

Review

## Severe stress urinary incontinence: Pelvic floor muscle training program

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**International guidelines recommend a first line therapy in the treatment of female stress urinary incontinence (SUI), the pelvic floor muscle (PFM) training. This case report assesses the effects of the PFM training program in treating women with severe SUI. The urodynamic parameters allow diagnosed intrinsic sphincter deficiency and urethral hypermobility. The subjective and objective parameters were assessed at the beginning and after six-month of PFM training program. This case report confirms the efficiency of the intensive training program in severe SUI. The medical implications of the PFM training as first treatment option reflect favourable individual results and additionally contribute to the selection of the non-invasive treatment, the reduction of the incidence collateral effects, low costs and that does not prevent future treatment options.**

**Key words:** Pelvic floor muscle training exercises, stress incontinence urinary, urodynamic assessment.

### INTRODUCTION

The Portuguese Association of Urology and Neurourology and Urogynecology, has requested to the service of Hygiene and Epidemiology of the Medical Faculty of the University of Porto, a study on the "prevalence and treatment of the urinary incontinence on the non institutionalised Portuguese population". The study took place in the mainland Portugal, between 2007 and 2008, on women of age  $\geq 40$  years, and the prevalence of female urinary incontinence (UI) was estimated in 21.4 and 39.9% of females with predominance of stress urinary incontinence (SUI).

The International Continence Society defines SUI as a "complain of involuntary loss of urine during the increase of the intra-abdominal pressure such as coughing, sneezing, physical activities". Intra-abdominal pressure is transmitted to the bladder and, if the increase of the intravesical exceeds the intraurethral pressure, with absence of contraction of the detrusor muscle, the resulting urinary loss is designated as SUI (Nygaard and

Heit, 2004).

The Intrinsic Sphincter Deficiency (ISD) is a subtype of SUI and it occurs when the urethral sphincter is unable to maintain the closure of the bladder neck during the stress activities (Wilson et al., 2005). The urodynamic criteria of diagnosis for ISD have included the low pressure of the proximal urethral closure in absence of contraction of the detrusor muscle and the valsalva leak point pressure  $\leq 20$  cmH<sub>2</sub>O (Bump et al., 1997). The etiology of the intrinsic sphincter may be related to hypo-oestrogen, changes of the urethral cells (age/genetic) and obstetric causes (Heesakkers and Gerretsen, 2004).

SUI has implications in the quality of life of women in physical, social, sexual and psychic aspects (Moreno, 2004). The female restrains or decreases her social and physical activities progressing to emotional changes, including low self-esteem, depression, shame and confinement (Sanchez et al., 2004).

Several types of UI are treated, such as SUI, urge UI

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**Table 1.** Urodynamic assessment.

Urodynamic	Assessment
Urofluxometry	Vesical capacity of 456 ml Post-micturition residual volume 12 ml Continuous urinating pattern
Cystometry	1st urge to urinate, 222 ml Normal urge, 385 ml Strong urge, 462 ml Pressure of the initial detrusor of 6 cmH <sub>2</sub> O reaching a maximum of 14 cmH <sub>2</sub> O
Profilometry	<b>Static profilometry</b> Urethral pressure, 53 cmH <sub>2</sub> O Maximum urethral closure pressure, 37 cmH <sub>2</sub> O
	<b>Dynamic profilometry</b> Abdominal pressure transmission factor between 54 and 87%
VLPP	Urinary losses at low abdominal pressure, 20 cmH <sub>2</sub> O

and mixed UI and the treatment options may include behaviour changes and advice on daily hygiene, pelvic floor muscles (PFM) training program, electric stimulation, biofeedback, medication and surgery.

Re-education of the PFM, through a PFM training program is considered the first choice for treatment of women with SUI, who have the ability of voluntarily and correctly contracting their PFM (Wilson et al., 2005). The best results were shown in light and moderate SUI (Bø, 2004). The PFM training exercises include voluntary and repeated contraction/relaxation of these muscles (Wilson et al., 2005).

The purpose of this case study consisted of analysing the effects of the PFM's training program on severe female SUI.

## ANAMNESIS

A 58 year old female, Caucasian, married, educational assistant, and 6 years of school, with a body mass index of 25.2 kg/m<sup>2</sup>, obstetric history of 2 vaginal deliveries, hereditary history of UI (mother), 3 yearly episodes of constipation, 4 years after menopause. The urinary losses have lasted for 3 years approximately and are caused by cough, sneezes and stress. The urinary losses occur daily and in small quantity/flow (Sandvik Index/8/severe) (Sandvik et al., 2000), use a regular pad daily. She refers great discomfort while carrying heavy objects and she is afraid of odours.

## Physical examination

The initial evaluation through digital palpation was that the maximum voluntary contraction (MVC), the levator ani muscle was 3 (moderate contraction) and the resistance/

contraction maintained was of 5 s. She had a correct perception of the contraction (absence of contraction of the synergistic muscles, valsalva maneuver and inverse perineal command). Both the stop test and the stress test (300 ml/vesical) were positive. The frequency of urinary loss was 11 episodes (7 consecutive days), quantity of urinary loss of 10 g (Pad-test/1 h), perineometry (maximum voluntary contraction=15 cmH<sub>2</sub>O), 72 h urinary diary (7 daytime urinary frequencies and 1 night/ingestion of 1.3 ml of liquids) and in the scale of Ditrovie [classification of 1 (excellent QV) and 5 (bad QV)] it showed a classification of 2.7. In the self-esteem evaluation (Scale of Rosenberg/10 points (low self-esteem) and 60 (high self-esteem), the rate reached 32 points, with a possible direct connection between the emotional disorder and the UI.

## History/medical diagnosis

The medical record registered a grade II cystocele, atrophic vaginitis and reflex and sensitive integrity. The Q-tip test was >20° and the Bonney test were positive. The usual medication included Crestor (20 mg/daily) and Zolpidem Ratiopham (10 mg/daily).

The urodynamic assessment included urofluxometry, cystometry and profilometry (Table 1). The urodynamic diagnosis is severe SUI with ISD and urethral hypermobility.

## Treatment plan

Education is a key feature for any successful treatment. Clinical guidelines recommend that educational actions are included in the PFM training program, because an

**Table 2.** PFM training Program.

Training	Program
Educational conduct	-Teaching of the anatomy and physiology of the lower urinary tract;
	-Risk factors;
	-UI mechanism;
	-Locating and identifying the PFM;
Perception of the correct contraction	-Program for exercise at home;
	-Hygienic behaviour and lifestyle changes.
Supervised PFM training program	-Effective contraction of the PFM, suitable for increasing the pressure of the urethral closing, through digital palpation.
	-Intensity was verbally stimulated (isolated CVM of the PFM);
	-Resistance was defined by the contraction maintained, varied between 5 to 10 seconds,
	-Volume was registered by series (8-10) and repetitions (8-12),
	-Frequency was weekly with a 45' duration, for 20 weeks;
Training program at home	-Between series there were stretching, muscular strength and respiratory re-education exercises.
	-Progression of the program included the parameters: position (increasing resistance to gravity), duration of the contraction, number of repetitions in each series and increase of the abdominal pressure.
	-Voluntary contractions of the PFM during day-to-day activities (washing the dishes, seating on the sofa, at the bus stop...)
	- 3 series of 10 contractions in different positions during the day-to-day activities.

understanding of UI increases and promotes the motivation of women with SUI (Wilson et al., 2005) (Table 2).

The international continence society has concluded that a simple verbal or written direction does not represent a proper learning of the correct contraction in the exercises program for PFM. Observation of the correct contraction of the PFM was clinically demonstrated through magnetic resonance imaging (Bø et al., 2001). Kari Bø et al. (2001) have observed that during a voluntary contraction of the PFM, the coccyx showed a cranial movement towards the pubic symphysis, this voluntary contraction is a simultaneous contraction of all of the PFM and describes an elevation movement towards the head while closing the pelvic openings. It cannot involve any movement of the pelvis or contraction of other muscular groups in relation with the weak and untrained muscles of the pelvic floor (Table 2).

The supervised PFM training program has followed the Sports Medicine's strength training recommendations, based on the principles of physiology of exercise for the striated muscle (DiNubile, 1991). The strength training program for the PFM comprises the progressive training of the parameters: intensity, frequency, rest time, volume, duration and specificity (Kraemer et al., 2002) (Table 2). The PFM training program was based on scientific evidence as shown subsequently.

## RESULTS

After the 20 PFM training sessions the results of the perineometry were 18 cmH<sub>2</sub>O (increase of 3 cmH<sub>2</sub>O), the

quantity of urinary loss was reduced to 3 g and the frequency of the losses decreased to 4 weekly episodes.

For the subjective evaluation, the female refers having urinary losses one or several times a week and in drops (Sandvick Index/moderate/3), a day time daily pad, and the qualitative classification of the changes after the training of the PFM, she refers improving after the five months (the urinary losses have decreased) and is pleased with the results. Her quality of life has improved (scale of Ditrovie/2) and had repercussions in her day-to-day activities, that is, she participated more in social and leisure activities. Her self-esteem was influenced by the effective results of the training of the PFM, who reach from 32 to 54 points, expressing an attitude of value and self approval.

## DISCUSSION

The support structure (anterior vaginal wall, puborectal ligament, tendinous arch of pelvic fascia, endopelvic fascia and pelvic diaphragm) allows the maintaining of the urethra and the bladder in an intra pelvic position during the increase of the intra-abdominal pressure. The pressure transmitted to the urethra and bladder is neutralised by the balanced distribution of forces. The active concept of urinary continence comprises the reflex contraction of the intrinsic urethral sphincter and the resistance of the levator ani muscle "hammock", resulting in an increase of the urethral closure pressure (Heesakkers and Gerretsen, 2004).

On the case study, the urodynamic parameters of

pressure transmission rate are lower than 70 to 80% and the physical exam (Q-tip test) was higher than 20°, suggesting the presence of urethral hypermobility (Sand et al., 1990). The deficiency of the intrinsic sphincter was also confirmed with the valsalva leak point pressure (VLPP) lower than 60 cmH<sub>2</sub>O (McGuire et al., 1993). The pathophysiology of the SUI comprised the combination of urethral hypermobility and deficiency of the intrinsic sphincter.

Therefore, the principles for treatment of the SUI are (1) restore the anatomical position of the bladder and proximal urethra; (2) increase the urethral closure pressure. This supervised intensive training program has allowed a correct and effective teaching of the PFM contraction, feedback of the muscle control and awareness of the anticipated contraction of the PFM to stress. These features of the training program aim to increase the muscle strength, resistance, coordination and automatic contraction. The increase of the rest tone and contraction strength of the PFM, in association with a timely contraction to the increase of the intra-abdominal pressure may promote the stability of the support structures and increase the urethral closure pressure.

The results from this case study suggest that an intensive PFM training program may be effective on severe SUI. The results reflect a reduction of the quantity of urinary loss in 70%, decrease of the frequency of episodes of the urinary losses in 63.6 and 20% increase of the strength of the maximum voluntary contraction.

Hypo-oestrogen, age and neurological damage may contribute to the inefficiency if the muscles of the urethral sphincter (Heesakkers and Gerretsen, 2004). However, in the healthy striated muscle, a loss of the urethral closure pressure may be compensated with an increase of strength in 30% after intense and frequent exercise for 8 to 12 weeks (Skelton et al., 1995). This study, when assuming an increase of 30% from exercise, the initial rest closure pressure of 37 cmH<sub>2</sub>O increased to 48 cmH<sub>2</sub>O, an increase higher than a tenth of 100 cmH<sub>2</sub>O of the intravesical pressure during stress. So, it has been concluded that the training of the PFM may relieve the symptoms of severe SUI on sedentary women, that is, with activities of scarce effort.

Literature considers that the diagnosis of grade III/IV prolapsed and severe SUI, the training of the PFM should be excluded when following surgery. Some studies have also shown better results with light and moderate SUI (Pages et al., 2001; Bø et al., 1999). This study allows suggesting that, although training of the PFM has limited benefits for severe SUI, some women may respond favourably to treatment. Therefore, training of the PFM should not be an exclusion criterion when diagnosing severe SUI.

Future research should develop techniques and/or instruments to allow an evaluation of the tone of the intrinsic and extrinsic sphincter, morphologic changes of the PFM, coordination of the automatic contraction on

increase of intra abdominal pressure and anatomical position of the support structures.

## Conclusions

This case study confirms the efficiency of the intensive training program in severe SUI. The medical implications of the PFM training as first treatment option reflect favourable individual results and additionally contributes to the selection of the non invasive treatment, the reduction of the incidence collateral effects, low costs and that does not prevent future treatment options.

## REFERENCES

- Bø K (2004). Pelvic floor muscle training is effective in treatment of female stress urinary incontinence, but how does it work? *Int. Urogynecol. J.* 15:76-84.
- Bø K, Lilleas F, Talseth T, Hedland H (2001). Dynamic MRI of the pelvic floor muscles in an upright sitting position. *Neurourol. Urodynam.* 20:167-174.
- Bø K, Talseth T, Holme I (1999). Single blind, randomised controlled trial of pelvic floor exercises, electrical stimulation, vaginal cones, and no treatment in management of genuine stress incontinence in women. *B.M.J.* 318: 487-493.
- Bump RC, Coates KW, Cadiff GW, Harris RC, Weidner AC (1997). Diagnosing ISD: Comparing urethral closure pressure, urethral axis, and valsalva LPP. *Am. J. Obst. Gynecol.* 177: 303-310.
- DiNubile, NA (1991). Strength training. *Clin. Sports Med.* 10(1):33-62.
- Heesakkers JPFA, Gerretsen RRR (2004). Urinary incontinence: Sphincter functioning from a urological perspective. *Gisgestion* 69: 93-101.
- Kraemer WJ, Adams K, Cafarelli E, Dudley GA, Dooly C, Feigenbaum MS (2002). Progression models in resistance training for healthy adults. *Med. Sci. Sports Exerc.* pp. 364-380.
- McGuire EJ, Fitzpatrick CC, Wan J (1993). Clinical assessment of urethral sphincter function. *J. Urol.* 150:1452-1454.
- Moreno AL (2004). Fisioterapia em uroginecologia. Manole.
- Nygaard IE, Heit M (2004). Stress Urinary Incontinence. *ACOG.* 104: 607-620.
- Pages IH, Jahr S, Schaufele MK, Conradi E (2001). Comparative analysis of biofeedback and physical therapy for treatment of urinary stress incontinence in women. *AM. J. Phys. Med. Rehabil.* 80: 494-502.
- Sanchez GF, Gutiérrez VF, Pinazo RP, Moreno MFM, Ibañez MB, Cubero JLC (2004). Estudio epidemiológico de la incontinencia urinaria femenina en edad laboral. *Rehabilitación* 38(4):162-167.
- Sand PK, Bowen LW, Ostergard DR (1990). The prognostic significance of augmentation of urethral closure pressure and functional urethral length. *Int. J. Gynaecol. Obstet.* 33:135-139.
- Sandvik H, Seim A, Vanvik A, Hunskaar S (2000). A severity index for epidemiological surveys of female urinary incontinence: comparison with 48-hour pad-weighing tests. *Neurourol. Urodynam.* 19:137-145.
- Skelton DA, Young A, Greig CA, Malbut KE (1995). Effects of resistance training on strength, power, and selected functional abilities of women aged 75 and older. *J. AM. Geriatric Soc.* 43(10):1081-1087.
- Wilson PD, Berghmans B, Hagen S (2005). Adult conservative treatment In Abrams P, Cardozo L, Khoury S, Wein A. *Incontinence.* Health Publication: pp. 855-965.