Dynamic rehabilitative ultrasound for pelvic floor disorders – Introduction in techniques and hands-on-workshop

W37, 30 August 2011 14:00 - 17:00

Start	End	Topic	Speakers
14:00	14:10	Welcome and Objectives	• Baerbel Junginger
14:10	14:25	Scientific background of pelvic floor motor control	• Kaven Baessler
14:25	14:55	Development of an individual and specific pelvic floor rehabilitation program	• Baerbel Junginger
14:55	15:10	Different ultrasound applications to assess and treat pelvic floor dysfunction	• Kaven Baessler
15:10	15:25	Hands-on: Abdominal muscle ultrasound to assess the transversus abdominis and external oblique muscles	All
15:25	15:30	Questions	All
15:30	16:00	Break	None
16:00	16:15	Hands-on: Supra-pubic (abdominal) ultrasound to assess the bladder and pelvic floor movements	All
16:15	16:35	Hands-on: Perineal (translabial) ultrasound to evaluate the bladder neck and puborectalis muscle	All
16:35	16:40	Questions	All
16:40	16:55	Results of a specific rehabilitation program employing ultrasound as biofeedback tool	• Baerbel Junginger
16:55	17:00	Discussion	All

Aims of course/workshop

Ultrasound is a promising instrument for pelvic floor rehabilitation for physiotherapists and other health care professionals treating women with pelvic floor disorders. Dynamic rehabilitative ultrasound is used to image function and dysfunction of musculo-skeletal and pelvic floor disorders. The aim is to directly evaluate the effect of muscle contraction and relaxation, e.g. bladder neck elevation and descent. Workshop participants will practice amongst each other abdominal muscle ultrasound to assess the transversus, external and internal oblique muscles as well as perineal and supra-pubic ultrasound to evaluate the bladder movements during pelvic floor contraction, straining, coughing and other functional tasks.

Educational Objectives

This hands-on-workshop will firstly provide the theoretical background of a specific, bladder neck effective pelvic floor rehabilitation program and then practice the different ultrasound applications amongst each other. Health care professionals will be familiarized with the use of ultrasound as a method for pelvic floor assessment and biofeedback. Ultrasound is the ideal tool to assess muscle recruitment and teach muscle contraction with visual biofeedback. The results of recent studies employing ultrasound will be reviewed. Influences of different muscle contraction of the abdominal wall and their influence on bladder neck position will be shown using suprapubical and perineal ultrasound imaging. Pelvic floor activity during coughing or straining can easily be assessed and evaluated and integrated into exercises and daily life. Videos and cases will be presented and discussed in an interactive part.

Dynamic rehabilitative ultrasound for pelvic floor disorders

Introduction in techniques and hands-on-workshop

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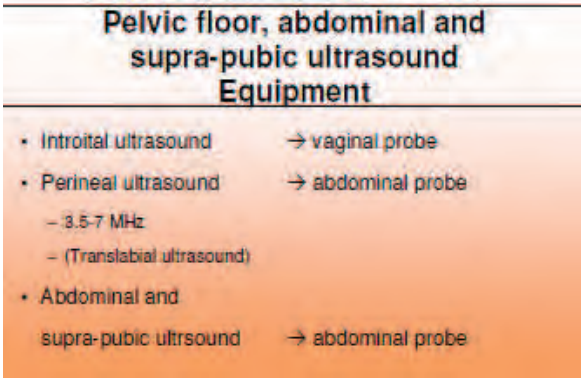
1. Introduction:

- Ultrasound is a medium for pelvic floor rehabilitation for physiotherapists and other health care professionals treating women with pelvic floor disorders.
- Dynamic rehabilitative ultrasound (DRUS) is used to image function and dysfunction of musculo-skeletal and pelvic floor disorders.
- For pelvic floor rehabilitation several muscles are of interest:
  - abdominal muscles: abdominal ultrasound probe
  - pelvic floor muscles: abdominal or endovaginal ultrasound probe

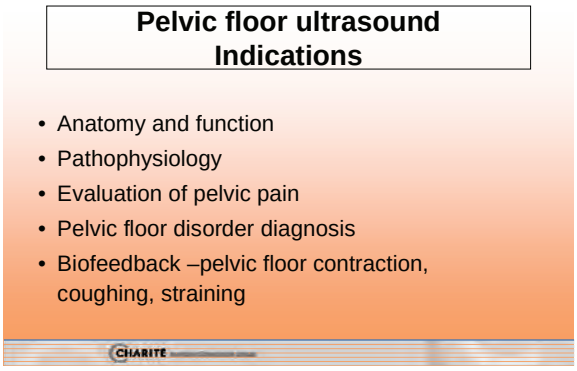
Ultrasound can be used as an instrument for evaluation of physiological and pathophysiological movements of the bladder. It can also be used as a biofeedback instrument, for example via perineal ultrasound, to enhance the understanding of normal pelvic floor function during coughing e.g. The physiological pre-contraction of the pelvic floor can be taught, known as the "Knack", a pelvic floor contraction that is generated before coughing or sneezing to prevent urinary leakage [1, 2]. The Knack has been confirmed to improve the stability of the bladder neck during coughing. A loss of pre-contraction has been shown in incontinent women during a daily function (rapid arm movement) [3]. In conjunction with abdominal ultrasound, perineal ultrasound is a valuable instrument to assess the synergy of the pelvic floor and deep abdominal muscles. It can be used for pelvic floor re-education especially for retraining of functional tasks that result in urinary leakage in the individual subject [4]. Recent studies have shown that motor learning with selective muscle contraction under US-guidance leads to faster and better outcomes (performance, strength, repeatability). In Van et. Al' study [5] patients increased their strength within 2 weeks after teaching selective multifidus muscle activation with US. At this early stage an increase in strength is a sign for better coordination and better performance of the exercise because "real" muscle strength cannot occur in such a short time. In the field of PFM and trunk muscle rehabilitation US biofeedback is also commonly used [6-8].

2. Equipment

- Ultrasound machine – simple, no colours or Doppler or 3/D facilities required
- Abdominal ultrasound probe or (endovaginal ultrasound probe)



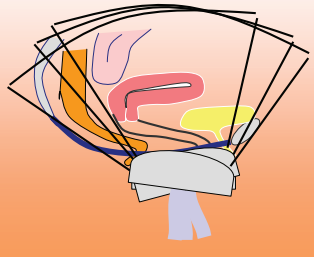
3. Indications of pelvic floor ultrasound



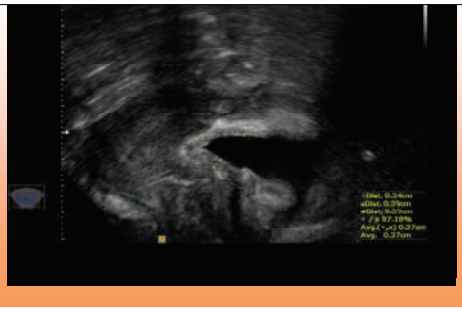
4. Perineal ultrasound: application and normal anatomy and function

Pelvic floor ultrasound
Normal Anatomy

- Urethra, bladder
- Rectum
- (Vagina)
- Anal sphincter
- Uterus



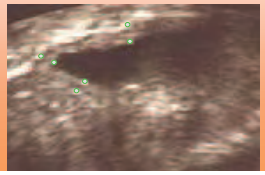
Perineal ultrasound with normal position of uterus



Perineal or introital ultrasound

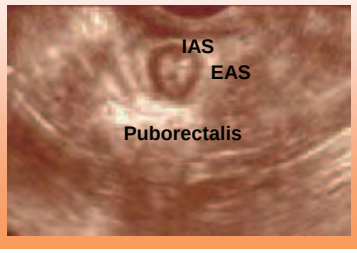
Bladder wall thickness

- Normal: <5mm
- 3 measurements >5.5mm: detrusor overactivity

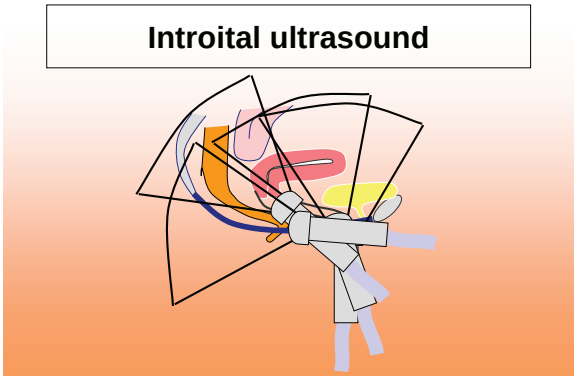


Pelvic floor ultrasound

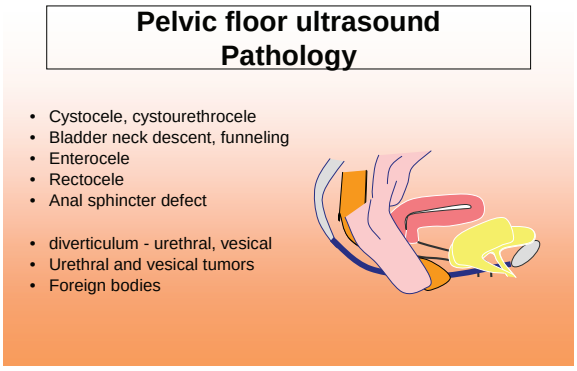
Anal sphincter



5. Application of introital ultrasound

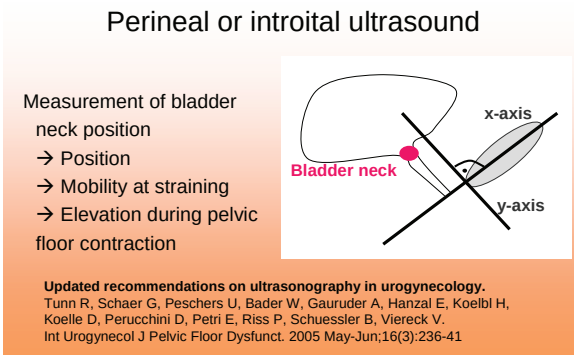


6. Pelvic floor ultrasound: pathology



7. Measurement of bladder neck position

- For pre-post assessment e.g.
- Mainly for scientific evaluation

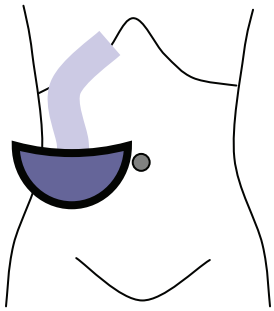


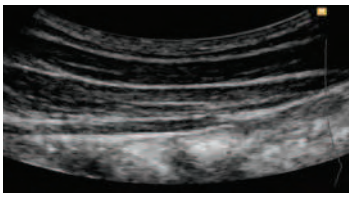
8. Aims of dynamic rehabilitative ultrasound

- Evaluation of the effect of pelvic floor muscle contraction and relaxation
  - bladder neck elevation
  - bladder neck descent.
  - Movement of the puborectalis muscle and rectum
- To directly evaluate the changes in abdominal muscle thickness and muscle sliding

9. Techniques used in pelvic floor rehabilitation

- Technique of ultrasound application for assessment of transverse, external and internal abdominal oblique muscles





- Perineal (females) and supra-pubic ultrasound (females and males).
    - Evaluation of bladder neck and puborectalis muscle movements.
- Measurements should be performed during pelvic floor contraction/ relaxation, straining, coughing and other functional tasks.

10. Findings of normal and pathological pelvic floor function (video examples)

- during pelvic floor contraction
- coughing
- lifting and other activities of daily life

11. Description of a rehabilitation program employing DRUS, palpation and functional teaching:

The main goal is to teach a bladder neck-effective pelvic floor contraction in women with stress and urge incontinence. Bladder neck effective means a cranio-ventral movement with an elevation of the bladder neck which can be maintained during breathing and coughing e.g. The co-activation of the transverse abdominal muscle (TrA) and the elimination of internal and external oblique muscle contraction is of further importance.

Evaluation includes bladder neck elevation, pre-contraction, voluntary pelvic floor contraction at maximal strength and with submaximal effort, hold during breathing and coughing, stabilization of the urethra, hold of bladder neck position during coughing or abdominal manoeuvres and typical physical exercises.

Ultrasound is the method of choice to visualize the bladder neck. Palpation and ultrasound are both employed to teach pelvic floor contractions. Palpation of PFM leads to a better perception and awareness whereas ultrasound shows the patient that the performed contraction is sufficient, insufficient or even not effective. Both, the visual and the tactile biofeedback are utilized to teach how to perform a sufficient and bladder neck effective PFM contraction.

The assessment of the bladder neck elevation seems important given that during typical so-called pelvic floor gymnastic exercises the bladder neck is not necessarily elevated or even supported (Posterpresentation IUGA 2010 Baessler&Junginger).

First comes awareness and subsequently individual dysfunctions of the PFM and the TrA will guide next steps of the program. At the end, functional integration into daily life and the patient's incontinence patterns is instructed. This is considered essential to guarantee life long implementation of the pelvic floor instead of life long training and exercises. It also serves the autonomy of the patient.

12. Case reports and interactive discussion about training strategies, modalities and experiences:

Case 1: Woman with stress urinary incontinence (SUI): descent of the bladder base during coughing on ultrasound.

Slight anterior vaginal wall prolapse
Palpation Oxford: 2, problems with endurance, no problems with fast contractions, breathing during contraction but loss of contraction
Bother scale: greatly bothered of SUI – Australian pelvic floor questionnaire/ German version [9]
Previous physiotherapy: 12 supervised group training sessions

Therapy:

Case 2: Woman with OAB and SUI showing bad coordination and co-contraction of all abdominal muscles during PFM contraction.

Palpation Oxford: 4, no problem with endurance, no problem with fast contractions, no breathing during contraction
Bother scale: moderately bothered of SUI - Australian pelvic floor questionnaire/ German version [9]
No supervised previous physiotherapy

Therapy:

Case 3: Woman with no contraction at all, no visible effect during contraction, no perception, no PF awareness.

Palpation Oxford: 0
Bother scale: moderately bothered of SUI, occasionally flatus incontinence but greatly bothered of it - Australian pelvic floor questionnaire/ German version [9]
No supervised previous physiotherapy

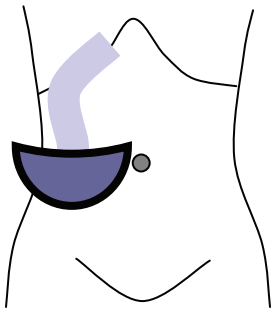
Therapy:

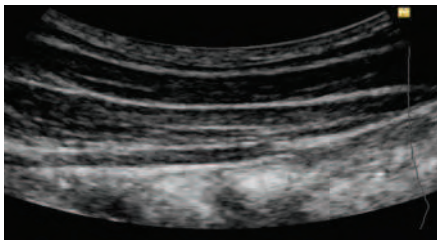
Practical Session:

1. Abdominal muscle ultrasound:

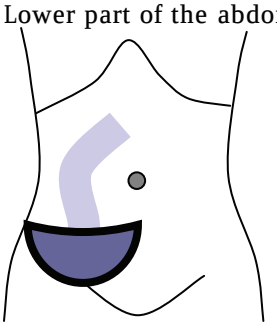
Transversus, external and internal abdominal oblique muscles, transversus-pelvic floor co-contractions and adverse external oblique contractions [10].

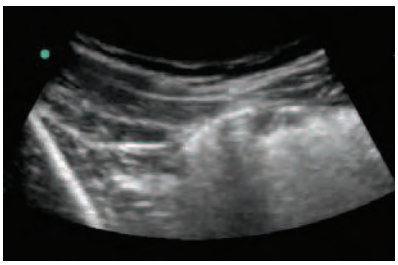
Upper and middle part of the abdominal muscles [11]





Lower part of the abdominal muscles [11]

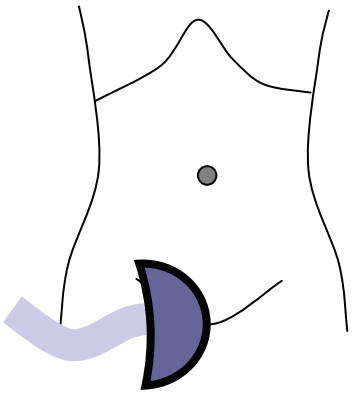


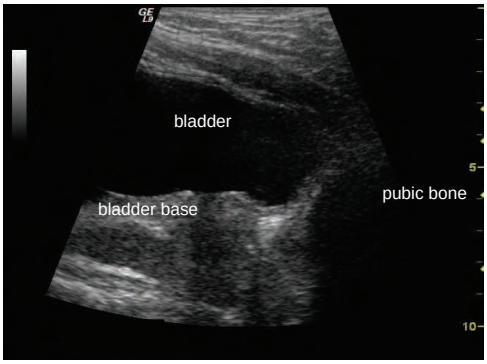


2. Supra-pubic (abdominal) ultrasound.

Assessment of movements of the bladder base during pelvic floor contraction, straining and coughing

This method is applicable in female and in male.

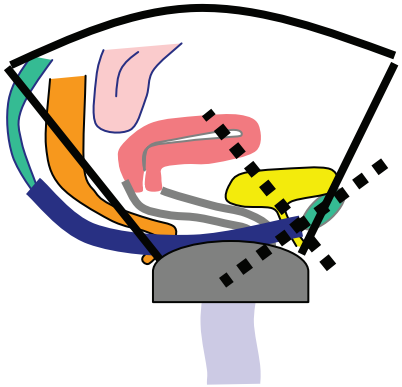




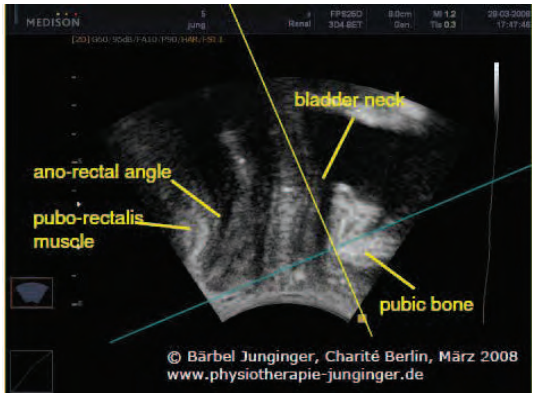
3. Perineal (translabial) ultrasound

In females to evaluate the bladder neck and the puborectalis muscle movements during pelvic floor contraction, straining, coughing and other functional tasks.

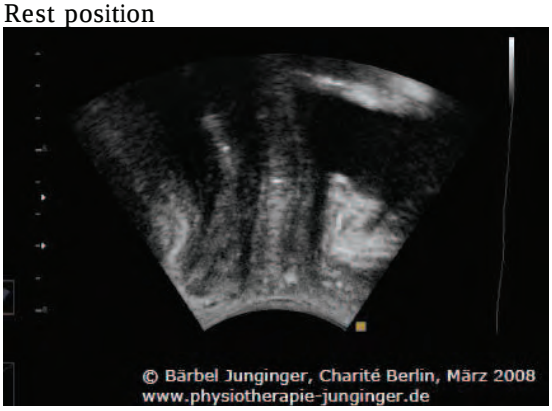
Perineal probe and application:



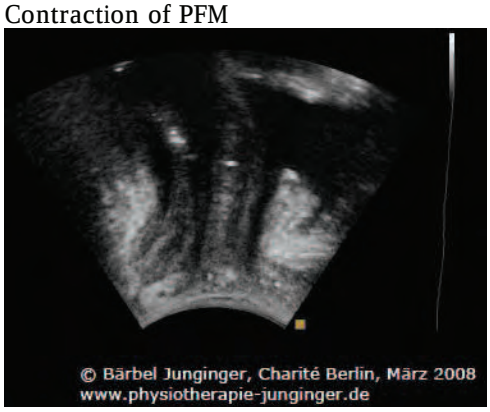
Landmarks for perineal ultrasound



Rest position



Contraction of PFM



References:

1 Miller JM, Perucchini D, Carchidi LT, DeLancey JO, Ashton Miller J. (2001) Pelvic floor muscle contraction during a cough and decreased vesical neck mobility. Obstet Gynecol 97: 255-60
2 Peschers UM, Gingelmaier A, Jundt K, Leib B, Dimpfl T. (2001) Evaluation of pelvic floor muscle strength using four different techniques. Int Urogynecol J Pelvic Floor Dysfunct 12: 27-30
3 Smith MD, Coppieters MW, Hodges PW. (2007) Postural activity of the pelvic floor muscles is delayed during rapid arm movements in women with stress urinary incontinence. Int Urogynecol J Pelvic Floor Dysfunct 18: 901-11
4 Sapsford R. (2004) Rehabilitation of pelvic floor muscles utilizing trunk stabilization. Man Ther 9: 3-12
5 Van K, Hides JA, Richardson CA. (2006) The use of real-time ultrasound imaging for biofeedback of lumbar multifidus muscle contraction in healthy subjects. J Orthop Sports Phys Ther 36: 920-5
6 Dietz HP, Wilson PD, Clarke B. (2001) The use of perineal ultrasound to quantify levator activity and teach pelvic floor muscle exercises. Int Urogynecol J Pelvic Floor Dysfunct 12: 166-8; discussion 168-9
7 Ariail A, Sears T, Hampton E. (2008) Use of transabdominal ultrasound imaging in retraining the pelvic-floor muscles of a woman postpartum. Phys Ther 88: 1208-17
8 Hodges PW. (2005) Ultrasound imaging in rehabilitation: just a fad? J Orthop Sports Phys Ther 35: 333-7
9 Baessler K, O'Neill SM, Maher CF, Battistutta D. (2009) Australian pelvic floor questionnaire: a validated interviewer-administered pelvic floor questionnaire for routine clinic and research. Int Urogynecol J Pelvic Floor Dysfunct 20: 149-58
10 Hodges PW, Pengel LH, Herbert RD, Gandevia SC. (2003) Measurement of muscle contraction with ultrasound imaging. Muscle Nerve 27: 682-92
11 Urquhart DM, Hodges PW, Story IH. (2005) Postural activity of the abdominal muscles varies between regions of these muscles and between body positions. Gait Posture 22: 295-301

Scientific background of pelvic motor control, coordination training and specific stabilisation of the pelvic floor

Kaven Baessler, MD
Bärbel Junginger, PT, MT (OMT)

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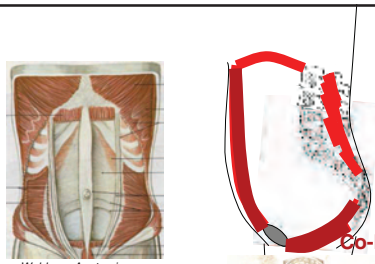
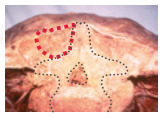
Spinal Pain, Injury & Health
The University Of Queensland Australia



Waldeyer Anatomie



Joint Stability Group

Co-Kontraktion

Sapsford et al. 2001

Waldeyer Anatomie

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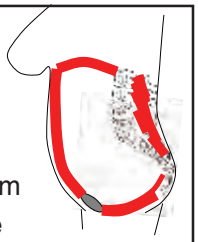
Pelvic floor muscle



- Part of the tonic muscle system
- Part of the abdominal capsule
- Predominantly slow-twitch-fibres

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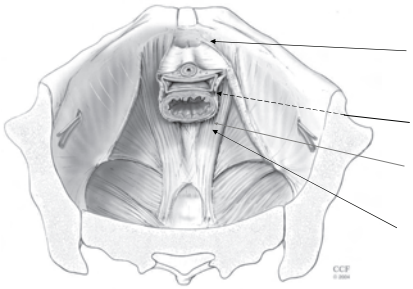
Type I – slow twitch fibres in the pelvic floor



Periurethral Levator ani 95%

External anal sphincter 78%

Puborectalis 75%

Pubococcygeus anterior 67% posterior 76%

Gilpin 1989, Swash 1992, Gosling 1981

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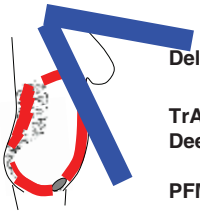
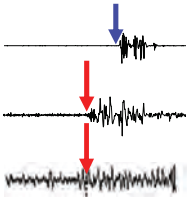
physiological reactions: „pre-programming“



Deltoid muscle

TrA
Deep multifidus

PFM



Hides et al. 1996, Hodges et al. 1996-2005, Smith et al. 2006

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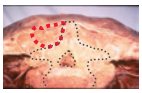

Physiological and pathophysiological studies: an overview

- Hides et al. 1996: pain inhibition of deep multifidus muscle
- Hodges et al. 1996: Loss of pre-programming of transverse abdominis muscle
- Smith et al. 2006: Loss of pre-programming of pelvic floor muscles
- Hungerford et al. 2003: EMG-onset of multifidus muscle delayed in SIJ- pain-patients
- Hodges et al. 2003: Immediate loss of pre-programming after experimentally induced pain

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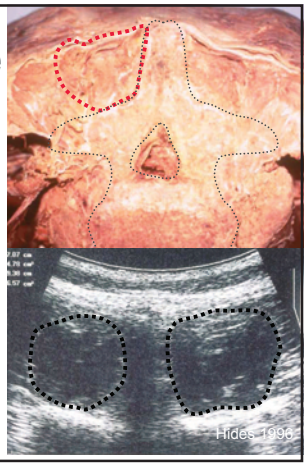
Multifidus muscle

Patients
- First episode of low back pain (unilateral); n=41

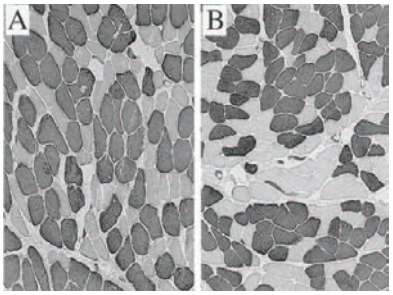
Control group:
- no back pain

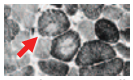
Outcome measures
- cross sectional area in ultrasound and MRI

Results:
- Muscle atrophy within 24 h
- Cross sectional area symmetrical in controls
- US correlates with MRI measures

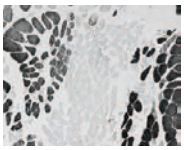


Morphological changes





moth-eaten cells



large group atrophy of multifidus

Normal (A) and diseased side (B) of multifidus muscle

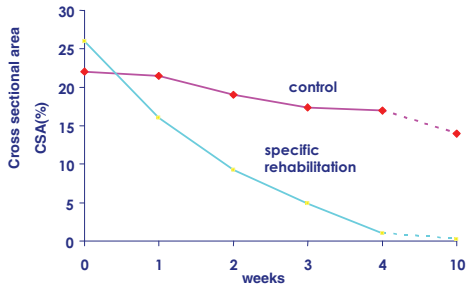
Specific rehabilitation of TrA

- RCT: versus standard treatment in patients with radiological diagnosed spondylolysis or spondylolisthesis
- follow-up at 3, 6, 30 months
- Results:
  - Statistic significant reduction in pain and function; maintained after 30 months[1]
  - Significant reduction in recurrence of back pain in the specific training group compared with the control group at 1 and 3 years follow-up **after** specific rehab and without recommendation of specific ongoing exercises[2]

	Specific training	control
1 year follow-up	30	84
3 years follow-up	32	78

1. O´Sullivan, 1997; 2. Hides, 2001

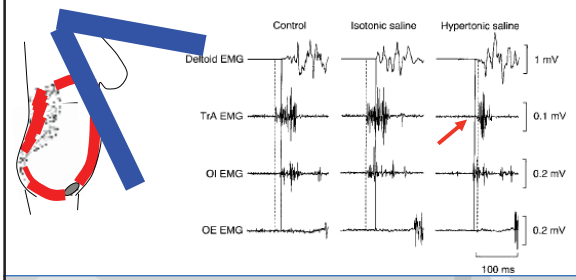
Cross sectional area after treatment



Induced pain

Hodges et al. 2003:

loss of pre-programming of TrA immediately after injection of hypertonic saline into longissimus muscle



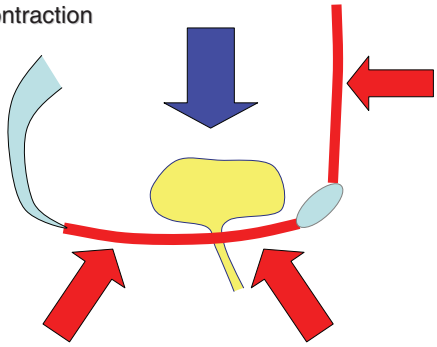
Motor control

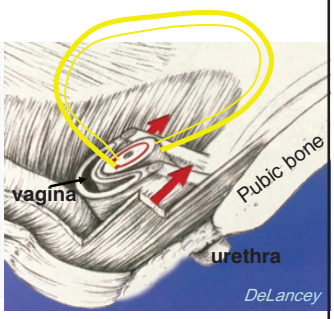
- Emotional components like anticipation of pain are responsible for changes in strategy of muscle control (delayed onset of deep muscles, hyperactivity of superficial muscles)[1]
- Isometric leg contractions: patients show a significant smaller increase in TrA thickness compared with healthy controls, but no difference in IO/EO [2]

1. Moseley, 2004; 2. Ferreira, 2004

Pre-programming:

- co-contraction of PFM + transverse abdominis (TrA)
- pre-contraction

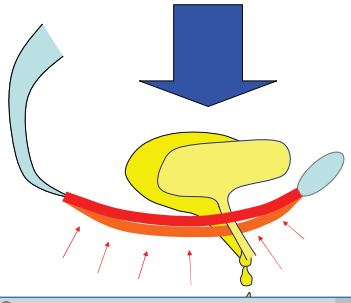




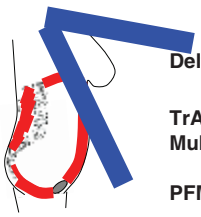
Baessler et al.,edts., Pelvic floor reeducation

Stress urinary incontinence

Involuntary loss of urine at physical exertion



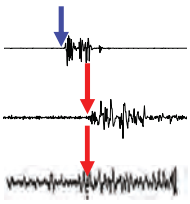
Dysfunction in stress incontinent patients: loss of pre-programming



Deltoid muscle

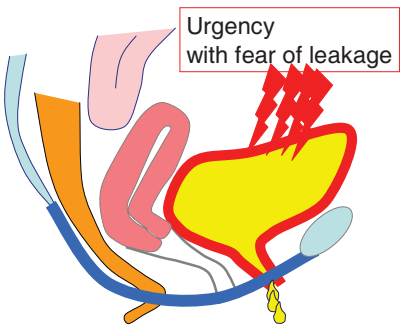
TrA
Multifidus

PFM



Hides et al. 1996, Hodges et al. 1996-2005, Smith et al. 2006

Urge incontinence



Continence during increases in abdominal pressure

1. Pre-contraction
2. Bladder neck elevation and support
   → maintained during "stress"
   → with sufficient increase in intraurethral pressure
3. Correct coordination

Incontinence

1. Loss of Pre-contraction
2. Delayed "Pre"-contraction
3. Loss of bladder neck support or failed bladder neck elevation
4. Incorrect coordination (e.g. loss of pelvic floor contraction during breathing)
5. Loss of supportive pelvic floor contraction e.g. while standing up
6. Pelvic floor contraction that does not result in an elevation of an unsupported bladder neck

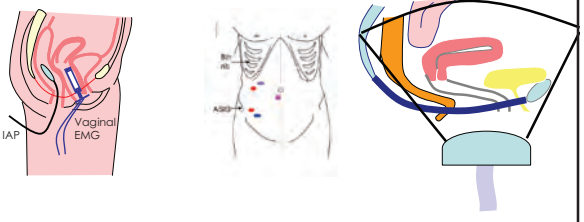
Needle EMG and intravaginal surface EMG reveal the relationship between contractions of abdominal and pelvic floor muscles, bladder neck elevation and intra-abdominal pressure in healthy women

Junginger B[1,2], Baessler K [2], Sapsford R[1], Smith M[1], Hodges PW[1]

1. Division of Physiotherapy The University of Queensland Brisbane Australia, 2. Charité University Hospital Berlin Germany

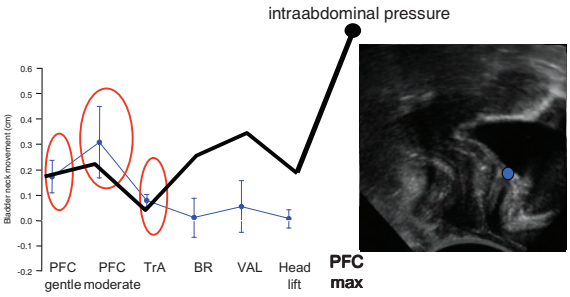
Junginger, Baessler, Sapsford, Hodges, 2009, IUJ

Methods



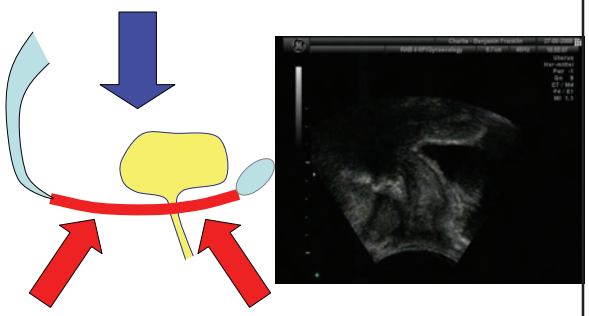
ccre spine centre of clinical research excellence — Spinal Pain, Injury & Health — NHMRC funded centre

Results

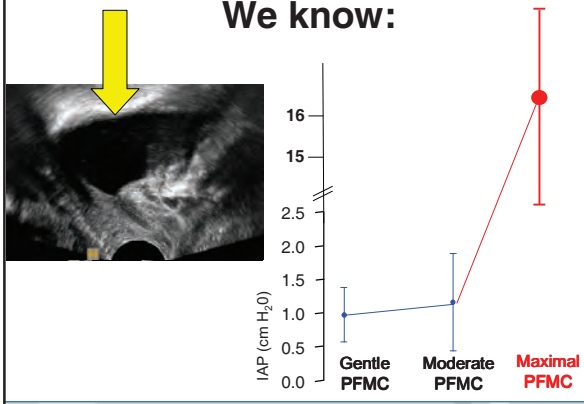


Pelvic-floor rehabilitation:

pre – contraction before coughing, sneezing, etc.



We know:



Bladder neck elevation with different levels of effort of pelvic floor muscle contraction

The **aim** of this study was to assess the effect of maximal and submaximal voluntary pelvic floor muscle contractions on the bladder neck, transverse abdominis and internal oblique muscles and on the intraabdominal pressure IAP

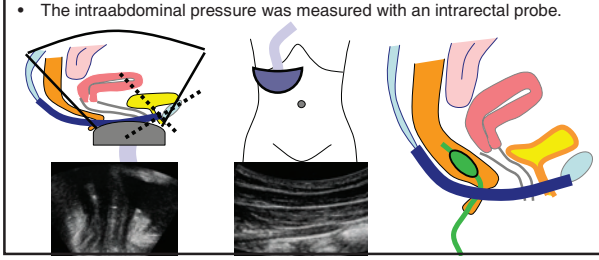
Kaven Baessler, Bärbel Junginger

CHARITÉ

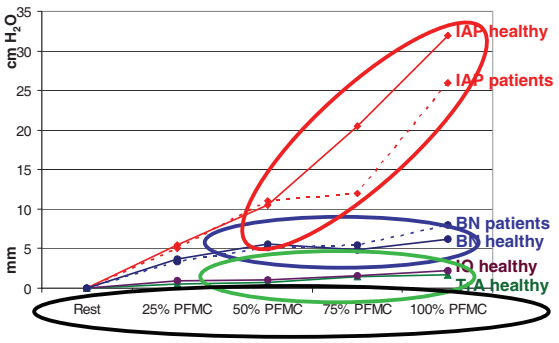
Charité Universitätsmedizin
Pelvic Floor Centre
Berlin, Germany

- Methods -

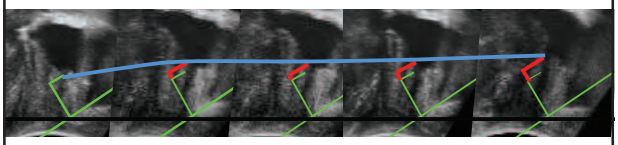
- 20 premenopausal nulliparous women without pelvic floor disorders
- 20 urogynaecological patients without pelvic organ prolapse beyond the hymen or previous PF surgery
- BN position was estimated with PUS using a coordinate system running through the pubic symphysis
- The thickness of the Tra and IO was measured simultaneously with an abdominal ultrasound probe using a previously validated method
- The intraabdominal pressure was measured with an intrarectal probe.



Results



Pelvic floor contraction, bladder neck elevation and intraabdominal pressure



Rest	25%	50%	75%	Max. PFMC
Intraabdominal pressure (cmH_2O):				
0	5	10	20	35

Conclusions

- Already 25% of a maximal pelvic floor contraction significantly elevates the bladder neck
- A maximal pelvic floor contraction does not further elevate the bladder neck after 50% of effort in pelvic floor-healthy women
- There is a considerable increase in intraabdominal pressure with maximal PFM contraction power similar to pressure increases during a nose blow and moderate coughing
- Maximal pelvic floor muscle contractions are not necessary to elevate the bladder neck and have the disadvantage of increasing the intraabdominal pressure undesirably due to co-contractions of the superficial abdominal muscles

Implications for specific pelvic floor rehabilitation

Re-education integrating physiology

- Pre-contraction
- Co-contraction
- Bladder neck support and elevation

Ensure bladder neck effective pelvic floor contraction

Avoid excessive increase in intraabdominal pressure

- No maximal PFM contraction
- Submaximal (25%-50%) pelvic floor contractions

Ensure maintenance of pelvic floor contraction during coughing or breathing e.g.

Pelvic floor rehabilitation program based on physiological motor control, applying ultrasound and palpation as tools to diagnose pelvic floor dysfunction and to give biofeedback and employing validated questionnaires to assess the efficacy

Bladder neck effective, controlled, integrative pelvic floor therapy

Specific PF rehabilitation programme

Dynamic rehabilitative ulstrasound (DRUS): assessment of pelvic floor function and application as a biofeedback instrument

Bärbel Junginger, PT, MT (OMT)
Kaven Baessler, MD

CHARITÉ ccre spine centre of clinical research excellence Spinal Pain, Injury & Health NHMRC funded centre The University Of Queensland

Specific pelvic floor rehabilitation programme

„Bladder neck effective, controlled, integrative pelvic floor therapy“

Assessment of individual symptoms

Evaluation of individual dysfunction

Explanation of individual pathophysiology

Teaching of bladder neck elevation

Training and integration of PFMC

Follow-up evaluation

- Individual symptoms
  - SUI
  - OAB
  - Mixed incontinence
  - (Voiding problems)
  - (Defaecation problems)
  - Prolapse symptoms

- Individual dysfunction
  - Lack of coordination
  - Reduced PFM contraction
  - Lack of PFM contraction
  - Delayed PFM contraction
  - No bladder neck elevation

Instruments to assess pelvic floor dysfunction for teaching, biofeedback and follow-up

- Abdominal ultrasound (abdominal muscles, bladder)
  - co-contraction TrA/ PFM
  - elimination of undue co-activation of IO
- Perineal ultrasound (bladder neck, puborectalis muscle)
  - Bladder neck elevation and support essential for continence
- Vaginal and rectal palpation
  - evaluation of quality and quantity of parts of a PFM contraction
  - Teaching of awareness and perception of PFMC
  - Localization of pain
- PF questionnaire
  - Validated assessment of symptoms
  - Pre and post therapy

Characteristics of the programme

- Evaluated programme (our study IUGA poster literature)
- Validated assessment instruments (questionnaire, ultrasound, palpation)
- Bladder neck effective PFM contraction and avoidance of maximal contractions
- (re-)education of pre-contractions
- Perineal ultrasound as a tool for diagnostic and didactic biofeedback and as a control instrument
- Follow-up part of the programme

Goals

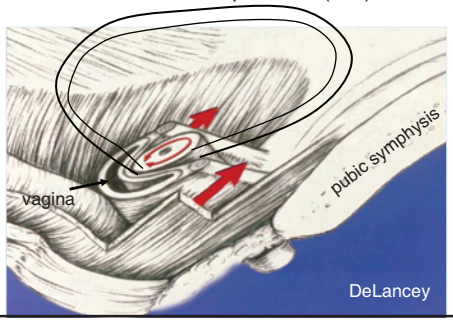
- bladder neck effective PFM contraction
- normal PFM-TrA-coordination during stress, urge, etc.
- Reduction of symptoms and increase of QoI
- integration of PFM into daily routine (in contrast to life-long-training)

Ultrasound - validated instrument for measurements in clinic and research

- Direct mesurement of muscle thickness and position (TrA, IO, EO; Hodges 2003)
- Imaging of blader movement via suprapubical ultrasound (Sherburn, Murphy 2002)
- Validation of movement of the bladder base (perineal ultrasound) during PFM contraction and during straining (Schaer et al. 1995)

continence

For the maintenance of continence, pelvic floor muscle (PFM) contraction is required to stabilise the bladder neck and to compress the urethra during increased intra-abdominal pressure (IAP)



History of ultrasound for evaluation of BN position and movement

- 1958 Hodgkinson: Lateral bead chain cystography
- 1978 Hodgkinson and Green
- 1975: lateral chain urethrocystography
- 1992 Wise et al.: perineal sonography
- 1995 Schaer et al.: reproducibility, good inter-examiner agreement

Advantages of US

- Not dangerous
- Easy to apply for examiner
- easy to understand for patient
- Accepted (scientifically, clinically)
- No radiation – important for longer lasting during biofeedback procedures

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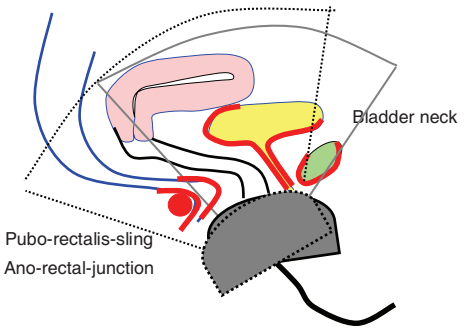
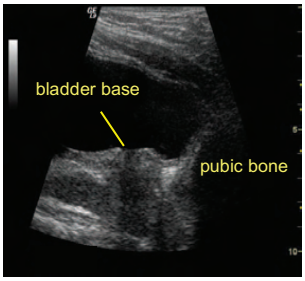
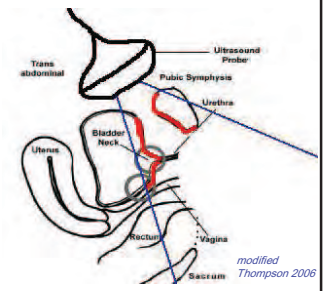
perineal ultrasound or translabial US: midline-sagittal view



Alternative method of bladder movement assessment

Abdominal supra-pubical ultrasound

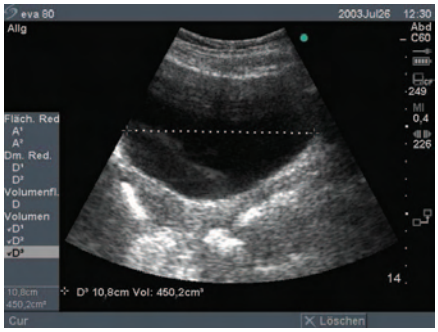




modified Thompson 2006

Assessment of bladder movement

Assessment of bladder volume

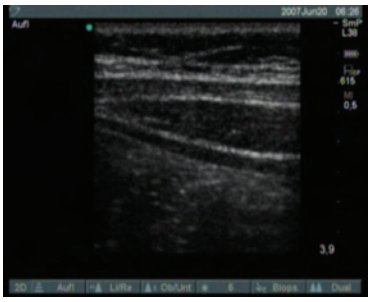


Advantages of abdominal US

- Not invasive
- No undressing necessary
- **Also possible in male patients**

- Specialised physios are used to apply abdominal US for abdominal muscle assessment (TrA and IO; EO)

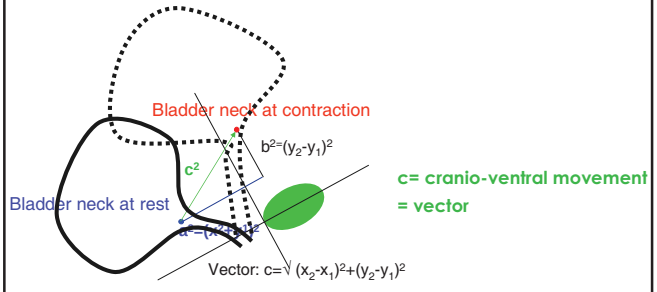
Assessment of abdominal muscles via abdominal US



Skin and sub-cut. tissue
EO
IO
TrA

Advantage of perineal ultrasound: validated assessment of BN movement

- Schaer et al. 1996
- Method with coordinate system through pubic symphysis



c= cranio-ventral movement
= vector

Normal values and hypermobility of BN movement

- **Normal**: 0-40 mm in young, nulliparous, continent women (Brandt, Peschers, Reed, Dietz)
- **Hypermobility**: a cut-off value between 5 mm [Reed, Reilly] and 14 mm [Lin, Meyer]
- Lower BN position in standing than in supine (Meyer)
- Women with joint hypermobility have a lower BN position at rest (King)
- Valsalva manoeuvre: important to distinguish functional testing with PFM contraction or evaluation of pelvic organ prolapse with relaxed pelvic floor (Örnö and Dietz 2007)

Ultrasound for biofeedback

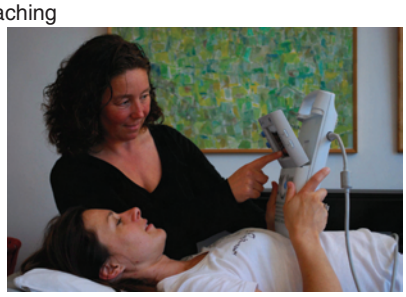
- Imaging of PF function
- Imaging of a region of the body that is normally not visible
- Application possible in different patient positions: lying, sitting, standing

- Application during functional tasks: sneezing, coughing and during urge symptoms (OAB)
- Application symptom-specific (e.g. bending over)

Terminology: Rehabilitative ultrasound imaging or DYNAMIC REHABILITATIVE US

Rehabilitative:

1. assessment
2. explanation/ teaching
3. training
4. re-assessment



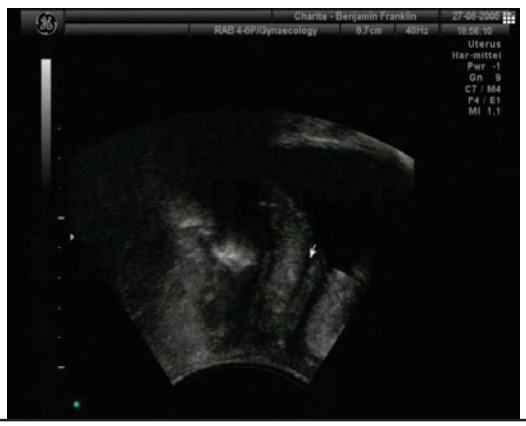
The Use of Real-Time Ultrasound Imaging for Biofeedback of Lumbar multifidus Muscle Contraction in Healthy Subjects

- 2 groups people: voluntary contractions of multifidus muscle with and without US biofeedback
- Follow-up time: 1 and 2 weeks
- results: US-group better results after 1 week, increase in muscle thickness (maintenance in week 2)

Van, Hides et al. 2006

Normal function and findings in patients

Healthy woman: function during coughing and laughing

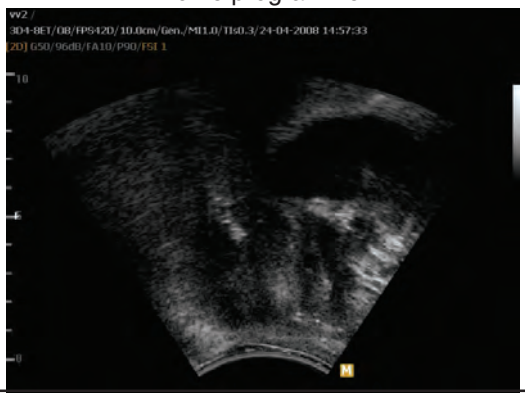


Patient with no pre-contraction and therefore:
BN-funneling and -hypermobility
during coughing

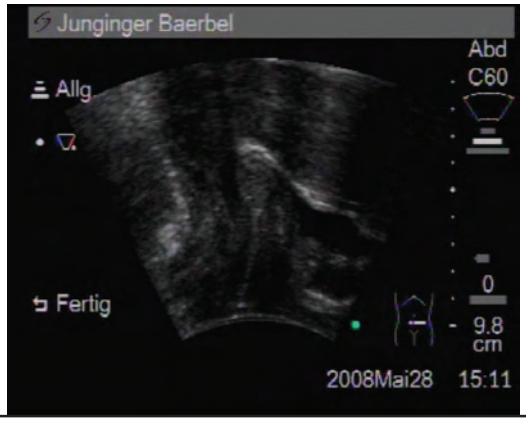
Patient with no pelvic floor awareness

Patient with bad coordination;
co-contraction of all abdominal muscles

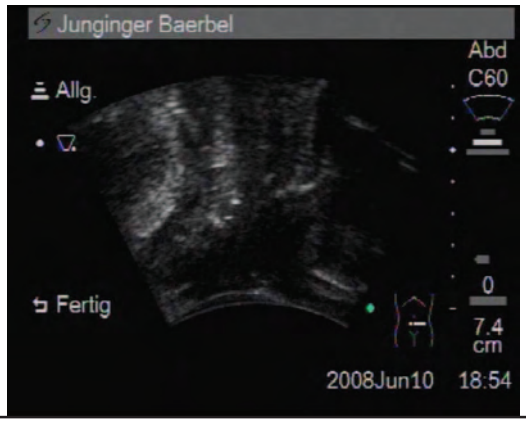
Same patient 3 days later after **one** biofeedback session and coordination training as a home programme

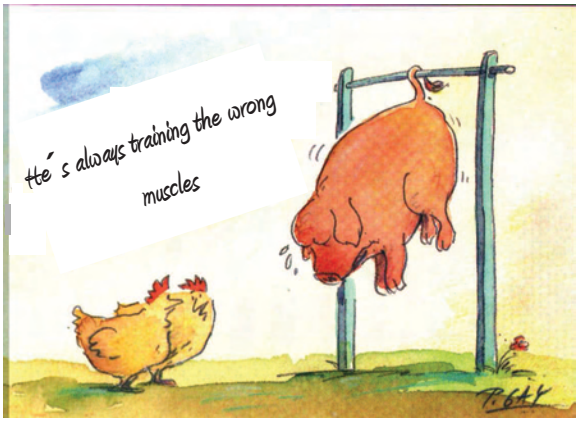


Insufficient perception; some activity of dorsal PFM but counter-activity of abdominal muscles **(IAP ↑)**



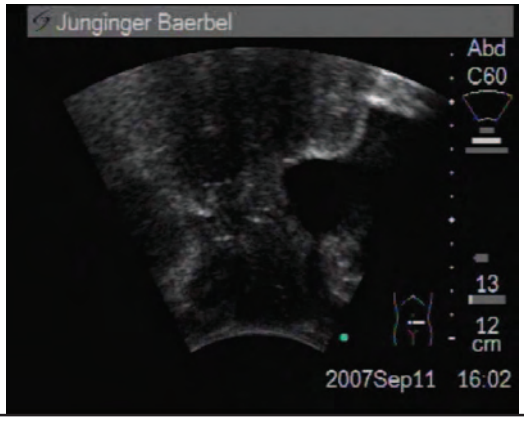
Better coordination 2 weeks later: no IAP ↑ but still insufficient elevation





Patient with a good contraction but unable to hold during breathing

Same patient during coughing



Patient with a stage II cystocele: reposition possible but no hold because of structural defects

Follow up of a rehabilitation programm with focus on coordination using US

- n=55 women; 34-83 years (median 52 years)
- pure SUI n=9; pure OAB n=9, mixed OAB-SUI n=37
- Exclusion criteria: neurogenic bladder, previous pelvic floor surgery
- 0-4 children (median 2; four nulliparas)

- validated „German pelvic floor questionnaire“
- Visual analogue scale (VAS) for satisfaction with care and with treatment
- Improvement scale for bladder, bowel and sexual function (much better-a little better-no change-a little worse-much worse)

Junginger, Greiner, Baessler 2008

Results

- Follow-up time: median 7 (1-18) months
- Median treatment sessions: 2 (1-6)
- Duration of one session: 15 min - 90 min
- Initial treatment session: 60 min

Results pelvic floor function

- **91%** (50 / 55) improvement of **bladder function**
  - a little better: n=22 / much better: n=28
- Correlation between satisfaction with treatment and subjective improvement - 0.47, P< 0.001
- **67%** (31/ 46) women with **SUI** symptoms cured/improved
- **78%** (36/ 46) women with **OAB** symptoms cured/improved

- No association between length of follow up and treatment success/satisfaction with treatment

- ***Pre-contraction:*** Routinely performed by 71% (39/55 women)
- Women who performed pre-contractions were more likely to report fewer urinary incontinence (p=0.021)