Aim/Purpose: First study: to describe PFM function, hip mobility and hip strength profiles and compare measures between women with and without self-reported SUI and second study: to compare gait biomechanics between women with and without self-reported SUI.

Introduction

Strengthening hips has improved power of PFM in nulliparous women and decreases SUI, possibly due to a fascial relationship of Obturator internus and Levator Ani. (Ref 27, 28).

- Hip function didn't improve PFM function, but improved leakage, in another study.
- Hip Abduction weakness has been linked to SUI vs. controls.
- Hip ER testing has only been done seated and some in extension and we don't have enough information - it is conflicting.
- This warrants testing women in with SUI in prone, for hip ER weakness.
- Women with SUI often also report LBP with PFM weakness. SUI often worsens with age and parity (but they did not control for any of these factors)
- According to other studies, primary hip ERs in prone, are: Gluteus Maximus and short hip ("best measured" seated), external rotators: Piriformis, Obturator Internus (OI), Gemelli Superior and Inferior and Quadratus Femoris, assisted by "secondary" rotators of Gluteus Minimus, Obturator Externus, Sartorius and Biceps Femoris, long head (all more active in prone vs seated).
- OI appears to be the first muscle that activates in Abduction/ER, possible as a stabilizer to prime movers of Gluts and Piriformis.

Methods: This study is part of a larger study on PFM, hip function and gait biomechanics in women with SUI (see other outline and article).

Sample of convenience, through university and PT clinics, of adult women, regular menses for past 3 months, who understood/spoke English, with BMI of < 30 kg/m2

Excluded: see article

- On pg, 164, table 3 gives demographics-
- None in non-SUI group were parous and they were 7 years younger
- Unknown: if c-sections
- Unknown: non reported ICIQ scores, except question 6, absence or presence of SUI, which was used to determine SUI or non-SUI groups.

SUI/non-SUI groups were also determined with self report. None had hip or pelvic pain reported.
Researchers collecting measures and data were blinded to groups. All subjects filled out a questionnaire about age, parity, and hx of LBP and severity of SUI sx. Data collection was of PFM measurement checked bilaterally (Tables 1 and 2, pgs 162-3). Hip ROM was measured with a goniometer and Ober test was measured as degrees of ABD above neutral (negative numbers). Joint torques were measured: Hip IR/ER in sitting and prone, Hip Abduction in side lying and strength testing in both (All on Table 5)

**Data analysis:** Continuous variables of PFM function (Table 4) and Hip measures, (Table 5) : using T tests and ANOVA. Catagorical data such as LBP, co-contraction of TrA w/ PFM differences were not ultimately controlled for in the analysis.

**Results:**

**Group Differences:** (Tables 3 and 4, p. 164-6), Hx of LBP and BMI didn’t differ between SUI/non-SUI groups. **Also no significant differences for PFM performance.** No sig. differences for all other measures between groups except (see Table 5, p. 166):

**SUI group vs. non-SUI group, had:**
- Older age, greater parity, more tender points in PFM (Tables 3,4)
- Longer hip external rotators in prone (“greater hip IR angles”) (Table 5).
- **less flexibility per Ober (tighter ITB/TFL) (both LE’s)**
- lower seated hip ER force (both LE’s)
- lower hip Abduction force (both LE’s)

**Discussion:**
- Women with SUI did not have less PFM performance than women without SUI.
- **Unstated in this study:** SUI patients with PFM connective tissue laxity at the bladder neck need stronger PFM to overcome this.
- Women in SUI group had more tender points and although both groups had high tone in both groups, similarly, only 2 in SUI group had low tone.
- **The study found that women with SUI sx, are more likely to have, less flexible ITB, long hip external rotators (“increased internal rotation angles”), (non-dom leg only), and weak hip External rotators and Abductors, bilaterally.**
- **These group differences for strength were large and likely clinically meaningful.**
- **Weaker hip ER in SUI group may be due to less force production of short hip external rotators (O1, piriformis, gemelli sup/inf and quadratus femoris).**

Another study, (Siff et al,: “The Effect of Commonly Performed Exercises on the Levator Hiatus Area and the Length and Strength of Pelvic Floor Muscles in Postpartum Women” (see ref) states “Conclusions: Bird-dog, plank, and leg-lift exercises should be evaluated as alternative exercises to Kegel as they affect PFM strength and length and LH area similarly to Kegel, and leg lifts generate a stronger contraction than Kegel.” Clams showed lower PFM function, and wider LH than “Kegels”. This brings into question what is the mechanism of effect on SUI from hip rotator/abductor strengthening.

- They state the clinical implications of this include:
- **1) WHPTs may want to include thorough hip exam and treatment as standard practice.**
• 2) General ortho patients who present with this pattern of hip impairments (greater IR angles prone and less flexible Ober test, or weakness with hip abduction or seated ER), should be screened for SUI and
• 3) If hip impairments don’t improve as expected, patient should be possibly checked for PFM impairment.

Researchers point out that statistical significance may not be clinically relevant and correctly note that more research is needed. Overall this study is a good starting point.

Results- Hip gait study Women in SUI groups:

Hip Joint Angles:
• Greater Adduction (weak hip abductors), during WA- weight acceptance
• Greater hip IR angles (weak external rotators) during MS- midstance
• Relatively less hip ER hip angles (weaker hip external rotators), during MS, than non-SUI

Muscle Activity: Increased glut max and TFL activity in both limbs
• Maybe to overcome ITB stiffness
• Assist with ER- due to weaker OI
• Overflow to PFM

Most novel finding: SUI group had significantly higher Glut max activity in TS (terminal stance), than non-SUI (~100% higher in Dom limb and ~75% higher in non-dom limb).

Only SUI group had unique between limb differences (read more on your own in the article)

To compare the second study findings with the first:
This (PFM performance, hip mobility and strength w and w/o SUI) article results for SUI group had similar findings:
• greater hip internal rotation angles (ROM) in prone (long external rotators - associated with weakness).
• less flexibility (tighter ITB/TFL) (both LE’s)
• weaker hip ER’s, seated (both LE’s)
• weaker hip Abdutors (both LE’s)

These two articles present information on strength/ROM testing which agree with gait results.
Often overflow techniques for UI include abductor and ER strengthening
We cannot report cause and effect with these papers but decreased hip stability seems to be more prevalent in women with SUI

Siff used pressure and US to test size of the urogential hiatus and vaginal pressure
They found clam (for ER strengthening) exercise increased the size of the urogential hiatus and resulted in significantly less closure during the exercise, than isolated PFM exercise.

Take home - ER strength probably does not strengthen or improve PFM function but may result in decreased UI through improved stability of the hip.

Strengths: Exploratory study gives a comprehensive description and comparisons of hip and PFM findings in women w and w/o SUI.
Limitations  The authors state their limitations on page 168. This was a good study except it was not powered to recognize the effects of age and parity on SUI. Limb dominance not established objectively with push test

Questions for Discussion:

1) Are you currently incorporating into your usual PFM testing/treatment for SUI patients, also non-PFM tests and ex’s (such as hip strengthening or stretching) for SUI patients? If so, which ones? Would you test PFM function and support in individual patients during various exercises, to determine usefulness of a particular exercise (such as clams), for that patient?

2) If not using hip exercises, would you consider that and again, which ones? Does this study seem like a plausible explanation for why some women don’t get better with PFM training? If not, what other factors do you consider?

3) What do you think about their statement that “SUI sx don’t necessarily warrant PFM training”?  

4) What do you think about subpar hip or PFM performance as something that may contribute to or create SUI issues or prolapse in the future with women who are currently asymptomatic?