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Editorial

Surface EMG application in clinical biomechanics

"The course of a movement is nothing else but a projection to the outside of a pattern of excitation taking place in a corresponding setting in the central nervous system". This citation of Hess (1954, according to Waterland, 1968) has caught my attention since the first day of my studies of the neuro-musculo-skeletal system in kinesiological tasks. Pursuing a bioengineering approach and investigating the function of this system in *in vivo* conditions I have always considered surface EMG (sEMG) as a rather non-invasive window into its action, which, combined with other available measurement quantities, provides a unique, second to none, information. Later on, in my PhD research, I have witnessed a high degree of sensitivity and specificity offered by this signal in studying, specifically, movement skill acquisition and co-ordination in artistic gymnasts; sEMG signals being for this purpose processed in a smoothed, full-wave rectified and low-pass filtered form. It was therefore my great pleasure when being approached by Prof. Zeevi Dvir, Reviews editor for Clinical Biomechanics, with the offer to devise a four-paper series which would describe the current state-of-the-art of sEMG with particular attention to its clinical biomechanics aspects.

I have therefore laid out a four-part series, which in my opinion, should give a fair cut-through of the field. An exhaustive scholarly elaboration, however, cannot be attempted in this manner but must be left to book-length works such as Basmajian and De Luca's (1985) or the more recent Merletti and Parker's (2004).

In succession the issues that are covered consist of the sEMG signal detection and measurement aspects, force to sEMG relationship, clinical application of sEMG in gait analysis and finally muscle fatigue evaluation by sEMG signal processing. I was lucky to find authors who were not only willing to contribute but are truly international authorities on the subject. The Roberto Merletti group has integrated vast USA (Boston University) and Italian experience. Authors Roberto Merletti, Alberto Botter, Amedeo Troiano, Enrico Merlo and Marco Alessandro Minetto have presented the critical technological aspects of modern instrumentation for sEMG signal detection and conditioning. Professor Günter Rau has backed up the German team consisting of Catherine Disselhorst-Klug, Thomas Schmitz-Rode, and himself, which addressed the often unresolved and intriguing issue of sEMG to force relationship, indicating corresponding limits and new approaches. Carlo Frigo and Paolo Crenna, maybe the most well known to the biomechanical community for their vector diagram ground reaction force representation aimed to be applied in medical diagnostics, have presented the latest issues in clinical gait analysis with special emphasis on interpreting available sEMG information. Finally, our University of Zagreb biomedical engineering group, led by Mario Cifrek, and including Saša Ostojić, Stanko Tonković and myself, has elaborated on modern signal processing methods for EMG-based extraction of relevant information needed to evaluate the state of muscular fatigue, both in static and – what is particularly delicate, difficult and important – dynamic conditions.

Through these four articles the reader will, I hope, gain a fair insight into the current state of affairs regarding the most important issues relevant to the applications of sEMG in the field of clinical biomechanics. The style of all papers is suited both to those with either engineering, medical or kinesiological background.

We are in the time of rapid proliferation of instrumented measurement and signal processing methods and devices for use in the clinical atmosphere. I hope, and this hope is certainly also shared by all contributing authors who are to be thanked for their considerable effort, that the readers of this journal will find those four papers informative, and that their niche called 'Surface EMG' will – at least for the moment, as it is always in science – be updated.

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