A hand-held elastometer for measuring pelvic floor muscle stiffness

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Background
Female pelvic floor (PF) muscles support pelvic organs, help ensure continence and facilitate childbirth. 20% of women will develop some form of pelvic floor disorder (PFD) during their lifetime (1).

There are strong correlations between muscle damage and PFD (2), but a lack of data describing the mechanical properties of the pelvic muscles in health and disease.

We have developed a novel hand held elastometer to assess the stiffness of the pelvic floor muscle with high repeatability and reliability (3). We are using this tool to measure stiffness of the PF muscle during pregnancy, post delivery and among different ethnic groups.

Design
The elastometer consists of a hand-piece, real time controller and laptop computer.

Performance
• Performance was tested against spring load measurements from an Instron and the elastometer with excellent correlation (Figure 3).
• Force-displacement data are displayed using a LabVIEW application on a laptop computer.
• Experimental measurement protocols can be varied as required. Data are filtered and acquired at 100Hz, presented as a force displacement plot (Figure 3).

Pelvic-floor stiffness measurements
• Three cycles are conducted per patient, using a prescribed protocol; first cycle is treated as tissue pre-conditioning.
• Linear trend line fitted to the most linear portion of the curve to calculate stiffness (Figure 4).

Current clinical study
• 107 first time pregnant women have enrolled for the study (65 European; 42 Maori/Pacific Islander).
• 71 have ante and postnatal elastometry data.
• Overall there is a significant difference (p < 0.01) between ante and postnatal elastometry data (Figure 5).
• There is also a significant difference (p=0.03) in elastometry data between the ethnic groups, with Maori/Pacific Island women measuring.

Conclusion
• The elastometer is able to discriminate differences in stiffness measures both pre and post delivery and between ethnic groups.
• The study is ongoing.

References