Force Generation in the Woman Pelvic Floor- Is It Possible to Scan Its Co-ordination Capacity?

Study Background

The pelvic floor is a group of muscles, joints and fascia, forming the base of the abdomino-pelvic cavity, considered an understudied region of the body from a biomechanical perspective. The strength, resistance, coordination and symmetrical contraction of the pelvic floor muscles (PFM) are essential for (i) the sphincteric function, (ii) the maintenance of urinary/fecal continence, (iii) the sexual function and satisfaction, and (iv) the prevention of genital organs prolapse. However, there is a high percentage (45%) of women that are not able to contract their PFM satisfactorily, what explains the fact that urogynecological disorders are highly prevalent in the majority of women, (25-35%) for at least some time in their lives[2]. Therefore, the assessment of the PFM function has been strongly recommended as a routine part of the physical examination[3], and the training of the PFM is widely spread as the first-line management for women with any type of urinary incontinence[4]. Clinicians usually evaluate the PFM function either subjectively by digital palpation[5], or indirectly by perineometers (intra-vaginal manometers) or even with bipolar surface EMG[6]. In the past decade, several dynamometers have been proposed[7-9] to directly assess PFM strength, but despite the improved accuracy, they still do not precisely map the vaginal wall deformation, being unable to determine its symmetry (between anterior and posterior walls, and between both lateral walls), coordination (spatial-temporal distribution of forces all over the vaginal cavity) or even the ideal cranial orientation of muscles contraction. Considering that these parameters **may be part** of urogynecologycal pathophysiology, it is imperative to find a reliable way to perform the assessment of PFM.

Intention

Our aim is to study the PFM load distribution, taking into account its flexible surface with 3-dimensional deformations, to precisely describe the physical capabilities of the PFM in different groups of women: (a) with urinary incontinence, (b) with sexual dysfunction, and (c) trained by pompoir technique. With this study we intend to deepen the understanding of PFM function, to improve dysfunction diagnosis and training practice.

Methodology

A single protocol will be applied to attend our three goals, which will include symptoms questionnaires, vaginal palpation and load distribution assessment during an adapted PERFECT test (series of tests for a typical clinical evaluation of the PFMs). We will use a vaginal probe designed based on the anatomical characteristics of the female PFM. It involves 110 capacitive transducers placed on a 11x10 matrix configuration (fig.1).

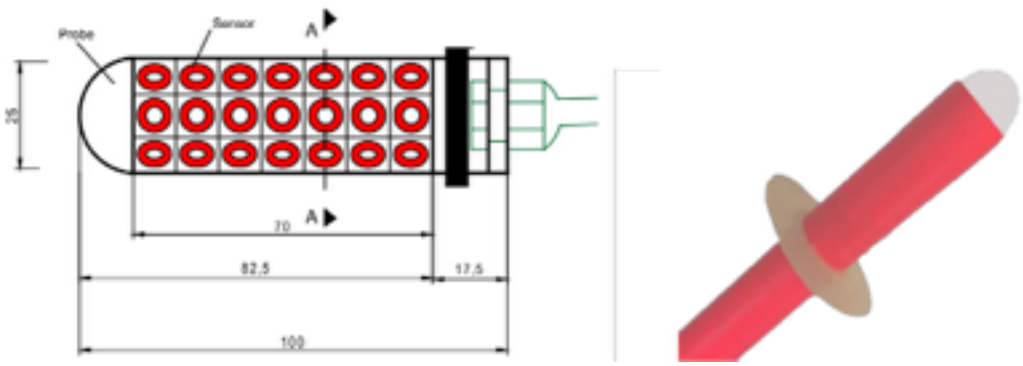

Figure 1. Instrumented vaginal probe

The proposed 2.5cm diameter and 7cm length probe, according to previously described prototypes[10-11], allows assessment of the entire pelvic floor musculature (located approximately 3.5 cm from the opening of the vaginal cavity[12]) and respects the normal vaginal length (6.9 to 11.8cm).

The intention is to evaluate 90 nulliparous and primiparous female adults, not pregnant, without current urinary or vaginal infection, excessive vaginal scarring, vulvar or vaginal pain or any other disease that may interfere with PFM measurements (fig. 2 shows the distribution of women into the groups that will be studied). The women will be divided in the groups: with and without urinary incontinence, with and without sexual dysfunction, pre and post pompoir training. They will be assessed in supine with their hip and knees flexed. The probe will be covered with two condoms and hypoallergenic gel and it will be inserted 7cm deeper than the hymenal caruncle. Subjects will receive visual feedback during the whole assessment. The adapted PERFECT test will include 5 trials of 10-sec sustained PFM contractions with a 1-min rest period between them, followed by 2-min rest period and one trial of ten 1-sec consecutive contractions. The force and pressure time series for each of 8 selected regions (anterior, posterior, left and right; all of them cranial and caudally) will be analyzed and discrete variables will also be extracted, such as maximum force and pressure, time-integrals, load rates and relative load parameters. Data will be compared between groups by repeated measures ANOVAs for each project objective (fig.2).

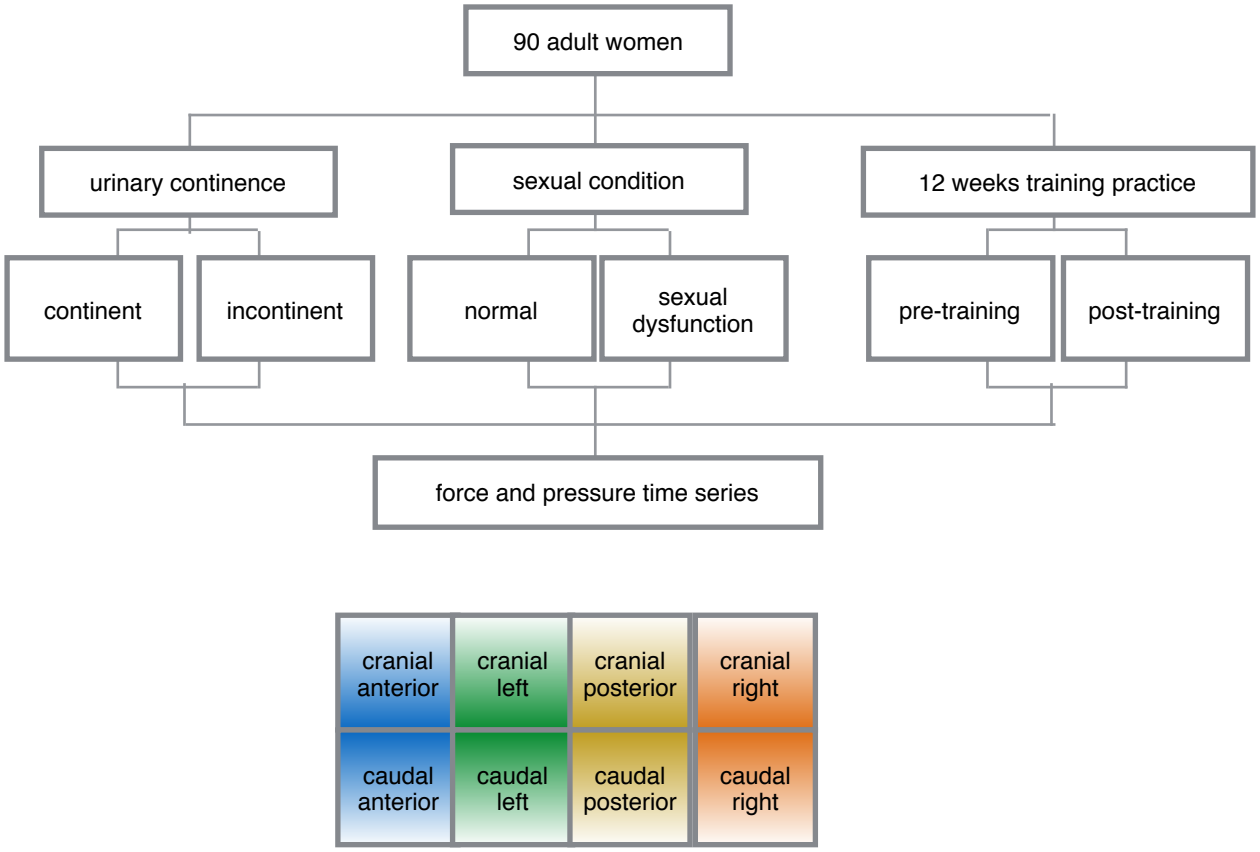

Figure 2. Study protocol

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