

## DIFFERENCES IN ACTIVATION PATTERNS OF PELVIC FLOOR EMG UPON STIMULATION OF SACRAL ROOTS– NEW INSIGHTS IN OPTIMIZING LEAD PLACEMENT FOR SACRAL NEUROMODULATION

### Hypothesis / aims of study

Sacral neuromodulation (SNM) is a successful and minimally invasive treatment modality for patients with the overactive bladder (OAB) or non-obstructive urinary retention. Clinical success on intention to treat analysis vary between 50 and 60% and depends on patient selection and critical lead placement to ensure placement of as many of the four electrodes in close proximity of the proper rootlet of sacral root(1). Currently lead placement is guided through X-ray and correct positioning monitored by an inward movement of the bellows or anal contraction (wink) upon stimulation of the electrode. This is done by visual inspection of the perineum, and is therefore subjective and highly dependent on the surgeon's expertise. The aim of this study was to evaluate the pelvic floor musculature (PFM) response upon stimulation of different needle positions in S3 giving a clinical observable anal wink response.

### Study design, materials and methods

After ethical approval was granted, patients presenting for sacral neuromodulation therapy were asked to participate in the study. A standard peripheral nerve evaluation (PNE) needle (insulated hollow needle only stimulating at the tip) was introduced in S3 and electrical stimulation (square wave pulses – 210  $\mu$ sec – 5 Hz – 3V) was applied. The needle position was adjusted so that an anal wink was observed clinically. Electromyography (EMG) activity of the PFM was sampled at a rate of 1000 Hz and filtered to suppress common mode interference. EMG response of the PFM to the electrical stimulation on the needle was measured intravaginal with the Multiple Array Probe (MAPLe<sup>®</sup>). The MAPLe is a probe with a matrix of 24 electrodes enabling measuring EMG signals from the different sides and layers of the PFM(2). These registrations were repeated after the needle was removed and re-inserted with a slightly different puncture angle and/or adjusting the depth of the needle to elicit an anal wink. Per patient three different needle positions were measured.

### Results

Five patients were tested with this protocol. Figure I shows the detailed EMG responses of a single patient with 3 different needle positions in the same foramen (S3 right) with 3V stimulation at the anterior, contralateral (left), posterior and ipsilateral (right) side of the pelvic floor. Figure I A shows the response at position 1. The stimulus artefact is indicated with a small black line. The EMG response or action potential is indicated with AP. For position 1, EMG response was measured at the ipsilateral (right) and posterior side of the pelvic floor. A different needle position in the same foramen is presented in Figure I B. For this position there was no EMG response at the ipsilateral (right) or posterior side. However, AP's were present at the anterior and contralateral (left) side which were higher in amplitude than the AP's in position 1. Figure I C shows the third needle position. Here EMG response was present in all 4 quadrants of the pelvic floor with higher amplitudes AP's compared to the other positions. Similar observations were found in the other patients.

### Interpretation of results

PNE needles can be positioned differently in the same sacral foramen and give rise to a clinical observable anal wink. However the results in this study show that the underlying EMG response of the PFM can be completely different. This indicates that, with different needle positions, other parts of the sacral roots that lie in the vicinity of the needle tip may be stimulated. As shown in Figure I, some of the needle positions may induce only a partial activation of the PFM of the ipsilateral, contralateral, anterior (urethral sphincter) or posterior (anal sphincter) side, while another position with the same stimulation parameters results in EMG response of the PFM in all quadrants suggesting an activation of the whole pelvic floor.

### Concluding message

The results in this study show that in case of an anal wink response, the underlying electrically evoked PFM response can be clearly different with different needle positions. The observation that the anal wink may be the result of activation of different parts of the PFM may perhaps explain the variable results of sacral neuromodulation. Realizing that the afferent stimulation of the sacral roots also play a role in the clinical results, further experiments are conducted to study the impact of PFM activation upon the outcome of sacral neuromodulation.

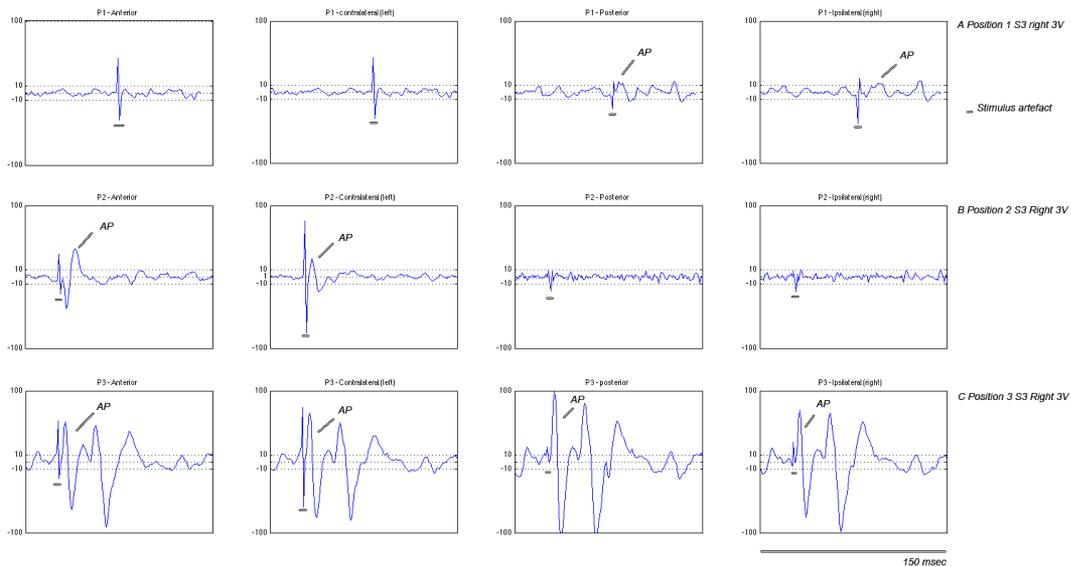


Fig I: EMG response with different needle positions

#### References

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#### Disclosures

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