Fujisaki et al. Influence of adequate pelvic floor muscle contraction on the movement of the coccyx during pelvic floor muscle training, J Phys Ther Sci 2018
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**Why I chose these articles:** I have come to believe that the incidence of coccyx involvement in patients with pelvic floor dysfunction whether it be pain, sexual, bladder, or bowel symptoms is under recognized by physical therapists and medical providers alike. In our profession, when physical therapists are trained to examine the pelvic floor, in most training programs they do not learn how to examine the coccyx until much later in the training. It is not emphasized as a core component of evaluation largely because of the delay in learning rectal PFM exams. As a result, involvement of the sacrococcygeal joint is often missed, particularly by less experienced physical therapist. I wanted to learn more about the evidence surrounding the relationship of the mobility of the SC joint and PFD. This first article looks at exactly that subject.

**Background:** Research indicates that the tip of the coccyx moves ventrally and cranially at the time of PFM contraction. The association between PFM contraction and movement of the coccyx has been reported by a few studies to date including Dynamic MRI studies by Bo 2001 and Grassi in 2007; however, no studies have included the relationship between movement of the coccyx and Modified Oxford grading scale (OS) or “inadequate “muscle substitution patterns. So Fujisaki apparently (but not clearly stated) theorized that women with inadequate power of contraction and women who used substitution patterns during PFM contraction would demonstrate inadequate movement of the coccyx.

**Objective:** To clarify the influence of adequate PFM contraction and other inadequate muscle substitution patterns on the movement of the coccyx during PFMT.

**Methods:** 57 patients with SUI and 6 healthy volunteers were recruited.

- Subjects had CC of SUI, received PFMT instructions and underwent Dynamic MRI
- Specialist nurses or physicians evaluated the participants for Oxford Scale (OS) 0-5 B, and presence/absence of “inadequate muscle substitution patterns” defined as the simultaneous contraction of the gluteus maximus, outer abdominal, erector spinae, femoral, and hip adductor muscles during attempted PFM contraction.
- 6 healthy nurse volunteers were also evaluated, 3 with prior experience as a PFMT instructor, and 3 who did not.
- Participants were assigned to the following two groups: the (1) who we could call “Normal” with-adequate-contraction group (good OS (≥3) and without inadequate muscle substitution patterns and the (2) without-adequate-contraction group (all other participants) who we could call “Impaired”
- On sagittal MRI images, the movement of the tip of the coccyx both at rest and during attempted contraction of the PFM was assessed. See Figure 1 The X-axis is the SCIPP (sacrococcygeal-inferior
pubic point line and the origin is the inferior pubic point. The line perpendicular to the SCIPP line through the inferior pubic point is the Y-axis. The positive direction of the X axis is the dorsal direction. The positive direction of the Y axis is the cranial direction. The tip of the coccyx location is given as an XY coordinate.

Analysis: Continuous variables were presented as medians, because the studied variables were not normally distributed. Fisher's exact test was used to compare the occurrence of inadequate muscle substitution patterns between participants with and without good OS. The Mann-Whitney U test was used to compare the movement of the tip of the coccyx between participants with and without inadequate muscle substitution patterns. A correlation analysis was conducted to investigate the potential association between the movement of the tip of the coccyx and OS. The Mann-Whitney U test and Fisher's exact test were used to identify factors associated with adequate contraction.

Results:

- Movement of coccyx was observed in all participants
- 33 (52.4%) demonstrated inadequate muscle substitution patterns (IAMSP)
- 14 had ≥3/5 OS, 49 did not
- IAMSPs were observed in 1 healthy and 32 pts; significant (p<0.01)
- Among all participants, the rate of joint mobility between the sacrum and the coccyx tip during the attempted PFM contraction and strain on sagittal MRI was 81.0%.
- Remember: The positive direction of the X axis is the dorsal direction. The positive direction of the Y axis is the cranial direction.
- No significant difference was observed in the movement of the tip of the coccyx in the direction of the X-axis (p=0.43) when comparing participants with and without IAMSP
- Median movements of the tip of the coccyx in the direction of the X-axis were as follows: −0.3 (range, −5.75 to 4.75) (without IAMSP) and −1.15 (range, −5.0 to 4.05) (with IAMSP).
- No significant correlation was found between OS and the movement of the tip of the coccyx in the direction of the X-axis (p=0.96, rs=0.01). However, depending on the presence or absence of inadequate muscle substitution patterns, a significant difference was observed in the movements of the tip of the coccyx in the direction of the Y-axis (p<0.01). The median movements of the tip of the coccyx in the direction of the Y-axis were as follows: +1.5 (range, −2.9 to 7.1) (without IASM P group), and −0.1 (range, −6.8 to 4.7) (with IASMP).
- Furthermore, a significant correlation was detected between OS and the movement of the tip of the coccyx in the direction of the Y axis (p<0.01, rs=0.42).
- Subsequently, the with-adequate-contraction and without-adequate-contraction groups were compared. There was no significant difference in age, height, BMI, parity, joint mobility between the sacrum and the coccyx tip, and movement of the tip of the coccyx in the direction of the X-axis. However, there was a significant difference in the movement of the tip of the coccyx in the direction of the Y-axis. The tip of the coccyx shifted more toward the positive direction (i.e., the cranial side) in the with-adequate-contraction group than in the without-adequate-contraction group.
- There was no report on strain measurements
Conclusions:

- This is the first study to demonstrate the movement of coccyx in relation to OS (Power), inadequate muscle substitution patterns, and adequate PFM contraction.
- The movement of the tip of the coccyx in the without-adequate-contraction group shifted to the Y-axis (i.e., toward the caudal side) compared with that in the with-adequate-contraction group.
- The movement of the tip of the coccyx in the with-adequate-contraction group shifted more cranial side (i.e., the positive direction on the Y-axis in this study) compared to that in the without-adequate-contraction group. p statistically significant.
- So, when teaching patients with SUI unable to contract the PFM appropriately, we may be able to assist them in producing an appropriate contraction of the PFM without inadequate muscle substitution patterns by providing them with a verbal cue such as contract “in such a way as to make the tip of the coccyx move toward the cranial side or by touching the tip of the coccyx (as shown in Stensgaards 2014 study).
- Joint mobility between the sacrum and the coccyx tip during PFM contraction and/or strain was examined on sagittal MRI, and demonstrated that 19.0% of the joints did not ACTIVELY move. (confusing because as stated on 545 in Results, “movement of the coccyx was observed in all participants) This suggests that the movement of the coccyx tip is not only affected by joint mobility observed on sagittal MRI, but is also associated with the sacral nutation that may induce the coccyx tip shift regardless of the movement of these joints. ... SO my interpretation is that the IAMSPs may negate the actual active movement of the SC joint itself.
- Authors comment that PF PT is not covered by insurance in Japan, so this may be a good way to tech women “an easy way to confirm an adequate PFM contraction for the patients themselves.”, avg cost of PFM ex = $45 which is higher than other medical rx.

Questions for Discussion:

1. Why do you think mobility of the coccyx is important in PFM function?
2. Do you screen for dysfunction and/or assess SC joint mobility in your PFM patients?
3. How do you compare IAMSPs to incoordination of the PFM (i.e. Slow incomplete relaxation)