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What is the most effective verbal instruction for correctly contracting the pelvic floor muscles?

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Aims: The purpose of the present study was to compare the effectiveness of four different verbal instructions in correctly contracting pelvic floor muscles (PFMs), examined as a displacement of the pelvic floor by transabdominal ultrasound.

Methods: Fifty-six female undergraduate physiotherapy students, mean age 24.2 ± 2.5 years, participated in the study. A 6 MHz 35-mm curved linear array ultrasound transducer (Mindray M5) was placed in the transverse plane, suprapubically over the lower abdomen and angled at 15-30° from the vertical depending. The participants were randomly divided into two groups: posterior and anterior. Each group received four different verbal instructions as to how to correctly contract the PFMs. Only one verbal instruction differed between the groups: "squeeze the anus" (posterior group) compared with "stop the flow of urine" (anterior group).

Results: In the posterior group, 27 participants (90%) performed a correct contraction compared with 17 participants (65%) in the anterior group, thus demonstrating a statistically significant difference in favor of the "anus" instruction ($P = 0.025$). Forty-seven participants (84%) exhibited a downward movement during the verbal instruction combining transversus abdominis contractions with breathing, that is, "take a moderate breath in, let the breath out then draw in and lift your pelvic floor."

Conclusions: Our findings suggest that the most effective verbal instruction for correctly contracting the PFMs among 56 physiotherapy students was the posterior instruction of "squeezing the anus." The majority (90%) of participants succeeded in correctly contracting the PFMs.

KEYWORDS
incontinence, pelvic diaphragm, ultrasound, verbal instruction

1 | INTRODUCTION

Urinary incontinence (UI) is common problem affecting women of all ages and may possibly negatively impact their quality of life, that is, physically, psychologically, sexually, emotionally, and social well-being.[1] The International Continence Society (ICS) and the International Urogynecological Association (IUGA) define UI as the unwanted and involuntary leakage of urine.[2] There are three types of UI: stress, urge, and mixed. Stress urinary incontinence (SUI) was found to be the most frequent UI.[3] SUI is defined as the involuntary leakage of urine during an increase of intra-abdominal pressure, such as coughing, sneezing, effort, or exertion.[2]

Extensive high-quality evidence confirms that specific pelvic floor muscle (PFM) training reduces stress and mixed

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UI.[4] The goals of PFM training are to increase strength, power, endurance, and neuromuscular facilitation by utilizing exercise programs that incorporate elements of intensity, timing, repetition, and duration.[5,6] PFMs are the only muscles capable of increasing urethral closure pressure, lift the pelvic floor, and improve structural support.[5]

A correct pelvic floor muscle contraction (PFMC) may be difficult to perform. Several studies have shown that >30% of women are unable to contract their PFMs on their first attempt.[7,8] Bo et al advocate a mass contraction utilizing all regions of the pelvic floor musculature, with instructions to inward lift the PFMs and squeeze around the urethra, vagina, and rectum.[9] This technique is widely used by specialist physiotherapists. Other published instructions may not facilitate recruitment of all pelvic floor musculature regions but rather concentrate on the lift around the vagina, that is, "draw in, close around the vagina and lift the pelvic floor up towards the head."[10] Thus, differing instructions may facilitate greater or lesser recruitment of the PFMs.

Clinical observation of the inward lift of the perineum and vaginal digital palpation are commonly used methods to assess and instruct how to correctly perform a PFMC.[7] However, these methods are based on subjective judgment, may have low inter-tester agreement, and often yield an incorrect depiction of what is occurring inside the pelvis.[11]

Ultrasound is non-invasive and recommended as a valid instrument to measure the lifting aspect, thereby, the correctness of the PFMC.[12] One of the advantages of a transabdominal ultrasound is that a woman does not have to undress and the pelvic floor movement during contraction can be directly visualized and assessed.[13] Bo et al recommended that ultrasound should be utilized as an important addition to clinical observation and a standard tool both for teaching, biofeedback, and research purposes.[5] This is especially significant, as it was found to be correlated and can measure comparable parameters such as digital palpation when evaluating a PFM contraction.[14]

Diverse verbal instructions as to how to correctly contract PFMs may influence the displacement of the pelvic floor. However, it is still being debated in the literature as to which recruitment strategy optimizes the displacement of the pelvic floor.[15–18] For example, should all regions of the pelvic floor musculature around the urethra, vagina, and rectum be mentioned in the instruction; should only one region that is, the anus or the urethra be mentioned or should the transversus abdominis and correct breathing also be utilized?

Our hypothesis was that the most effective verbal instruction would be to "squeeze the anus." We believe that everyone knows the location of the anus and squeezing is a reflective movement, hence this would be the simplest verbal instruction to the participants. The main purpose of the present study was to compare the effectiveness of producing correct PFMC employing diverse verbal instructions, measured as displacement of the pelvic floor when imaged on transabdominal ultrasound.

2 | MATERIALS AND METHODS

2.1 | Procedure

In this cross-sectional exploratory study, 56 physiotherapy students were recruited, asked to complete self-reported questionnaires and undergo a non-invasive transabdominal ultrasound (TUS) assessment. Inclusion criteria were female physiotherapy students and their willingness to participate in the study. Exclusion criteria were pregnancy or receiving physiotherapy treatments for pelvic floor disorders. The Ethics Committee of Ariel University, Israel, approved the research proposal. All participants signed an informed consent form prior to their inclusion. The rights of the subjects were protected. The NIH Article number in clinicaltrials.gov is NCT03400540. The students knew that the study would appraise different verbal instructions for PFM contraction, yet, they were blinded to the research hypothesis.

Each participant completed two questionnaires: (i) a questionnaire relating to demographic characteristics (age, parity), and lifestyle (BMI, smoking, physical activity, PFM exercise); (ii) the Short Form (ICIQ-SF) questionnaire relating to symptoms of UI taken from the International Consultation on Incontinence Questionnaire.[19] The ICIQ-SF comprises three questions: the frequency of incontinence, amount of urine lost, and how bothersome the incontinence was in life. The maximal score is 21; the higher the score, the worse the incontinence status.[19,20] Background variables are listed in Table 1.

To image the pelvic floor, a 6 MHz 35-mm curved linear array ultrasound transducer (Mindray M5) was placed in the transverse plane, suprapubically over the lower abdomen, and angled at 15-30° from the vertical line. Intra-class correlation (ICC) for inter-rater reliability ranged between 0.92 and 0.94 and intra-rater reliability, between 0.79 and 0.89, when measuring pelvic floor displacement.[13] One investigator (GD) with experience in performing ultrasound imaging, examined all the participants.

2.2 | Protocol

A bladder filling protocol was implemented to ensure that the participants had sufficient fluid in their bladders to allow clear imaging. This entailed subjects consuming 600-750 mL of water during a 1-h period and completing the task half an hour prior to the testing time. The participants were examined in a crook-lying supine position with a pillow placed under their heads for comfort and were randomly divided into two

TABLE 1 Baseline demographics and clinical characteristics of participants

	Participants $N = 56$
Age (yr)	24.21 ± 2.5
Married, *n* (%)	15 (26.7%)
Have children, *n* (%)	4 (7.1%)
Bodymass index (BMI)[a]	22.07 ± 2.6
Smokers, *n* (%)	1 (1.8%)
Participating in regular physical activity, *n* (%)	43 (76.7%)
Performing regular pelvic floor muscle training, *n* (%)	3 (5.3%)
Reporting urinary leakage about once a week or less often, *n* (%)	9 (16%)
A small amount of urine, *n* (%)	7 (77.7%)
Reporting SUI during the last week, *n* (%)	5 (55.5%)
Reporting urge incontinence during last week, *n* (%)	4 (44.4%)

Values shown are means (SD) unless otherwise stated.
[a]BMI, body-mass index was calculated as weight in kilograms divided by the square of the height in meters.

groups. Each group was given four different verbal instructions as to how to contract the PFMs:

Group A: anterior instruction

1. "Squeeze your pelvic floor muscles"
2. "Squeeze and lift your pelvic floor muscles as if stopping the flow of urine"
3. "Take a moderate breath in, let the breath out, then draw in and lift your pelvic floor"
4. "Perform an inward lift and squeeze around the urethra, vagina and rectum"

Group B: posterior instruction

1. "Squeeze your pelvic floor muscles"
2. "Squeeze your anus"
3. "Take a moderate breath in, let the breath out, then draw in and lift your pelvic floor"
4. "Perform an inward lift and squeeze around the urethra, vagina and rectum."

The only difference between the groups was verbal instruction number 2. The main hypothesis of the current research was that the instruction for squeezing the anus would be better understood and produce an improved contraction than with the instruction to "squeeze and lift the PFMs as if stopping the flow of urine." In order to further examine this hypothesis, the anterior group received a fifth instruction (after completing previous contractions) that included the verbal instruction to "squeeze the anus." All contractions were held for 3 s with a resting break of 10 s between each contraction. The participants performed three contractions of each maneuver. During the first two contractions, the participants were instructed to perform a strong and short contraction (3 s). During the third contraction, endurance of PFMs was measured and the participant was instructed to contract the PFMs for as long as possible. Time of contraction was measured in seconds.

Pelvic floor displacement was measured for each contraction. A clearly defined edge of the endopelvic fascia in the region of its greatest observed displacement, clearly visible throughout the entire movement, was selected for measurement. The resting position of the pelvic floor was marked by an on-screen marker. The subjects performed a contraction, the image was then frozen on the screen and the muscle relaxed. The examiner assessed whether a good contraction was performed meaning bladder displacement occurred in an upward direction and if so, the distance of displacement was measured by an on-screen caliper (Figure 1). The displacement was recorded and the procedure repeated, strictly maintaining the position of the US transducer for the entire procedure.

2.3 | Statistical analysis

Statistical analysis was performed by the SAS for Windows, version 9.4. Continuous variables were reported either by mean and standard deviation or by median and interquartile range depending on their normal or abnormal distribution, respectively. Categorical variables were reported according to their relative frequencies.

Univariate analysis determined the relationships between each explanatory variable and group. Univariable analysis examined the association of all potential predictor variables with the primary outcome measure (pelvic floor displacement). The Pearson chi-square test or Fisher exact compared the groups with respect to categorical variables. Two sample *t*-tests compared the two groups with respect to variables with normal distribution; two sample Wilcoxon tests compared the two groups with respect to variables with an abnormal distribution. To ascertain if there were differences in pelvic floor displacement and endurance between the four types of verbal instruction, the Friedman test was employed. If the overall test showed significance, post hoc tests such as the Wilcoxon signed-rank tests were run in order to examine where the differences actually occurred. A *P*-value of 0.05 was considered significant.

3 | RESULTS

Fifty-six female physiotherapy students, mean age 24.2 (SD 2.5) years, participated in the study; most were physically

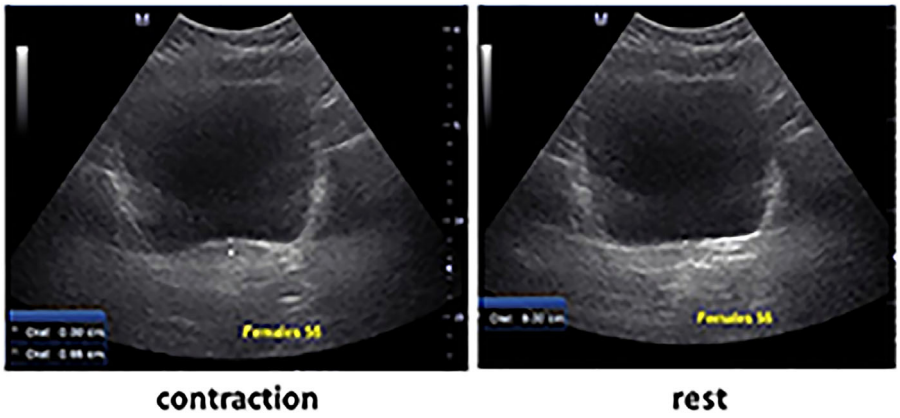

FIGURE 1 Ultrasound assessment of pelvic floor displacement during rest (right) and contraction (left)

active, non-smokers, and a good BMI. Most (92.86%) did not routinely practice PFMC. Nine (16.07%) reported that UI occurred approximately once a week or less. The participants were allocated into two groups: the anterior group (Group A) which included 26 individuals and the posterior group (group B) which included 30 individuals. No differences in background variables were observed between the two groups. Baseline demographics and clinical characteristics according to groups are described in Table 2.

3.1 | Differences between groups

Mean displacement in centimeters and endurance time in seconds for each verbal instruction and differences between groups are described in Table 3.

Similar results for the first verbal instruction, "squeeze your pelvic floor muscles" were observed in both groups. No significant differences between groups were seen in bladder displacement ($P = 0.58$), in the number of participants who performed a correct contraction ($P = 0.08$) and in endurance time of the contraction ($P = 0.91$). The mean displacement for the entire sample was (0.53 ± 0.23) cm. Out of the 56 participants, 34 (60.7%) performed a correct contraction in an upward direction with a mean endurance time of 6.28 ($\pm$4.7) s. During the second verbal instruction, which was the only different instruction between groups, the mean bladder displacement was observed at 0.5 (SD 0.2) cm and 0.6 (SD 0.3) cm in the anterior and the posterior instruction groups, respectively ($P = 0.10$). In the anterior group ("stop the flow of urine"), 17 (65%) participants performed a correct contraction compared with 27 (90%) in the posterior group ("squeeze your anus"), demonstrating a statistically significant difference between groups ($P = 0.025$). No significant difference in endurance of the PFMs was found between groups ($P = 0.56$).

During the third verbal instruction, which was the same instruction for both groups, ("take a moderate breathe in, let the breath out and draw in and lift your pelvic floor muscles"), only 9 (16%) participants were able to correctly contract their PFMs, 30 (53.5%) demonstrated a downward movement, 12 (21.4%) did not succeed at all to move their PFMs, 2 (3.57%) demonstrated a first contraction with a downward movement and a second good contraction, and 3 (5.36%) succeeded in contracting only once with displacement and the second contraction, without displacement. No significant differences were observed in bladder

TABLE 2 Baseline demographics and clinical characteristics of the research groups

	Group A: anterior instruction $N = 26$	**Group B: posterior instruction** $N = 30$	***P*-value**
Age (yr)	24 (23, 26)	24 (22, 25)	0.37
Married, *n* (%)	6 (23%)	9 (30%)	0.56
Have children, *n* (%)	3 (12%)	1 (3%)	0.22
Body-Mass Index (BMI)[a]	22.6 ± 3.0	21.6 ± 2.2	0.14
Participating in regular physical activity	20 (77%)	23 (77%)	0.98
Performing regular PFM training	2 (8%)	1 (3%)	0.51
Reporting urinary leakage	4 (15%)	5 (17%)	0.90

Values shown are means (SD) unless otherwise stated.

[a]BMI, body mass index calculated as weight in kilograms divided by the square of the height in meters.

TABLE 3 Differences in mean displacement (cm) of pelvic floor muscle (PFM) and muscle endurance between groups

	Group A anterior instruction $N = 26$	Group B posterior instruction $N = 30$	*P*-value	Group A Number of correct contraction *N* (%)	Group B Number of correct contraction *N* (%)	*P*-value
Instruction 1: bladder displacement (cm), mean (±SD)	0.50 ± 0.2	0.60 ± 0.2	0.58	19 (73%)	15 (50%)	0.08
Endurance median (Q1, Q3)	5.0 (2.0, 7.0)	4.0 (3.0, 12.0)	0.91			
Instruction 2: bladder displacement (cm), mean (±SD)	0.5 ± 0.2	0.6 ± 0.3	0.10	17 (65%)	27 (90%)	0.025*
Endurance mean (±SD)	7.8 ± 3.8	8.7 ± 4.3	0.56			
Instruction 3: bladder displacement (cm), median (Q1, Q3)	0.4 (0.3, 0.6)	0.4 (0.4, 0.7)	0.48	3 (12%)	6 (20%)	0.39
Endurance median (Q1, Q3)	5.0 (5.0, 5.0)	3.0 (2.0, 7.0)	0.77			
Instruction 4: bladder displacement median (Q1, Q3)	0.4 (0.3,0.6)	0.6 (0.4,0.9)	0.19	8 (31%)	14 (48%)	0.19
Endurance median (Q1, Q3)	7.5 (6, 7.5)	6.0 (4.0, 7.0)	0.65			
Instruction 5: bladder displacement (cm). mean (±SD)	0.40 (±0.13)			16 (84%)		

displacement between groups ($P = 0.48$), in the number of participants who correctly performed a contraction ($P = 0.39$) and in endurance time ($P = 0.77$). During the fourth instruction ("squeeze around the urethra, vagina and rectum"), only 22 (40%) were able to correctly contract the PFMs. No significant differences were observed in bladder displacement between groups ($P = 0.19$) in the number of participants who correctly performed a contraction ($P = 0.19$) or in endurance time ($P = 0.65$).

3.2 | Learning procedure

During the second instruction ("stop the flow of urine"), 9 (35%) participants in the anterior group, did not correctly contract their PFMs For this group, we added a fifth instruction ("squeeze the anus") and consequently, 6 (66.6%) amended to a correct direction contraction. In addition, 18 (69%) who failed to correctly perform a contraction with instruction 4, were taught at the final stage to contract with the verbal instruction of "squeeze the anus" with 14 (77.7%) succeeding to change the direction of the contraction following this instruction. All participants in the posterior group succeeded in correctly contracting their PFMs during at least one of the instructions, as such no learning procedure was needed. The anterior group received the instruction to "squeeze the anus" during the last stage and consequently, 22 (84.6%) succeeded in correctly contracting their PFMs.

3.3 | Differences between the four verbal instructions

Post-hoc analysis was performed to evaluate the differences between the four verbal instructions regarding PFM displacement (upward displacement) and endurance. Displacement and endurance were found to be lower during the third verbal instruction compared with the other instructions. When separately performing the same analysis of the two groups, identical results were found in the posterior group. In the anterior group, no significant differences were observed between the four verbal instructions. As for endurance, no significant differences were observed between the four different verbal instructions, however, endurance was higher for instruction number 2 in both groups (7.8 ± 3.8 s and 8.7 ± 4.3 s in the anterior and posterior group, respectively).

3.4 | Urinary incontinence

Out of the 56 participants, 9 (16.07%) reported UI. Most (8) reported a leakage frequency of once a week or less. On a scale from 0 to 10 as to how much the incontinence is a disturbing factor in their lives (0 representing not disturbing at all), one participant scored 7, one scored 5 and $7 < 3$. The range of the ICIQ-SF questionnaire score results were 1-12, indicating moderate to slight incontinence. Five participants reported SUI and four, urge incontinence. No differences between groups in the number of

participants reporting UI ($P = 0.9$) and no difference between the participants who reported UI and those without, regarding bladder displacement or endurance ($P > 0.05$).

4 | DISCUSSION

Our findings suggest that the best verbal instruction for correctly contracting the PFMs, among physiotherapy students, is the posterior instruction—"squeeze the anus"; 90% of the participants succeeded in performing a correct contraction ($P = 0.025$). Only 60.7% succeeded in contracting the PFMs after the first instruction ("squeeze the pelvic floor muscles"), 65% succeeded in contracting after the urine instruction, 16% after the "draw-in" instruction and 40% after the global instruction ("around the urethra, vagina, and rectum"). The anterior group received a fifth instruction of "squeeze the anus" during the last stage and 22 (84.6%) succeeded in correctly contracting the PFMs. The "draw-in" instruction was the worst prompt for the participants; only 16% were able to correctly contract the PFMs, suggesting that adding a contraction of the abdominal muscle to a PFMC disrupts the performance of a correct contraction.

There are diverse opinions about the correct verbal cues for PFMs contraction. Bo et al[5] proved that an instruction to contract the PFMs produces a significantly more effective PFMC than an instruction to perform a transversus abdominis (TrA) contraction. Crotty et al[15] performed a pilot study ($n = 17$) on continent women who were taught selective PFMC using different cues: anterior (urine), posterior (anus), and anterior and posterior, combined. Similar to our findings, their results suggest that a posterior cue produces a better contraction. Henderson et al[17] however, performed a cross-sectional study of 779 women finding that most women (68.6-85.8%) with no (57.1%) or mild pelvic floor disorders (42.9%) could correctly contract their PFMs after a simple brief anterior verbal cue ("now please squeeze the muscles in the vagina and hold as if you are holding in your urine").

The methods employed in various studies as to which verbal cues to use, differ from each other as well. Henderson et al[17] used an invasive technique of finger palpation into the vagina; Crotty et al[15] used perineal ultrasound images while Bo et al[5], Kelly et al[21], and our study used abdominal ultrasound. It was previously established by Bo et al[5] that ultrasound is a more valid method than palpation or clinical observation to assess PFM function. The abdominal ultrasound is a noninvasive method enabling the participants to be more relaxed during the examination and thus, greater cooperation can be established.

Bladder displacement as measured by abdominal ultrasound was examined by Kelly et al[21] in two different positions (crook-lying and standing). The results of the PFM displacement during lying were similar to our results (4-6 mm), however, the endurance in Kelly et al's study was higher (16.1 s compared with <10 s in our study). Similar PFM displacement (5 mm) was also observed in Thompson et al's study.[22] It should be mentioned, that among the studies using transabdominal ultrasound, there is a slight differences between techniques as transverse or sagittal images can be employed. This can reflect different vector components of a PFM contraction.[23]

The NICE 2015 guidelines[24] concluded that women with mixed UI should receive supervised pelvic floor training as the first-line of treatment in conjunction with bladder training. The guidelines state that women who experience stress or mixed UI are often just given a leaflet on PFM training but are not provided with additional support. As a result, these women, who presented for specialist treatment, have been incorrectly performing PFM exercises for many years with no improvement in their symptoms. In order to improve our treatment for women with SUI and to increase their compliance to learn and perform a correct PFM contraction, a simple technique is needed.

Using the posterior cue can assure that at least 90% will be able to correctly perform a contraction. However, our study included only young female physiotherapy students. In order to determine how this would best affect our patients, it is necessary to examine a larger sample size comprising different populations such as older adults, both men and women and adults with PFM or UI disorders. Further studies are being conducted now on different patient's populations.

Our study results can influence and assist women health. Many women perform exercises such as yoga, Pilates, etc to strengthen their PFMs, without the aid of a physiotherapist who would determine if the contraction is being executed correctly. By using a simple verbal cue such as "squeeze your anus," the likelihood of a correct contraction is increased.

4.1 | Limitations of the study

An ultrasound examination cannot determine if the pelvic floor is initially over or under active and does not take into consideration how this might affect the amount of bladder movement. This can influence how the patient responds to instructions. Contracting the PFMs in patients with pelvic floor tension might increase their symptoms. The physiotherapist should be aware as to how to adjust the right intervention to the patient. Furthermore, being able to cue a person as to how to correctly contract the pelvic floor does not necessarily lead to having the skills to correctly prescribe exercises for a patient, therefore, further research should be performed to better establish relevance to clinical and research practice.

5 | CONCLUSION

Our findings suggest that the best verbal instruction for contracting PFMs, among 56 physiotherapy students, was the posterior instruction—"squeeze the anus"; 90% of the participants succeeded in performing a correct contraction of the PFMs.

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CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

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