician and PFM strength was graded using the Oxford 0-5 Classification Scale. The new probe consisted of 4 leaf-spring-like arms, each arm containing a displacement transducer and a contact pressure transducer (Fig1 and Fig2). For correct placement, each of the 4 arms can be adjusted to move completely independently. For the vaginal insertion, a condom is placed over the retracted probe. Following insertion of the probe into the vagina, the individual arms are allowed to open to approximate the vaginal wall. Movement and the force of PFM in the different four directions (anterior, posterior, right and left) were measured and presented on the computer monitor graphically. During the measurement, patients were asked to perform voluntary pelvic floor muscle contractions (VPFMC) 3 times and coughing (CPFMC) 3 times. Correlation between the manually graded scores and the parameters (movement and force) measured by the new device was tested by Spearman's rank correlation.

Fig 1



By sliding the outer pipe, the four sensor arms can be expanded or retracted. Fig 2.

Results

There was a statistically significant correlation between manually graded scores and the parameters of the new device (score vs movement: $r=0.89$, $p<0.01$. score vs force: $r=0.92$, $p<0.01$). In VPFMC, both the movement and force of PFM were largest in the posterior direction whereas in the cough induced PFM contraction, the same amount of movement and

force development of PFM were found in all directions except anterior direction. The movement and force in anterior direction were always smallest among all directions in both VPFMC and CPFMC. Fig 3 and 4 show the raw data obtained from a 74-year old subject.

Concluding message

This new probe provides objective measurements of PFM function, and because of its directional sensitivity, localizes their weakness and asymmetry of contractility. Furthermore it can be used to explore the mechanism of PFM contraction and resolve the differences between voluntary PFM contraction and cough-induced PFM contraction. Ultimately, we expect that after the systematic measurements using this probe, the biomechanical properties and role of the pelvic floor in the continence mechanism will be better understood.

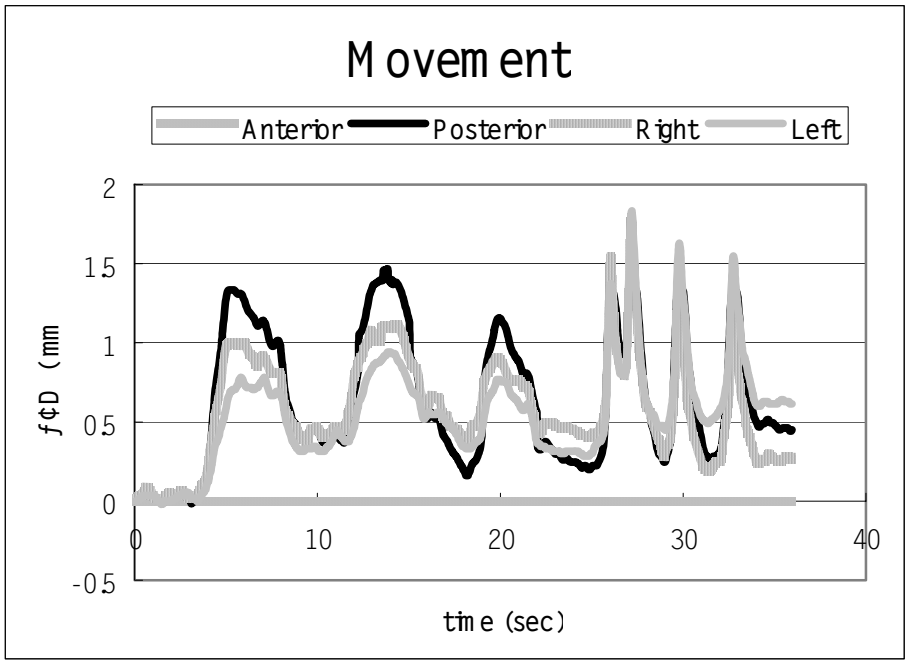


Fig 3

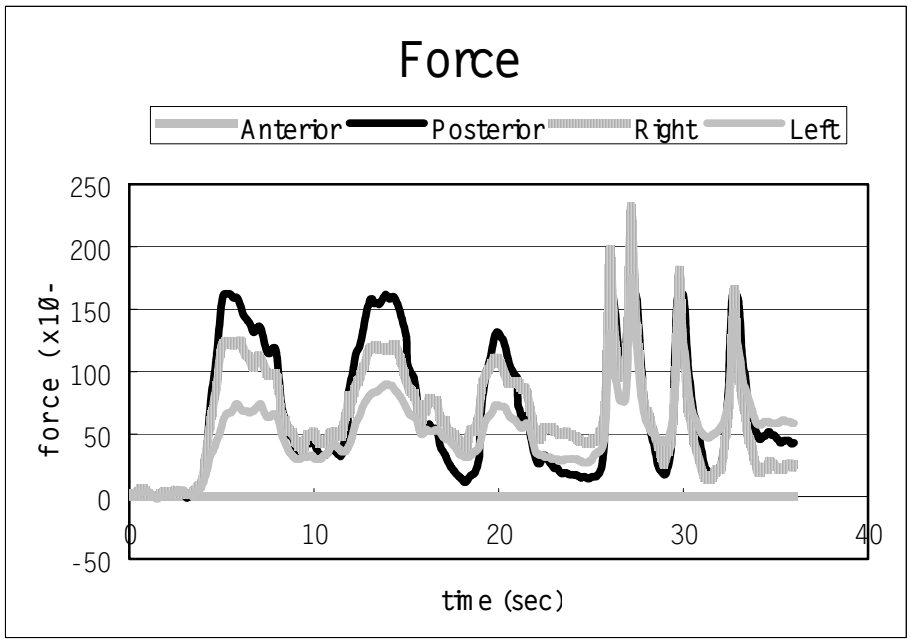


Fig 4