Pelvic floor muscle activity during impact loads in continent and incontinent women: A systematic review

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Purpose

- The aim was to investigate electromyography activity of female pelvic floor muscle (PFM) during impact loads.
- This may help clarify the pathophysiology of stress urinary incontinence (SUI).
- A systematic review (PROSPERO: 2016:CRD42016035624) was conducted to summarise current evidence for PFM activity during impact loads in both continent and incontinent women.

Methods

- Pubmed, EMBASE, Cochrane, and SPORTDiscus databases were systematically searched for literature.
- The PICO approach (Patient, Intervention, Comparison, Outcome) was applied in order to construct the search query.
- Original articles were included that investigated PFM activity during impact loads if they included terms related to muscle activity, measurement methods, test positions, activities performed and continence status.
- Two reviewers screened titles and abstracts independently to ascertain if included papers fulfilled the inclusion criteria and extracted data on outcome parameters.

Table 1 Summary of results concerning measurements methods, test position and activities, EMG activity, timing, comparison within pressure measurements or test activities and reliability of EMG data

Measurements methods	Test position	Test activity	EMG activity	Timing	Relationships PFMs to	Reliability
Vaginal probe Periform Femiscan Stimpon DSE® MAPLe Surface EMG EAS Perineum Needle EMG PFMs side Bulbo-cavernosus Wire EMG Pubo-coccygeus	Supine Crook lying Semi lithotomy Hemi supine Sitting Standing Treadmill Horse sitting	Coughing Running Horse riding Rapid arm move-ments Weight catching	Maximal EMG activity in % Mean EMG activity in % Maximal EMG activity in µVolt Mean EMG activity in µVolt Area under the EMG average curve in µVolts MAD in %MVE	EAS – EIC EAS – bladder pressure EAS – intra-abdominal pressure PFMs – posterior vaginal wall pressure EAS – OI, OE, RA and ES PFMs – heel strike	Bladder pressure Intrarectal pressure Intravesical pressure Cough leek point pressure Intensity of coughing Coughing Recruitment of motor units Pelvis posture Sphincter of urethral wall Wight loading Running speed Pace of horse riding Bladder filling	ICC Intra-session reliability Inter-session reliability Motion artefact

EMG electromyography, *MAD* mean absolute differences, *%MVE* percentage of maximum voluntary electrical activation, *PFMs* pelvic floor muscles, *EAS* external anal sphincter, *EIC* external intercostal muscle, *OE obliquus* externus, *OI obliquus* internus, *RA* rectus abdominis, *ES erector spinae, ICC* intraclass correlations, *DSE*® differential suction electrode, *MAPLe* Multiple Array Probe Leiden

Results

- Twenty-eight studies fulfilled inclusion criteria;
  - 26 cross-sectional studies
  - 1 cohort study
  - 1 literature review
- Different electromyography measurement methods, test activities, test positions and comparisons to other structures were used.
- PFM contracts before other trunk and arm muscles [1,2,3,4].
- During impact loads incontinent showed a delay in PFM activity compared to continent women observed during:
  - coughing [1,2]
  - rapid arm movements [3,4]
- Coughing significantly increased PFM EMG activity [1,2]
- Gradual adaptation of PFM in terms of increasing activity was observed for:
  - the intensity of coughing [5]
  - running speeds [6]
  - pace of horseback riding [7]
- During running, the maximal PFM activity varied from 98.6 to 238.7 %EMG (MVC-normalised); pre-activity (activation before heel strike) varied from 72.1 to 136.9 %EMG [6].
- Posture did not influence timing, but in a neutral pelvis position PFM activity was highest [8].
- Parous SUI women showed asymmetrical and uncoordinated levator ani muscle activation patterns [9] .

Conclusions & Practical implications

- Future research should focus on dynamic PFM activities, due to the fact that continence is also based on reflex activity of the PFM.
- The results suggest that impact activities should furthermore be validated, as we still do not clearly understand how the PFM react during impact loads.
- PFM rehabilitation programs for SUI women should include training control and coordinated abdominal muscle activity.
- Eventually impact loads may be included in a PFM rehabilitation to exercise and activate fast twitch muscle fibres in their involuntary function.

Keywords

MeSH terms: female, pelvis, stress urinary incontinence, cough, electromyography, exercise, sports, locomotion

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