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# MOTOR CONTROL STRATEGIES INVOLVED IN PELVIC FLOOR ELEVATION AND DEPRESSION

## Hypothesis / aims of study

As elevation of the bladder neck is critical to maintain continence, to be effective, PFM exercises need to elevate not depress the pelvic floor. In a previous clinical study, using transabdominal ultrasound it was found that 43% of women with incontinence and prolapse strained and depressed the pelvic floor when attempting to do a lifting contraction with the pelvic floor muscles (PFM) [1]. It is recognized that the PFM do not work in isolation, but act in co-activation with the abdominal muscles[2, 3] and together with the diaphragm, to generate and control intra-abdominal pressure (IAP). Therefore this study aimed to compare the patterns of muscle activity around the abdomino-pelvic cavity and their effect on IAP and vaginal pressure generation during a correct PFM contraction that elevated the pelvic floor and a Valsalva manoeuvre causing PFM depression

## Study design, materials and methods

A repeated measures study design was used to compare the patterns of muscle activity used during elevation and depression of the pelvic floor. Thirteen continent, healthy women (mean age 37, parity 0-3) were recruited. Inclusion criteria were, being able to elevate the pelvic floor when requested to perform a PFM contraction and also perform a Valsalva manoeuvre. The subjects were tested in crook lying with a comfortably full bladder. The position of the bladder was monitored using transabdominal ultrasound in the sagittal plane using a 3.75MHz curved linear array probe, to obtain a clear image of the bladder. A marker was placed at the edge of the endo-pelvic fascia in the region of the greatest displacement visualized during a pelvic floor muscle contraction. EMG activity from the PFM, the transverse fibres of internal oblique (IO), the upper lateral fibres of external oblique (EO), rectus abdominus (RA), and the chest wall (CW; which records from the costal fibres of the diaphragm and the intercostal muscles), were recorded using surface electrodes. Simultaneous measurements of IAP from a sensor in the posterior fornix of the vagina were recorded. Vaginal pressure (VP) measurements using the Peritron perineometer were also carried out. The subjects were asked to perform a lifting contraction of the PFM and a Valsalva manoeuvre. The EMG data were normalised to the maximum voluntary contraction of each muscle.

## Results

Comparing the muscle activation during PFM contraction (pelvic floor elevation) to Valsalva manoeuvre (pelvic floor depression), there was a difference in the mean of the normalised EMG activity of all the individual muscle groups. There was a difference in the change in IAP (mmHg) but the change in vaginal pressure (VP) ($cmH_20$) was comparable. The means (SD) are shown below in Table 1.

**Table 1**

| **Condition** | PF | IO | EO | RA | CW | IAP | VP (n=6) |
|---|---|---|---|---|---|---|---|
| Rest | 12% (7) | 5% (2) | 7% (3) | 5% (4) | 7%(3) | | |
| PF | 80% (20) | 26% (18) | 9% (4) | 6% (4) | 10% (5) | 6 (3) | 6 (3) |
| Valsalva | 41% (24) | 48% (18) | 28% (13) | 14% (13) | 40% (17) | 28 (14) | 5 (4) |
| p value | <0.001 | 0.006 | < 0. 001 | 0.01 | < 0. 001 | < 0.001 | 0.69 |

## Interpretation of results

These results show that there is a complex interaction of the muscles around the abdomino–pelvic cavity affecting the position and movement of the pelvic floor and IAP generation. An elevating contraction of the PFM was associated with high-level activation of the PFM and co-activation of the transverse fibres of IO, but with minimal activation of EO, RA and the chest wall and a minimal increase in IAP. During Valsalva manoeuvre (PF depression) there was a significant increase in activity of all the abdominal muscles and the chest wall with a significant rise in IAP but with a lower level of activation of the PFM when compared to the PFM contraction.

## Concluding message

These findings highlight the complex motor control strategies involved with the generation of a pelvic floor muscle contraction. This has implications for PFM rehabilitation, particularly in the early stages when training a *lifting* contraction of the PFM in subjects with PFM dysfunction. Co-activation of the PFM and lower transverse abdominal wall is desirable, whereas global abdominal bracing combined with an increase in chest wall activity and breath holding will increase in IAP and may have a negative influence on pelvic floor and bladder neck elevation as well as lumbo-pelvic stability.

## References


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