

ANAL ACOUSTIC REFLECTOMETRY: A NEW CLINICALLY RELIABLE METHOD OF ASSESSING ANAL SPHINCTER FUNCTION IN CONTINENT AND INCONTINENT SUBJECTS.

Hypothesis / aims of study

Anal Acoustic Reflectometry (AAR) is new technique of assessing anal sphincter function, providing a greater physiological insight compared with conventional manometry.

The aim of this study was to see AAR is clinically reliable.

Study design, materials and methods

Study design:

Measurement of normal continent subjects and those with Faecal Incontinence (FI) with both AAR and conventional manometry.

45 pairs of females (continent vs. incontinent) were recruited. These were age matched (to within 5 years). There was no significant difference between the two groups in terms of weight, parity, No. and type of deliveries. The two groups were compared using paired t test for parametric data and the Wilcoxon Signed Ranks Test for non parametric data. A p value <0.05 was taken as significant. Twenty-five patients per group were required for the paired t test to have a 80% chance of detecting a difference in Opening Pressure with AAR at a 5% significance level.

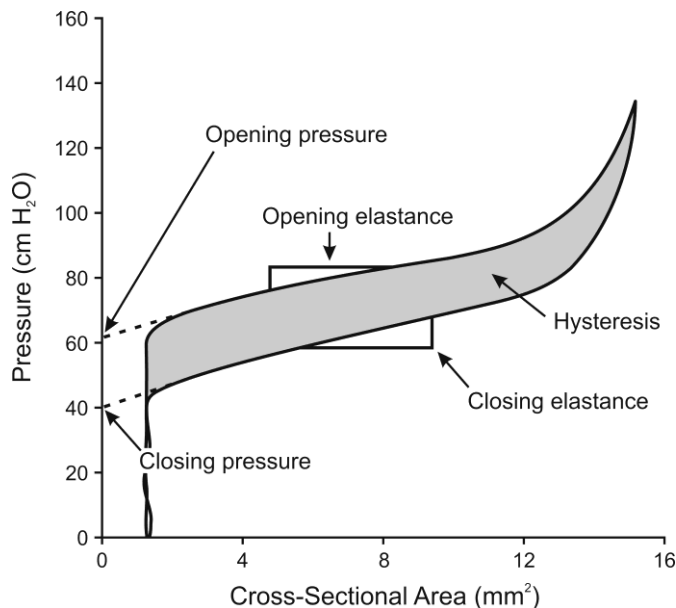
Materials and Methods:

In AAR a thin polyurethane bag is place within the anal canal. It measures 6cm in length and 5mm in diameter when fully distended. A transmitter sends wide band sound waves (100Hz to 16KHz) into the bag and from the reflected sound waves the cross sectional area within the bag is calculated. Cross sectional area measurements within the bag are made every millimetre along the length of the bag and anal canal. A pressure pump inflates the bag from its collapsed form to fully distended (pressure increases from 0 to 100cmH₂O, in 5 cmH₂O pressure steps). The inflation of the bag causes the anal canal to open. The bag is deflated in a similar stepwise manner allowing the anal canal to close.

During inflation and deflation of the bag, while the anal canal is opening and closing, area measurements are made at each pressure step. Area measurements at each pressure level are plotted on a graph of pressure vs. area. From this graph we are able to calculate five parameters of collapsible biological tube function: **Opening and Closing Pressures** (the pressures at which the anal canal just opens/closes), the **Opening and Closing Elastances** (the resistance of the anal canal to opening and ability of the canal to close down against a reducing pressure) and the **Hysteresis** (an expression of the energy dissipated during opening and closing of the anal canal). See Figure below.

Manometry was performed with a closed water-filled micro-balloon system, using a station pull through technique.

A more detailed explanation of the materials, methodology and technique of AAR has recently been published (1).



Results

Results shown in tables below, new Acoustic parameters in italics in first column of each table

During measurement at REST

Parameter	Continent Group	Incontinent Group	p value
<i>Opening Pressure</i> [^]	54 (20.5)	33 (18.9)	0.0001*
<i>Opening Elastance</i> [~]	1.36 (0.46)	1.21 (0.62)	0.23
<i>Closing Pressure</i> [^]	47 (19.0)	27 (18.7)	0.0001*
<i>Closing Elastance</i> [~]	1.15 (0.40)	0.94 (0.38)	0.01*
<i>Hysteresis</i>	13 (11)	20 (14.5)	0.01*
Manometry Resting Pressure [^]	81 (29)	61 (28)	0.002*

Values are means with SD in brackets.*=significant at 0.05 level.^=measured in cmH₂O, ~measured in cmH₂O/mm². All data normally distributed according to Shapiro-Wilk test.

During VOLUNTARY CONTRACTION assessment:

Parameter	Continent Group	Incontinent Group	p value
<i>Squeeze Opening Pressure</i> [^]	103 (48)	52 (40)	0.001*
<i>Squeeze Opening Elastance</i> [~]	1.86 (0.60)	1.49 (0.68)	0.02*
Manometry Squeeze Pressure [^]	152 (59)	92 (43)	0.0001*

Values are means with SD in brackets.*=significant at 0.05 level.^=measured in cmH₂O, ~measured in cmH₂O/mm². All data normally distributed according to Shapiro-Wilk test.

Interpretation of results

Overall 4 of the 5 AAR parameters at rest and both AAR parameters during squeeze assessment were significantly different between the two groups.

The pressure at which the anal canal just opens and closes was significantly lower in Incontinent patients. Hysteresis, reflecting the energy dissipation during anal canal opening was significantly greater in the Incontinent group, which corresponds to a greater collagen/scarring component as opposed to elastin content within the canal.

Concluding message

Anal Acoustic Reflectometry is a new promising technique of assessing the function of the anal sphincter complex. This study has proven that AAR is clinically reliable with measured parameters being significantly different between continent and incontinent subjects.

References

- Anal Acoustic Reflectometry: a new technique for assessing anal sphincter function. Mitchell PJ, Klarskov N, Hosker G, Lose G, Kiff ES. Colorectal Dis 2010 Jan 12 epub ahead of print. PMID20070337

Specify source of funding or grant	NIL
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	Stockport NHS Research Ethics Committee, UK. REC Ref No.

08/H1012/47

Was the Declaration of Helsinki followed?

Yes

Was informed consent obtained from the patients?

Yes
