

CONSIDERATIONS UPON THE KINESIOLOGY OF THE PELVIC FLOOR STRIATED MUSCLES.

Hypothesis / aims of study

Discuss the Kinesiology and Biomechanics of the striated muscles of the Pelvic Floor according to the available scientific literature between the years 1990 and 2007.

Study design, materials and methods

A MEDLINE search was performed using the keywords "pelvic floor muscle", "pelvic floor anatomy", "pelvic floor kinesiology" and "pelvic floor biomechanics", limited to human studies in women. References found in these articles were reviewed to identify research reported before 1990 and articles not included in the search. Studies were accepted if they contained direct observations of female specimens. Only those that contained specific descriptions or illustrations of the muscle origin, insertion, biomechanics or kinesiology were included.

Results

Review of 444 (387, 0, 57) studies yielded 24 qualifying articles, and reference tracing disclosed 7 additional reports. The levator ani muscle is divided into pubovisceral, puborectal and iliococcygeous. The most distal part of levator ani (pubovisceralis) is inserted in viscera, not on coccyx. Pubovisceral, which is not "U" shaped, is divided into pubovaginal, puboperineal, and puboanal. Each muscle is constituted by a pair of homologous inserted in the same organ – vagina, perineal body or anus. Each homologous pair has a unique mechanical function. Puborectalis slings rectum above external anal sphincter, forming the anorectal angle and stresses the posterior vagina wall putting it in contact with the anterior one. Altogether, the levator ani counterbalance the caudal momentum acquired by the pelvic viscera with the raise of abdominal pressure and reduce the lumen of both the urethra and the vagina by compression. The iliococcygeous, virtually plane, produces the cranial momentum of the pelvic content. Iliococcygeous is too flat and dorsal to act upon the vagina. By the perineal membrane level, urethrovaginal sphincter (pin-shaped) compressor urethrae (belt-shaped) join, as well as the urethral sphincter (round), form the urogenital sphincter. Superficial transverse muscle lies along the posterior margin of the perineal membrane. It's not a constant muscle. Isquiocavernosus lies along the lateral margins of the perineal membrane. Bulbocavernosus, inserted on the clitoral tunica albuginea, and runs adjacent to, but does not connect with, the terminus of the urethra. Because it's inserted on the clitoris, bulbocavernosus cannot be put under pressure by caudal strengths.

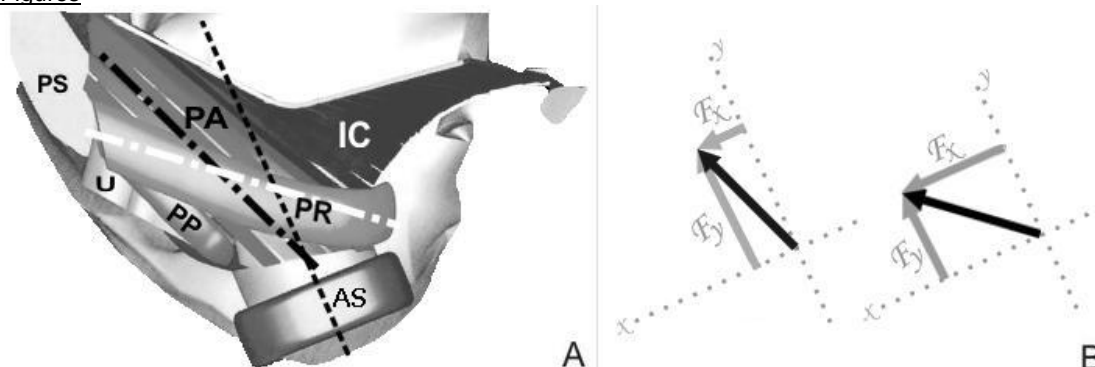
Interpretation of results

The major originators of the intravaginal and intraurethral pressures measured at the clinic are pubovisceralis and puborectalis. Pubovaginalis is not U shaped: is straight, paired, inserted diagonally (about 45 degrees) on vagina, anus or perineal body. Bilateral contraction and in closed kinetic chain of each pair pulls its respective organ cranioventrally, towards pubic symphysis and against the abdominal pressure, crushing those ducts (urethra, vagina, rectum) against that joint and pressure. The puboanal action line is almost parallel to the anal duct and perpendicular to the sphincters, therefore the action of puboanal in the decreasing of the rectal lumen is irrelevant, in opposition to puborectalis, which insertions are more parallel to the rectum. The perpendicular angle also in relation to the vagina and urethra, makes the closing action of the muscle upon both ducts be also influential. Diametral differences of pubovisceralis may be related to on-sidedness or injury. Urethral sphincter produces circular compression, like a knot, while urethrovaginal sphincter (UVS) e compressor urethrae (CU) slings up urethra, producing its caudal movement similarly but in an opposite orientation to the relation of puborectalis to the rectum. UVS acts more perpendicularly upon the urethra than the CU, assisting the lateral compression of the duct. Two groups can increase the urethral pressure: urethral sphincter e levator ani. Even if the levator or the sphincter fail, urethral pressure can increase, since there is no simultaneous fail of both. Nevertheless, is yet unknown the magnitude relation of these variables to the maintenance or not of the continency. Iliococcygeous has support function, not sphincter. The surface muscles – bulbocavernosus, ischiocavernosus and superficial transverse – do not influence on the mechanical support of viscera and the lumen reducing of neither of the urethra nor the vagina. Ischiocavernosus and bulbocavernosus pull down the clitoris, and the bulbocavernosus helps in the vestibule closure. The superficial transverse seems to help in the protection of the perineal membrane. Their action in the continency mechanisms seems to be null.

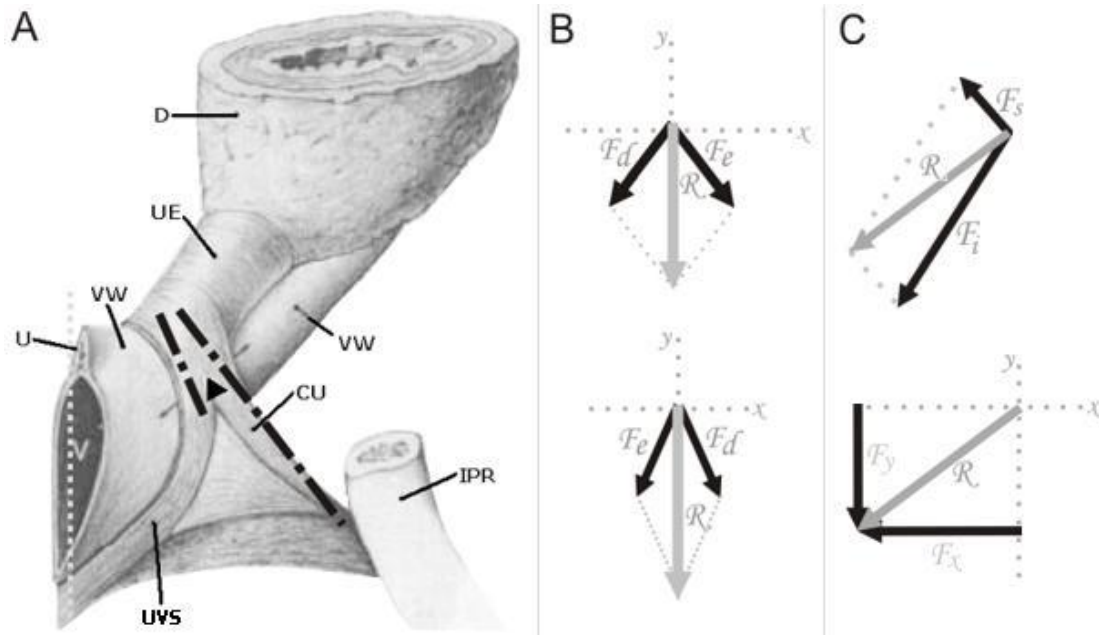
Concluding message

Further and more accurate studies are needful to implement the entire understanding of pelvic floor muscles kinesiology. A clear understanding of those kinesiology and biomechanics will guide evidence-based medical and physiotherapeutical intervention.

Figures



(Legend resumed) - Fig 2 A: Fig 2 A: Sagittal view of pelvic floor muscles. B: Vetorial decomposition of puboanal (left) and puborectalis contraction.



(Legend resumed) - Fig 4 A: Components of the urogenital sphincter. B: Vetorial sum of compressor urethrae (up) and urethrovaginal sphincter. C: Vetorial decomposition of superior and inferior halves of urethrovaginal sphincter (up) and decomposition of urethrovaginal sphincter resultant over urethra and vagina.

Specify source of funding or grant	None.
Is this a clinical trial?	No
What were the subjects in the study?	NONE