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

This study investigates the mechanism underlying vaginismus. Vaginistic reactions 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; a threatening, erotic, neutral and sexual-threatening film excerpt. Subjects were 45 physician- or self-referred patients with vaginismus and 32 control subjects with no sexual or pelvic floor complaints. 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 excerpt 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.
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 (American Psychiatric Association, 1994). The muscles involved in these contractions, the pelvic floor muscles, surround the urethra, vagina and anus. These muscles are under voluntary control and play, among others, 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 is seen during orgasm (Perry & Whipple, 1981). During vaginistic reactions the pelvic floor muscles contract involuntarily as well. These contractions are spastic as opposed to the rhythmic contractions during orgasm (Fertel, 1977). 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. Everaerd, 1991). According to Buytendijk (1957) defensive reflexes develop as consequence of experience. They anticipate on a coming event, and develop, by experience, to a movement that is adapted to the situation. Defensive reflexes are based on the startle reaction. This is a nonspecific reaction that consists of a motoric disorganization, a muscle cramp, followed by a paralysis. Although defense mechanisms are learned reactions that develop depending on experiences, the reactions occur, from the beginning, automatically.

The objective 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, both women 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 will not be restricted to the pelvic floor muscles, but will occur in other defensive muscle groups like the muscles in the trapezius region, as well.

Methods

Subjects

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 (SD = 5), ranging from 18 to 45 years. The women with vaginismus met the criteria of the Diagnostic and Statistical Manual of Mental disorders (DSM-IV) (American Psychiatric Association, 1994). The control subjects had no history of sexual or pelvic floor problems. They were able to insert menstrual tampons without difficulty. All women of the control group were experienced with vaginal intercourse. The in- and exclusion criteria were checked in 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 earlier. This diagnosis included a physical examination. Of the control women, thirteen (41%) had had a gynecological exam, all without abnormal findings.
Design
A 2 (Group) x 4 (Order) x 4 (Stimulus) x 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 x 4 Latin Square design (Kirk, 1968), such that a 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 and sexual-threatening film excerpt. The stimuli consisted of 5 min. videotapes with sound. The excerpts have been used before and have been shown to evoke the expected emotions (Laan, Everaerd & Evers, 1995).

Physiological recordings. Pelvic floor muscle activity was measured using a vaginal surface EMG device (Perry, 1987). It was sterilized in a solution of Cidex-activated glutaraldehyde before use (Geer, 1980). Bipolar surface EMG recordings of surrounding muscle groups and muscles in the trapezius region were made by means of Ag-AgCl pellet electrodes (1 cm² 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 1Hz - 1000Hz, and a gain of 1000. The output of this amplifier was lead to a variable-gain contour follower with the time constant set at 25 msec, 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 analogue/digital conversion, with an input range of +/- 5 volt. All physiological measures were recorded on a WEKAGRAPH OEM 821060 thermo writer (paper speed 100mm/min.). To verify the accuracy of the measurements, the raw EMG of the pelvic floor was sampled at 100 Hz. Off-line 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 privacy, anonymity and confidentiality. 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 sec) the first film excerpt was presented. Baselines were measured before and after each excerpt. After a 2.5 minute inter stimulus 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 to the film excerpts, 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 off-line 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 μVolt) per baseline recording. Muscle activity was calculated as the computer detected change from the preceding baseline.

The BMDP 4V program (BMDP Statistical Software, 1990) was used for the analysis of variance. The recordings of pelvic floor muscle activity were submitted to a 2 (group) x 4 (order) x 4 (stimulus) x 10 (repeated measures) ANOVA with group and order as the between subject variables and stimulus as the within subjects variable. The Greenhouse-Geisser epsilon procedure was applied to the repeated measures ANOVAs to correct for the violation of the sphericity assumption in repeated measures designs (Vasey & Thayer, 1987).

Results
Manipulation check
Responses during debriefing indicated that subjects had felt comfortable during the experiment. None of the subjects 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 as much as possible aroused/threatened. There was a significant effect for selfreported sexual arousal ($F(2.00,133.74) = 132.33, p < 0.0001, \epsilon = 0.67$) and threat ($F(2.44, 163.30) = 197.99, p < 0.0001, \epsilon = 0.81$) during the excerpts. Subjects felt sexual aroused during the erotic excerpt (mean = 5.33) and to a lesser extend 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) x 4 (order) x 4 (stimulus) x 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 ($F(2.78,208.75) = 20.99, p < 0.0001, \epsilon = 0.93$) was significant (see Figure 1). These changes occurred in women with vaginismus as well as in the control group. As is shown in Figure 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 ($F(2.51,178.50) = 4.33, p = 0.009, \epsilon = 0.84$).
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Figure 1. Mean pelvic floor muscle activity (in µV with SEM) in response to the threatening, erotic, neutral and sexual-threatening stimulus.

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

Involuntary activity of pelvic floor muscles occurred during exposure to a threatening situation. Both women with and without vaginismus showed this increase in muscle activity. The change in muscle activity was not restricted to the pelvic floor area but occurred in the trapezius muscle region as well. 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 defensive to a threatening situation.

Pelvic floor muscle activity was investigated using a vaginal surface EMG device. For this reason only women who could insert this sensor in their vagina were able to participate. In the literature and in clinical practice variation in the onset and context of vaginistic reactions is often reported. This does not imply that women who are under some circumstances able to insert something in their vagina have a milder form of vaginismus. Furthermore, there is no reason to expect that the mechanism underlying the involuntary contractions of the pelvic floor muscles will differ between women who are able to insert for example this device, menstrual tampons to have a gynecological examination and women who are not.