



Review Article

A SCITECHNOL JOURNAL

Role of Pelvic Floor Muscles in Female Orgasmic Response

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Abstract

There are many important outcomes from the responsive muscle contractions in the female orgasm. A number of these outcomes are structural and these structural outcomes have a direct positive effect on the well-being of the woman. Though these direct physiological outcomes may or may not have an adaptive history, they affect the well-being of the woman and include structural load management, continence, and sexual function. These benefits of orgasm for adult women last a lifetime; positive outcomes do not end at menopause—female urinary incontinence and pain in the lower back, hip(s), and knee(s) are not a de facto consequence of aging. So although the conveyance of sperm helps the act of reproduction and is considered the major function of the orgasm, this reading is limited; glossing the appreciation of the female orgasm in maintaining pelvic floor muscle tone and missing the function of the clitoral gland in maintaining pelvic floor muscle tone.

The point of this paper is to suggest that the role of the pelvic floor muscles in female orgasmic response has much more immediate and more wide-ranging physiological outcomes for the human female than the reproductive primacy perspectives suggested in many studies to date.

Clearly defining the broad structural importance of the pelvic floor muscles in female orgasmic response would have positive epidemiological outcomes for all women.

While pelvic floor muscle performance has psychological outcomes that synergistically affect the woman's well-being, the psychological outcomes are not within the scope of this paper.

Keywords: Female orgasm; Pelvic floor muscles; Psychological outcomes

Introduction

The World Health Organization (WHO, 2006) defines sexual health as a state of well-being [1]. Orgasm serves as a critical physiological tool toward our well-being. The data support this view but unfortunately, popular culture—ranging from movies, including screenwriter Nora Ephron and director Rob Reiner's *When Harry Met Sally*, to novels including D.H. Lawrence's *The Rainbow*—make the female orgasm, or the faking of it, into a joke about interrelations or a panacea for uptightness. Perhaps much of this difficulty is a reductive assumption that the primary outcomes of the female orgasm is reproductive whether or not the outcomes have an adaptive history.

An evolutionary adaptationist view suggests that the female

orgasm is an adaptation, and that its presence in the population is the result of natural selection for its role in performing some function related to reproduction (i.e., heterosexual intercourse). The purpose of female orgasm, in this view, is to promote successful reproduction. This can be distinct from promoting the health or well-being of the individual in cases where the individual's health or well-being has no bearing on the production and viability of offspring. David A. Puts et al. assert that the female orgasm may help convey sperm in the process of successful reproduction, i.e., the sperm competition hypothesis [2]. No wonder, then, that the female orgasm becomes synonymous with sexual intercourse even though neither fertilization nor female orgasm is the most reliable outcome of the enterprise. This troubling skew vis-à-vis sexual orientation also proves beyond the scope of this paper but the privileging of heterosexuality in such an adaptationist assessment proves obvious because it skews the epidemiological outcomes of orgasm to be seen as sexual only. The author hypothesizes that data discussed below support the primacy of the structural outcomes over insemination as the reason for the human female orgasm through the outcomes may be traits without an adaptive history.

In her book, *The Case of the Female Orgasm: Bias in the Science of Evolution* [3] Elisabeth A. Lloyd compiles abundant evidence that counters the theory of the primacy of the conveyance of sperm. For instance, women may become pregnant without having an orgasm; she points out, and strive to achieve orgasm without the intent of becoming pregnant. Women also are capable of experiencing orgasm before their menses and long after menarche, Lloyd continues.

The purpose of the female orgasm can be found by examining the many different paths to orgasm and the physiological outcomes of the female orgasm by way of the role of pelvic floor muscle tone in women's orgasmic response. This most personal of shaping maintains continence effective load management of the musculoskeletal structure and the orgasm prepares the woman's body for a life of well-being, i.e., mobility and optimal load management to avoid pain and injury, for effective nurturing, not only insemination to effective birthing.

Review of Literature

Why does the woman orgasm? Professors David Puts, Khytam Dawood, and Lisa Welling summarize that “there are two broad competing explanations for the evolution of orgasm in women: (1) the mate-choice hypothesis, which states that female orgasm has evolved to function in mate selection and (2) the byproduct hypothesis, which states that female orgasm has no evolutionary function, existing only because women share some early ontogeny with men, in whom orgasm is an adaptation.” Puts et al. dismiss the latter and uphold the former by contending that the sperm of multiple males competing for fertilization is the hallmark of adaptation and the primary function of the human female orgasm [2]. This perspective includes the hypothesis that the female orgasm causes contractions to “up suck” sperm to aid conception—a notion popular ever since British biologists Robin Baker and Mark Bellis published their research in 1993. Pavilcev and Wagner suggest ontogenesis [4]. With regular menses, clitoral stimulation is no longer strictly necessary for ovulation, so the clitoris descends and moves further from the vagina assuming a secondary maintenance role – not its original role.

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Received: September 01, 2016 Accepted: September 20, 2016 Published: September 25, 2016

However, “The actual incidence of the reflex of orgasm has never been tied to successful reproduction,” states Lloyd. Indeed, Lloyd believes the female orgasm is not an evolutionary adaptation, but a byproduct, or, as sex counselor Ian Kermer suggests, “a fantastic bonus” [5]. After all, sexuality is much more than sexual intercourse [6] and not all women engage in sexual activity or do so to reproduce [7]. As Kim Wallen puts it in a paper coauthored with Lloyd, “Women’s orgasms in intercourse are highly variable and are under little selective pressure as they are not a reproductive necessity” [8]. Lloyd and Wallen also maintain, “The culmination of sexual arousal, and the promise of orgasm, may provide primary motivation for individuals to engage in sexual intercourse. However, sexual arousal itself is rewarding and likely common to the sexuality of all “mammals” [8]. No evidence exists that the physical reflex of orgasm is adaptive primarily for reproduction. But perhaps a women’s overall well-being, including physical fitness is vital to the advancement of the species by not only improving successful reproduction (e.g., by carrying the fetus to term and better birthing) but also mobility and nurturing (e.g., engaged in society) and that is primarily why the female is capable of orgasm and why the orgasmic capability continues past menopause.

This begs the questions; What is a female orgasm? How is it triggered? And what is the physiological importance of the female orgasm? The definition: female orgasm occurs after a reflexive muscle contraction-release sequence primarily of the pelvic muscles at certain contraction intervals. Orgasms vary with the individual and, depending on stimulation and/or muscle tone, may be as layered and complex as the theories surrounding them [9], from contractions [10-12] to a physiological excitatory response capable of inciting a meditative-like state [13]. Yet orgasm is not universal among human females (at least 10% of women never report having achieved orgasm) [8] and not conclusive among female primates [14].

The pleasure centers that rouse human female orgasm and the following muscle reactions— answering how an orgasm is triggered— seem to depend on the type of stimulation, routing of the stimuli, muscle tone, and may include the significant differences in vaginal anatomy that may exist among women [15]. Indeed, sexual intercourse is far from the exclusive pathway to female orgasm. The vaginocervical sensory system is extensive, running throughout the body [16], the sheer variety in non-genital orgasms, those incited by imagination and/or stimulation of the nipple, lips, mouth, anus, rectum, prostate, and other body parts—even on phantom limbs—as documented by Komisaruk and Whipple [17] indicate the orgasm is not intromission specific. If the human female orgasm were primarily reproductive, would not the female orgasm be more intromission-dependent and therein the structure of the clitoris more anatomically mission-focused (e.g., inside the vagina)? This disassociates the primary function of the orgasm from the sperm competition hypothesis. It does not question the validity of the research studying the peristaltic conveyance of sperm. It does question the evolutionally theory about stimulation for ovulation [4].

Numerous studies confirm stimulation of the clitoris (Figure 1), directly or indirectly, is the sole noncontroversial effective trigger of female orgasm [18]. The clitoral gland is the only visible part of an extensive clitourethrovaginal complex that bifurcates twice (Figure 1) as its structure runs along the pelvic floor; first the corpus cavernosum (each branch extending toward the nearest hip) and then at the clitoral bulb (surrounding the vagina on three sides, close but perhaps not touching the wall of the vagina’s cervix)—in proximity to the Gräfenberg spot as identified in 1981 by Dr. John Perry and Dr. Beverly



Figure 1: The clitoris *in situ*: the gland, raphe and corpus cavernosum of the clitoral structure in soft pink; the clitoral bulb in brighter pink.

Whipple [19]. The G spot, as it became known [20] is not a distinct anatomical entity [21] but Jannini has identified the clitoris and vagina as a functional unit in arousal as the clitourethrovaginal complex and embraces the G- Spot as identified by Perry and Whipple [18]. The extensive clitourethrovaginal complex is so robust that even if there is an anatomical change to the female genitalia e.g. clitorectomy [22] it maintains its ability to respond to stimulation causing the muscles of the pelvic floor to contract and relax in orgasmic response. Perhaps muscle response to clitoral stimulation as a trait and not evolutionary function is the reason for the clitoris running along the pelvic floor and the clitoral shaft readily accessible from outside the body for effective non-intromission stimulation.

Furthermore, women who experience multiple orgasms do so because their brains continue to receive signals from the genitals after orgasm and because the nerve pathways from the clitoris to the brain differ from those from the vagina to the brain [23,24] perhaps resulting in different perceptions to stimulation [25] Komisaruk and Whipple have repeatedly demonstrated that women with complete spinal cord injury above the level of entry of the pelvic and hypogastric nerves have been able to experience orgasm with genital stimulation [23,26,27]. This afferent pathway [27] could involve the vagus nerve that enters the medulla oblongata of the brain stem directly, and this suggests a neuro-system redundancy in women specifically for experiencing orgasm, which emphasizes the importance of the intentionally initiated non-intromission female orgasm.

The female orgasm is not only buttressed with an apparent neuro-system redundancy, but also it can include other body systems, including the release of oxytocin for pain relief. Komisaruk and Whipple have repeatedly demonstrated that genital stimulation suppresses pain [17,28] and the release of the pain-relieving oxytocin can remain in a healthy woman’s bloodstream five minutes after orgasm [29]. Oxytocin is released in exercise and a neuropeptide involved in the encouragement of important processes in sport, encouraging exercise and may prolong it [30]. Motivation to overcome remaining at rest is a principal factor in initiating exercise [31]. Autonomous motivation for physical activity results in better

behavioral pursuit, self-regulation, and sustainability. That is to say, “intrinsic” [autonomous] motivation, or being active for the inherent pleasure it brings, is the type of motivation most strongly associated with sustainability in exercise [32]. So to associate the dispersal of pain-relieving oxytocin with sexual activity as well as exercise in effect may suggest that orgasm is not only the conveyance of sperm but a boon of biopsychological processes aimed the realization of desire-muscle tone. And, the oxytocin release during the muscle work-rest of exercise suggests the female orgasm’s origin as a primary drive for muscle tone, not a secondary evolutionary development. “In Sexual Functions of the Pubococcygeus Muscle,” Kegel claimed, “sexual feeling within the vagina is closely related to muscle tone, and can be improved through muscle education and resistive exercise” [33]. What if muscle tone is the primary goal of the stimulation? After all, orgasm is a perception under psychorelational control, i.e., the intrinsic exerciser. Perhaps deliberate patient initiated female orgasmic muscle contraction reflex by duration, type, location, and transmission route, and with pain relief serves more physiological functions than simply insemination, muscle tone being important to the well-being of all women, regardless of age or fecundity.

Primary Postural Outcomes in Muscle Tone from Orgasm

To understand how an orgasm facilitates well-being necessitates comprehending how the pelvic floor maintains musculo-skeletal regulation. The primary function of the pelvic floor muscles is postural. The muscles of the pelvic floor help hold the visceral organs in proper position and respond to intra-abdominal (urinary) cues. As such, pelvic muscle tone affects continence. These are the same muscles that contract during orgasm. Consequently, firmer muscle tone of the pelvic floor muscles adds intensity to the muscle contractions during orgasm and enables a woman to identify, isolate, and command muscles of the pelvic floor. But when pelvic muscles atrophy, they can contract spasmodically, resulting in urge incontinence [34]. If the pelvic muscles no longer hold the organs in natural postural position, the organs shift, putting pressure on the bladder and this result in stress urinary incontinence [35]. Mixed female urinary incontinence happens when the patient has both urged and stress urinary incontinence. Pathophysiologic factors leading to postmenopausal urinary incontinence also include the thinning of vaginal and urethral epithelium (tissue) and the loss of elasticity in vaginal tissues. Dyspareunia and related problems are largely due to atrophy of vulvovaginal epithelium as well as weakening of muscle layers [36].

Urinary incontinence is a very common disorder in women. More than 24 million women in the United States suffer from some form of urinary incontinence [37]. It significantly lessens quality of life even after adjusting for comorbidities. And the physical discomfort often prompts an emotional burden of shame and embarrassment, [38] as well as low self-esteem and it may diminish sexual activity. The literature suggests a convincing comorbidity between urinary incontinence and sexual dysfunctions, including dyspareunia, vaginismus, diminished sexual desire, and orgasm disorders [39].

Peer-reviewed literature advocates treating female urinary incontinence with pharmaceuticals, surgery, or muscle tone enhancement. Preferred non-narcotic, non-surgical FDA-recognized methods include exercise (Kegels) and neuromuscular electrostimulation (NMES) The importance of such recommendations: the pelvic floor muscles toned to treat female urinary incontinence are

the same muscles that contract during a woman’s orgasmic response. But considerably more than half of the women who tone their pelvic floor muscles with Kegel exercises find it difficult to determine if they have performed these exercises correctly [40]. A properly designed NMES device will perform muscle-toning exercise comfortably, reliably, and effectively. Of course, the allure for setting aside time for an orgasm are the positive outcomes, including the treatment of urinary incontinence in women and maintaining continence in otherwise healthy women. Female orgasm is the reinforcer for muscle tone and significant for more than maintaining continence, as discussed below.

Furthermore, the pelvic floor muscles play an important role in the dynamic stability of the musculoskeletal structure, affecting the spine and lower back, and in load management through the sacroiliac joints to the coxal bones and distal to the legs, minimizing musculoskeletal strain (Figure 2) [41]. In-other- words, imagine a woman’s musculoskeletal structure as a Gothic arch managing the load forces from the point where the spine enters the pelvis down to the heels; the joints between the pelvic bones and sacrum sacroiliac articulation act as the keystone. In a cathedral, flying buttresses usually manage the load (black “stress lines” in Figure 2). But, as in the Amiens Cathedral, France, chains hold the structure together by circumnavigating the choir, the crossing, and the nave (blue lines in Figure 2). These load- distribution features counter outward forces that can cause structural failure (Figure 3). The muscles of the pelvic floor accomplish the same load management in a human-even more so for a woman, as do the chains in the walls at Amiens Cathedral.

Similarly, in humans, pelvic floor muscle tone is critical for load management. As muscles of the pelvic floor atrophy, muscles of the back may overwork trying to compensate [42]. Likewise, leg muscles may strain as the shear

load forces push outward at the hips and in at the knees. The uneven load on joints may consequently cause pain or uneven wear to the point of osteoarthritis of the knee (Figure 4).

Medical device usability studies suggest that among women seeking to avoid pharmaceutical or surgical solutions to urinary

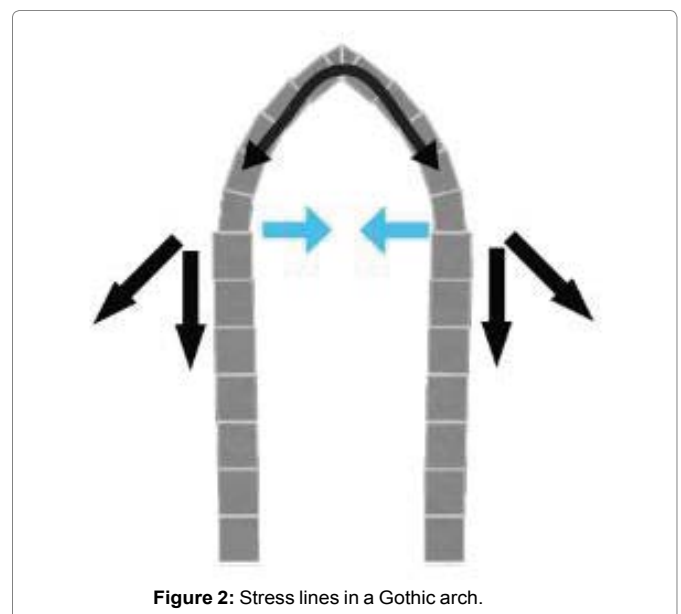


Figure 2: Stress lines in a Gothic arch.

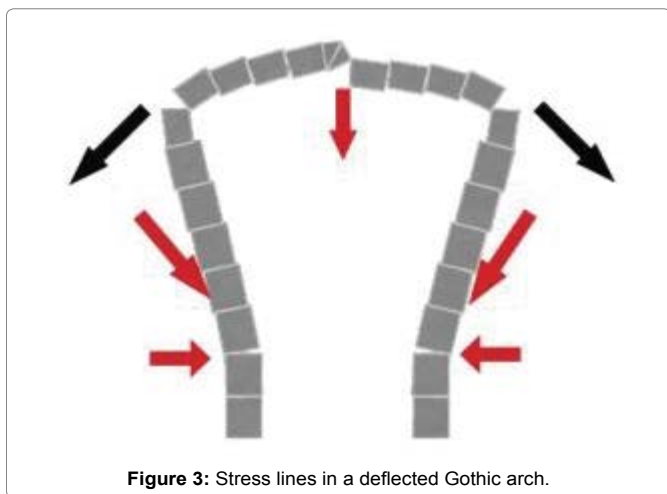


Figure 3: Stress lines in a deflected Gothic arch.

incontinence, their primary self-reported complaints prior to the onset of female urinary incontinence are lower back pain followed, at a later date, by knee joint pain [43]. When the woman's lower back pain and knee pain were diagnosed by a physician, the responses were not confined to a high body mass index. Lower back pain becomes more common among American women as they age, the onset occurring between 30 and 50 years of age [44]. Among women 50 years and older nearly two-thirds have some degree of knee pain, and that pain is often due to degenerative osteoarthritis [45]. In the United States, 60.5 percent of knee-replacement surgeries are for women [46]. Globally, where accurate data are available, intracapsular and extracapsular femoral fractures occur about three times more often in women than men [47]. Comparatively, the numbers for lower back pain and knee replacement and hip replacement surgery follow nearly the same percentage and age of onset progression as the suggested number of woman with female urinary incontinence [48]. Estrogen may provide some protection of the knee joints in premenopausal women [49]. I hypothesize that the onset of back pain, the statistically higher rates of erosion of the knee joints, and the greater susceptibility for the hip fractures in woman are symptoms of increasing lateral shear line forces as the muscles of the pelvic floor atrophy, causing the woman's Gothic arch to deflect (Figure 3). So, again, female orgasm is the reinforcer for muscle tone, and orgasmic muscle tone has outcomes that affect musculoskeletal load distribution. It seems unlikely that the clitourethrovaginal complex has descended around a number of visceral organs to position itself along the pelvic floor muscle structure to maintain posterior control.

The female Gothic arch failure concept is concordant with women in medical device usability studies; before onset of female urinary incontinence there is frequent unexplained lower back pain potentially followed by inexplicable pain in the knees—again, lower back then knee pain were not confined to a high body mass index [50]. Indeed, investigations by Brown, et al. suggest there is a connection between female urinary incontinence in older women and fractures [51].

Certainly, the intracapsular and subtrochanteric extracapsular femoral fractures occur exactly where the stress lines are greatest in a female skeletal Gothic arch (intracapsular and subtrochanteric extracapsular locations in Figure 5 and the fracture at the [black] stress lines in Figures 3 and 4). A slight increase in the transverse dimension (pelvic width acetabulum to acetabulum) of the pelvic Gothic arch, results in a significant increase in the lines of force outward portentously contributing to possible intracapsular and



Figure 4: Stress lines down the female Gothic arch formed by human leg bones.



Figure 5: Femoral neck (Female Hip Bone).

subtrochanteric extracapsular femoral failure. A study suggests the human pelvis widens with age and that on average pelvic width can be an inch wider for a septuagenarian than a 20 year-old irrespective of height or body fat [52]. It is possible, as it is integral to the overall integrity of the female structure, that long-term pelvic muscle tone could interact with hormonal and proteases incited pelvic plasticity to influence the magnitude of the widening of the female pelvis. Since primate females are not walking upright, this might explain the absence of conclusive evidence of orgasm among primates [14]. Simply, primate females do not need orgasm to incite exercise to tone the pelvic floor muscles. In effect, I suggest that toning of the pelvic floor muscles, including improved pelvic floor muscle tone by orgasm, could reduce the high incidence of back, hip, and knee joint pain and possibly intracapsular and subtrochanteric extracapsular femoral failure in women. So, again, I suggest that the female orgasm is the reinforcer for muscle tone, and orgasmic muscle tone has outcomes that affect musculoskeletal load distribution.

Conclusion

Pelvic floor muscle tone maintains continence, effective load management of the musculoskeletal structure, and the orgasm prepares the woman's body for a life of well-being, not only insemination to effective birthing. I hypothesize, the data indicate pelvic floor muscle tone can treat stress, urge, and mixed incontinence in adult women and suggests pelvic floor muscle tone will have positive outcomes in structural load management and in improved mobility in adult women. Thus, the positive physiological outcomes from the female orgasm are critical to a woman's well-being and do not lose their relevancy at menopause; orgasm being important for muscle tone throughout their lives. To argue that the primary function of the female orgasm is the peristaltic conveyance of sperm does not fit the facts. If that were the case, would not orgasm be prevalent, if not conclusive among primates? As Lloyd asserts, the musculature reflex of the female orgasm is not primarily reproductive. Komisaruk, Whipple, Perry and Jannini are precisely correct to identify the clitourethrovaginal complex as the functional entity in arousal that promotes the orgasm for requisite muscle tone [18]. Furthermore, they accurately identify accessible areas in the clitourethrovaginal complex for manual stimulation naturally positioned and noncontroversial effective triggers of female orgasm and there in improved muscle tone of the pelvic floor. As such, the orgasm is a critical physiological trait in maintaining muscles tone and the many positive outcomes that result contributing toward a woman's life long well-being.

Potential Implications

Accurate prioritization of the outcomes of the female orgasm relating to continence and mobility aligns the data with the WHO definition of sexual health as a state of well-being [1]. Female urinary incontinence is a condition many women find too personal to disclose, so the scope of the matter is far greater than quantified [53]. There is even a high incidence of urinary incontinence among female athletes in collegiate sports [54] and active mature adults [55,56] adversely affecting performance. By reprioritizing the manifold life-long outcomes of the female orgasm from overstated reproductive priorities related the orgasm's primacy in the conveyance of sperm to include continence and musculoskeletal load management would be a paradigm shift in medicine. By clearly defining the physio-evolutionary primacy of the deliberate patient initiated female orgasm and the identification of the clitoral body as a physiological muscle tone exercise maintenance switch, public and personal health issues could involve the female orgasm as a dimension of primary and secondary

prevention interventions before surgery and pharmaceuticals – trying treating the cause, before using narcotics or surgery to treat the symptoms. Perhaps, over time, the positive outcomes of the female orgasm could be co-joined in pedagogy for women's health. In particular, the link between sports related injuries of the lower back or extremities and pelvic floor muscle tone (orgasmic frequency and continence) is a worthwhile line of investigation for athletic fitness and the pursuit of high performance in sport.

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