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Edited by

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International Journal of Impotence Research

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MEETING REPORT

Current trends in corpus cavernosum EMG

**Conclusions of the 'First International Workshop on
Smooth Muscle EMG Recordings/Leiomyogram'
April 15 to 17, 1993 in Mannheim, Germany**

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Smooth muscle EMG recording from cavernous tissue has become one of the most interesting issues in impotence research, but significant controversy still exists in this encouraging field. Worldwide groups, specializing in corpus cavernosum EMG recording, were invited to participate in this workshop.* It was the aim of the workshop to collate current opinions on the methodology, interpretation and possible clinical relevance of smooth muscle EMG recording from penile tissue. In order to encourage free information flow, the workshop procedure was designed to allow informal presentations and discussion.

*These representatives of the respective groups attended the meeting:

- EVERT KOLDEWIJN, MD, Department of Urology, University Hospital Nijmegen NL-6500 Nijmegen, The Netherlands.
ANDREAS FLOTH, MD, Department of Urology, Donau Spital Langobarden Straße 122, A-1220 Vienna, Austria.
THOMAS GERSTENBERG, MD, Department of Urology, Herlev Hospital, DK-2730 Herlev, Denmark.
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Generally, the workshop deliberations reflected three different attitudes towards signal evaluation:

- 1 *Single potential analysis* (Stief, Koldewijn, Floth, Fabra, Krishnamurti, Merckx, Tjandra, Pörtner, Leontaridis).
- 2 *Continuous signal analysis* (Gerstenberg).
- 3 *Digital numerical analysis and pattern recognition* (Bührle, Jünemann).

Additionally, five presentations were primarily concerned with basic aspects of smooth muscle electromyography (Mandrek, Wagner, Bührle, Persson-Jünemann, Jünemann).

As expected, there was considerable confusion regarding terminology, recording procedures and the conclusions to be drawn from data. One drawback of the discussions was the lack of comparable experimental or clinical findings. Surprisingly enough, however, during the course of proceedings, mutual understanding increased and, finally, a common basis existed for the acceptance of uniform guidelines. This resulted in a consensus with respect to terminology, methodology and general procedures.

In order to reach uniform standardization in this field, the experts participating in the workshop suggested that the International Society of Impotence Research adopt the consensus of this meeting as the given standard. The following conclusions were reached:

- 1 The term 'SPACE' was rejected in favour of the more precise and neutral term 'corpus cavernosum EMG' (CC-EMG), which does not imply a validation of the results.
- 2 It was generally agreed that large amounts of data from normal patients must be compiled in order to establish reliable, normal values and to make data exchangeable. As a consequence, an internationally standardized CC-EMG study was drawn up with an analog system, which will become the most common recording system. The *minimum demands* are as follows:

Recording procedures:

Amplifier

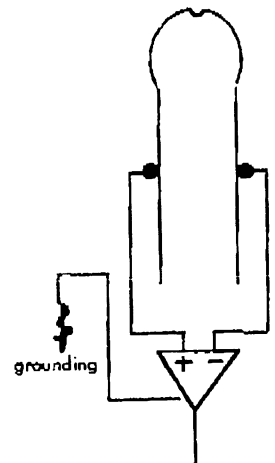
Frequency range: 0.5 Hz to 20 Hz
 Gain: 100 to 1000 μ V full scale
 Increment steps: 1, 2, 5, 10

Paper speed

Slow: 1 mm/sec, or
 Fast: 5 mm/sec

Electrodes

Surface electrodes: Material: AgCl₂, or
 Concentric needle
 Monopolar needles



Electrode placement

Two needles/one tracing
 Mid shaft
 Centre of cavernous body

Recording conditions

Examiner present in the room
 Comfortable condition, no smoking, low noise
 Patient position reclined (relaxed)
 Flaccid state
 Time setting 30 min. after needle placement.

Patients

Ten patients in each group (*normal*, potent volunteers)

To enhance the imminent diagnostic input of this method and in addition to a normality study group, a provocation group was established with the aim of identifying the most potent and selective provocation protocols such as VSS, pharmacostimulation, etc.

The following specifications were set:

Provocation in normal, potent volunteers

AVSS:	at least 10 min
Valsalva:	three times
Hyperventilation:	3 min
Unexpected noise or needle pricking:	twice

At present, pharmacological agents are considered premature.

To facilitate the conversion from analog to digital data acquisition and processing, which was considered desirable by the majority of the participants, a digital group was formed with the following aims in mind:

- Acquisition of interchangeable data
- Establishment of hardware standards
- Creation of software for CC-EMG analysis
- Establishment of the parameters to be recorded and assessed.

In order to control the A/D converter board and to transform the data into the machine's core and hard disk memory, a data uptake program (TRANS) has been designed.

Interchangeable data acquisition

Interchangeable data acquisition is best accomplished by converting the analog data into ASCII values of 12 bit precision. For subsequent data analysis for the MYDAS routines, a segmentation of data (epochs, windows) of 16 KByte is recommended.

Establishment of hardware standards

As hardware standard, an IBM 486 DX/33 or above is recommended with at least 120 MB of disk space. The most cost effective analog digital conversion card found so far is a PCL 880 high performance 12 bit slot card from the following company: Bitzer Digitaltechnik, Postfach 1133, Heinrich-Rorbeck-Weg 16, W-7060 Schorndorf, Germany (Tel.: +49-7181-68282, Fax: +49-7181-66450) used in conjunction with the appropriate wiring board obtainable from the same company.

Creation of software for CC-EMG analysis

In order to commence proceedings, a file/browser that permits inspection of the unprocessed recorded files will be made available. In addition, a power spectrum (SFT) routine and an autocorrelation program, the latter for separating stochastic from deterministic signal parts, is mandatory. The outputs of all these routines will also be in the ASCII format so that they can be imported into all generally-used scientific graphing routines.

Establishment of the parameters to be recorded and assessed

For different algorithms, the following parameters should be determined on a routine basis.

- (a) Fourier transform (power spectrum):
 - frequency precision and amplitude for the principal peaks (oscillators).
 - frequency range of the continuum.
 - amplitude ratio between the highest peak and continuum (as a measure of signal to noise ratio).
- (b) Autocorrelation function:
 - degree of regularity of autocorrelation function.
 - decline of amplitude of autocorrelation function (as a measure of frequency stability).
- (c) Amplitude distribution:
 - mean value (should be zero if there is no serious amplifier volt).
 - variance (dispersion of amplitude data).
 - skewness (symmetry between positive and negative events).
 - kurtosis (relation between small and large events).

This basic package should suffice for a quantitative EMG analysis. For more specialized purposes, additional modules, such as those derived from non-linear dynamics, may be obtained from the digital group.

The participants designated the following to be responsible for the three different study groups, who will gladly give assistance on queries:

- 1 Normality group: Luc Merckx, MD, Department of Urology, A.Z. V.U.B. Jette Vrije Universiteit Brussel, Laarbeeklaan, 101, B-1090 Brussels, Belgium, Tel.: +32-2-477-6011, Fax: +32-2-477-5800
- 2 Provocation group: Thomas Gerstenberg, MD, Department of Urology, Herlev Hospital, DK-2730 Herlev, Denmark, Tel.: +45-44-535300, Fax: +45-44-5352332
- 3 Digital group: Christian Bührle, MD, Department of Urology, Klinikum Mannheim der Universität Heidelberg, Theodor-Kutzer-Ufer 1, W-6800 Mannheim 1, Germany, Tel.: +49-621-335639, Fax: +49-621-377274

There was a general agreement to uphold this type of workshop and a decision was made to hold the Second International Workshop on CC-EMG on February 25 and 26, 1994 in Hannover, Germany. Christian Stief will host the next workshop.