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Surface electromyography and three/four-dimension ultrasound assessment of the pelvic floor in women with severe perineal tear.

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INTRODUCTION

- Pregnancy and vaginal birth are well-known risk factors for pelvic floor muscles (PFM) injuries and pelvic floor dysfunction.
- 3rd and 4th degree perineal tears are less prevalent; prevalence rates vary from 4 to 6%; extend into or through the anal sphincter complex and may be associated with pelvic floor dysfunction.
- To date there is scant knowledge on PFM function after severe perineal tears and normative data.
- In Physiotherapy practice vaginal palpation is commonly used to teach and evaluate PFM strength, but its validity and responsiveness have been questioned.
- We have not found studies comparing assessment of PFM variables by sEMG and 3/4D transperineal ultrasound in women with 3rd and 4th grade perineal tears.

? Test the **association** between measurement with **surface electromyography (sEMG) of the PFM** and transperineal ultrasound of **levator hiatus (LH) dimensions** during maximum voluntary contraction (MVC) of the PFM in women with diagnosed 3rd and 4th degree perineal tears.

METHODS AND MATERIALS

\\ STUDY DESIGN - cross-sectional study conducted in the North Lisbon University Hospital Center.
\\ INCLUSION CRITERIA - primi- and multiparous women who delivered vaginally after 32nd week of gestation, with 3rd and 4th degree perineal tears identified during, and corrected after delivery.
\\ EXCLUSION CRITERIA - previous pelvic surgery, cognitive impairment, severe pain that did not allow insertion of the vaginal sEMG probe and/or neurological disorders.
\\ PROCEDURES - Both evaluations for each participant were conducted on the same day in average 16.7 months after delivery (range 4 -27).

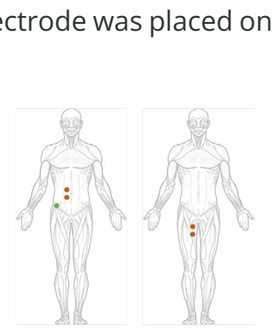
Sociodemographic and obstetric data; ICIQ-UI-SF; anal incontinence symptoms.

Explanation of PFM anatomy and function (images); Individual instruction – how to perform a correct PFM contraction by an experienced physiotherapist.

Vaginal palpation- to assess the ability to perform a correct PFM contraction.

EMG

- Portable EMG biofeedback device - Physioplux Clinical.
- Intravaginal probe- periform.
- Bipolar adhesive electrodes- placed unilaterally on the right rectus abdominal muscle and the right hip adductor muscle + activation of the gluteal muscles was controlled by visual observation → In order to reduce crosstalk and ensure isolated contraction of the PFM.
- Reference electrode was placed on the skin over the right anterior superior iliac spine.

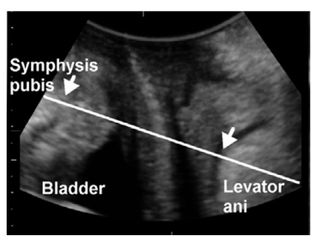


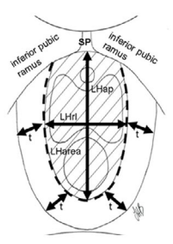
Supine position with hips flexed at 45⁰ and slightly abducted, knees bent at 90⁰, feet resting on the table and arms alongside the body.

"squeeze and lift the probe as strongly as you can"

US

- GE Voluson Expert 8 ultrasound.
- 4-8 MHz curved array volume transducer, acquisition angle of 85º.
- LH dimensions - measured in the plane of minimal hiatal dimensions, defined as the minimal distance between the symphysis pubis and the anterior margin of the central aspect of the puborectalis muscle.





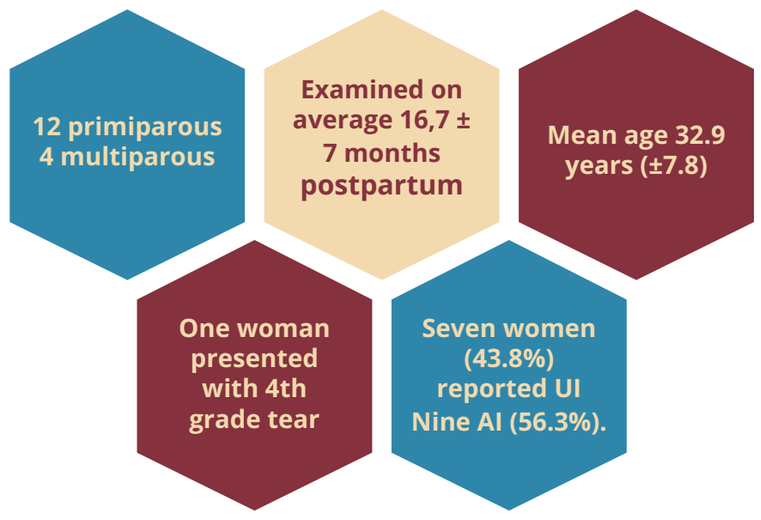
Empty bladder, dorsal lithotomy position.

sEMG - Maximum Voluntary Contraction (MVC) - peak.

US – Levator Hiatus dimensions - area, AP and TR diameters

30 sec rest value
3 MVC – 4 sec
Resting period- 60 sec

RESULTS



MVC of the PFM measured through sEMG resulted in a signal amplitude of 23.3 ± 13.9 µV (peak) (range 4-50).

	Mean (SD)	Minimum	Maximum
LH area (%)	21.47 ± 15.42	-2.07	50.92
LH AP diameter (%)	18.82 ± 11.25	- 4.19	38.96
LH diameter (%)	4.94 ± 11.47	-24.92	22.84

LH – levator hiatus; AP- anteroposterior; TR- transversal

[a] Proportional change (%) = $((LHdimension_{rest} - LHdimension_{MVC}) / LHdimension_{rest}) \times 100$

Proportional change in LH dimensions: AP diameter and LH area greater than TR diameter.

- PFM MVC – LH **area** (r=0,412) - **Good correlation**
- PFM MVC – LH **antero-posterior diameter** (r=0,615) - **Good correlation**
- PFM MVC – LH transverse diameter (r=-0,046) - negative and weak association

DISCUSSION

- The comparison of our findings with other studies **is limited** -- we have not been able to find otherstudies that have assessed the correlation between PFM strength **using sEMG** and LH variables measured by **ultrasonography** in women with severe perineal tear.
- Some authors demonstrated a **stronger correlation between PFM strength measured by manometry and LH AP diameter than LH TR diameter** → support the results of the present study.
- The MVC measured through sEMG in the present study showed **lower values** than those reported by other studies conducted in women with **pelvic floor dysfunctions** (but without 3rd and 4th degree perineal tears) and in **healthy women** + values are lower than those found by Mota et al. on nulliparous and primiparous with **grade II perineal tear** → As there was no comparison with a group of women with no tears or less severe tears in the present study, **our results can only indicate that women with 3rd and 4th degree perineal tear may have lower PFM activation.**
- Proportional change in LH area and AP diameter between rest and contraction were lower than the values found by Majida et al. and Volloyhaug et al. Still, these studies were conducted in **healthy women who may have a stronger PFM contraction.**

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- Test procedures were standardised. A **strict assessment protocol** was used to minimise possible sources of errors and to make this measurement as reliable and reproducible as possible,
- **Anatomy, location and function of PFM** were explained to all participants by an experienced physiotherapist, and we ensured that all women were able to perform a correct and isolated PFM contraction through vaginal palpation and verbal feedback
- Possible **cross-talks** from accessory muscle activation were controlled through sEMG.
- Assessments using the two different methods were performed on the same day, always by the same rater and sEMG and ultrasonography were carried out by a professional physiotherapist and urogynecologist, respectively. The urogynecologist was trained by and followed the protocol of Dietz.

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- Sample size.
- Possible sources of sEMG measurement errors are also a limitation, namely probe and electrodes shape and cross talk → Periform was chosen because it is a pear-shaped probe, less prone to intravaginal movements and motion artifacts than cylindrical-shaped probes. Periform also has shown good stability and reliability in assessment of PFM activation.

CONCLUSIONS

- The results may be important for clinical practice **as sEMG is portable, a widely used tool, requires less experience and with a low cost, therefore being more accessible** and providing data to improve physical therapist's assessment and evaluate the effectiveness of their intervention in preventing and treating pelvic floor dysfunctions resulting from severe perineal tears.
- To our knowledge, this is the **first study** to investigate the correlation between sEMG andultrasonography in women with 3rd and 4th degree perineal tears.
- Most of the published studies carried out with these instruments have included **healthy** women only.
- The present study's results are in line with Mota et al., showing that **perineal tears can influence PFM activation and contribute to pelvic floor dysfunctions in the long term.**
- Since postpartum is a critical moment throughout a women's lifespan, our findings provide **new and normative data** on the assessment of women with severe perineal tears- who are at increased risk of developing pelvic floor dysfunctions, with sEMG showing **good correlation** with ultrasonography.