CLINICAL QUESTION: *What can I accurately and reliably gain from clinical use of surface EMG and what information is appropriate to share with my patient to help them be motivated during our sEMG sessions?*

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Name of Article: Electromyographic assessment of women's pelvic floor: What is the best place for a superficial sensor? Neurology and Urodynamics. 2017;9999:1-7. Moretti, E., Galvao de Moura Filho, A., Correia de Almedia, J., Araujo, C., Lemos, C.

Introduction: Vaginal palpation and sEMG are the best measures we have to quantify the ability to contract the PFM. The 2 types of electrodes for sEMG are intravaginal/intrarectal probe and skin electrodes. There is no current scientific validation for the placement of the surface electrodes for evaluation of the PFM via sEMG.

Aim/Primary Aim: To compare EMG signal of different surface electrodes and to identify the channel that has the highest mean and peak Root Mean Squares (RMS).

Study Design/Study Format: Observational study, October 2014-December 2015 at the Clinical school of Physical Therapy in Brazil.

Definitions:

RMS = Root Mean Squares = a measurement of magnitude for a set of numbers (similar to average but takes positive and negative numbers into consideration).
MF= median frequency = the point at which the EMG power spectrum can be divided into 2 equal parts with equal amounts of power and is a measure of fatigue/endurance.

Methods:

- 3 sets of electrodes were connected concurrently, intravaginally (placed by the volunteer), 3 and 9 on anal clock, and just below the labia majora on both sides (Figure 1).
- Participants performed a 2 minute rest period and then 3 reps of 3 maximal voluntary contractions with 30 sec rest between each. This was repeated on 3 different occasions/days at least 48 hours apart each.

Results: Average data was collected for each woman over the 3 days, (30 women participants). Table 2 shows the statistical analysis.

RMS mean(magnitude): $p = <0.001$ for perianal and LM (statistically signif diff), $p = 0.016$ for LM vs probe (different and $p<0.05$), $p = 0.225$ for perianal vs probe (not statistically different)

Perianal: 35.53 uV
Labia Majora: 17.15 uV
Probe: 31.78 uV

*results indicate agreement between the perianal electrodes and vaginal probe but both recorded significantly higher EMG data magnitudes than the LM placement.

Arithmetic Mean also calculated: did not report these data points clearly in the study but did report stats.

Perianal vs vaginal probe, $p = 0.218$ (agreement)
Labia Majora vs perianal, $p = <0.0001$ (statistically significant difference)
Labia Majora vs Vaginal probe, $p =<0.0002$ (statistically significant difference)

Discussion: The researchers conclude that there was agreement between the intravaginal probe and the 3/9 o'clock perianal electrodes in recording of RMS mean (average magnitude of change) and RMS peak (highest recorded). Skin electrodes may be a useful option in a woman who may not be sexually active or a pediatric patient.

Strengths:

- Researcher A was blind to the placement of electrodes when data was being collected.

- Repeated testing 3 times and repeated testing on multiple days.
- Took an avg of each patient's own net rise each session, so that each patient was her own comparison from baseline.
- Watched the participant closely for activation of facilitatory muscles.

Weaknesses/limitations:
- Per Authors' Discussion:
    - possible crosstalk as a factor in all locations of electrodes interfering with data collection.
    - Mention that many vaginal sensors have design flaws.
    - surface electrodes may not differentiate from other local muscles

My own concerns regarding study limitations:
-not clear *exactly* where skin electrodes were placed.
-single body position of data collection,
-did not test different hold times (10 sec, gold standard in vaginal MMT).
- Did not discuss how they confirmed a correct contraction of the PFM before testing began
-Authors do a very poor job of explaining the Root Mean Squares and Median Frequency in the way it is applicable to clinicians.

Conclusion/Summary: Authors conclude that the intravaginal electrode and perianal 3 and 9 o'clock electrodes demonstrate equivalent data collection in young healthy nulliparous women. However, there is a discussion about median frequency and how lower data points may related to Type 1 slow twitch fibers (seen in the perianale electrodes) vs higher data points may relate to Type 2 fast twitch fibers (see in the vaginal probe data and the labia majora location (table 2, page 5 and paragraph 3 on page 6). The authors go on to say "perianal electrodes may not be representative of the entire pelvic floor."

Clinical Application: Choosing skin electrodes can be considered just as good as intravaginal probe for data collection of sEMG data in the clinic. One should consider clinical supplies available, financial resources, patient preference and likeliness of infection with intravaginal probe to make a decision individual to patients.

List discussion questions:
1. Do you use the skin electrode set up at 3 and 9 as cited in this study? ….or perhaps more like the Gynecological Manual suggests 2/8 o'clock on the anal clock?
2. What do you explain to the patient as a tool for motivating positive change based on your EMG session? (Magnitude of average contraction? Consistency of contractions? Relationship between the PFM and Abs? net rise?)
3. Is it possible that the location of the perianal electrodes and the intravaginal electrodes more accurately measure more of the pelvic diaphragm and that the electrodes inferior-lateral to the labia majora are actually collecting data from different muscle fiber types or different muscles? (More type II close to the EAS, so the peak activations/magnitude of activation may be higher?)
4. Do you always confirm a correct PFM contraction using digital assessment prior to use of sEMG? Why or why not?