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Original Article

Vaginismus, a Component of a General Defensive Reaction. An Investigation of Pelvic Floor Muscle Activity during Exposure to Emotion-Inducing Film Excerpts in Women with and without Vaginismus

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Abstract: This study investigates the mechanism underlying vaginismus, which may be part of a general defense mechanism. Exposure to a threatening situation will evoke an increase in muscle activity. This muscle reaction will not be restricted to the pelvic floor but will also occur in postural muscles, such as in the trapezius region. Women with and without vaginismus were exposed to four stimuli: excerpts from threatening, erotic, neutral and sexual-threatening films. Subjects were 45 physician- or self-referred patients with vaginismus and 32 controls with no sexual or pelvic floor complaints. The activity of the pelvic floor muscles and of the muscles in the trapezius region was recorded with surface electrodes. There were no differences between women with and without vaginistic reactions. EMG measurement of both the pelvic floor muscles and the trapezius muscle showed an increase in muscle activity during the threatening and sexual-threatening excerpts in women with and without vaginismus. This increase of involuntary pelvic floor muscle activity is part of a general defense mechanism that occurs during exposure to threatening situations. This reaction is not restricted to a situation with a sexual content. The results of this study shed new light on the concept of vaginismus as a primarily sexual dysfunction.

Keywords: EMG; Pelvic floor; Psychophysiology; Vaginismus

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Introduction

Vaginismus is defined as an involuntary contraction of the muscles of the outer third of the vagina. The contraction interferes with coitus and occurs during attempts at penetration with, for example, a penis, finger, speculum or menstrual tampon [1]. The muscles involved in these contractions – the pelvic floor muscles – surround the urethra, vagina and anus. These muscles are under voluntary control and, among others, play a role in holding urine and feces when there is an urge to void or defecate. However, the pelvic floor muscles can also contract involuntarily, as seen during orgasm [2]. During vaginistic reactions the pelvic floor muscles contract involuntarily as well. These contractions are spastic, as opposed to the rhythmic contractions during orgasm [3]. The mechanism underlying the involuntary contraction of the pelvic floor muscles has not been investigated.

Vaginistic reactions are often associated with a defense mechanism [e.g. 4]. According to Buytendijk [5], defensive reflexes develop as consequence of experience. They anticipate a coming event and develop, by experience, into a movement that is adapted to the situation. Defensive reflexes are based on the startle reaction. This is a non-specific reaction that consists of motor disorganization, a muscle cramp, followed by a paralysis. Although defense mechanisms are learned reactions that develop according to experience, they initially occur automatically.

The object of this study was to investigate involuntary changes in pelvic floor muscle activity in women with and without vaginismus. We hypothesized that the vaginistic reactions may be part of a general defense mechanism. If so, women both with and without vaginismus will react with increased muscle activity in a threatening situation. Furthermore, we expected this defense reaction to be a general mechanism, that is, the muscle reaction would not be restricted to the pelvic floor muscles, but would also occur in other defensive muscle groups, such as the muscles in the trapezius region.

Materials and Methods

Subjects were 45 physician- or self-referred patients with vaginismus and 32 control subjects with no sexual or pelvic floor complaints. The mean age was 23 years (SD = 5), ranging from 18 to 45. The women with vaginismus met the criteria of the Diagnostic and Statistical Manual of Mental disorders (DSM-IV) [1]. The control subjects had no history of sexual or pelvic floor problems. They are able to insert menstrual tampons without difficulty. All the women in the control group were experienced with vaginal intercourse. The inclusion and exclusion criteria were checked by a questionnaire assessing pelvic floor function and sexual function.

Thirty-five of the women in the vaginismus group (78%) had been diagnosed by a general practitioner or a gynecologist. This diagnosis included a physical examination. Of the control women, 13 (41%) had had a gynecological examination, all without abnormal findings.

Study Design

A 2 (group) × 4 (order) × 4 (stimulus) × 10 (repeated measures) design was employed, with group and order as between-subjects factors. All subjects were exposed to four film excerpts (threat, erotic, neutral and sexual-threat). Four order-groups were created using a 4 × 4 Latin square design [6], such that any film excerpt was preceded or succeeded by each of the other film excerpts only once. Subjects were randomly assigned to one of the four order-groups.

Setting and Apparatus

Stimulus materials The specificity of the pelvic floor muscle reaction to a sexual situation was assessed by exposing women to four stimuli: a threatening, erotic, neutral or sexual-threatening film excerpt, consisting of 5-minute videotapes with sound. The excerpts have been used before and have been shown to evoke the expected emotions [7].

Physiological recordings Pelvic floor muscle activity was measured using a vaginal surface EMG device consisting of an acrylic plug with three electrodes embedded lengthwise in its surface. The electrodes were 3 cm in length and placed at 3, 6 and 9 o'clock [8]. The device was sterilized in a solution of Cidex-activated glutaraldehyde before use [9]. Bipolar surface EMG recordings of surrounding muscle groups and muscles in the trapezius region were made by means of Ag-AgCl pellet electrodes (1 cm^2 contact area).

All EMG signals were recorded continuously during baselines and film excerpts. EMG signals were recorded using a preamplifier with a frequency range of 1–1000 Hz and a gain of 1000. The output of this amplifier led to a variable-gain contour follower with the time constant set at 25 ms, and the gain set at 60 for the pelvic floor and 30 for the surrounding muscle groups, resulting in an overall gain of, respectively, 60 000 and 30 000. The output of the contour follower (commonly referred to as 'integrated EMG') was sampled at a rate of 10 samples per second using a personal computer (IBM-compatible 80486/33) and a Keithley System 570 for 12-bit analog/digital conversion, with an input range of ± 5 V. All physiological measures were recorded on a WEKA-GRAPH OEM 821060 thermowriter (paper speed 100 mm/min). To verify the accuracy of the measurements, the raw EMG of the pelvic floor was sampled at 100 Hz. Offline integration of this signal showed no significant difference from the output of the contour follower sampled at 10 samples per second. Therefore, the contour follower output was used for analyses.

Procedure

Subjects received written information about the procedure and were invited for an interview. During the interview the experimental procedures and conditions were explained and questions answered. Subjects were assured of privacy, anonymity and confidentiality, and it was stressed that they could withdraw from the experiment at any time. Women who were willing to participate signed a written informed consent form. Subjects were tested individually. Subjects were not tested during menstruation.

After a relaxation period (5 min) and a first baseline measurement (30 s) the first film excerpt was presented. Baselines were measured before and after each excerpt. After a 2.5 minute interstimulus interval the next excerpt was presented. At the end of the experiment subjects were questioned about their emotions during the excerpts, the degree to which they had paid attention, and whether they had previously seen the excerpts.

Data Reduction, Scoring and Data Analysis

All EMG data were entered into a computer program developed at our laboratory that allowed for offline graphical inspection of the raw data. For each baseline recording responses were averaged over the entire 30-second period, resulting in one baseline score (mean baseline in μV) per baseline recording. Muscle activity was calculated as the computer-detected change from the preceding baseline.

The BMDP 4V program [10] was used for the analysis of variance. The recordings of pelvic floor muscle activity were submitted to a 2 (group) $\times$ 4 (order) $\times$ 4 (stimulus) $\times$ 10 (repeated measures) ANOVA, with group and order as the between-subject variables and stimulus as the within-subjects variable. The Greenhouse–Geisser ε procedure was applied to the repeated-measures ANOVAs to correct for the violation of the sphericity assumption in repeated-measures designs [11].

Results

Manipulation Check

Responses during debriefing indicated that subjects had felt comfortable during the experiment. None reported problems or discomfort with inserting the vaginal device. Subjects reported that they paid attention to the excerpts and had tried to identify themselves with the situation.

Subjective Reported Emotions

Subjects were asked to report their level of sexual arousal and threat during the excerpts, with 1 being no arousal/threat at all and 10 being maximal arousal/threat. There was a significant effect for self-reported sexual arousal (F (2.00, 133.74) = 132.33, P<0.0001, ε = 0.67) and threat (F (2.44, 163.30) = 197.99, P<0.0001, ε = 0.81) during the excerpts. Subjects felt sexually aroused during the erotic excerpt (mean = 5.33) and to a lesser extent during the sexual-threatening excerpt (mean = 2.38). The highest levels of threat were reported during the threatening excerpt (mean = 6.90) and the sexual-threatening excerpt (mean = 5.61).

Physiological Responses

A 2 (group) $\times$ 4 (order) $\times$ 4 (stimulus) $\times$ 10 (repeated-measures) ANOVA was performed. There was no difference in response between groups (F (1,75) = 0.65, P=0.42). The stimulus main effect (F (2.78, 208.75) = 20.99, P<0.0001, ε = 0.93) was significant (Fig. 1). These changes occurred in women with vaginismus as well as in the control group. As is shown in Fig. 2, the ANOVA of the EMG measurements of the trapezius region yielded the same response pattern. There was no difference between the women with and without vaginismus (F (1,75) = 1.11, P=0.30). There was a main effect of stimulus (F (2.51, 178.50) = 4.33, P = 0.009, ε = 0.84).

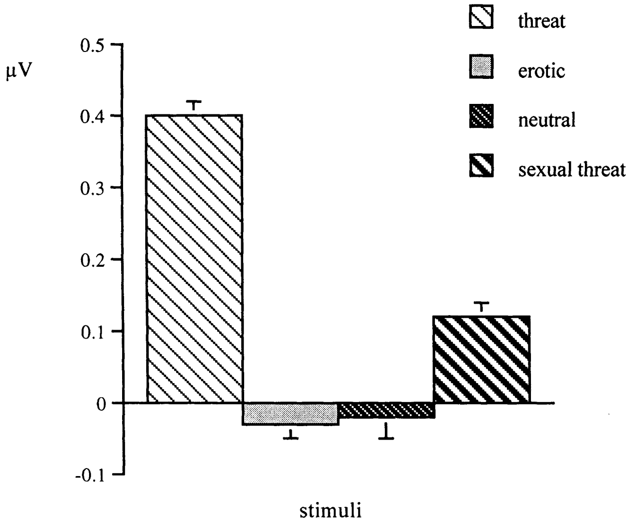

Fig. 1. Mean pelvic floor muscle activity (in μV with SEM) in response to the threatening, erotic, neutral and sexual-threatening stimuli.

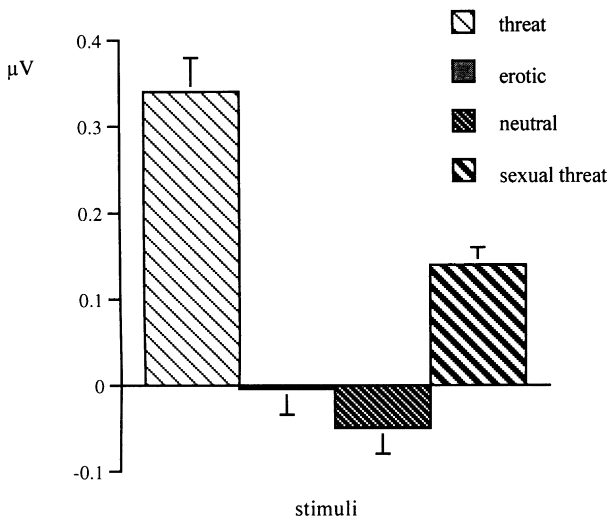

Fig. 2. Mean activity in the trapezius muscle region (in μV with SEM) in response to the threatening, erotic, neutral and sexual-threatening stimuli.

Discussion

Involuntary activity of pelvic floor muscles occurred during exposure to a threatening situation. Women both with and without vaginismus showed this increase in muscle activity, which was not restricted to the pelvic floor area but also occurred in the trapezius muscle region. It is important to note that it was not the sexual situation that evoked the reaction, but rather the threatening aspect of it. These data supported our hypothesis that vaginistic reactions are part of a general defense against a threatening situation.

Conclusion

Pelvic floor muscle activity was investigated using a vaginal surface EMG device. For this reason, only women who could insert the sensor in their vagina were able to participate. Replication of this experiment using surface EMG measured on the perineal skin, with a group of women who in all situations are unable to insert anything into their vagina, is necessary to confirm the generalizability of our findings.

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Reviews of Current Literature

Effect of Pelvic Floor Re-education on Duration and Degree of Incontience after Radical Prostatectomy: A Randomized Controlled Trial

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The study objective was to determine whether pelvic floor re-education reduces the duration and degree of urinary incontinence after radial prostatectomy. A randomized controlled study was performed, with 48 patients in the treatment arm and 50 in the control group completing therapy. Patients were categorized according to severity of incontinence on day 1 after catheter removal, and whether or not previous transurethral resection had been performed. The treatment group received individual treatment weekly, with instruction in active pelvic floor exercises and biofeedback, including initial electrical stimulation in 7 patients. Patients were to perform 90 pelvic floor contractions daily at home, and integrate them into daily activities. The control group attended the clinic weekly and received education about incontinence as well as sham electrotherapy.

All patients were treated for 1 year by the same therapist, or until continent. The primary endpoint was the incontinence rate at 3 months, which was 43/48 (88%) in the treated and 29/50 (58%) in the control group. At 1 year 2 patients in the treated and 9 in the control group remained incontinent. The degree of incontinence was lower in patients in the treated group. The average number of physiotherapy sessions was 8 in the treated and 16 in the control group. Treatment was most effective in the first 4 months after surgery.

Comment

This is an excellent study performed in a prospective randomized manner. The eventual outcome after radical prostate surgery is that most incontinence resolves spontaneously in the year after surgery. Some of the incontinence may be due to bladder dysfunction and some to sphincter incompetence. Urodynamics was not performed prior to therapeutic intervention. Those patients with persisting incontinence at 1 year would have urodynamic testing prior to further therapy. Active therapy for 8 weeks significantly speeds recovery in this group of patients.