Examination of the electrical potential and field distribution at the Transurethral Resection in Saline (TURIS)

Felix Hochgeschurz[(1)], Tino Morgenstern [(1)], Stephan Klöckner[(2)], Olfa Kanoun[(3)] and Jörg Himmel[(1)]

[(1)] Institute for Measurement and Sensor Technology,
Hochschule Ruhr West - University of Applied Sciences,
45479 Mülheim an der Ruhr, Germany
E-Mail: Joerg.Himmel@hs-ruhrwest.de
Web: www.hochschule-ruhr-west.de

[(2)] Olympus Surgical Technologies Europe,
Kuehnstraße 61
22045 Hamburg, Germany

[(3)] Fakultät für Elektrotechnik und Informationstechnik,
Technische Universität Chemnitz,
09126 Chemnitz, Germany

Abstract –Transurethral Resection in Saline (TURIS) is a minimally-invasive urological procedure to remove diseased prostatic tissue. The surgeon is able to cut the tissue with a high current density at the end of the resectoscope, which is inserted through the patient's urethra.

Although complications during this kind of surgery or similar procedures are rare, they cannot be excluded by any operator. One reason is the lacking knowledge regarding the spatial temperature distribution, which is caused by the cutting current. Especially medical scientists demand that the risk management of different devices and its adjustments still have to be compared with each other [1].

In laboratory it is possible to investigate the temperature distribution with high resolution. In Literature [2, 3] a method is described to measure the potential distribution around a resectoscope with a multi electrode system.

The measurement electrodes are placed concentrically in three equally spaced positions around the resectoscope and are together shifted plane wise. By this methodology, there are in a cutting plane lengthwise of the resectoscope for each plane one measurement curve, which consists of six measured potential values within a distance of 106.5 mm (see fig. 1a).

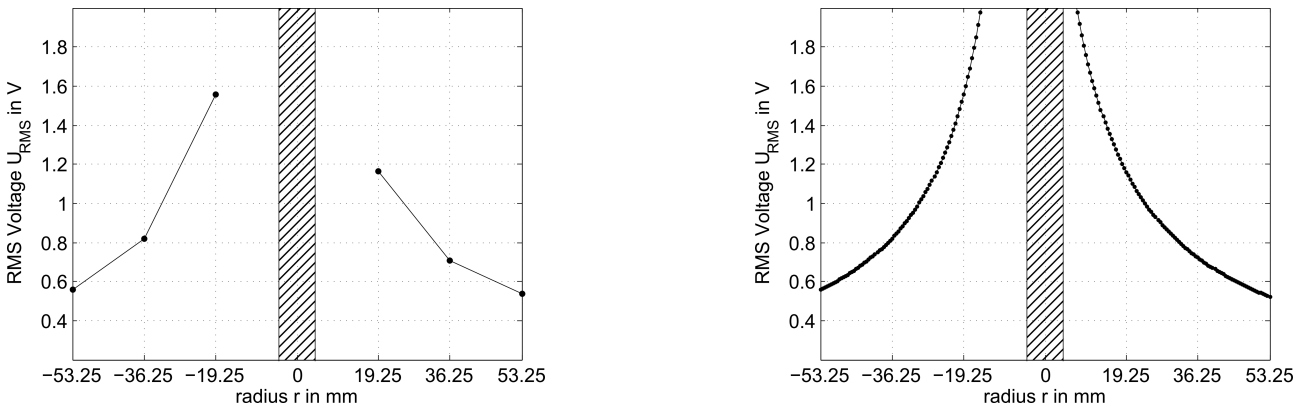

Fig.1: (a) Low number of measured potential values [2, p.130] and (b) expected measurement points with a new measurement setup.

The objective is to get data of more measurement points (see fig. 1b) for the so far chosen inter- and extrapolation procedures, to approximate the real potential distribution and to be able to get a clearly spatial improved image of the potential distribution.

The new measurement setup [4] is featured with electrodes that are able to be moved by linear motors. Thus the measurement positions can be changed in 0.5 mm steps in radial direction from the resectoscope with a distance up to 80 mm from it.

Currently the optimization of the setup and the validation of the results obtained from the experiments are being investigated. In this process the complete measurement setup and in particular the signal conditioning is being checked. The different influences of the various components of the measurement setup leading to a disturbed electrical field distribution are examined. In the focus of these tests are for example experiments to find out the minimal possible distance of the measurement electrode to the cutting plasma of the device.

After the validation of the results the methods of Knopf [2, 3] can be used in order to get a temperature distribution with high resolution around the resectoscope. As a result different adjustments at the resectoscope can be tested to find or to exclude possible reasons for complications at the Transurethral Resection.

References

[1] O. Reich, "Bipolar Transurethral Resection of the Prostate: What Did We Learn, and Where Do We Go from Here?," *European Urology*, vol. 56, pp. 796-797, April 2009.

[2] C. Knopf, J. Himmel, F. Hochgeschurz, S. Klöckner, K. Thelen, O. Kanoun, "Power Loss Density Distribution in Biological Tissue to Analyse Processes in Electrosurgery," *11th International SSD Conference on Sensors, Circuits and Instrumentation Systems (SCI)*, February 11-14, Castelldefels, Spain, Special Session on Biomedical & Environmental Measurements and Instrumentation, 2014.

[3] Christoph Knopf, *Feldverteilung und thermischer Vorgänge bei der bipolaren transurethralen Resektion.* Dissertation Technische Universität Chemnitz, Chemnitz, February 14, 2014.

[4] F. Hochgeschurz, J. Himmel, S. Klöckner and O. Kanoun, "Potential Measurement in Electro Surgery – Optimized Measurement Setup," *Sensorica - 2015*, November 17-19, St. Petersburg, Russia, pp. 25f, 2015.