Is there a relationship between the strength of the hip external rotators and the severity of pelvic floor muscle activation and bladder dysfunction?

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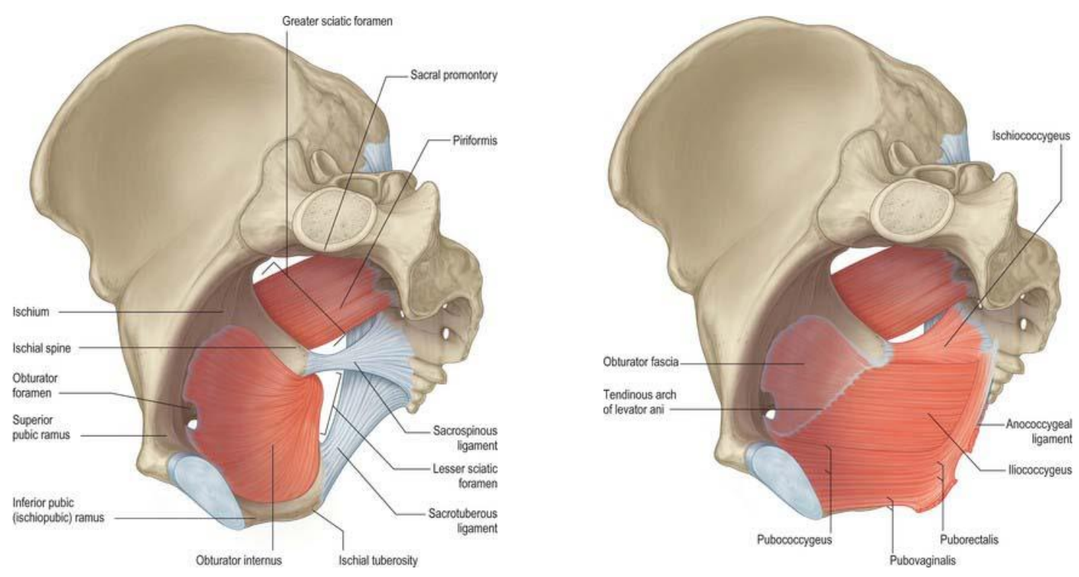
Hypothesis / aims of study

The pelvic floor muscles, including the pubovisceral, puborectalis, and iliococcygeus, have their origins in the pubis and the tendinous arch of the levator ani. They insert on various points such as the perineal body, vaginal wall, between the internal and external anal sphincters, posterior to the rectum, and into the iliococcygeal raphe. Working collectively, these muscles aid in the support of internal organs and contribute to maintaining posture as well as urinary and fecal continence.

It is found in the literature that other anatomical structures such as connective tissue, fascia, and surrounding synergistic muscles can make significant contributions to normal pelvic floor function. In particular, the obturator internus (OI), which is the external rotator muscle that originates from the ischiopubic ramus of the pelvis and the obturator membrane and attaches to the medial aspect of the greater trochanter of the femur, supports synergistic work by making a fascial connection with the pelvic floor muscles (Figure 1). This link has been proven in studies conducted in the adult female population (1, 2).

Our hypothesis was to examine the effect of global hip external rotators (ER) muscle strength on pelvic floor muscle activation and the severity of bladder and bowel dysfunction (BBD) since isolated measurement of the OI muscle is not possible.

Figure 1. Obturator Internus Muscle



(Adapted from Drake, Vogl and Mitchell 2005.)

Study design, materials and methods

This is a prospective, cross-sectional study conducted on children aged 5-12 years who were diagnosed with BBD by a pediatric urologist in 2022 and 2023. Before starting the study, ethics committee approval was obtained, and clinical trial registration was completed (NCT05182671).

Electromyography (EMG) is a well-established noninvasive, and practical method to measure relative pelvic floor muscle (PFM) activity. Before the EMG measurement, participants were asked to empty their bladders so that no residual urine remained, and then they were taught to isolate and relax their PFM. Superficial electrodes were attached to the external anal sphincter and PFM activity was measured with the NeuroTrac Myoplus4 Pro device. It recorded PTK work average (μv) and work average deviation (%) parameters.

The dysfunctional voiding and incontinence scoring system (DVSS) was used to determine the severity of the complaints.

Functional bladder capacity volume (%) was obtained from uroflowmetry data, while daily voiding frequency (times/day) was collected from bladder diary data.

To measure hip ER muscle strength, the participant was positioned in a seated position on the examination table with the hips and knees flexed to 90 degrees. To evaluate the ER, the hip was positioned in slight lateral rotation with the medial malleolus aligned with the midline of the body. In this position, the subject performed a maximum isometric contraction of the hip ER with resistance to movement applied just superior to the medial malleolus (3).

All data were analyzed with the SPSS software program (IBM, SPSS version 25, Chicago, IL, USA). Correlation analysis was done with the Pearson test.

Results and interpretation

50 children (female = 27, male = 23) with a mean age of 9.12 ± 2.67 years and a BMI of 18.18 ± 4.03 kg/m^2 were included in the study (Table 1).

Hip ER muscle strength (dominant and non-dominant side) shows a weak and significant negative correlation with work average deviation (%) ($r_{nondominant}$= -0.28, $r_{dominant}$= -0.34 and daily voiding frequency in the bladder diary ($r_{nondominant}$= -0.30) ($p<0.05$) (Table 2). In addition, hip ER muscle strength (dominant and non-dominant side) did not show a significant relationship with the DVSS score and the EMG parameters work average (μv) and functional bladder capacity (%) of the participants ($P>0.05$) (Table 2).

The increase in hip ER muscle strength of the participants was inversely correlated with the activation deviation used to interpret the endurance of PTK, indicating that hip ER may be important in maintaining PTK endurance and stability. The increase in force in ER reduces the deviation percentage value, which means that the muscle is more stable and there is less deviation from the constant microvolt value. In addition, it may be thought that the increase in strength in the hip ER muscles may increase the contact ability of the PTK, causing a decrease in daily urination frequency.

Table 1. Demographic and clinical characteristics of the patients

Variables	Total Mean± SD (n=50)
Age (y)	9.12±2.67
BMI (kg/m^2)	18.18±4.03

SD: standard deviation, BMI: body mass index, P: independent sample t-test

Table 2. Correlation analysis

Variables		r	p value
Hip ER Strength (nondominant)	daily voiding frequency (times/day)	**-0.30**	**.033**
	Work average deviation (%)	**-0.28**	**.044**
	DVSS (score)	0.10	.455
	Work avarage (μv)	-0.03	.842
	Functional bladder capacity (%)	0.02	.870
Hip ER Strength (dominant)	daily voiding frequency (times/day)	-0.13	.354
	Work average deviation (%)	**-0.34**	**.015**
	DVSS (score)	0.12	.413
	Work avarage (μv)	-0.05	.738
	Functional bladder capacity (%)	0.21	.138

ER: external rotators, DVSS: dysfunctional voiding and incontinence scoring system, p: Pearson correlation

Conclusions

More studies are needed to investigate the effect of hip ER muscle weakness on the severity of symptoms and PTC activation in children with pelvic floor dysfunction in different age groups.

References

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