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HIGH DEFINITION MANOMETRY FOR INTRAVAGINAL OBSERVATION OF PELVIC FLOOR MUSCLE CONTRACTIONS

Hypothesis / aims of study

Pelvic floor support structures and muscles are thought to be significant factors in the development of pelvic floor conditions. The objective of this study is to estimate pelvic floor muscle contraction changes by prolapse, age, and parity using a new high definition manometric probe.

Study design, materials and methods

Between May 2013 and December 2013, 22 women were enrolled in the observational case controlled study with Vaginal Tactile Imager (VTI). The analyzed data set included 20 subjects aged from 41 to 70 years. Among them 4 women had normal pelvic floor conditions, 8 had pelvic organ prolapse Stage I, 7 Stage II, and 1 Stage IV. Two subjects were excluded from analyzed data set because they have had prior pelvic floor surgery. The clinical protocol was approved by the local Institutional Review Board and all women gave written informed consent. The VTI pressure response patterns (tactile images) were obtained and recorded at the time of scheduled routine gynecologic visits. The VTI includes a vaginal probe, a data acquisition electronic unit, and a computer with a touch screen monitor. The vaginal probe (Fig. 1) is comprised of 96 pressure sensors, an orientation sensor, temperature sensors and micro-heating elements. The pressure sensors are installed along both 120 mm sides of the probe. The VTI examination was performed on patients in the standard position for a routine gynecologic exam with an empty bladder and rectum. The full VTI examination requires 1-2 minutes to complete. The patients were asked to contract pelvic floor muscle and VTI recorded the muscle rest tone and contraction patterns with a resolution of 2.5 mm along the entire vagina. The pressure sensors in the probe were calibrated before every examination to provide pressure measuring accuracy of ± 3 mmHg.

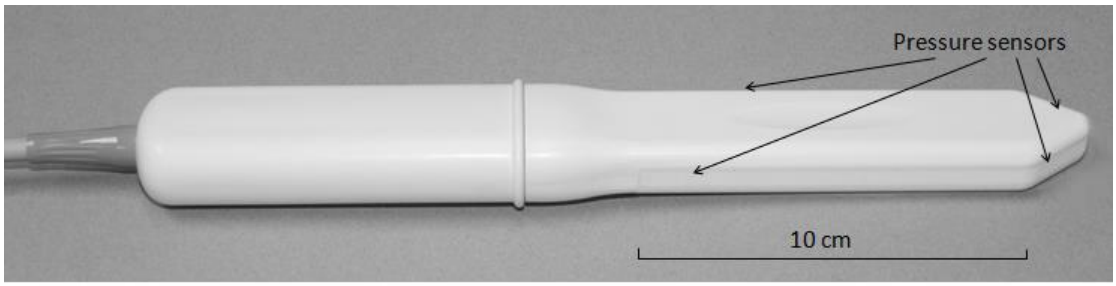

Fig. 1 Vaginal probe

One-way analysis of variance (ANOVA), paired *t*-test, and Pearson's correlation coefficients were calculated to determine whether the various parameters extracted from muscle contraction data showed dependence on the pelvic floor conditions, patient age, and parity.

Results

All 22 enrolled women were successfully examined with the VTI and pressure patterns for pelvic floor muscles within the vagina were recorded and stored. We observed contraction capabilities of five pelvic floor muscle regions as shown in Fig. 2. For 4 of 5 pelvic floor muscle contraction values we found correlations with pelvic organ prolapse (normal, Stage I-IV). The correlation factors for these muscles are in the range 0.43-0.52, ANOVA p=0.09-0.26, *t*-test p= 0.08-0.21.

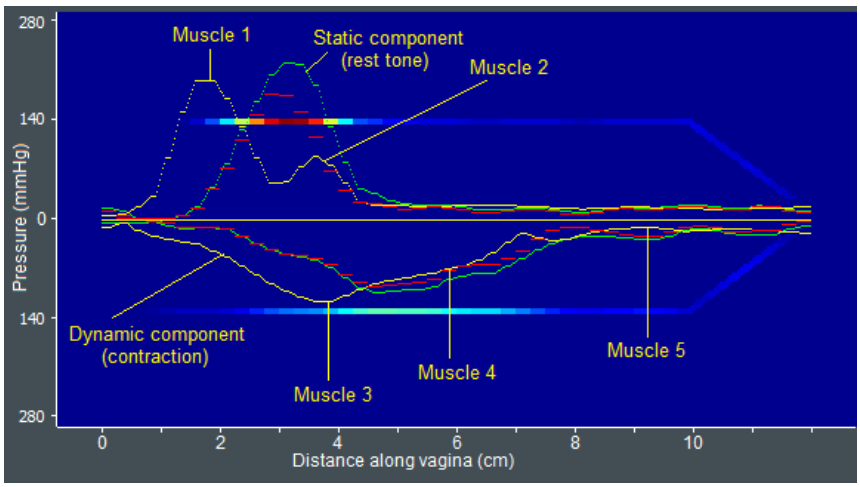

Fig. 2 Static and dynamic pressure patterns for pelvic floor muscle reordered by high definition manometric probe within the vagina.

We did not find significant muscle contraction change with the age for muscle 1-4 in analyzed data (see Fig.2). Muscle 5 demonstrates unexpected effect: the contraction capability is increasing with age with correlation factor 0.46 as shown in Fig. 3.

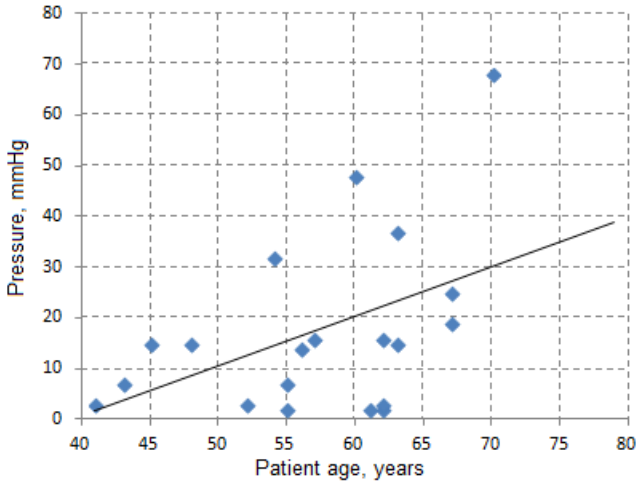

Fig. 3 Dynamic pressure patterns (contraction) for pelvic floor muscle (see Muscle 5 on Fig. 2) *vs* patient age as recorded by a high definition manometric probe within the vagina.

We found that static pressure (rest tone) decreases with parity for Muscle 2 (see Fig. 2); it demonstrated correlation factor 0.33. The patients were asked also to assess the comfort level of the VTI examination relative to manual palpation: 54% said that VTI procedure was more comfortable, 36% the same, and 10% less comfortable than manual palpation.

Interpretation of results

The pressure patterns recorded from passive and active (contraction) phases for the pelvic floor muscles can directly assess underlying strength and weaknesses correlated with pelvic floor disorders. To the best of our knowledge, it is the first attempt to visualize simultaneous two-sided dynamic muscle contractions along the entire vaginal length with high resolution measurements. The resulting images have demonstrated 5 separate pelvic floor muscle regions with independent contractions. Correlation with anatomical imaging would be helpful to further identify these muscles.

Concluding message

Our findings suggest that introvaginal high definition manometry measuring static and dynamic pressure responses during muscle contractions may be used for further quantitative assessment and characterization of female pelvic floor conditions.

Disclosures

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