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Title: MAFU – MUSCLE ACTIVATION FUNCTION FOR UROLOGY – A NOVEL EMG TEST IN LUT DIAGNOSTICS

Aim of study:

The neurophysiological functional diagnostics of LUT during different states of human body is important for improving the diagnostic assessment of the closing / voiding function of detrusor / bladder and bladder neck on one side and the urethral closing muscles on the other side. Both have to function in harmony and must regulate different changes of the abdominal pressure, movements and urine storage in LUT applying the harmonic interplay.

Methods:

The striated and smooth muscles of the LUT can only be assessed properly by surface multi-channel painless detecting techniques. The present state of the art is knowing the urethral and bladder EMG sensors (Figures 1,2) being painless, flexible, multi-channel and compatible with the most advanced quantitative urodynamics, ultra-sound, video-cysto-urethrography and MRI. Here we should stress that the needle EMG can never be useful in the complete neurophysiological diagnostics of the LUT dysfunction, as it cannot detect the smooth EMG. MAFU seems, due to the considerable smooth neuromuscular character of the LUT, to be outperforming. The surface detecting techniques are due to the achieved high quality and advanced signal analysis mature to be introduced. Here not only the strength of the muscle activation / relaxation and recruitment order is important, but also the timing of it and the correlation with the activation / relaxation with the other synergistic or antagonistic muscles. The urodynamics is based unfortunately on the consequences of the LUT function.

Figure 1: Urethral – female EMG sensor® (left) and male's EMG-pressure sensor catheter ® formed – (right)

Figure 2: Bladder surface EMG multi-channel basket pro

Here not only the strength of the activation is important, but also the timing and the art of it (striated / smooth muscles' contribution, and further tonic / phasic motor units recruited) and the coordination with the other synergistic or antagonistic muscles.

Results:

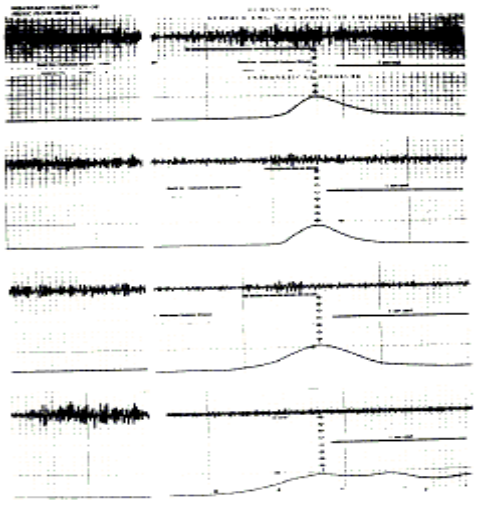
The main neurophysiological quantitative finding published (1) in different stress and mixed incontinent women in 40 females have shown that the tonic activity is different (called as hypo tonic urethra while in neurogenic LUT (e.g. patients with extensive hesitancy or neurogenic obstruction) the urethral tonic EMG activity tends to be hyperactive.

During stress situations the increased EMG being recruited in the external urethral sphincter has to be present some hundred milliseconds before the pressure rise in the bladder (in Figure 3). The absence of this reflex activation, named a delayed activation, can be besides also weak – as in case d) in Figure 3 and can therefore cause the urine leakage, in spite that the stress coughing UPP can demonstrate the positive pressure response. Here many explanations originate for the false stress incontinence treatment. One has to be very sure that MAF test has been performed to have enough explanation for the patient's symptoms, before any treatment is given.

Figure 3: Photo of the paper recording
Closing urethral interference EMG during coughing in 4 stress incontinent women of different grades of leakage:

a) – mild with weak sphincter but timely activation (upper pair (EMG signal – upper, Intravesical pressure lower) group of traces),

b) – in drops during coughing with too weak activation (second pair of traces),
c) – stronger leakage due to delayed and normal strength in sphincter (third), and
d) – severe leakage in stream - with delayed and weak sphincter (lowest) with bed reflex activation (dashed line) of the sphincter.
-Time scale 1 sec./ drawn line on the right.
-The left shorter parts of all the pairs are for comparison the traces during voluntary holding of urine.



Conclusions:

All the LUT dysfunction need MAFU. It will improve the LUT functional diagnostics in a way that the treatment will be much better managed and will give better Quality of Life and satisfaction to the heaviest patients. Many of the unsuccessful treatment cases till now have been due to the lack of not applying MAFU; especially together with detrusor EMG this test will be a promising investigation and will improve conservative treatment methods. We are planning to improve this technique and make it modular and combined with other urodinamics. The long lasting resistance against the surface technique due to all sorts of 'fears' and technical weaknesses is over. The future clinical mass promotion will help in establishing the

reference values for different dysfunctions of LUT and make it developed further. It will explain the therapy effects on the better function of LUT. References: – **(1) Book, University of Oslo, 1992, 350 p.**