Prospects for effective uterine and cervical elastography

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The goal of this dissertation was to determine whether ultrasound strain imaging (elastography) could provide additional diagnostic information for evaluating the causes of dysfunctional uterine bleeding and cervical incompetence and allow the physician to decide the appropriate treatment method.

An *in vitro* strain imaging study demonstrated that ultrasound strain imaging is able to distinguish between normal uterine myometrial tissue and other pathologies that cause dysfunctional uterine bleeding. No significant difference in the cervical strain distributions between women of different ages, menopausal state, or obstetric history. Strain contrast can be used to differentiate between uterine leiomyomas and endometrial cancer or endometrial polyps but not between endometrial polyps and endometrial cancer.

The MTS Nanoindenter XP was used to map out mm-scale distributions of the Young's storage modulus and tan(δ) of tissue-mimicking (TM) phantoms and uterine and breast tissue specimens. Nanoindentation results using TM phantoms provide insight into the limitations of the nanoindenter mapping in soft tissues.

Two anthropomorphic uterine phantoms were constructed of TM oil-in-gelatin materials and were used to mimic the saline-infused-sonohysterography (SIS) technique. The first phantom had 3-mm TM fibroids distributed in the TM myometrium while the second phantom had TM endometrial polyps and fibroids protruding into the endometrial cavity. Strain images of the first uterine phantom depict the TM fibroids in the TM myometrium, while strain images of the second phantom show that parts of inclusions projecting into the uterine cavity will appear very stiff, regardless of whether they are soft or stiff. Strain images produced from data collected on curved arrays were of poorer quality resulting in limitations in detecting lesions at greater depths or further away from the central axis of the image sector.

Preliminary strain images from *in vivo* SIS scanning presented are noisy but demonstrate the feasibility of producing *in vivo* strain images using saline infusion for the necessary tissue deformation.