

CONSTRICTOR AND ELEVATOR FUNCTIONS OF THE PELVIC FLOOR ARE DISTINCT: EVIDENCE FROM STUDIES IN PATIENTS WITH FECAL INCONTINENCE.

Hypothesis / aims of Study

Pelvic floor muscles provide elevator function (support to pelvic organs) and constrictor function (continence to anal canal / urethra) to the pelvic viscera. We hypothesize that fecal incontinence patients (FI) have normal elevator but impaired constrictor function.

Study design, materials and methods

Cranio-caudal and dorso-ventral movements of the anorectal angle (ARA) were used as surrogate for elevator and constrictor function, respectively. Patients with fecal incontinence (FI)(n=26) and parity matched asymptomatic controls (C)(n=26) were studied. Images were acquired at rest (R) and squeeze (S) which was defined as the peak of pelvic floor contraction. Philips 3 dimension ultrasound system and software program Sigma Scan© were used for acquisition and measurement, respectively. For constrictor function, the dorso-ventral distances between a fiducial point on the pubic symphysis and ARA: for elevator function the cranio-caudal distances between the perineal skin and ARA were measured (figure 1).

The observer was blinded to the names, order and patient group for image analysis and measurements were repeated after a period of three months to determine the intra-observer variability in the measurements.

Comparison between the two groups was analyzed using paired t-test and the significance was established at $P < 0.01$. The intra-observer reliability was assessed using linear regression analysis.

Results:

1. During squeeze, the ARA moved in the cranial and ventral directions in controls and patients. Following table shows the measurements of ARA movement in the 2 groups.

Table 1.

(mm)	Cranio-caudal distance			Dorso-ventral distance			
Group	Rest	Squeeze	Delta	Rest	Squeeze	Delta	%Delta
C	26.7+7.3	32.4+6.8	5.7+3	50.9+9.1	39.8+8.8*	11.1+5.0*	21.8+9*
FI	25.7+8.9	30.2+9.1	4.5+3	54.5+12.6	47.1+12	7.4+5.1	14.6+8.6

*Difference is statistically significant; (mm)=millimetres.

2. Linear regression analysis showed US measurements made 3 months apart were reproducible with an R value of 0.91, a slope of 1.05 and an intercept of (-1.2).

Interpretation of results

1. Cranio-caudal distances at rest, squeeze, and their difference (delta) were similar in the C and FI groups. Dorso-ventral distance at rest was also similar in 2 groups (table 1, figure 2). However, during squeeze the dorso-ventral distance was significantly larger in the FI compared to C group. Delta for the movement in dorso-ventral plane in FI was significantly smaller than C group (table 1, figure 3), suggesting a weaker constrictor function in FI patients compared with controls.
2. There was a good intra-observer reproducibility.

Concluding message

Our data support the hypothesis that constrictor, but not the elevator function of the pelvic floor muscles is compromised in fecal incontinence patients. It is likely that elevator and constrictor functions are due to different components of the pelvic floor muscle. Therefore, it is possible that the two pelvic floor disorders namely, fecal incontinence and organ prolapse, may result from injuries to different components of pelvic floor musculature.

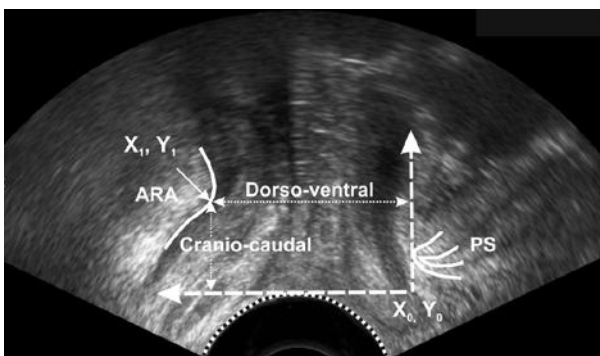


Figure 1: Schematic showing the method by which measurements were made using Sigma scan. Please note that the distances were measured using x,y coordinates of anatomical structures in a Cartesian coordinate system.

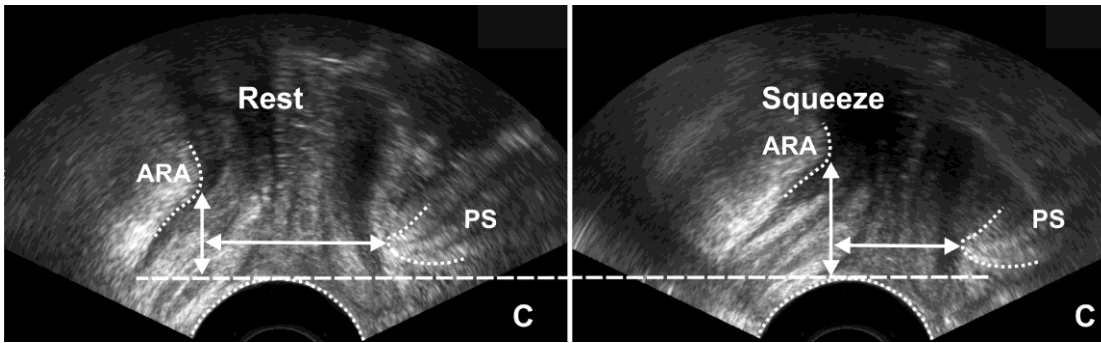


Figure 2: Schematic showing dorso-ventral (horizontal arrow) and cranio-caudal (vertical arrow) distances moved by anorectal angle (ARA in control (C) group. With squeeze, both distances shorten.

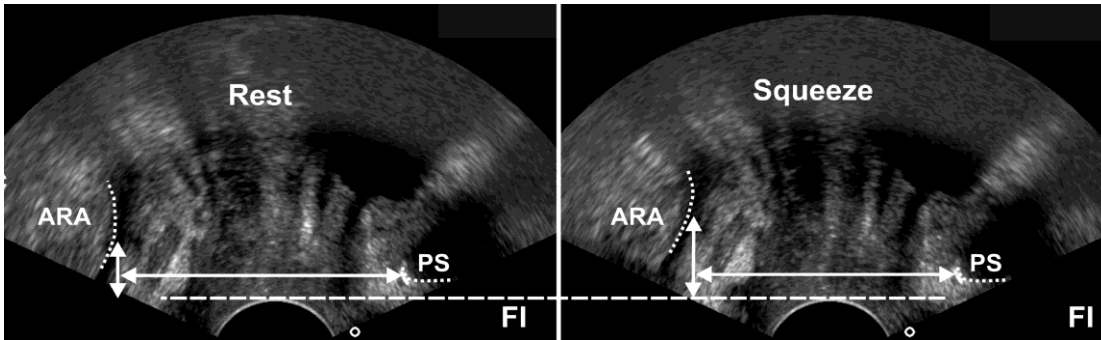


Figure 2: Schematic showing minimal dorso-ventral (horizontal arrow) and normal cranio-caudal (vertical arrow) distance moved by anorectal angle (ARA) in fecal incontinence (FI) group. With squeeze, the dorso-ventral distance does not shorten.

<i>Specify source of funding or grant</i>	This study was supported by an NIH RO1 grant (DK60733).
<i>Is this a clinical trial?</i>	No
<i>What were the subjects in the study?</i>	HUMAN
<i>Was this study approved by an ethics committee?</i>	Yes
<i>Specify Name of Ethics Committee</i>	Institution review board (IRB), University of California, San Diego
<i>Was the Declaration of Helsinki followed?</i>	Yes
<i>Was informed consent obtained from the patients?</i>	Yes