

The Effect of a Combined Pelvic Floor Muscle Training and Gross Motor Strengthening Program on Urinary Incontinence in School-Aged Children With Typical Development: A Descriptive Retrospective Case Series

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ABSTRACT

Introduction/Background: Daytime incontinence (DI) in a school-aged child with typical development has a substantial impact on the affected family and child's quality of life. The purpose of this descriptive retrospective case series is to add to the existing knowledge of nonpharmacological treatments for dysfunctional voiding (DV) in the pediatric population.

Case Description: Participants included 4 children (median age of 8.9 ± 1.7 years) with typical development who presented to physical therapy (PT) with symptoms of DI. All participants had been successfully toilet-trained during the day for more than 2 years prior to onset of DI. All participants completed a comprehensive rehabilitation program with varying symptom severity at the start of therapy. The case series includes participants with co-occurring disorders including attention-deficit hyperactivity disorder (ADHD), anxiety, and combination ADHD and encopresis. Each child was evaluated for the frequency of DI and the parent completed a urinary symptom questionnaire pre-treatment and at a 1- to 2-year follow-up (median time to follow-up: 1 year, 4 months). The frequency of DI was also recorded at the last PT treatment.

Outcomes: At the time of discharge, all 4 participants had resolution of DI. At the 1- to 2-year follow-up, 3 of 4 participants continued to report no DI. Participant 1 reported a return of daytime leakage of 3 times/month. All 4 participants reported improvements in perceived severity of their problem.

Discussion: This retrospective case series suggests that a comprehensive PT program can positively influence a reduction in DI episodes, straining with bowel movements, and perceived severity of the child's DV condition in 4 children with differing co-morbidities.

Informed Consent: This study was approved by the local institutional review board. A parent(s) (ie, legal guardians) and participants provided consent and assent, respectively.

Key Words: pediatric dysfunctional voiding, pediatric physical therapy

INTRODUCTION

Pelvic floor dysfunction with daytime incontinence (DI) limits full engagement and participation of school-aged children. While these children often have a history of being fully toilet trained, pelvic floor dysfunction can occur. Although the prevalence is unknown, one population study reported up to 16.9% of school-aged children experience daytime urinary incontinence ranging from very mild to severe.¹

In children without pelvic floor dysfunction, voiding occurs when there is an absence of a pelvic floor muscle (PFM) contraction with detrusor contraction. This allows for children to fully empty and manage their bladder during voiding without abnormal urinary retention. Commonly pediatric DI is secondary

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to urinary holding and other learned behaviors leading to incomplete PFM relaxation resulting in an additional diagnosis of “dysfunctional voiding” (DV). Dysfunctional voiding is generally evaluated using uroflowmetry measurements that quantify the external urethral sphincter function and is reflected in a staccato curve that is continuous with peaks and troughs.² If a staccato curve is seen on urine uroflowmetry measurements, there is an incoordination between the bladder and external urethral sphincter,² indicating PFM training may be warranted. However, diagnosing DV with uroflow pattern alone can be deceptive. A comprehensive approach to diagnosis often includes verifying the uroflow pattern with use of simultaneous pelvic floor electromyography.³ External urethral sphincter dysfunction manifests in voiding difficulties and compensatory holding patterns in attempts to prevent urinary leakage or postpone voiding. Holding patterns include crossing legs, sitting on the heel, and holding genitalia.²

Daytime incontinence in school-aged children with typical development is not without consequence. It can lead to a reported 2-fold increase in psychological problems including attention problems, oppositional behavior, and conduct problems when compared with children with no DI.⁴ Additionally, the problem impacts the entire family’s quality of life, as children experiencing DI may limit themselves from social outings with peers, require multiple clothing changes throughout their day, and manage constant hygienic problems.⁵ Current interventions in the management of lower urinary tract symptoms in children consist of a conservative medical program including urotherapy and biofeedback therapy if necessary; however, the most effective treatment for DV is unknown.^{6–8}

Minimal research exists on pediatric pelvic floor training in conjunction with physical therapy (PT), including respiratory training and gross motor strength training, for patients with DV. Prior real-time dynamic magnetic resonance imaging work suggests that coordinated use of the PFM and diaphragm occurs during respiration including quiet breathing and with forceful expiration.⁹ To date, the majority of research investigates the diaphragm and PFM activation patterns and PFM use in healthy adult women, creating a gap in the literature to guide intervention for pediatric DV.^{9,10}

The purpose of this descriptive retrospective case series is to examine the treatment outcomes at 1- to 2 years (median time to follow-up: 1 year, 4 months) in 4 children with DV and to add to the existing knowledge of nonpharmacological treatments for DV in the pediatric population. The PT interventions described in this case series include a combination of (1) education, (2) respiratory and PFM neuromuscular training (ie, biofeedback), (3) gross motor strength training, and (4) home exercise programming.

CASE DESCRIPTION

Procedure

Following IRB approval, participants who completed their PT treatment for DV 1 to 2 years prior were invited to participate. Consent and assent were obtained from caregivers and participants prior to collecting data. Baseline data were collected for each participant including demographic data, initial Pediatric Health History and Screening Questionnaire (PHHSQ), and documented bladder and bowel symptoms prior to participation in PT.¹¹ The PHHSQ provides information on bowel/bladder symptoms and severity and the results reflect the perception of both the patient and caregiver on the severity of condition. The PHHSQ is available through the copyright of Herman & Wallace Pelvic Rehabilitation Institute (<https://hermanwallace.com>). Data were collected for each questionnaire item, and changes from the initial questionnaire (pretherapy) to the follow-up questionnaire (median time to follow-up: 1 year, 4 months posttherapy) were compared for each participant. The principal investigator recorded frequency of DI at 3 time points: pretherapy, immediately following the therapy program, and 1 to 2 years posttherapy.

Additional clinical measurements and observations were incorporated into PT evaluation and treatment sessions including PFM resting tone, respiratory breathing patterns (eg, chest rise or lateral ribcage excursion), and gross motor skills (eg, ability to squat with lower extremity alignment). To assess and train the PFM, the physical therapist utilized The Prometheus Group Pathway MR20 Series EMG system (Dover, New Hampshire) with Synergy 3-Dimensional software to provide a visual connection to the PFM. Typical electrode placement included 2 active surface electrodes, which were placed on the right and left perianal musculature around the anal orifice, with a reference electrode on the gluteus maximus.¹²

Participants

This case series includes 4 children between the ages of 6 and 10 years who experienced previous daytime continence for 2 years or more prior to the onset of DI. We describe baseline clinical characteristics including urinary symptoms reported on the PHHSQ (Table 1) and additional PT objective measures (Table 2).

Participant 1

Participant 1 was a 9-year-old girl who achieved urinary continence as developmentally expected, however started to experience urinary incontinence at age 4. The participant was diagnosed with recurrent afebrile urinary tract infections (UTIs) occurring once per month. Prior interventions included standard

Table 1. Subjective Urinary Symptoms and Severity Summary^a

Participant	Caregiver Ratings and Descriptive Reports										Child Rating	
	Frequency of Urinary Leakage (# of Episodes)		Severity of Leakage		Bladder Control Medications		"My Child's bladder is controlling his/her life."		Severity of This Problem		Pretherapy	Posttherapy
	Pretherapy	Posttherapy	Pretherapy	Posttherapy	Pretherapy	Posttherapy	Pretherapy	Posttherapy	Pretherapy	Posttherapy		
1	3-6 episodes per day	3 episodes per month	Wets outer clothing every time	Mostly wets underwear; occasionally wets outer clothing	Oxybutynin	None	7	3	7	2	7	2
2	1 episode per week	No Leakage	Wets outer clothing	No leakage	None	None	7	1	7	2	7	2
3	3-4 episodes per week	No Leakage	Few drops	No leakage	None	None	5-6	3	Child had no response	2	Child had no response	2
4	1 episode per month	No Leakage	Wets underwear	No leakage	Oxybutynin	None	1	0	7	0	7	0

^aDescriptive symptoms were measured before the initiation of therapy and 1 to 2 years posttherapy (median time to follow-up: 1 year, 4 months). Child and caregiver ratings are based on a 0- to 10-point scale, where 0 indicates not a problem and 10 indicates a major problem. Symptom report and caregiver and child ratings are quantified using the Pediatric Health History Symptoms Questionnaire.

urotherapy and PT with no reported improvement. The participant had a history of incomplete bladder emptying and detrusor overactivity demonstrated on urodynamic study with a significant postvoid residual. At the time of PT evaluation, the participant was taking an anticholinergic medication for overactive bladder and a prophylactic antibiotic to reduce UTI risk.

The caregiver completed the PHHSQ with responses indicating that the participant had stopped or been unable to do certain activities because of her condition. For example, peers were aware of accidents and refused to be partnered with her for classroom activities. The caregiver reported that the participant had urinary leakage and a strong urge to urinate during daily activities. The participant had a range of 3 to 6 episodes of DI per day resulting in the need to change clothing despite wearing incontinence pads.

Participant 2

Participant 2 was a 10-year-old boy diagnosed with recurrent UTIs for the prior 2 years and hematuria. The medical work-up revealed a forceful stream, yet the child reported he did not feel like he emptied his bladder fully. The participant had a diagnosis of attention-deficit hyperactivity disorder (ADHD) that was being treated with medication at the start of PT. The caregiver completed the PHHSQ with responses indicating that the participant had urinary leakage while watching television or video games, with a strong urge to go, and nighttime sleep wetting. The caregiver reported approximately 4 episodes of DI per month resulting in wetting of the clothing.

Participant 3

Participant 3 was a 6.5-year-old girl who was diagnosed with anxiety specific to toileting. The parent reported that her daughter stated her bladder did not fully empty during voiding. Co-occurring conditions included a history of constipation, allergies (ie, mold, seasonal allergies), and asthma. The participant worked with a child psychologist prior to starting PT. At the time of PT evaluation, the parent reported all anxieties had resolved except for with toileting. The parent reported that the child displayed frequent attempts to urinate and the child had great concern about accidents, even though accidents rarely occurred. The caregiver completed the PHHSQ and identified anxiety with toileting. The caregiver reported that the child was observed to have a strong urge to go and nighttime sleep wetting with approximately 3 to 4 episodes of DI per week that resulted in a few drops.

Participant 4

Participant 4 was a 10-year-old boy with urinary symptoms of incontinence, urgency, and frequency,

Table 2. Physical Therapy Objective Measures in a Case Series of Children With Pelvic Floor Dysfunction^a

Participant	BM Frequency and Description		PFM Resting Tone and Coordination		Baseline Respiration Patterns		Gross Motor Skills: Squat	
	Pretherapy	Posttherapy	Pretherapy	Posttherapy	Inhalation	Exhalation	Pretherapy	Posttherapy
1	1 BM per day normal; strain with BM once in a while	1 BM per day normal; no longer strains with BM	5.0-7.0 μ V gravity-eliminated Impaired coordination	<3 μ V gravity-resisted Intact coordination	Upper chest rise with shallow inhalation	Short exhale	Sustains knee together with medial progression and knees straight	Neutral knee alignment sustains against light resistance
2	1 BM per day normal or hard; strains with BM	2 BM per day normal; no longer strains with BM	5.0 μ V gravity-eliminated Impaired coordination	1 μ V gravity-resisted Intact coordination	Upper chest rise with shoulder hiking	No data collected	Knees collapse toward midline but do not touch	Neutral knee alignment, no resistance; inconsistently holds squat 60 s
3	4 BM per day; strains, but not always	2 BM per day normal; very rare if strains with BM	5.0-7.0 μ V gravity-eliminated Impaired coordination	3.0-5.0 μ V gravity-resisted Intact coordination	Upper chest rise with upper trapezius compensation	Short strong 1-2 s exhale	Sustains knees together with medial progression with attempt to sustain a squat position	Neutral knee alignment, no resistance, 30 s \times 2 repetitions
4	2 BM per week loose to normal; Bowel leakage: 1 episode per month with small amount in underwear	1 BM per day normal; no straining with BM	10-15 μ V gravity-eliminated Impaired coordination	<2 μ V gravity-resisted Intact coordination	Shoulders rise upward with compensatory activation of upper trapezius and scalenes	Short exhale	Sustains knees together	Neutral knee alignment with deep squat, no resistance; continue to address through home exercise program

Abbreviations: BM, bowel movement; PFM, pelvic floor muscles.

^aEach parent and participant were asked to indicate the frequency and describe the participant's bowel movements before and after intervention as a part of the evaluation process. All items related to BM are quantified using the PHSQ (Pediatric Health History Symptoms Questionnaire). PFM was assessed with sEMG. Gross motor skills are reported based on clinical observation.

combined with constipation with encopresis. The participant received medical treatment for urinary incontinence for 4 years prior to PT evaluation. Medical record review revealed that the child had incomplete bladder emptying with significant postvoid residual urine as evidenced by clinical ultrasound. Medical management included anticholinergic medication, timed voiding, and stool softener (ie, Miralax). The participant previously tried PT without successful results. The participant was diagnosed with learning disabilities and ADHD that was treated pharmacologically. The caregiver completed the PHHSQ reporting that the child experienced bladder leakage in multiple daily activities including when playing, watching television or video games, and sleeping. Additionally, the child reported a strong urge to urinate. The caregiver reported approximately 1 episode of DI per month that resulted in the wetting of underwear.

Similarities in Clinical Presentation

Clinically, all participants at initial evaluation presented with similarities in elevated PFM resting tone, gross motor deficits, and accessory breathing patterns.

PFM Assessment

To date there are no definitive norms for PFM resting tone. Specialists within the field of pelvic health utilize a value of less than 2 μ V to be considered within normal limits.¹³ All participants presented with a PFM resting tone of greater than 5 μ V when positioned in supine hook-lying, a gravity-eliminated position. All participants were unable to demonstrate a coordinated PFM contraction/relaxation with verbal commands.

Gross Motor Deficits

During a general gross motor assessment, participants were asked to retrieve an object from the floor with no specific instructions or cues. All 4 participants utilized compensatory strategies including collapsing knees to midline (Figure) and/or locking knees into extension with flexion through spine to retrieve the objects. None of the participants was able to perform or sustain a squat with lower extremities in a neutral (knee over foot) position.

Accessory Breathing Patterns

Each participant primarily utilized an upper chest accessory muscular breathing pattern demonstrated with a chest rise and shoulder hiking compensation on inhalation, resulting in a shallow breath and short exhale. PT outcome measurements for each participant are reported in Table 2.

Intervention

Each of the 4 patients participated in a multifaceted treatment consisting of respiratory, PFM, and gross



Figure. Collapsing knees to midline with reaching for the floor.

motor training administered by the same physical therapist. Visit frequency and duration were determined collaboratively with the participant and family to optimize interventions while minimizing the burden to the family. At each therapy treatment, there were 4 components to structuring the treatment session including (1) Education, (2) respiratory and PFM neuromuscular training utilizing biofeedback, (3) gross motor strength training exercises, and (4) review/progression of the home exercise program. Resolution of DI was the metric used to discharge a patient from PT care.

Education

The first component of treatment, education, was based on the participant and the caregiver's level of understanding of their child's condition of DI.¹⁴ Education focused on standard urotherapy concepts including anatomy, bladder health and dietary irritants, voiding posture, voiding schedule, and strategies to avoid constipation.¹⁴ Instruction on optimal voiding posture included a position with legs abducted and feet on a stool increasing hip flexion, straightening the rectoanal canal, to decrease straining during defecation.¹⁵

Respiratory and Pelvic Floor Muscle Neuromuscular Training

The second component of intervention included respiratory and PFM neuromuscular training. A series of

PFM relaxation exercises utilizing respiratory training and PFM coordination exercises were taught to participants at each PT session.¹⁶ The therapist utilized respiratory training in diaphragmatic breathing for abdominal musculature relaxation to decrease the PFM resting tone prior to PFM coordination training at each session.¹⁷ The therapist provided individual tactile and verbal cues for postural control and lateral ribcage excursion on inhalation to achieve diaphragmatic breathing.

Pelvic floor muscle coordination training was performed using biofeedback on a laptop computer. The therapist cued the participant on breathing with an inhalation including a lateral ribcage excursion followed by an exhalation. Exhalation was paired with a brief volitional PFM contraction of approximately 2 seconds and then a resting period of 4 seconds.

Respiratory and PFM coordination training exercises were performed in conjunction with biofeedback. Participants performed exercises in varying gravity-eliminated to gravity-resisted positions including supine hook-lying, sitting (criss-cross to short sit), and were progressed to standing. Exercises were repeated during sessions and incorporated into the home program until a PFM resting tone reduction was achieved in each position demonstrated on electromyography equipment. During the exercises, the child was instructed to focus on the computer screen where an animation would provide feedback that correlated with the child's PFM activity. Dosing (repetitions/sets) of exercises was based on the child's ability to attend to the training consistent with standard clinical practices. Instructions were based on the individual child's needs and therapist's clinical expertise.

Gross Motor Strength Training Exercises

The third part of the intervention program utilized individually tailored lower extremity and trunk stability training and strengthening exercises to address specific weaknesses observed during the evaluation. Sessions included training in low-demand functional tasks such as squatting, lunges, and side-stepping. During low-demand functional tasks, the participants were coached on trunk alignment to sustain their ribcage over their pelvis to maximize recruitment of the trunk and spine stabilizers (ie, diaphragm, abdominal and obliques, paraspinal and gluteal muscles, and pelvic floor and hip muscles).¹⁸ Exercise repetition and duration were based on the child's baseline strength and exercise completion without compensations.

Review/Progression of Home Exercise Program

The fourth component of the intervention was developing a daily home exercise program (HEP) that included exercises for home practice between PT sessions. Each HEP included respiratory/PFM training

exercise along with a gross motor strengthening and endurance exercise(s) focusing on 2 to 3 exercises total.

All 4 participants completed 25 to 30 minutes of each therapeutic exercise and PFM neuromuscular training at the beginning of therapy after the initial evaluation. Therapeutic exercise included time for instruction in HEP. Variations in clinical treatment sessions were observed in the clinical environment (eg, participant was late for a session, differences in anxiety in response to treatment). Participants were discharged from PT when either the parent and/or participant verbally reported no longer having DI. No additional PT treatments were provided for pelvic floor dysfunction between the time of last PT appointment and 1- to 2-year follow-up.

Outcomes

All 4 participants successfully completed the respiratory, PFM, and gross motor training program and had full resolution (no urinary leakage during waking hours) of DI as indicated by subjective reports at the time of discharge from the therapy program. We describe changes reported in urinary symptoms on the PHHSQ (Table 1) and additional PT objective measures (Table 2).

Participant 1

Participant 1 completed 8 therapy treatments during a 5-month period. During PT, Participant 1 decreased PFM resting tone to less than 3 μ V in a gravity-resisted position and was able to coordinate PFM contraction followed by relaxation. Participant 1 progressed gross motor strength to being able to sustain a squat with neutral lower extremity alignment against light Theraband resistance. At visit 5 of the therapy program, participant 1 expressed difficulty with adherence to home exercise. To increase compliance, a reward contract was written and signed by the participant, therapist, and caregiver.

1- to 2-Year Follow-up

The caregiver and the participant completed the PHHSQ at 1 year, 5 months following the last PT visit, and results suggested that the child had no limitations, because of urinary leakage with full engagement in peer activities. The caregiver and the participant reported that the participant had DI when playing and nighttime sleep wetting. Additionally, the child reported a strong urge to urinate. The caregiver reported the participant only had 3 episodes of DI a month, with the severity of wetting underwear and outer clothing. The participant no longer wore any protection from leakage. Additionally, the participant averaged 1 bowel movement per day of normal consistency that did not require straining to produce. The

participant was no longer taking any medications for overactive bladder.

Participant 2

Participant 2 completed 9 PT treatments during a 4-month period. At therapy visit 3, the participant was diagnosed with a UTI that was treated with an antibiotic. He returned to therapy the next week with a cast on his arm due to a fracture incurred from play activities unrelated to PT intervention. Clinical modifications to the exercise program were made to accommodate his arm restrictions. At the time of discharge from PT, participant 2 displayed decreased PFM resting tone to less than 1.0 μV in a gravity-resisted position and was able to coordinate PFM contraction followed by relaxation. Participant 2 progressed gross motor strength to being able to sustain a squat with neutral lower extremity alignment. At the last PT visit, participant 2 continued to present with weakness in trunk stabilizers along with moderate scapular winging.

1- to 2-Year Follow-up

The caregiver and the participant completed the PHHSQ at 1 year, 3 months following the last PT visit, and reported that the child no longer experienced urinary leakage allowing for full engagement in peer activities with no limitations. The caregiver reported that the participant had 2 bowel movements per day of normal consistency that did not require straining to produce. The participant was taking over-the-counter medications including fiber, probiotic, and multivitamins.

Participant 3

Participant 3 completed 6 therapy treatments during a 2-month period. During the first month of treatment, the participant performed diaphragmatic breathing exercises at an increased frequency of 3 times a day for physiological relaxation. The participant verbalized increased anxieties with toileting. By the sixth therapy visit, we observed clinically meaningful changes within the session by measuring PFM resting tone. The participant displayed a PFM resting tone of 3.0 to 5.0 μV in a gravity-resisted position at the start of the session, completed respiratory and PFM coordination training, and then displayed a decrease in PFM tone to less than 2 μV following the intervention. The participant progressed gross motor strength to be able to sustain a squat with neutral lower extremity alignment for 30 seconds for 2 repetitions. The participant reported improvements in urinary urgency by 90%. At 5 months after PT completion, the caregiver reported that the participant had no day- or nighttime urinary incontinence.

1 to 2-Year Follow-up

The caregiver and the participant completed the PHHSQ at 1 year, 2 months following the last PT visit, and reported the child no longer experienced urinary leakage. The caregiver indicated that the participant had 2 bowel movements per day of normal consistency and very rarely strained with bowel movements. The participant's caregiver reported the child is currently taking over-the-counter probiotics.

Participant 4

Participant 4 completed 11 therapy treatments during a 4-month period. The participant was provided with verbal and visual cues to reinforce learning and accurate completion of therapy exercises. An incentive program was outlined to motivate the participant to sit on the toilet for longer duration to allow for full bladder emptying and to allow for bowel movement if needed. By visit 9, the parent reported the child no longer had fecal stains in his underwear. Oxybutynin medication, taken for overactive bladder, was decreased and eventually discontinued prior to the 11th visit that was scheduled approximately 1 month after his 10th visit. By the 11th visit, the participant's PFM resting tone decreased to less than 2 μV in gravity-resisted position and the participant was able to perform a deep squat with neutral lower extremity alignment. The PT recommended that the participant continue to address gross motor strength through participation in a continued HEP.

1 to 2-Year Follow-up

The caregiver and the participant completed the PHHSQ at 1 year, 7 months following the last PT visit, reporting the child no longer experienced urinary leakage allowing for full engagement in peer activities with no limitations. The caregiver indicated that the participant had 1 bowel movement per day of normal consistency, which did not require straining to produce. The participant was no longer taking any medications for overactive bladder.

DISCUSSION

This descriptive retrospective case series demonstrates how education, respiratory and PFM neuromuscular training, in combination with gross motor training, can improve the severity of urinary symptoms in a study of 4 children. In addition, each participant's improvements were quantified using a parent-completed questionnaire and report by the participant, implying the intervention had a positive impact on their quality of life.

In all 4 cases, improvements in bowel and bladder symptoms were achieved immediately following treatment and maintained at 1- to 2-year (median

time to follow-up: 1 year, 4 months) follow-up. Each participant reported resolution of DI at discharge from PT plan of care and decreased perceived severity and limitations presented by their condition. At a 1- to 2-year follow-up, only 1 participant had a return of DI occurring at a frequency of 3 episodes a month. Although undesirable, this frequency of DI is improved as compared with prior to PT when the participant experienced an average frequency of 4.5 episodes per day, as reported by the caregiver. This participant had also presented with the most severe urinary symptoms at the start of therapy. In addition to improvements in DI, all 4 participants had reported improvements in bowel movements. In 2 cases, oxybutynin was being administered daily for overactive bladder prior to therapy. A pediatric urologist discontinued this medication for overactive bladder either during or after the PT program. The duration of therapy treatments ranged from 2 to 5 months, with an average treatment frequency of 8.5 ± 2 sessions based on response to treatment.

We observed that each child presented with gross motor strength deficits at the start of therapy. A study examining PFM exercises on the treatment of functional constipation involved having participants walk in a semi-sitting (squatting) position twice a day for 8 weeks. After 8 weeks, 90% of participants reported subjective improvements in symptoms including stool frequency and consistency.¹⁹ Even though stool frequency and consistency were not the primary focus of this descriptive case series, bladder and bowel dysfunction manifested by constipation has been linked to lower urinary tract symptoms such as DI and DV.²⁰ Through individualized gross motor training exercises, each participant made improvements in lower extremity strength as evidenced by the ability to squat with neutral lower extremity alignment (eg, knees in line with feet). The consideration of gross motor strength in this population needs further investigation.

The 4-part session structure (ie, education, respiratory and PFM neuromuscular training, gross motor training, and HEP) utilized in these case examples differs from other approaches, as it combines respiratory and PFM training with gross motor strength training. In a recent systematic review of urotherapy in the treatment of children and adolescents, “standard urotherapy” that includes PFM training, occurred in only 3 of the 14 studies included in the review. The remaining studies in the systematic review included clinical trials and 1 quasiexperimental study where the investigations included a variety of techniques such as PFM training and animated biofeedback among others.²¹ Another study included other forms of strengthening such as combining PFM exercises with a Swiss ball in their experimental group.²² In our experience,

2 participants had trialed previous PT with a primary focus on PFM training only resulting in little relief, per medical record and caregiver report. These are examples of how variability exists in the components necessary for intervention for children with bladder and bowel dysfunction.²¹ The treatment components to effective intervention warrant further investigation.

Strengths and Limitations

This case series provides evidence supporting the feasibility and acceptability of a novel approach to PT intervention in urinary incontinence in children. The findings are limited by study design, clinical feasibility, and sample size. The treatment strategy presented in this descriptive case series warrants further investigation in a larger sample and with a standardized protocol using a randomized controlled clinical trial to determine the specific effect of treatment on outcomes. Variability in the capacity to attend to task, follow instructions, and maturation added to inconsistency in treatment frequency/duration. Future studies with a clinical protocol could assist in standardizing treatment approaches and dosing. We did not include a validated questionnaire such as the Dysfunctional Voiding Symptom Score and the Pediatric Incontinence Questionnaire. A future study could add a caregiver burden measure or perception of intervention to further explore the quality-of-life impact on the entire family.

SUMMARY

In conclusion, this descriptive retrospective case series provides preliminary data as to how a multifaceted approach to treatment could be an effective method in treating DI with lasting improvements. This approach provides consideration of the body in its entirety and not just the PFM when treating the pediatric patient with pelvic floor dysfunction. This case series adds to the current evidence on pediatric pelvic floor dysfunction by expanding on descriptions of children with typical development who experience pelvic floor dysfunction and their response to PT intervention. We examined an intervention structure for children with pelvic floor dysfunction based on education and remediation with an exercise program to bridge concepts to the home setting.

Further research investigating the relationship between pediatric pelvic floor dysfunction and the factors of gross motor strength compensations and respiration patterns in children with pelvic floor dysfunctions could guide intervention design in the future. Understanding this relationship could assist the clinician in designing a comprehensive, targeted treatment and assist in developing future clinical practice guidelines for this population.

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