

Translational research in acupuncture—teleacupuncture bridges science and practice

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ABSTRACT

In March 2009, the first teleacupuncture between China and Austria was performed. This publication summarizes the first important results. 24-hour electrocardiograms were registered in Beijing and analyzed in Graz. A heart rate variability monitor partly developed in Austria was used for recording. Data were transferred via internet over a distance of 7,650 km. For the spectral analysis of heart rate variability a new method, the so-called ‘Fire of Life’ illustration, was applied. The state of health of a 31-year-old patient before, during and after acupuncture treatment sessions was documented. Despite several limitations, transcontinental teleacupuncture opens up new possibilities in public health.

Keywords: Teleacupuncture; Heart Rate Variability (HRV); Electrocardiogram (ECG); Sustainable Health Research

1. INTRODUCTION

Telemedicine in general is defined as the ‘delivery of health care and the exchange of health care information across distance’ [1]. Telecommunication technology includes the assisted transmission of signals and biological data over a distance. In this context, telemedicine like telesurgery and also teleanesthesiology has become more interesting [2]. However, teleacupuncture has only been performed by our research group up to now [3]. The term ‘teleacupuncture’ was first mentioned and defined by our research group at the international symposium ‘Modernization of Traditional Chinese Medicine’ in May 2009 in Graz [4]. The first scientific descriptions by Litscher can be found in publications in a Korean [5], Austrian [6] and American [3] journals in the respective 2009 autumn issues.

The present paper summarizes the first important results obtained in China and Austria in the research area of

teleacupuncture.

It was the aim of these biomedical pilot measurements to investigate whether teleacupuncture using computer-controlled HRV analysis can be performed over long distances (transcontinentally) via common internet connections.

2. METHODOLOGY

Teleacupuncture integrates mainly medical acupuncture and telecommunication. Telecommunication in this context means data transfer over a distance of 7,650 km via internet between Graz, Austria and Beijing, China (**Figure 1**).

In China, 24-hour electrocardiograms (ECGs) are registered and the data are transferred via internet to the Medical University of Graz immediately following the acupuncture treatment. In Graz, the analysis of the ECGs is performed. The acupuncturists in China are informed about the results of the analysis immediately (**Figure 2**).

The autonomic nervous system plays an important role in the current investigations. Computer-based heart rate and heart rate variability (HRV) measurements are the main parameters. The ECG was recorded with a sampling rate of 4096 Hz using a system partly developed in Austria (medilog AR12, Huntleigh Healthcare, Cardiff, UK; **Figure 3**).

Heart rate variability is measured as the percentage change in sequential chamber complexes (RR-intervals) in the ECG, which is controlled by the blood pressure control system, influenced by the hypothalamus and, in particular, controlled by the vagal cardiovascular centre in the lower brainstem. [7] In these pilot measurements, a new method of analysis, the so-called ‘Fire of Life’ diagram, was used. For the calculation of changes in spectral density the medilog Darwin HRV software (Huntleigh Healthcare, Cardiff, UK) including the method of Burg (autoregressive model) was applied.

3. RESULTS

Figure 4 shows exemplarily the first teleacupuncture

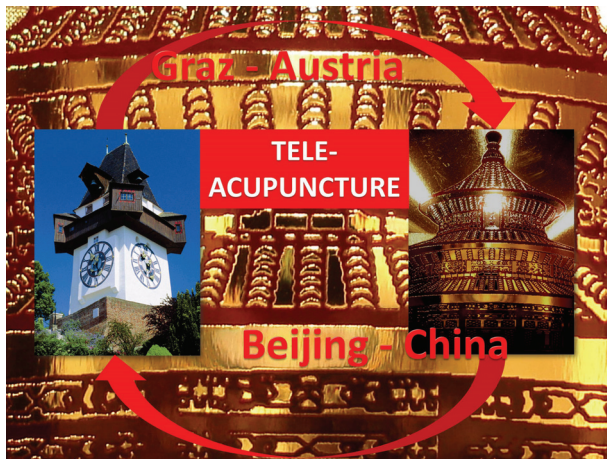


Figure 1. Teleacupuncture between the TCM Research Center Graz and the China Academy of Chinese Medical Sciences (CACMS) over a distance of 7,650 km.



Figure 2. Acupuncture and data recording is performed in China, the analysis at the Medical University of Graz (modified from [6]).

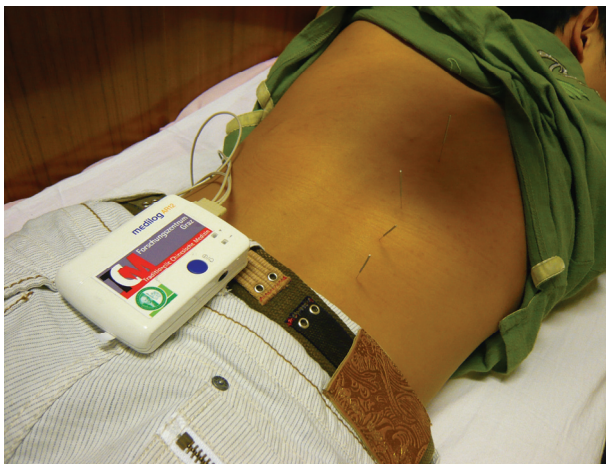


Figure 3. Bio-signal registration is performed in China using equipment from the TCM Research Center Graz (modified from [6]).

measurement in a 31-year-old female patient suffering from burn-out syndrome (Chinese diagnosis: kidney deficiency and blood stagnation).

The figure shows a ‘Fire of Life’-analysis of the HRV and can be interpreted as an indicator of the state of health and the quality of sleep of the patient. Note the appearance of the three typical main spectral components (~ 0.3 Hz; ~ 0.11 Hz; < 0.05 Hz). The component at 0.3 Hz was significantly reduced. These different components represent biological rhythms that seem to be currently distinguishable among the following:

- Respiratory sinus arrhythmia (~ 0.3 Hz); centrally nervous respiratory impulses and interaction with pulmonary afferents;
- The so-called “10-second-rhythm” (~ 0.11 Hz); natural rhythm of cardiovascularly active neurons in the lower brainstem (circulatory center and its modulation by feedback with natural vasomotoric rhythms via baroreceptor feedback). Analogous blood pressure waves (blood pressure waves of third order) prove the connection;
- Longer wave HRV-rhythms (< 0.05 Hz); effects from the renin angiotensinsystem or temperature regulation as well as metabolic processes.

Figure 5 depicts the improvement of the state of health (sleep-wake-cycle) of the same 31-year-old patient from Beijing over a period of more than two months. At the beginning of the acupuncture treatment (comp. **Figure 4**) no distinct sleep-wake-cycle can be found. Already after four acupuncture sessions there is an obvious respiratory sinus arrhythmia during sleep (centre of **Figure 5B**; 0.2-0.3 Hz). After ten sessions this norm pattern has become stabilized (**Figure 5C**).

4. DISCUSSIONS

Heart rate and its variability are important parameters for the assessment of the autonomic nervous system and are indicators for ‘neurocardial fitness’ [7]. It has long been known that an extremely steady pulse represents a deadly risk. Using computer-based analysis in the time and frequency domain the influence of acupuncture treatments on HRV parameters was evaluated. HRV has its origin in the function of the vegetative nervous system. Therefore the state of health can be quantified [7].

Teleacupuncture may contribute to the omission of redundant research studies and a simplification of the diagnostic and therapeutic procedure, thereby not only cutting costs but also saving time [3-6].

The common research between Graz and Beijing shows one thing quite clearly: teleacupuncture bridges on the one hand Eastern and Western medicine and on the other hand science and practice. The next goal will be to translate the research results into arising practical possibilities available to all participants in different countries.

Heart Rate Variability – Frequency Domain Analysis (Spectral Analysis)

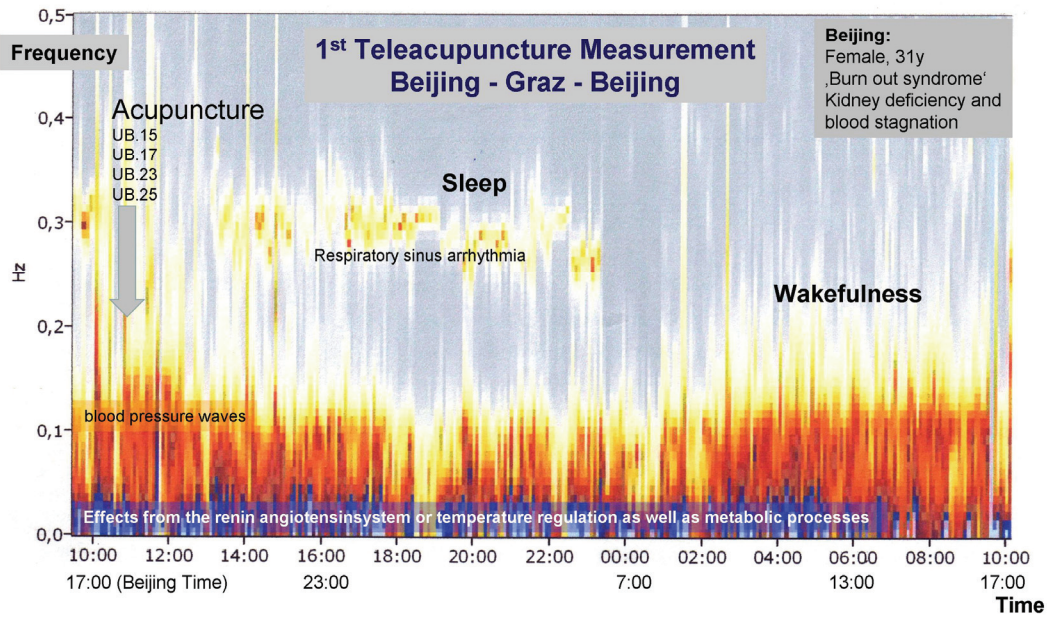


Figure 4. First teleacupuncture between Europe (Graz) and Asia (Beijing). Heart rate variability data of 24 hours are shown (modified from [5]).

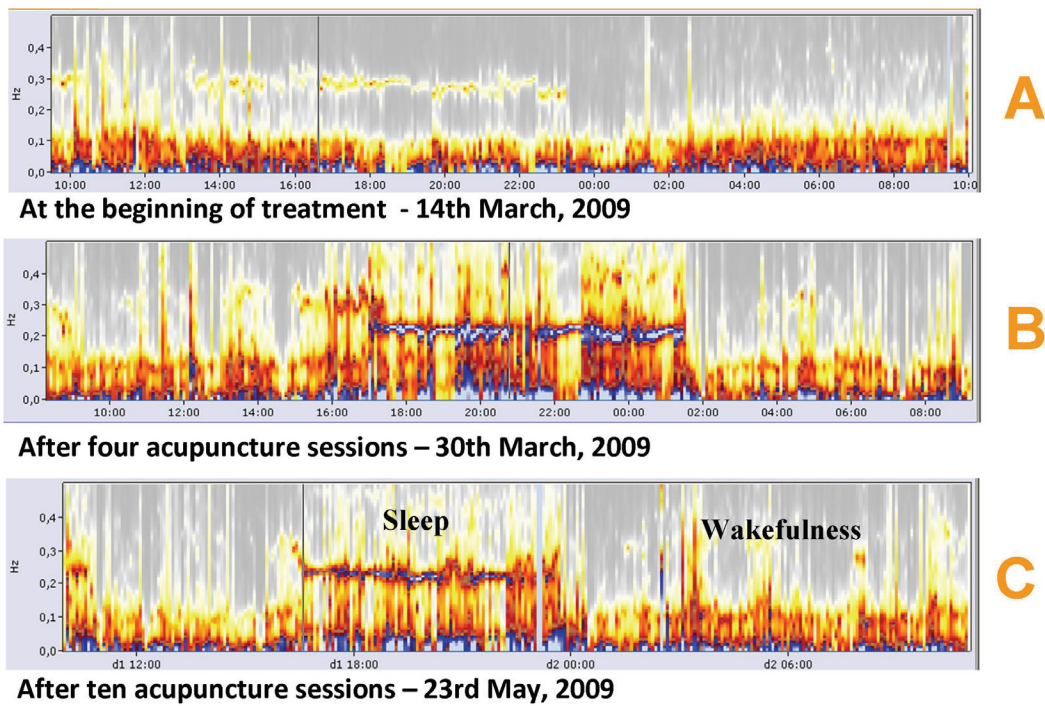


Figure 5. Follow-up investigations during a total of ten acupuncture sessions in China. Note the appearance of an obvious sleep-wake-cycle already after the fourth acupuncture treatment (modified from [6]).

5. CONCLUSIONS

Apart from the research-related aspects, transcontinental teleacupuncture opens up new possibilities for interactive education and practical training in public health. This represents another important aspect in quality control and quality assurance in complementary medicine.

6. ACKNOWLEDGEMENTS

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