

DURABLE IMPROVEMENT IN ANAL CANAL FUNCTION FOLLOWING SURGICAL ADJUSTMENT OF EXTERNAL ANAL SPHINCTER SARCOMERE LENGTH

Hypothesis / aims of study

We recently found that the anal canal function and external anal sphincter (EAS) contraction can be enhanced by surgically adjusting the EAS muscle sarcomere length. Our results show that a 20% length EAS muscle plication (optimal length) results in maximal increase in the EAS muscle tension (optimal tension) without affecting its passive tension. The goal of our study was to determine the long-term effects of optimal EAS plication on the anal canal pressure and EAS sarcomere length.

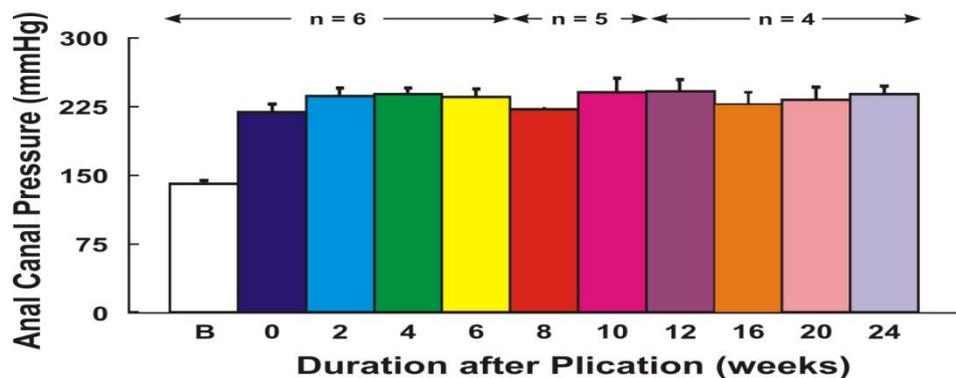
Study design, materials and methods

Female rabbits (n=8) were anesthetized and either sham (n=2) or EAS plication (n=6) surgery was performed as follows: the circumference of anal canal was measured with a caliper. An incision was made on the skin of the anal canal to expose the EAS muscle and sutures (4.0-gauge polypropylene) were placed at 2 points, at a distance of 20% of the circumferential length of the anal canal. The 2 ends of the sutures were tied together (EAS plication) and the skin incision was closed. Anal canal pressures were recorded using a 3 mm sleeve sensor catheter, before and after surgery, at 2-4 week intervals. Effect of EAS plication on the anal canal pressure during electrical (1-6mA) stimulation of the EAS (active contraction) was recorded. Fecal pellet diameter was measured before and after surgery as a marker of anal canal opening function. Animals were sacrificed at the end of six months and anal canal was harvested for histological as well sarcomere length evaluations. EAS muscle fibres were micro dissected at the 3, 6, 9, and 12 o'clock positions around the anal canal and sarcomere lengths were measured using laser diffraction technique.

Results

Electrical stimulation of the EAS muscle results in a stimulus dependent increase in the anal canal pressure. With 20% plication, there was 60-70% increase in the anal canal pressure (during maximum electrical stimulus), as compared to no plication. This beneficial effect was durable for up to 24 weeks post-plication (Figure 1). The faecal pellet size was not different between the sham and plicated animals. After six months of plication, EAS Sarcomere length around the anal canal was significantly higher than the controls.

Figure 1: **Long-term Effect of EAS Plication on Anal Canal Pressure (mmHg) with Maximal Electrical Stimulus (6 mA). Data are shown as (mean ± SE)**



Interpretation of results

Our data demonstrate that the EAS muscle operates at a short sarcomere length and it is possible to enhance the anal canal pressure/ EAS muscle tension by surgically adjusting the EAS sarcomere length to its optimal length. This improvement in anal canal pressure is durable up to six months.

Concluding message

Our results suggest that the beneficial effect of 20% EAS plication on the anal canal function is durable and the EAS plication has no untoward effect on the anal canal opening function up to 24 weeks post-plication.

References

1. Rajasekaran M, Jiang Y, Bhargava V, Littlefield R, Lee A, Lieber R, Mittal RK: Length-Tension Relationship of the External Anal Sphincter Muscle: Implications for the Anal Canal Function. American Journal of Physiology. 295:G367-73, 2008.

Specify source of funding or grant

VA Merit

Is this a clinical trial?

No

What were the subjects in the study?

ANIMAL

Were guidelines for care and use of laboratory animals followed

Yes

or ethical committee approval obtained?

Name of ethics committee

VA San Diego IACUC
