Bladder-neck effective, integrative pelvic floor rehabilitation program: follow-up investigation

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A R T I C L E   I N F O
Article history:
Received 12 March 2013
Received in revised form 2 September 2013
Accepted 12 December 2013

Keywords:
Bladder neck
Incontinence
Pelvic floor rehabilitation
Perineal ultrasound
Sub-maximal contraction
Visual biofeedback

A B S T R A C T

Objectives: To evaluate the effectiveness of a pelvic floor rehabilitation program consisting of pelvic floor (PF) and transverse abdominal muscle (TrA) pre-contraction, coordination training and sustained submaximal contractions employing a validated pelvic floor questionnaire.

Study design: Fifty-five consecutive women with stress urinary incontinence (n = 9), overactive bladder (n = 9) or mixed symptoms (n = 37) were invited to participate. The German version of the Australian pelvic floor questionnaire was completed by all women before and after treatment, and additional validated improvement and satisfaction scales assessed patient-centered outcome. Individual treatment programs were selected according to the dysfunction evaluated by vaginal palpation and perineal ultrasound. Bladder-neck effective pelvic floor contraction was ensured using perineal ultrasound. Co-contraction of TrA was incorporated. Active integration of the pelvic floor contraction into daily life and individual incontinence triggering activities was practiced (duration, submaximal contraction, maintenance, pre-contraction before breathing, getting up and urgency).

Results: Of 46 women with stress urinary incontinence symptoms, 67% and of 46 women with OAB symptoms 78% were improved or cured. Bladder, bowel and sexual function domain scales improved significantly after 1–6 sessions (median 2). Pre-contraction of PF and TrA was routinely performed by 39 of 55 women (71%) resulting in less incontinence.

Conclusion: The bladder-neck effective, integrative pelvic floor rehabilitation program is highly effective for SUI and OAB. Although PF strengthening with maximal contractions was omitted, these results are comparable with strength programs in the literature. Due to the integration of submaximal PF contractions into daily life and individual incontinence situations, life-long strength training might be unnecessary, and this has to be studied further.

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1. Introduction

There is no doubt that pelvic floor rehabilitation should be offered to most patients complaining of urinary and/or anal incontinence [1,2]. The best treatment regime, however, is not known [1]. Most treatment programs consist of pelvic floor muscle (PFM) strengthening and many do not involve integration of pelvic floor (PF) activity into daily life [1]. These programs are based on principles of regular skeletal muscle strength training resulting in an increased cross-sectional area (hypertrophy) of muscles with type II muscle fibers [3]. Up to 80% of the PFM, however, consists of type I muscle fibers (slow-twitch fibers) [4] mainly responsible for tonic activity and endurance. The PFM is part of the abdominal capsule, a muscle cylinder that stabilizes the trunk, together with the transverse abdominal muscle (TrA), the multifidi muscles and the diaphragm [5]. In healthy women, the TrA co-contracts with a PFM contraction [6–8]. There is also a PFM pre-contraction as a postural response before trunk perturbation [9], but this pre-contraction might get lost in incontinent women [9]. In a clinical study it has been demonstrated that teaching a PFM pre-contraction (the so-called “Knack”) [10], e.g. in advance of a cough, can prevent urinary leakage [10] and reduces bladder neck (BN) descent [11]. Significant reductions in urine loss were achieved within one week, which is too early to be a result of PFM strength increase and hypertrophy [12].

Taking the above findings into account, we developed a specific pelvic floor rehabilitation program. Perineal ultrasound is used to assess PFM function, to teach a BN effective PFM contraction and especially a pre-contraction (“Knack”). Abdominal ultrasound is employed to ensure the physiological co-contraction of the TrA and to avoid pathological co-activity of the oblique abdominal muscles. Maximal PFM contractions are omitted to prevent undue increases
in intra-abdominal pressure (IAP) [8] and to allow for longer PFM contractions. Finally integration of correct PFM activity into daily life is practiced.

The aim of this study was to prospectively evaluate the effectiveness of this pelvic floor rehabilitation program with focus on motor control and integration into daily life, employing ultrasound as a visual biofeedback method and a self-administered validated pelvic floor questionnaire [13].

2. Materials and methods

Terminology conforms to the standardization of the International Urogynecological Association (IUGA) and International Continence Society (ICS) [14]. Initial assessment was performed by one physiotherapist, experienced in the rehabilitation of TrA, multifidus and PFM and in the use of ultrasound for rehabilitation. Follow-up assessment was performed by one independent health care provider, (E.S.), registrar in urology. This study was approved by the Institutional Ethics Committee and conformed to the Declaration of Helsinki. Informed written consent was obtained.

Women with stress urinary incontinence (SUI) or overactive bladder symptoms (OAB) who were referred by gynecologists, urologists or general practitioners were consecutively invited to participate. Exclusion criteria were neurogenic bladder dysfunction, pelvic organ prolapse stage II or more [14], previous pelvic floor surgery, or inability to voluntarily contract the PFM on vaginal palpation (Oxford = 0) [15].

The validated German version of the Australian pelvic floor questionnaire [16] was completed by all patients at their first consultation to assess bladder, bowel, prolapse and sexual symptoms with severity scores, bothersomeness and quality of life. After the rehabilitation program, it was completed again by all women including a validated post-treatment module with improvement scales for all domains (much better, a little better, no change, a little worse, much worse) and a visual analog scales (VAS) from 0 (not at all satisfied) to 100 (very satisfied) to assess satisfaction with care and with treatment [13]. Additional questions evaluated the patient' compliance and self-judged integration of the PFM into daily-life.

SUI, urgency and urge incontinence were defined according to the validated PF questionnaire. OAB symptoms included urgency with or without urge incontinence. Mixed incontinence was assumed when SUI and OAB were present concomitantly. Cure was defined when symptoms ceased after rehabilitation, and improvement when frequency of symptoms was reduced according to the PF questionnaire [13].

A vaginal examination of the pelvic floor muscle was performed at rest and during contraction. Functional aspects were palpable contraction, maintained contraction during inspiration and during consecutive breaths (co-ordination and endurance) and pre-contraction before a cough. Insufficiencies were noted and guided the individual rehabilitation.

Perineal ultrasound was applied to evaluate pelvic floor activity and BN position at rest, during breathing, speaking, coughing and during a voluntary PFM (SonoSite 180 plus, C60 curved transducer with 5–2 MHz).

Abdominal palpation and ultrasound were used to assess transverse abdominal and internal and external oblique muscle activation [17]. Ultrasound was performed medial to the anterior superior iliac spine, standing or supine as convenient (SonoSite 180 plus, L25 linear transducer with 10–5 MHz). This probe position corresponds to the lower part of the TrA [18] which specifically co-contracts with submaximal PFM contractions [8].

A specific PF rehabilitation program was devised according to motor learning principles and to the individual dysfunction identified on palpation and ultrasound. Goals included a bladder neck effective contraction on perineal ultrasound with submaximal contractions, a PFM contraction before an increase in abdominal pressure (pre-contraction, e.g. before coughing), a PFM contraction that can be maintained during breathing and coughing, a co-contraction of the TrA evaluated by palpation and with ultrasound, and integration of PFM pre-contractions into daily life, especially in individual situations that lead to urinary incontinence.

Elimination of internal and external oblique muscle activation was sought and maximal PFM contractions were avoided to omit undue increases of abdominal pressure [8]. Treatment included instructions to maintain a submaximal PFM contraction during breathing, urgency, and on the way to the toilet, e.g., and to pre-contract before coughing, lifting, blowing the nose, etc.

Responses to the instructions were checked on vaginal palpation and ultrasound. Patients were shown the effects of their PFM contraction on the BN position and their TrA co-contraction on the ultrasound screen (visual biofeedback). Visible bladder neck elevation was practiced employing perineal ultrasound during breathing and coughing and individual symptoms (Fig. 1). Whenever feasible, perineal ultrasound was used as a biofeedback instrument, e.g. standing, bending over or lifting.

Behavioral advice was given when OAB symptoms were present. This included instructions on submaximal PFM contractions with the urge sensation and to maintain the contraction until the urge subsides. The same applied to fecal urgency. Women were also advised to perform a gentle PFM contraction before a typical urge trigger, e.g. before the key is inserted into the lock or before the tap is opened. If appropriate, recommendations on voiding and defecation were given. No formal strength training or standardized home-training was added. Finally, patients were encouraged to integrate all components of the program into their daily life, sports activities and incontinence situations. The initial treatment session lasted approximately 60 min. Further appointments were scheduled as necessary.

SPSS 19.0 was used for statistical analyses. Descriptive methods as well as t-tests and non-parametric tests according to the distribution of the variables were employed. Chi-square or Fisher’s exact test as appropriate were used for assessment of risk factors (like age or BMI).

3. Results

Fifty-five consecutive women were included: no one declined participation. Four women were excluded before inclusion because...
they were unable to contract the PF (Oxford = 0). According to the PF questionnaire, nine women had pure SUI, 9 pure OAB symptoms and 37 mixed OAB and SUI. Patients had 0–4 children (median 2). The body mass index ranged between 16.9 and 32.0 kg/m² (median 23.5.). The specific PF rehabilitation program consisted of 1–6 sessions (median 2) lasting 15–90 min each, with a total of 60–240 min treatment time (median 120 min, mean 133 min) during a period of 4–6 weeks. Follow-up ranged from 1 to 16 months (median 7, mean 7.6). Nearly two-thirds of women (63%) had a follow-up of more than 6 months.

All included women were able to contract the PFM on palpation. Visible BN elevation and maintenance of the PF contraction on ultrasound was achieved by all women in the program. Of 46 women with SUI (pure or mixed), 31 (67%) were cured (n = 17) or improved (n = 14) after rehabilitation (p = 0.001; Wilcoxon test). OAB symptoms ceased (n = 25) or improved (n = 11) in 36 of 46 (78%) women (p = 0.002; Wilcoxon test). Subjective improvement of bladder function was reported by 92% (50 of 55) (a little better = 22; much better = 28). Five women (9%) considered themselves as unchanged. Bladder, bowel and sexual function domain scales improved significantly after treatment (Table 1). No woman reported deteriorating symptoms. Reduced frequency of pad use was associated with bladder domain score and subjective improvements (p = 0.032). Improvement of symptoms did not depend on length of follow-up or number of appointments and did not decline over time (p > 0.05). Median satisfaction with outcome was 80 (15–100) and satisfaction with care was 90 (40–100) (p < 0.001).

After the rehabilitation, 39/55 (71%) women reported they routinely contracted their PFM before coughing, lifting, etc. (pre-contraction). Women who performed pre-contractions were more likely to report fewer SUI symptoms (Chi-square test; p = 0.021). There was a significant correlation between frequency of pre-contractions (3–never, 0–always) and patient satisfaction with treatment (Spearman r = 0.36; p = 0.006). During the follow-up period women did not request further treatment (pelvic floor physiotherapy, pelvic floor surgery and anticholinergic drugs).

### 4. Comments

This study showed that a specific PF rehabilitation program employing pre-contraction, coordination training, vaginal palpation and perineal ultrasound as an assessment and biofeedback tool is feasible and effective for SUI and OAB, with improvement/cure rates of 67% and 78%, respectively. These results are comparable with PFM strength programs in the literature [1,19]. PFM strengthening programs require life-long training and adherence, and long-term results are discouraging [20]. In our study, SUI and OAB improved after approximately 2–3 sessions within 4–6 weeks of commencement of the program and persisted for more than 6 months without further supervised PFM training. An important component of our treatment program was the coordination of sustained submaximal pre-contractions and their routine integration into daily life, sports activities and urge episodes. We believe that these features were responsible for the excellent success rate for OAB.

To our knowledge, this is the first study that did not focus on PFM strength. In contrast it relied on PF awareness, coordination, and visualization of the BN effective PFM contraction and sustained submaximal PFM contraction. The biological rationale was not hypertrophy [2] but a retraining of known physiological continence mechanisms [9,10,21], such as the “Knack”.

That specific rehabilitation might be more efficient than strength training was shown in a randomized controlled trial of a specific multifidus and TrA muscle rehabilitation program vs. standard treatment in patients with lumbar back pain. Pain recurrence rates at 1 and 3 years were significantly lower after only four treatment sessions [22,23]. The cross-sectional area of the muscle recovered after 4 weeks, which is too early to be a result of hypertrophy. The specific rehabilitation involved selective contraction of multifidus muscle without other extensors of the spine, selective contraction of TrA without other abdominal muscles, and co-contraction and a pre-contraction of both muscles before postural movements and loads. The postural load represents a similar challenge for stabilization of the spine as the increase in IAP for the PFM and the bladder neck.

In patients with an acute first episode of lumbar back pain [22], the deep multifidus muscle was observed to decrease in size within 24 h and displayed signs of denervation and atrophy. This cannot be a “real” atrophy in this short time period, and the term “pain inhibition” was first used by these authors. The muscle was restored and symptoms alleviated by a specific muscle rehabilitation, similar to those used here in the present study, resulting in a cross-sectional area that was similar to the uninjured side [22].

The principles of the BN effective, integrative rehabilitation program are: correct and selective muscle contractions that elevate the BN, physiologic coordination of muscle recruitment, and specifically the integration of PFM pre- and co-contraction. Of course, the patient’s compliance and mental health are fundamental prerequisites. This is also very important for the integration of PFM activity into daily life. Our patients were taught BN-effective pre-contractions before lifting, getting up, coughing and other activities which increase the IAP. Those 71% of our patients who reported routine pre-contractions also reported fewer incontinence symptoms and more satisfaction with treatment. Whether there will be a change from a voluntary pre-contraction to an automatic one remains unclear. Following the basics of motor learning, automatism is the goal of integration of pre-contractions into daily life. As “staying dry” is an immediate positive feedback and gratification of a pre-contraction, adherence to this strategy is encouraged and may result in a restored automatism. Life-long PFM strengthening exercises might therefore not be necessary. However, the long-term efficacy of our rehabilitation program has yet to be assessed.

Perineal ultrasound is the instrument of choice to measure BN mobility [24]. It can facilitate teaching of a correct PFM contraction that elevates the BN and is therefore useful as a biofeedback instrument. In a recent study it has been shown sonographically that even gentle PFM contractions elevate the BN [8]. Although a maximal PFM contraction also elevated the bladder neck, it considerably increased the IAP to levels seen during nose blowing or a moderate cough [8]. The fast results (4–6 weeks after beginning and with only 2–3 treatment sessions) are perhaps a result of the visual biofeedback that increased patients’ awareness and knowledge on their PF function. Whether our results can be achieved without ultrasound remains unclear. Once a bladder-neck effective PFM contraction is assured, however, rehabilitation might proceed without ultrasound.
Ultrasound was also used to teach and control correct TrA-contraction without internal oblique activity. The position of the ultrasound transducer referred to the lower part of the TrA that is activated already with gentle PFM contractions [8].

There was a wide range in the number of treatment sessions from 1 to 6 and treatment duration from 15 to 90 min in our study. Patients with difficulties in relaxing their PFM or reduced awareness needed more time until they were able to perform a correct contraction. Furthermore, women with OAB and bowel symptoms required more attention. Short treatment sessions of only 15 min were sometimes necessary to supervise a patient and to help with perception and with correct performance.

Urge coping strategies are established and successful [25]. One strategy is to immediately contract the PFM to inhibit the detrusor contraction [26]. Our rehabilitation program improved OAB in 78%. This excellent result may be due to a submaximal PFM contraction that can be maintained longer, e.g. until the toilet is reached. Furthermore, a submaximal contraction does not increase the IAP as much as a maximal PFM contraction [8], which might result in BN descent and funneling of the proximal urethra.

We also noted significant improvement in the bowel and sexual domains of the PF questionnaire. Although we did not specifically recruit women with concomitant anal incontinence or sexual problems, these results are encouraging. Very few women reported prolapse symptoms which subsequently did not improve significantly. Whether our PF rehabilitation program can also reduce prolapse symptoms remains open.

We explicitly assessed satisfaction with treatment outcomes and satisfaction with care. Satisfaction with care was significantly higher. Women might be absolutely content with the care given by the physiotherapist although treatment results might not have been as satisfactory. This shows that women are able to differentiate between good care and good treatment, and satisfaction rates should distinguish between them. During the validation process of the PF questionnaire including the post-therapeutic module [13], the questionnaire correlated well with pad use reduction and subjective measures. We therefore chose not to add tests, e.g. a pad test, to keep patients as compliant as possible.

The strengths of the study are that validated assessment tools like the perineal and abdominal muscle ultrasound and PF questionnaire with improvement and satisfaction scales were used and that follow up assessment was performed by an independent examiner. The limitations include the lack of a control group or randomization to standard or specific treatment as well as a non-scheduled follow up. A randomized controlled trial is currently in progress to compare this specific PFM rehabilitation with standard electromyograph (EMG)-biofeedback training.

Pre-contraction and coordination training of the PF with BN-effective submaximal contractions and subsequent integration into daily life is a suitable treatment regime in women with PF disorders. Obviously further studies are needed to prove the long-term efficiency of this program.

Acknowledgment

We want to acknowledge Christiane Guenzel, physiotherapist and Ulrike Thiel-Moder, continence adviser, for their contribution to the study with data collection and patient’ recruitment.

References