Female Pelvic Medicine & Reconstructive Surgery 2015; 21(5): S149–S150.

HIGH DEFINITION PRESSURE MAPPING OF THE PELVIC FLOOR MUSCLES DURING VALSALVA MANEVER, VOLUNTARY MUSCLE CONTRACTION AND INVOLUNTARY RELAXATION

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Introduction:

The effective management of pelvic floor prolapse (POP) requires an understanding of the anatomy and function of the female pelvic floor and its support structures. The most widely used assessment of POP has been limited to documenting surface anatomy, such as the POP Quantification system developed by the International Continence Society. Tactile imaging, translating the sense of touch into a real-time computer image, allows biomechanical assessment of pelvic floor conditions [1, 2].

Objective:

To introduce pelvic tissue evaluation with a vaginal tactile imaging probe, which allows high definition pressure mapping, to quantify behavior of female pelvic floor muscles with voluntary and involuntary use.

Methods:

A vaginal tactile imaging probe that images the entire vagina, the pelvic floor support structures and pelvic floor muscle contractions in real time was utilized [3]. The probe has 96 tactile sensors positioned along the both sides of the probe (11 cm length), a motion tracking sensor, temperature controller, and two microchips for communicating with a computer. We implemented the software support for high definition pressure mapping during Valsalva maneuver, pelvic floor muscle contractions and involuntary relaxation. We enrolled the first 24 subjects of 150 planned into an observational case-controlled study (NCT02294383). The patients were studied with the vaginal tactile imaging probe in lithotomy position. They were asked to complete an assessment of comfort and pain levels for the tactile imaging (pressure mapping) procedures.

Results:

All 24 patients were successfully examined and data were recorded using the Vaginal Tactile Imager. Mean patient age was 56.9 years (range 26 to 72), pelvic floor conditions were from normal to Stage III POP, and median parity was 2 (range 0 to 8). The preliminary data analysis reveals the following findings:

1) Under Valsalva maneuver we observed pressure patterns that were not uniform along the anterior and posterior compartments which are substantially different than under pelvic floor muscle contraction. It seems that high pressure zones correspond to softer tissues with low support capability; these high pressure zones (30-50 mmHg) appear to have been created by penetration of surrounding load through an internal strain (easily flexed). That means that this test allows detection of biomechanically weak structures and their locations.
2) We observed significant amplitude difference or a ratio in voluntary muscle contractions for anterior *vs* posterior and left *vs* right side which may allow recognizing of muscle avulsion and further characterization of their functional conditions. It seems possible to re-create their dynamics in 3-D.
3) During the involuntary muscle relaxation, the patient was asked to maintain a sustained pelvic muscle strain. By quantifying the pressure decline *vs* time (angle) at a region of interest or for specific muscle it seems possible to characterize functional conditions of multiple pelvic dynamic structures.

A typical examination with vaginal tactile imaging probe takes 2-3 minutes. 50% of patients classified VTI comfort level as more comfortable than manual palpation, 33% as the same, and 17% as less

comfortable than manual palpation.

Conclusions:

Our findings demonstrate that high definition pressure mapping during Valsalva maneuver, pelvic floor muscle contractions and involuntary relaxation may be used for quantitative characterization of POP. Functional imaging of the pelvic floor muscles may offer a needed insight into the biomechanics of the functional pelvic floor, to help understand the relative contribution of pelvic floor muscles into POP development and its effective treatment.

References:

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Acknowledgements:

The work was supported by NIH/NIA grant AG034714