

## INCONTINENT WOMEN HAVE ALTERED PELVIC FLOOR MUSCLE (PFM) CONTRACTION PATTERNS

### Hypothesis / aims of study

Pelvic floor exercises are invaluable in regaining continence, but mechanisms are not fully understood [1, 2]. To contribute to the understanding of these mechanisms, we investigated the perineal and intra-vaginal recorded difference in onset time between the deep and superficial PFM contractions. The contraction sequence of superficial versus deep PFM in six different positions in continent and incontinent women was examined.

### Study design, materials and methods

The onset of contraction of the superficial and deep (PFM) was recorded by perineal and intra-vaginal surface electromyography (EMG) in 32 continent and 50 incontinent women aged 40-65 years. Pre-gelled surface electrodes were fixed on the perineum at each side of the urethra and the anus. Intra-vaginal surface EMG was obtained by two vaginal sponges each containing a pair of electrodes. They were sewn together at a distance equal to the superficial and deep PFM. A two-minute period of complete relaxation preceded the command for maximum voluntary contraction of the PFM for 6 seconds in supine position with legs flexed to 45° and with the legs extended. The registration in sitting and standing positions were performed in the upright and bent forward position. The onset of increased activity was defined as any muscle activity whose averaged amplitude of a sliding window of 25ms exceeded the resting EMG by +2 standard deviations [3]. The agreement between perineal and intra-vaginal recordings was calculated with Kappa and percentage agreement. Differences in onset between superficial and deep PFM contractions were reported as median values and interquartile ranges. All women provided their informed consent, and the study was approved by the Medical Research Ethics Committee of the K.U. Leuven.

### Results

Perineal and intra-vaginal EMG recordings used to define the onset of muscle activity, showed a high level of agreement (0.91 and 100). The superficial (PFM) contracted before the deep in almost all positions in the continent group as measured by intra-vaginal as well as by perineal electrodes (Table 1).

**Table 1. Difference in onset of contraction (msec) between the superficial and deep (PFM) recorded by intra-vaginal and perineal surface electrodes in 32 continent women**

Intra-vaginal Position				Perineal		
	Med (msec)	IQR (msec)	Range (msec)	Med (msec)	IQR (msec)	Range (msec)
1 supine knees-flexed	+21	(+20,+21)	(+19, +25)	+32	(+30, +33)	(0, +39)
2. supine knees- straight	+20	(+17.5, +21)	(-10, +56)	+28,5	(+9, +34)	(0, +66)
3. sit leaning forwards	+34.5	(+21, +52.5)	(-43, +92)	+32	(+5.5, +50)	(-31, +90)
4. sit upright	+21	(+20, +22)	(+13, +55)	+32	(+23.5, +35)	(0, +68)
5. stand leaning forwards	+21	(+20, +23)	(-12, +85)	+30	(+2, +32)	(-71, +96)
6. stand upright	+21	(+21, +23.5)	(+17, +118)	+32	(+30, +33)	(0, +102)

Med: median difference in onset between the superficial and the deep (PFM)

IQR: interquartile range of the difference in onset between the superficial and the deep (PFM)

In the incontinent group, the reverse sequence was observed in three out of six positions. Higher and less consistent time differences in the onset of contraction of the two muscle layers were found in the incontinent women compared with the continent women (Table 2.)

**Table 2. Difference in onset of contraction (msec) between superficial and deep (PFM) recorded by intra-vaginal and perineal surface electrodes in 50 incontinent women**

Intra-vaginal Position				Perineal		
	Med (msec)	IQR (msec)	Range (msec)	Med (msec)	IQR (msec)	Range (msec)
1 supine knees-flexed	-43	(-81, -13)	(-204, +128)	-34	(-68, -32)	(-1186, +578)
2. supine knees- straight	+20.5	(-15, +55)	(-231, +213)	+34	(-32, +68)	(-272, +192)
3. sit leaning forwards	+43.5	(+20, +81)	(-87, +130)	+45	(+22, +64)	(-108, +252)
4. sit upright	-44	(-81, -12)	(-267, +953)	-36	(-68, -32)	(-238, +64)
5. stand leaning forwards	+36	(-43, +80)	(-320, +204)	+32	(-32, +64)	(-192, +270)
6. stand upright	-11	(-44, +53)	(-160, +920)	-31	(-60, +64)	(-204, +270)

Med: median difference in onset between the deep and the superficial (PFM)

IQR: interquartile range of the difference in onset between the deep and the superficial (PFM)

### **Interpretation of results**

In nearly all of the continent women, the superficial PFM contracted before the deep muscles. Therefore, this was considered the normal pattern. In the 50 incontinent women, the difference of onset of contraction was negative in three of the six positions: the supine position with knees flexed, and the sitting and standing upright positions. This indicated that the deep PFM contracted earlier than the periurethral wall muscles. This was also reflected in the negative values for the interquartile ranges in five of the six positions.

### **Concluding message**

Contractions of the superficial and deep PFM can be recorded by intra-vaginal or perineal electrodes. A consistent contraction sequence can be found in continent women, but is lacking in incontinent women. This might be a possible explanation for their incontinence. Differentiated muscle contraction exercises in the pelvic floor muscle exercise may further optimize treatment outcomes.

### **References**

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