247

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THE INTER-TESTER RELIABILITY OF 2D ULTRASOUND AND IMAGE PROCESSING METHODS TO EVALUATE THE PELVIC FLOOR MUSCLES (PFM) AND URETHRA DURING A COUGH IN CONTINENT AND STRESS URINARY INCONTINENT (SUI) WOMEN.

Aims of study

To establish the inter-tester reliability of a novel image processing method of analysing 2D ultrasound imaging during a cough.

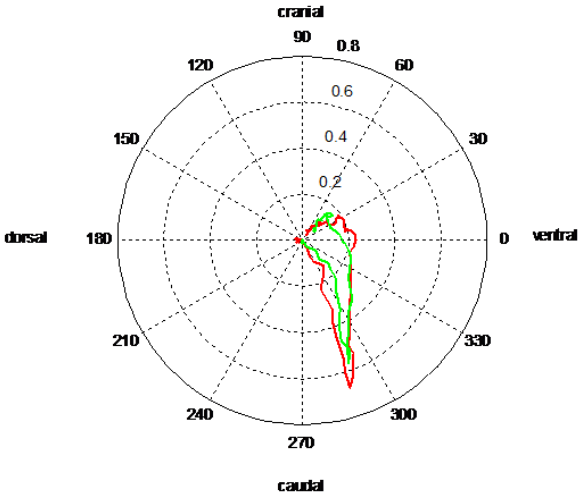
Study design, materials and methods

The captured audio-visual image (AVI) ultrasound files of 10 continent and 9 SUI women, during a cough, were evaluated using novel image processing methodology described elsewhere[(1,2)] by 2 independent observers blinded to each other's results. Examples of the wave forms produced by each observer are presented individually and the values of displacement at the synchronization point are compared using Bland and Altman and Intra-class Correlation Coefficient (ICC) statistical analysis.

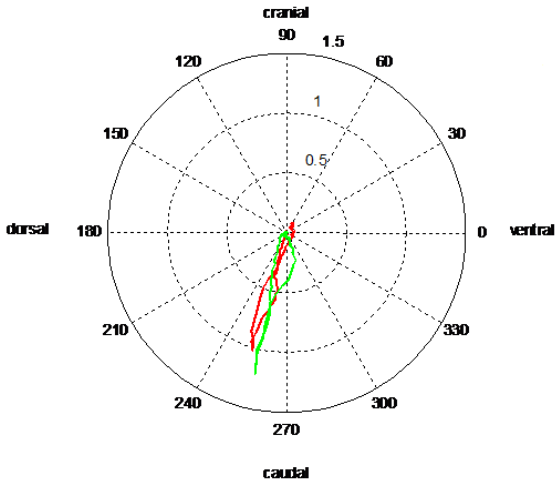
Results

Visually, in the continent group, the wave forms of the raters almost perfectly match in the all directions, although there is a slight drift at the end of wave form in the dorsal-ventral direction. However, in the incontinent group there is less exact overlap, although the match seems reasonable.

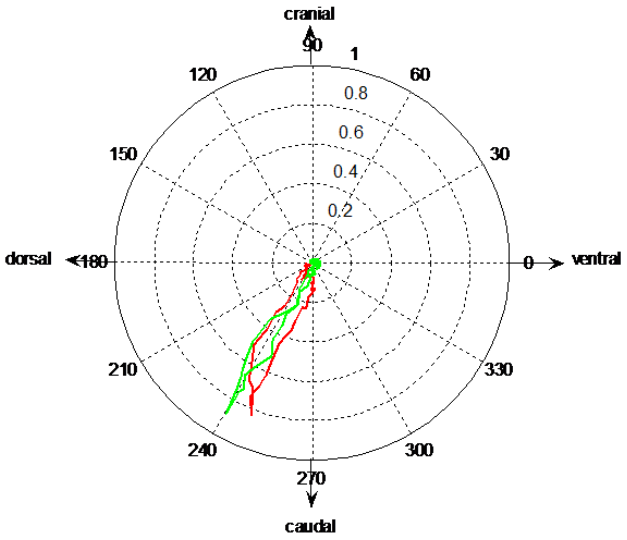
	ICC	ICC	Bland Altman	Bland Altman	Bland Altman	Bland Altman	**Bland Altman**
Inter-tester reliability	ICC co	95% CI	$\bar{d}$ (cm)	SE of $\bar{d}$ (cm)	95% CI for $\bar{d}$ (cm)	SD_{diff} (cm)	**95% LOA**
ARA							
Continent	0.94	0.72→0.95	-0.14	0.06	-0.27→0.01	0.18	**-0.49→0.20**
Incontinent	0.73	0.29→0.90	0.18	0.10	-0.03→0.38	0.42	**-0.65→1.00**
Urethra							
Continent	**0.88**	**0.72→0.95**	**0.03**	**0.05**	**-0.07→0.12**	**0.22**	**-0.42→0.47**
Incontinent	**0.86**	**0.63→0.95**	**0.24**	**0.11**	**-0.01→0.47**	**0.47**	**-0.68→1.16**



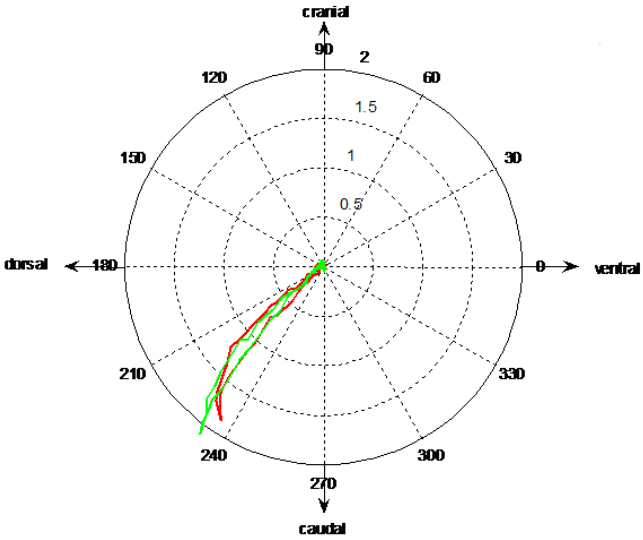
(1a)



(1b)



(2a)



(2b)

Comparison between two raters of the trajectory of the movement of the (1) ARA and (2) urethra during a cough from (a) 10 continent and (b) 9 incontinent women in supine, synchronised by the time point of the maximum caudal displacement of Y. The raters are shown in green and red.

Interpretation of results

The wave forms between raters are precise enough to be able to confidently describe the trajectory that the urogenital structures take during a cough, and the reliability for the displacement values at the synchronization point between raters are substantial. As the methodology eliminates the requirement to manually determine a fixed reference point, the measurements are not subject to the variance of repeatedly identifying the central axis of the pubic bone. Digital segmentation, used in this current study to identify the path of the urethra during a cough, significantly overcomes the difficulty of identifying the urethra whenever it is distorted during manoeuvres. Statistical values are slightly better for the continent group probably because there is more movement of the transducer when an incontinent women. More movement of the transducer will result in more apparent motion of the urogenital structures and pubic bone on the ultrasound images. In addition due to the extra movement of the transducer, more frequent and greater episodes of short term out-of-plane rotation is likely to occur.

Concluding message

2D perineal ultrasound imaging combined with image processing methods is a reliable method to describe and measure the trajectory of the PFM and urethra during a cough in continent and SUI women. It is hoped that this methodology can be used in the future to create more efficient assessment and treatment interventions and improve the rehabilitation of women with SUI and other pelvic floor disorders.

References

1. Annals of Biomedical Engineering (2006) **34**; 477-493.
2. Ultrasound in Medicine & Biology (2007) **33**; 342-352.

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Is this a clinical trial?	**No**
What were the subjects in the study?	**HUMAN**
Was this study approved by an ethics committee?	**Yes**
Specify Name of Ethics Committee	**Institutional Review Board of Stanford University**
Was the Declaration of Helsinki followed?	**Yes**
Was informed consent obtained from the patients?	**Yes**