

## RELATION BETWEEN THE END OF A RECTAL SENSATION, CONTRACTION IN THE INTERNAL ANAL SPHINCTER AND A REVERSED FLOW OF RECTAL CONTENTS IN THE ANAL CANAL – A SONOGRAPHIC STUDY

### Hypothesis / aims of study

The ability to end a rectal sensation without involuntary passing of bowel contents or urge is a prerequisite for anal continence. The knowledge about actions in the anal sphincter and the movements of the intraanal contents at the end of a rectal sensation is sparse. A radiographic study showed the rectal contents to enter the anal canal before a rectal sensation was reported by the subject (1). Electromyography revealed a contraction in the external anal sphincter (EAS) and a relaxation in the internal anal sphincter (IAS) during the sampling mechanism. Rectal contractions have a temporal relation to rectal sensations (2). With transperineal ultrasound both muscular activity in the anal sphincter and movements of the bolus in the anal canal can be studied (3).

The aim of this study was to visualize the muscle activity of the striated and smooth components in the anal sphincter and relate them to the intraanal transport of bolus at the beginning and end of rectal sensations.

### Study design, materials and methods

The anal canal was visualized by real-time transperineal ultrasonography (Hitachi EUB-6500, EUP-C524, 9 MHz) in 13 healthy female volunteers (median age 24 years, range 23-57). Rectal sensations were elicited by repeated injections of water (4-13 per subject) into the rectum, median 20 ml (range 3-120). Video-tapes with the voice of the subjects, the time and ultrasound images were analyzed off-line in order to calculate the time intervals between injections and the subsequent events in the anal sphincter complex, the onset and end of rectal sensations and the beginning and end of intraanal waves of contents from the rectum.

### Results

Contractions in the striated muscles were seen as changes in position and often as a more intense hyperechoic appearance. In the internal anal sphincter contractions were seen as a decrease in diameter.

Median time between an injection of water and the studied events was calculated in 105 rectal sensations. A relaxation in the IAS and an antegrade transport of bolus in direction towards the proximal part of the EAS occurred at 4 seconds (s). A contraction in the EAS was observed at 5 s, before a sensation was reported (6 s). (Figure 1). During the sensation the transport of bolus continued until the IAS contracted (18 s) and a retrograde transport of the bolus (17 s) was observed. Then, the sensation disappeared (18 s) and the EAS relaxed (22 s). The time-intervals between contraction of the IAS, the start of the retrograde wave and the relaxation of the EAS were significantly correlated to the end of the rectal sensation (Pearson correlation coefficient;  $p < 0.01$ ).

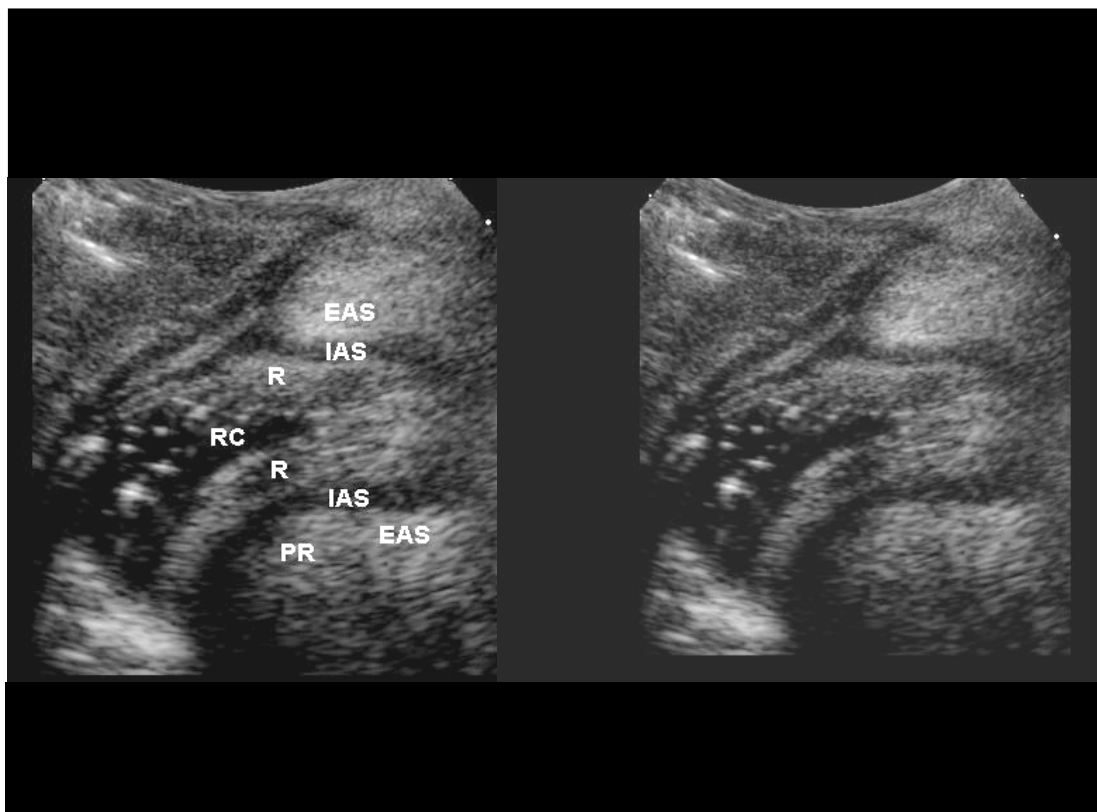


Figure 1  
Sagittal perineal ultrasounds scan of the anal canal during a rectal sensation.

The rectal contents (RC) have reached a position proximal to the puborectal muscle (PR) and are surrounded by the external anal sphincter (EAS). The proximal part of the hypoechoic internal anal sphincter (IAS) is dilated by the wave of rectal contents. The rectal columns are indicated as R.

#### Interpretation of results

The sampling mechanism is carried out i.e. the differentiation of rectal contents and the rectal sensations are elicited when the bolus is in the anal canal. This happens when the rectum contracts and the IAS relaxes, the rectoanal inhibitory reflex. The cooperation between smooth and striated muscles resulting in continence might be carried out by the contraction of the external anal sphincter around the distal part of the internal anal sphincter. The contraction prevents further antegrade transport of bolus and converts the relaxation in the distal IAS into a contraction propagating in a proximal direction which moves the bolus towards the rectum, away from the richly innervated area in the distal anal canal, resulting in disappearance of the rectal sensation.

#### Concluding message

Anal continence is maintained by a coordinated activity of the smooth and striated parts of the anal sphincter and the contractions in the rectum. This study shows the IAS to take part in anal continence in two ways. A relaxation results in transport of rectal bolus into the anal canal, which triggers rectal sensations and enables discrimination between different types of bolus. The subsequent contraction in the IAS starts in the distal anal canal and propagates in a proximal direction. This contraction together with a relaxation in the rectum moves the rectal bolus towards the rectum again. During these events the EAS remains contracted. The retrograde transport is related to the disappearance of rectal sensations.

1. Dis Colon Rectum 2002;45:1016-22.
2. Gut 1963;4:179-182..
3. Dis Colon Rectum. 2006 Feb;49(2):233-7.

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