

## LEVATOR ANI OR PELVIC DIAPHRAGM - WHAT IS IN THE NAME?

### Hypothesis/Background

The terms “levator ani” and “pelvic diaphragm” are used interchangeably. Levator ani literally means “the elevator of the anus”. Major textbooks of anatomy and urogynecology describe levator ani as a group of muscles consisting of pubococcygeus, ileococcygeus and puborectalis (also known as pubovisceralis).

Hypothesis: The primary function of the puborectalis is not elevation of the anus. Therefore, it should not be grouped under levator-ani muscles.

### Aim of the Study

To study the vector of movements of anorectal angle (ARA) and puborectalis muscle (PRM)

Study design and Methods: Dynamic MR images were obtained in 5 healthy women at rest and pelvic floor contraction. MR images were obtained in the coronal and sagittal planes to determine cranial and ventral displacement of the ARA.

A bag, 10 cm long and 35 mm in diameter was placed partly inside the vagina and inflated with increasing volumes of water to determine the location of the vaginal high-pressure zone. At each bag volume, dynamic MR images of the pelvis were captured in the mid sagittal plane during pelvic floor contraction.

Results: During pelvic floor contraction:

1: Sagittal images show that the anorectal angle (ARA) moved cranially (superior) by 6.72 mm and ventrally (anterior) by 10.84mm.

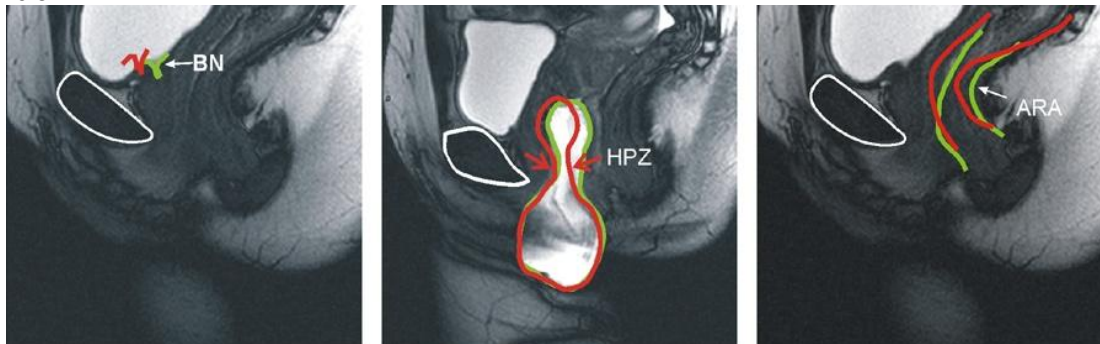
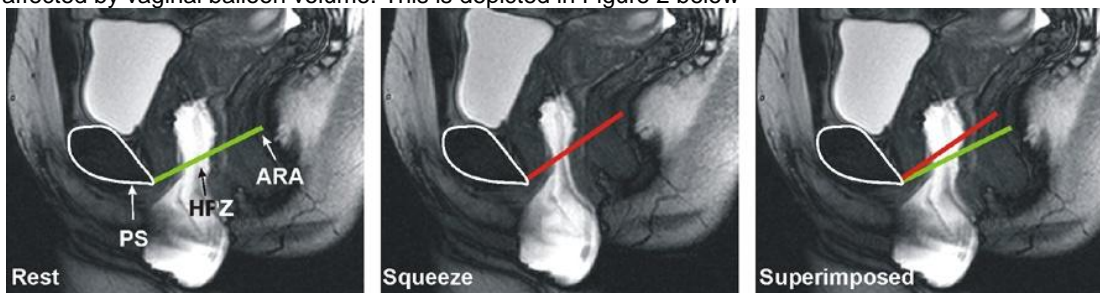


Figure 1 show differential movements of anatomical landmarks at rest and pelvic contraction. Bladder Neck (BN), Anorectal angle (ANA) and high pressure zone (HPZ). Red-Contraction, Green:Rest

2: A line connecting the apex of the ARA and the center of the constriction on the vaginal bag (at all bag volumes) in the MR images extended approximately to the lower edge of the pubic symphysis (PS) – at rest as well as contraction. The latter was not affected by vaginal balloon volume. This is depicted in Figure 2 below



### Interpretation

Since ARA and vaginal constriction are both related to PRM contraction, a line connecting the 2 points should determine the predominant direction of the muscle fibers in the PRM. Our images show that the line connecting the 2 points is always directed towards the lower end of pubic symphysis.

All muscles move towards the point of origin of the muscle, therefore the PRM contraction should move the ARA towards the lower end of pubic symphysis. MR images also show that the ARA is located cranial (superior) to the lower edge of pubic symphysis. Therefore, a PRM contraction can only move the ARA ventrally and caudally (towards origin of PRM). To the contrary the ARA moves ventrally and cranially during pelvic floor contraction, which suggests that the ventral and not the cranial movement of the ARA is related to the PRM contraction.

### Conclusions:

The pelvic floor muscles have 2 actions on the ARA, 1; elevation and 2; ventral movement. We propose that the ventral movement of the ARA is due to the PRM and the elevator movement is due to the other pelvic floor muscles (pubococcygeus and ileococcygeus muscle). The term levator-ani is a misnomer because it excludes an important function, i.e., constrictor function of the pelvic floor muscles.

<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>	UCSD Institution Review Board
<i>Was the Declaration of Helsinki followed?</i>	Yes
<i>Was informed consent obtained from the patients?</i>	Yes