W31: Conservative Management of Adult Pelvic Floor Dysfunction: a Physiotherapy Approach (Free workshop)

Workshop Chair: Margaret Sherburn, Australia

21 October 2014 14:00 - 18:00

Start	End	Topic	Speakers
14:00	14:10	Introduction to workshop and speakers	• Margaret Sherburn
14:10	14:30	Definitions and physiotherapy role in conservative management of UI and POP	• Margaret Sherburn
14:30	15:00	Functional anatomy of the PFM, manual assessment of the PFM, clinical reasoning and treatment planning	• Margaret Sherburn
15:00	15:30	Questions	All
15:30	16:00	Break	None
16:00	16:30	Principles of teaching PFMT and training regimes: evidence base, clinical application, training progression	• Andrea Marques
16:30	16:50	Beyond the pelvic floor – role of the abdomen and trunk	• Cristiane Carboni
16:50	17:30	Adjunctive treatments for pelvic floor dysfunction – e-stim, emg & US biofeedback, vaginal weights	• Elizabeth Shelly
17:30	18:00	Questions	All

Aims of course/workshop

The aims of this workshop are to provide:

1. An understanding of a physiotherapy assessment of UI and POP and the clinical reasoning undertaken to diagnose and plan the physiotherapy management of UI & POP
2. An opportunity to revise the functional anatomy of the PFM & how to assess PFM function
3. A forum to discuss the principles of teaching PFM exercise for motor control, strength training and functional training, including rationale, evidence base, clinical application and progression
4. A basic understanding of the functional interaction between the pelvic floor and trunk muscles
5. Evidence for the use of electrical stimulation and biofeedback in the management of PFM dysfunction, and rationale for their clinical application

14.10-14.30: Definitions: UI & POP & Physiotherapy Role in Management of Incontinence & Prolapse

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We all need to use the same terminology worldwide.
ICS/IUGA Standardisation of Terminology document:
Haylen et al. (2010) An International Urogynecological Association (IUGA)/International Continence Society (ICS) Joint Report on the Terminology for Female Pelvic Floor Dysfunction. *Neurourology and Urodynamics* 29:4–20

Other ICS Standardisation Committee documents available at:
http://www.ics.org/Documents/Documents.aspx?FolderID=189

Definition of Incontinence

Is the complaint of involuntary leakage of urine or stool
So, incontinence is a symptom, not a diagnosis *(like falls, headache, or confusion)*
Until diagnosis is made

Symptoms of Incontinence - definitions

1. *Stress urinary incontinence*

The complaint of involuntary loss of urine on effort, physical exertion, sneezing or coughing.

2. *Urgency urinary incontinence*

The complaint of involuntary loss of urine associated with urgency.

3. *Mixed urinary incontinence*

Complaint of involuntary loss of urine associated with urgency and also with effort or physical exertion or on sneezing or coughing

Causes of two main types of incontinence:

1. **Stress incontinence**

Low closure pressure in the urethra
Increased abdominal pressure (cough, sneeze) causes urine leakage
Impairment
Urethral sphincter insufficiency
Endopelvic fascial stretch or tear
Levator Ani muscle weakness
Pudendal neuropathy

2. Urgency incontinence

Uncontrolled Detrusor muscle contractions
Impairment
Increased bladder sensation
Urinary tract infections
Poorly compliant bladder wall
Idiopathic

Bladder storage symptoms

Frequency – Complaint of more frequent voiding than normal for that person

Nocturia - Complaint of interruption of sleep one or more times because of the need to urinate

Urgency - Complaint of a sudden, compelling desire to pass urine which is difficult to defer

Overactive Bladder Syndrome – Urinary urgency, usually accompanied by frequency and nocturia, with or without urgency urinary incontinence, in the absence of urinary tract infection (UTI) or other obvious pathology.

Other types of Incontinence

Postural – with change of position

Continuous - fistula

Functional - toilet access, cognitive failure

Insensible – unaware of leakage

Coital – at either penetration or orgasm

Definition of Pelvic Organ Prolapse (POP)

The descent of one or more of:

- anterior vaginal wall
- posterior vaginal wall
- uterus (cervix), or
- apex of the vagina (vaginal vault or cuff scar after hysterectomy).

Description of POP

- By compartment:
  - Anterior: bladder or cystocele
  - Posterior: rectocele or enterocele or perineal
  - Central / apical: uterus or vault
- Grading severity:
  - POP-Q system

Prolapse staging:

0 = None (no descent of pelvic structures during straining)

I= leading edge > 1cm above level of hymen;

II = leading edge $\leq$ 1cm above hymen

III = leading edge extends from 1cm above hymen to 1cm below hymenal ring

IV = complete eversion of total length of lower genital tract demonstrated.

Measurements are made in:

- left lateral position
- at maximal Valsalva

Functions of the PFM

1. Support the pelvic organs

DeLancey 'boat model'

Resist downward movement due to raised intra-abdominal pressure

2. Muscle that is responsive to IAP and postural changes

Quick and strong response

Ability to relax

During a normal PFM contraction ...
There is:

- Urethral closure
- Forward and upward movement of the PFM
- Resistance to downward movement of organs

Types of pelvic floor muscle (PFM) dysfunction (Messelink 2005)

Normal PFM

- PFM is able to contract and relax on command and in response to increased intra-abdominal pressure as appropriate
- Resulting in normal urinary, bowel, and sexual functioning
- Measured by strong or normal voluntary and involuntary PFM contraction and complete PFM relaxation
- Types of pelvic floor muscle (PFM) dysfunction (Messelink 2005)

Underactive PFM

- PFM is unable to contract sufficiently or when needed - weakness
- Resulting in urinary or fecal incontinence, or pelvic organ prolapse
- Measured by absent or weak voluntary and involuntary PFM contraction
- Types of pelvic floor muscle (PFM) dysfunction (Messelink 2005)

Overactive PFM

- PFM is unable to relax and may contract during functions such as defecation or micturition - muscle spasm
- Resulting in obstructive voiding or defecation, dyspareunia, or pelvic pain
- Measured by absent or partial voluntary PFM relaxation
- Management of pelvic floor and lower urinary tract dysfunction

Conservative management of incontinence

Is part of multidisciplinary management, which also involves management by:

Containment – pads, catheters
Surgery
Medication
Devices – eg pessaries

Conservative management involves:

PFMT, including motor control
Education
Electrical stimulation
Adjunctive/biofeedback
Bladder training
Functional – lifestyle management

PFM training for incontinence is a balance between decreasing the load on the PFM and increasing the integrity of the muscle complex

- PFM Training Results - Cure rates are reported as being between 56 - 84%

However: 'Pelvic floor muscle training should be offered, as first line therapy, to all women with stress, urge or mixed urinary incontinence'

Level 1a evidence, Grade A recommendation
3rd International Consultation on Incontinence, Abrams et al ICI (2009)

Effective interventions in the frail elderly

1. Progressive resistance training
    - Lower limb strength
    - Standing, gait & stairs
- Results: high-intensity exercise improves functional capacity in very elderly people

Fiatarone et al NEJM (1994), Barrett & Smerdely AJP (2002)

2. Strong association between functional improvement and improved continence
    - Ex program: mobility endurance, limb strength, physical activity
    - Prescribe gait aids, grab rails for frail elderly

Jenkins & Fultz NAU (2005)

Good clinicians can take the *stress* out of urinary incontinence

With: Well trained clinicians
And: Intensive, supervised, motivating pelvic floor muscle training
With: An understanding of:
Motor learning
Measurement tools
Trunk synergies
Co-morbidities
Ans: As a 'management program' & in a multidisciplinary team

14.30-15.00: Functional anatomy of the PFM, manual assessment of the PFM, clinical reasoning and treatment planning

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Clinical Examination using vaginal palpation skills

Doctors 'look' and physiotherapists 'feel'

Palpate for:

Objective assessment of PF muscle
Qualitative assessment of vaginal tissue and organ supports
Then base exercise prescription on assessment findings

Warning!

> 30 % are not able to contract when first instructed
Only 49% increased urethral pressure during a PFM contraction
25% strain instead of contract

(Benvenuti et al 1987, Bø et al 1988, Hesse et al 1990, Bump et al 1991)

PFM digital assessment

Digital / Manual Muscle Testing (DMT) is a quantitative tool to assess:

PFM Strength, endurance & fatigue

muscle tone/tension	extra-pelvic muscle activity
lift	coordination
symmetry	perineal movement
scarring/ adhesions	levator hiatus dimensions
pain	speed of contraction
trigger points	prolapse
ability to relax	

Digital Muscle Testing scales worldwide

> 25 scales since Kegel 1951.

Variations in:

- Number of fingers (1, 2)
- Scale points (3 – 15)
- Scale criteria (resistance, strength, hold time)
- Direction, pressure, duration, hold time, repetitions, reaction to cough

Most commonly used:

- In Nth America: Worth / Brink scales
- In UK, Europe, Aust / NZ: ICS, Modified Oxford (Laycock)

Website for Levator ani palpation diagram
http://www.med.usyd.edu.au/~pdietz/Site/Clinicallevatorassessment.html

Recording PFM palpation

Muscle Testing:

A. Maximum Voluntary Contraction: grade on 3rd contraction:

ICS scale (squeeze and lift):
□ absent □ weak □ moderate □ strong
OR:
Modified Oxford Scale (squeeze and lift):
Grade □ 0 □ 1 □ 2 □ 3 □ 4 □ 5

B. Endurance:
Sustained up to 60 secs:
length held …….. secs
quality of hold: ……
Repeated fast, strong contractions:
no. of repetitions ……
□ sluggish □ rapid

Alternatives to digital assessment?

- Digital assessment is currently the 'gold standard' for clinical assessment
  - ? not reliable enough for research
- Other methods available, but do not replace digital assessment for full clinical assessment
  - Manometry
  - sEMG
  - Ultrasound

*Note effect of and acceptability of test position on assessment results. Use same position for pre- and post-testing (Frawley et al IUJ 2006)

External observation can give preliminary information about ability to contract PFM but should be followed with internal assessment if possible

- Observe: Perineal body goes inward with PFM contraction with no …
  - Trunk movement
  - Buttock or thigh muscle action
  - Breath holding

Advantages of per vaginal examination

- Palpate introital and vaginal tissues for:
  - ✓ Muscle resting and active tension (hyper/hypo/normo-tonic)
  - ✓ PFM activation and responsiveness (rapid or sluggish activation/relaxation)
  - ✓ Trigger points
  - ✓ Pain, local or general
  - ✓ Strictures/scarring
  - ✓ Prolapse

Advantages of per rectal examination

- Palpate:
  - ✓ EAS muscle layers, resting and active tension
  - ✓ Puborectalis
  - ✓ Coccyx for musculo skeletal problems

Contraindications and Precautions for intimate examinations

- Unable to understand procedure or give informed consent
- Active infection or skin lesion – vaginal, bladder, STI, herpes
- Therapist not trained adequately
- Adolescent (what age of consent?)
- Pregnancy?
- Severely atrophic tissues
- History of sexual/physical abuse

Per vaginal or per rectal examination

Requirements:

- Need training in protocols for intimate examination
- Informed consent and understanding of legal requirements
- Private room
- Infection control
- *Clinical reasoning that underpins the purpose of undertaking an intimate examination*

Formulating Treatment

- Putting it all together … i.e. Clinical Reasoning
- Perform your assessment of a particular patient and
  - determine the aims of treatment
  - prioritise these aims
  - decide on the intervention
  - undertake the intervention
  - assess the intervention

Factors to consider in treatment:

- Predisposing factors:
  - female, older age, family history, congenital defects, connective tissue, neurological defects
- Inciting factors:
  - vaginal delivery nerve damage, neurological disease, lung disease, bladder outlet obstruction in men
- Promoting factors:
  - constipation, straining, obesity, occupation, recreation, smoking, pelvic surgery, menopause, menstrual cycle, medication, UTI, candida, toilet habits
- Decompensating factors:
  - Ageing, delirium, atrophic vaginitis, medications, mobility/debility, endocrine disorders (Thyroid & T2DM), stool impaction

Case Study

A typical patient, Kristy …

38 year old mother who presents un-referred to your private practice. She is concerned because she has been developing 'a weak bladder' since the birth of her 3rd child 2 years ago.

- What is the key information?
- What is her presenting problem?
- What might be the cause of her problem(s)?
- Do you need further information to refine your hypotheses?

More about Kristy

- She plays basketball x2/week, plus 1 pump class/week
  - Now has frequent small leaks when she runs or stretches for a ball
  - Sometimes has to change her pad at half time
- General health excellent, normal BMI, no surgery
- Job is a retail manager of a small-medium business
  - Works 2 days/week
- Has had 3 vaginal births
  - Last baby was largest at 3500gm, precipitate labour, large episiotomy
  - Did PFMT after all babies, but after this baby the 'exercises felt different'
- All babies breastfed to about 9 months
  - Other 2 children are 6 & 8yrs

Discussion …

- What if you found her PFM were strong, responsive, good occlusion, 30 sec hold, with full relaxation, reflex action with a cough?

versus

- What if her muscles were weak, minimal occlusion, in-coordinate contraction, 4 sec hold, perineal descent with a cough?

Decide on a treatment plan for Kristy

And remember, the patient needs to know …

- What her problem is
- Possible causes
- Treatment options available
- Expectations of treatment
  - Time frame
  - Number of treatments
  - Take home information
  - Your expectations of her
  - Options if initial treatment is not successful

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16:00-16:30 Principles of teaching PFMT and training regimes: evidence base, clinical application, training progression

Andrea Marques, PhD
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Pelvic floor muscle training (PFMT) is considered to have level 1A scientific evidence for urinary incontinence treatment (Wilson et al, 2004). This technique originated in the 1940s with the theories of Arnold Kegel, who associated pelvic floor muscle function with continence. In the last 50 years, physical therapists have established a connection between the physiological concepts learned for general muscular training to PFMT. The literature contains a range of training routines and recommendations and describes a variety of outcome measures and tools used to evaluate PFM function. However, at the present time, there is no consensus about what the best protocol for PFMT, since there is a wide variety of protocols available (Dumoulin , Hay Smith , Mac Habée-Séquin , 2014), or how best to measure PFM function.

There is large body of evidence that links exercise with health benefits. The American College of Sports Medicine recommends, for improving muscular strength and endurance, 8-10 exercises performed for two or more nonconsecutive days each week using "the major muscles" (Haskell et al, 2007). But what about pelvic floor muscle, which has a double function of support and continence, does the same rule apply?
Which are the changes that a PFMT promotes? Is there an optimal program for enhancing fibers type 1 or 2? How long does it last and how to evaluate it?

The purpose of this presentation will be to discuss the principles of muscular training and specificities of PFMT trying to establish a comparative analysis between PFM training and other muscular groups. Also, different protocols will be presented so participant will be able to choose the best options for their patients.
Besides physiologic*al* concepts and the available literature, the presentation also intends to clarify difficulties of the clinical practice: how to assure that the chosen protocol is being performed? How to stimulate the adherence of our patients? Strategies for educational approach and encouragement will be discussed.

Under this perspective, different technology has been used to evaluate PFM conditions. Among them, Near-infrared spectroscopy (NIRS) rises as a promising tool. Well known for general muscle evaluation, several investigators are using NIRS to monitor skeletal muscle function and the effects of exercise. It has been shown to be a reliable non-invasive measure for evaluating skeletal muscle oxidative metabolism and hemodynamic changes during and after exercise. It monitors changes in the concentration of oxygenated (O_2Hb) and deoxygenated (HHb) hemoglobin in tissue and the data derived can be used to indicate the level of muscle fitness in athletes, non-athletes and patients with muscle dysfunction (Neary, 2004).
The recovery interval of muscle oxygenation is the time needed for the recovery of (O_2Hb) concentration, and is a key to evaluated local metabolic conditions. Although the utilization of NIRS is an interesting technique, this procedure it is not validated for PFM. The presentation will present the results of NIRS in other muscular group, discussing its applicability to PFM.

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16:30 16:50 Beyond the pelvic floor – role of the abdomen and trunk

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Inspirar Faculty of Porto Alegre/Brasil

The muscles surrounding the abdomino-pelvic cavity form a flexible, plastic cylinder, which needs to respond rapidly to changes in intra-abdominal pressure (IAP), trunk muscle activity and posture and to the varied continence and respiratory demands during activities of daily living. These muscles display variable activation patterns specific to the different task demands of the body[1].
There is evidence that the pelvic floor muscle (PFM) contribute to both postural and respiratory functions and are likely to receive drive from multiple sites in the nervous system.

Due to the contribution of these muscles to the canister that surrounds the abdominal cavity, these functions provide an important contribution to the coordination of postural, continence, and respiratory functions. The PFM provide mechanical support to the spine and pelvis[2,3]. This is achieved by increasing of stiffness the sacroiliac joints, and modulation of intra-abdominal pressure which is important for control of the spine[4].

In view of the reported deficits in PF muscle strength and endurance, in women with incontinence, the postural function of the PF muscles may be altered, and impaired lumbopelvic stabilization may result. If postural activity of the PF muscles is insufficient in women with incontinence, this may help to explain the higher prevalence of back pain in this population[5,6].
In continent women, the PFM and abdominal muscles contract simultaneously during postural tasks. As intra-abdominal pressure is dependent on activity of the muscles that surround the abdominal cavity it is critical to evaluate activity of multiple muscles to interpret how mechanics of the system may change with incontinence[7].

The role of the abdomen and trunk

The abdomen is a fluid-filled cavity, intra-abdominal pressure (IAP) is distributed in all directions and the PFM, which form the floor of the abdominal cavity, contribute to its control. During periods of increased IAP, such as coughing or lifting, PFM activity is increased to prevent or limit rostral displacement of the floor, maintain the position of the bladder neck,6 and assist with urethral and anal closure[8].

PFM are also likely to be active with respiratory tasks. It is well accepted that PFM activity accompanies coughing and resisted expiration. However, as IAP is modulated during the respiratory cycle, it is likely that PFM activity may be modulated during other respiratory tasks, including quiet breathing. To further complicate this control, respiratory and postural activity of the muscles that surround the abdominal cavity must be coordinated. During quiet breathing in standing, PFM activity was modulated with respiration. It was hypothesized that PFM activity would be linked to periods of increased IAP, to meet the demands of continence and control of pelvic viscera. During quiet breathing, IAP increases during inspiration in conjunction with diaphragm activity[9].

As a result of this contribution to control of IAP, the PFM are likely to contribute to control of the spine and pelvis. PFM activity may also indirectly contribute to lumbopelvic control via an effect on tension developed in the thoracolumbar fascia; hoop tension of the fascia from contraction of the abdominal muscles is dependent on IAP[9].

Finally, simulated contraction of the PFM has been shown in vitro to increase the stiffness of the sacroiliac joints in women. Human and porcine studies confirm that IAP increases spinal stiffness and controls intervertebral motion. It is well known that muscles that surround the abdominal cavity, such as the diaphragm and abdominal muscles are active in association with tasks that challenge spinal stability[3,4].

When such challenges are predictable, activity of these muscles is initiated in advance of the perturbation and are pre-programmed by the nervous system. Although spinal and cortical mechanisms for control of the PFM have been studied, it is not known whether the nervous system activates the PFM as part of these anticipatory postural adjustments[10].

Studies indicate that during tasks that challenge the spine in a sustained manner, such as repetitive limb movements, tonic postural activity of the diaphragm, and transversus abdominis is modulated phasically at the frequencies of respiration and arm movements. PFM activity was initiated as part of the anticipatory postural adjustment associated with arm movement[11].

These responses involve activity of muscles of the limbs and trunk and are matched to the demands for control of postural equilibrium and joint stability in association with predictable challenges to the body. As the onset of activity of the trunk muscles (including PFM) precedes that of deltoid ,for example, these responses cannot be initiated in response to afferent input from the disturbance to the body and must therefore be pre-programmed by the nervous system[12,13].

Clinicians treating lumbar spine instability report that women comment on improved urinary control as their lumbar stability improves. Symptoms associated with a loss of PFM tonic hold are urinary urgency and frequency, stress incontinence, obstructed defecation (poor rectal support as occurs in the descending perineum syndrome), vaginal dragging and pain. Dysfunction also presents with overactivity of all the PFM. Voiding dysfunction, dyspareunia, obstructed defecation (sphincter non-release, sometimes called anismus) and perineal and perianal pain are associated problems. Many of these patients, frequently the young and very fit, have an over-active abdominal wall that is not released to allow PF relaxation[14].

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16.50-17.30: Adjunctive treatments for pelvic floor dysfunction Conservative management for adult pelvic floor dysfunction: a physiotherapy approach

Dr Beth Shelly PT, DPT, WCS, BCB PMD

Biofeedback for pelvic floor muscle (PFM) dysfunction

Why is feedback important?

- Verbal instruction of PFM contraction has been shown to be ineffective in generating urethral closure force in 51% percent of patients (Bump 1991)
- And results in adverse bearing down in approximately 15% of patients (Bo 1988)
- Biofeedback: information about a bodily function that is not easily observed
- It can be visual, auditory or tactile
- Biofeedback is not a standalone treatment is an adjunct to pelvic floor muscle training (PFMT)

Forms of Biofeedback

- Simple: without specialized equipment, therapist's palpation internally, patient's palpation internally, observing with mirror externally
- Vaginal weight: slippage of the weight signals muscle relaxation and need for increased contraction
- Pressure: using change in air pressure to signal closure
- Electromyography (EMG): using microvolts released during muscle contraction to signal muscle activity
- Rehabilitative Ultrasound Imaging (RUSI) - visual feedback on elevation of muscle

Indications for biofeedback

- Underactive PFM - PFM weakness
- Stress urinary incontinence (SUI)
- Urge urinary incontinence (UUI)
- Mixed UI (MUI)
- Fecal incontinence (FI)
- Pelvic organ prolapse (POP) – cyctocele, rectocele, urterine prolpase, rectal prolpase, pereineal descent

Contraindications for vaginal probe in biofeedback

- Pregnancy, Immediate postpartum: within 6 weeks
- Immediate post-pelvic surgery: within 6 weeks
- During menstrual flow: bridging of signal
- Vaginal infection, recurrent thrush, or cystitis
- Impaired cognitive ability
- Dysuria or sever pelvic pain

Possible poor outcome for biofeedback

- Younger than 5 years old

- Cognitive limitation that make learning difficult
- Unable to see or hear the feedback

Method of biofeedback for pelvic floor dysfunction

Types of Simple Biofeedback performed by the therapist or patient

- Look: Using a mirror, watch the perineal body move into the body during a contraction. A correct contraction occurs with downward movement of the clitoris and inward movement of the anus.
- Palpate externally: Palpate the perineal body or anus during a contraction. It should move into the body. This can be done on the skin, underpants, or sometimes through thin pants in an exercise class.
- Palpate internally: place a finger into the vagina touching one side. Feel the contraction moving inward and upward. Vaginal palpation increases awareness of the muscle.
- Proprioceptive feedback: The most abundant sensory nerve fibers in the vagina carry proprioceptive information. Many women find they can identify and contract the pelvic floor muscles more effectively if they have something to contract around. There are various devices.

Pressure biofeedback

- Kegel first described PFM injury and its potential for rehabilitation using a pressure-sensitive device more than 50 years ago (Kegel 1948)
- Good reliability and reproducibility (Bo 1990, Hudley 2005)
- Keep patient position consistent: Head of bed, legs
- Placement of the air chamber: middle of the air chamber placed 3.5 cm inside the introitus (Bo 2005); must ensure constant placement of the sensor between and during training sessions
- Standardize inflation of the sensor: same volume
- Visualize or palpate for inward movement of the sensor to verify proper contraction. Bearing down with abdominals and use of accessory muscles: will result in increase in pressure reading without contraction of the PFM (Bo 2005)
- Large vaginal vault: contraction may create little pressure change despite maximal muscle recruitment
- Most pressure devices are not able to measure changes in resting pressure; not well-suited for overactive PFM
  - Continent women had statistically significant higher maximal vaginal squeeze pressure when compared with incontinent women (Morkved 2004, Amaro 2005)

Rehabilitative Ultrasound Imaging RUSI

- PFM location, volume, and anatomy can be measured with ultrasound
- Mean PFM lift of 11.2 mm was visualized with the subjects positioned supine using real time ultrasound (Bo 2003)
- Used to measure the impact of PFM contraction on the urethra and bladder with transperineal and transabdominal approaches (Whittaker 2007)
- Can be used in supine and standing to training awareness of PFM elevation
- Continent women had statistically significant higher muscle thickness when compared with incontinent women (Morkved 2004)

- Several approaches have been described
  - Transabdominal - Suprapubically; sagittal or transverse placement of sound head
  - Transperineal / Translabial – placed on labia (Brækken 2009) Both squeeze and lift can be quantified during PFM contraction

Surface Electromyography (EMG or sEMG)

- Surface electrodes, vaginal or rectal probe
- Must be performed well for accurate test results. Biofeedback Certification International Alliance (BCIA)
- EMG recordings depict the summation of muscular electrical activity occurring in the muscle at rest and during contraction
- Surface EMG is superior to vaginal palpation in assessment of all variables except lift (Bo 2005)
- Correlation found between "PFM function as estimated by palpation" and EMG (Gunnarsson 1999)
- Interrater reliability and intraobserver reproducibility for EMG (Romanzi 1999)
- Test-retest reliability of EMG with significant clinical predictive validity (Glazer 1999).

Treatment protocols for all forms of biofeedback

- Based on strength training principles and evaluation results using components of PFMT
- Patient position
  - Anti-gravity: buttock up used with prolapse and very weak patient
  - Gravity eliminated: supine, most common starting position
  - Against gravity: sitting or standing, used with strong patients
- Work time - Based on evaluation results
- Rest time - At least equal to work, Weaker muscles need more rest
- Number of repetitions and sets
- Intensity - better to have a submaximal contraction of good quality than a maximal contraction with overpowering abdominals
- Block training is used initially – 5 second hold 10 times, 3 second hold 10 times
- Have patient observe contraction/release
  - Can they feel what they see? Have patient correlate PFM movement with biofeedback visual signal
  - Can they feel what they need to do to generate or release tension?

EMG Biofeedback Research for Underactive PFM

- Multiple RCTs have failed to show a statistically significant difference between outcomes with and without EMG training for UI and FI (Morkved 2002, Taylor 1986, Burns 1993, Burns 1990, Berghmans 1996, Glavind 1996, Aksec 2003, Solomon 2003, Hirakawa 2013)
- Association for Applied Psychophysiology and Biofeedback created a rating for research in this field – treatment of female SUI was the only diagnosis with the highest rating – efficacious and specific (McKee 2008)
- NICE Guidelines and Dutch Guidelines (level 4) - biofeedback should be considered in order to aid motivation and adherence to therapy, and to increase awareness.

- Fitz (2012) - systematic review, no significant difference in adding EMG
- Herderschee (2011) – Cochrane review on biofeedback with PFM exercises for UI
  - 24 Trials including 1583 women included
  - "Women who received biofeedback were significantly more likely to report that their UI was cured or improved compared to those who received PFM training alone (risk ratio 0.75).
  - Further research is needed to determine if the benefit is related to the use of the device or simply the increase in professional exposure.
- Norton (2012) - Cochrane review of biofeedback in patients with FI. Limited, poor quality research with some evidence that biofeedback plus exercise is better than PFMT alone.

- Biofeedback predictors – two unpublished ICS abstracts (Schaefer 2010, Yoo 2010), one AUA abstract (Cheng 2009), and one published paper (Resnick 2013) attempted to identify predictors of EMG biofeedback success
  - Frequency of UI
    - Less than 1 UUI/day (Schaefer 2010)
    - Less than 2 UUI per week resulted in significantly better outcome with BF (Resnick 2013)
  - Presence of detrusor overactivity (DO) - was not a predictor (Schaefer 2010)
  - DO characteristics on urodynamics– more brisk and higher amplitude DO was a significant negative predictor. Stronger detrussor contractions predicted less success. (Schaefer 2010, Resnick 2013)
  - Multivalent analysis – increase in average tonic contraction of the PFM was an independent positive predictive factor for decreased UI with BF - OR 1.66 (Yoo 2010)
  - No patient characteristics limit success in biofeedback therapy (Yoo 2010)
  - Reduced UI was associated with: improvement in self-efficacy, perception of control, self-concept, self esteem, and decreasing anxiety. High depressive scores predicted worse outcome (Cheng 2009)

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Electrical stimulation (ES) for PFM dysfunction

Indications for electrical stimulation

- Underactive PFM (weakness) - especially a very weak muscle (0/5 or 1/5) with poor awareness of PFM contraction
- Stress urinary incontinence (SUI)
- Urge urinary incontinence (UUI)
- Mixed UI (MUI)
- Fecal incontinence (FI)
- Pelvic organ prolapse (POP)

Contraindications for electrical stimulation

- On-demand pacemaker or history of arrhythmia - check with patient's physician and pacemaker company, it is possible to use ES with some newer pace makers
- Impaired cognitive function
- Vaginal infection, inflammation, or disease (for internal vaginal stimulation)
- Cancer - conflicting professional opinions - sensory stimulation will not increase blood flow and will not spread CA. Others do not use ES of any type with CA or radiation
- Atrophic vaginitis: do not use internal electrode

Considerations for vaginal and rectal ES treatment

- Pelvic organ prolapse (POP): grades 2 and 3, should make sure POP is up away from the electrode; advanced POP may not change significantly with ES
- Decreased sensation: potential for injury and may decrease effectiveness of stimulation

Possible adverse events

- Local vaginal, urethral, or anal irritation
- Bleeding
- Infection
- Pain and discomfort

Method of vaginal electrical stimulation

- There is a wide variability of parameters and protocols for ES reported in the literature
- It appears that some protocols may produce better outcomes than others; however, this has not been investigated yet (Berghmans 2005)
- Some practitioners suggest that having a patient actively contract PFM during ES may produce a better outcome; however, this has not been investigated yet
- Patient position
    - Supine: dorsal lithotomy is the most common position for treatment
    - Prolapse patients may need to be positioned with buttocks up on several pillows to move organs superior away from the electrode for better contact

Internal NMES for Treatment of Urge and Underactive PFM

	Typical Urge Protocol	**Typical Underactive PFM Protocol**
Frequency	5 to 20 HZ 12 Hz	5 to 50 Hz 50 Hz
Pulse Duration (Width)	200-350 usec 250 usec	200-350 usec 250 usec
Wave Form	Asymmetrical biphasic	Asymmetrical biphasic
Amplitude (Intensity)	To anal wink or patient tolerance	To anal wink or patient tolerance
Duty Cycle	5 seconds on 5 to 10 seconds off	5 seconds on 10 seconds off 10 seconds on 10 seconds off
Duration	15 to 30 minutes	15 to 30 minutes
Frequency of RX	3 to 5x/ week	3x/ week to twice per day
Length of RX	8 to 12 weeks to ongoing	8 weeks to on going

Organization guidelines for use of rectal and vaginal ES

- Dutch guideline for treatment of SUI (Bernards 2013)
    - There is insufficient evidence that ES alone is an effective treatment for SUI (level 1)
    - Adding ES to PFM exercises does not offer additional benefit (level 1)
    - Might be useful to increase awareness of how to contract the PFM correctly in patients with decreased voluntary control
- European Association of Urology guidelines on UI (Lucas 2013)
    - Evidence is inconsistent for whether ES alone can improve UI (level 2)
    - ES is no better than antimuscarinics (level 1)
- NICE Royal College of Obstetrics and Gynecology Guidelines (NICE 2013)
    - Do not routinely use ES in the treatment of women with OAB.
    - Do not routinely use ES in combination with PFMT.
    - ES considered in women who cannot actively contract PFM.
    - Do not offer transcutaneous sacral nerve stimulation to treat OAB in women.
    - Do not offer transcutaneous posterior tibial nerve stimulation for OAB. There is insufficient evidence to recommend the use.

Evidence for ES

- Systematic review (Shamilyn 2008)
    - Active ES was not better than PFM exercises or sham ES
- Cochrane review - ES in men (Berghmans 2013)
    - Some evidence that ES has a short term effect of decreased UI (6 months) but no significant difference was seen at 12 months
    - No evidence that adding ES to PFM exercises increases benefit
    - 17% adverse events

- Overall, it appears that ES is better than no treatment for UI (Bo 1998; Berghmans 2000)
- Overall ES appears to have a 50% improvement rate (Brubaker 2000; Brubaker 1997; Wang 1997)
- SUI - PFM exercise vs ES vs vaginal weights vs no treatment: PFM exercises best, ES second best in decreased leaks and subjective improvements (Bo 1999)
- RCT anal ES for fecal incontinence (FI) (Norton 2005): 35 Hz vs 1 Hz, 5 seconds on, 5 seconds off, 300 microseconds pulse width 20 to 40 minutes for 8 weeks. Patients who used the ES for more than 10 hours had a better outcome. All patients reported a significant reduction in BM frequency and number of incontinent episodes.

Conclusions for use of vaginal and rectal stimulation

- Research is lacking and inconsistent in the use of ES in patients with PFM dysfunction
- No evidence that it should be offered routinely to all patients
- ES may be beneficial to
    - Enhance awareness of PFM contraction
    - Especially if PFM is very weak
    - If PFM exercises or medications have failed
- Should always be used with other conservative management techniques.

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Vaginal weights

Vaginal weights (VWs) were developed by Plevnik in 1985. Theoretically, the sensation of having the weight inserted into the vagina provides sensory proprioceptive feedback, prompting a PFM contraction to retain the weight. (Hay-Smith 2005)

Indications for Use of VWs

- Underactive PFM: mild weakness
- Urinary incontinence - SUI, UUI, MUI
- Poor kinesthetic awareness
- Incoordination of PFM during activities of daily living (ADLs)

Contraindications for Use of VWs

- Pregnancy
- Immediate postpartum: within 6 weeks
- Immediate post-pelvic surgery: within 6 weeks
- During menstrual flow: slips too much
- Vaginal infection, recurrent thrush, or cystitis
- Impaired cognitive ability
- Dysuria
- Suspected retention or obstruction
- Vaginal, pelvic, or genital disease
- IUD unless specifically recommended by physician
- Atrophic vaginitis

Possible Poor Outcomes with Use of VWs

- Very weak PFM (0/5 or 1/5)
- Large vaginal vault: weight tips to the side and becomes wedged
- Poor motivation
- Severe sensory deficit: can't feel the weight slip
- PFM spasm or retention

Method

- The VW is inserted by the patient to a position above the PFM.
- When the muscle relaxes, the weight slips.
- Proprioceptive input prompts the patient to contract the PFM.
- Needle EMG studies show contraction of the PFM with weights inserted (Deindl 1995)
- Normal MMT (3/5 to 4/5): standing position with low exertional ADLs
    - Standing still
    - Motionless standing ADLs such as brushing teeth, showering, washing dishes
    - Increase the challenge by having patient move legs apart
    - Instruct the patient to weight shift in multiple directions
- Strong MMT (4/5 to 5/5): standing position with increases in intra-abdominal pressure and challenge functional coordination of the use of the PFM
    - Walking
    - Marching

- Bowing
- Transitions (sit to stand to stand squatting)
- UE strengthening, Dynamic stabilization
- Lifting
- Coughing
- Stair climbing
- Jumping
- Running

Frequency and Duration of Use: 10 to 15 minutes, One to two times per day
Progression of Training: Advancing weight, Advance activity

Cautions and Patient Instructions

- Empty bladder before treatment
- Remove tampon, pessary, or diaphragm before treatment
- Wash hands and VW before and after treatment with soap and water
- Do not use lubrication
- Be aware of VW becoming wedged
- Avoid frustration with short sessions of appropriate difficulty (ICI 2013, Dutch guidelines level 1)
- Single user device per manufacturer
- Variations in strength occur with time of day, fatigue, and hormonal fluctuation
- Patient have reported abdominal pain, vaginitis, and bleeding (ICI 2013, Dutch guidelines level 1)

Evidence for the Use of VWs in Practice

- Evidence from 4 RCT suggests VW are better than no treatment (ICI 2013)
- There was no statistical difference between VW and electrical stimulation for SUI; both treatments appear equally effective (Bo 1999; Olah 1990, ICI 2013, Dutch guidelines level 1)
- There is no statistically significant difference between VW with PFMT vs. PFMT alone (Cammu 1998, Pereira 2012, Pereira 2013, Dutch guidelines level 1)
- Combining VW with PFMT may be effective (Dutch guidelines level 3)

Cochrane review on vaginal weights (Herbison 2008)

- 17 studies randomized or quasi-randomized controlled trials comparing weighted vaginal weights with alternative treatments or no treatment (6 were abstract only)
- Use of VW is better than no active treatment
- VW “may” have similar effectiveness as PFMT and electrical stimulation
- Not enough evidence to demonstrate additional improvement with VW + PFMT treatment vs. PFMT alone.

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