DOCTORAL THESIS ABSTRACT

The model of patient's behavioral and physiological profile in the aspect of prediction of therapy parameters using a proprietary diagnostic-rehabilitation system Disc4Spine

Author: mgr inż. Patrycja Romaniszyn-Kania

Supervisor: prof. dr hab. inż. Andrzej W. Mitas   **Auxiliary supervisor**: dr Anita Pollak

Nowadays, the postural defects are at the top of the list of civilization diseases. Any health disorders (pathologies) affect all aspects of life, also causing the depreciation of emotions. Based on the available literature, it has been stated that there is a lack of a comprehensive system enabling multidisciplinary therapy that includes full diagnostics and continuous monitoring of the treatment.

The aim of this thesis was to develop a methodology for multi-criteria analysis of the patient's condition during long-term spinal therapy, and based on the obtained results, the mathematical model was created to determine the behavioral and physiological profile reflecting the subjective assessment of emotions as a response to the implemented therapeutic procedures.

The research group consisted of 20 children with postural defects undergoing specialized therapy in the prototype Disc4Spine device weekly for four months. The analysis of psychological data allows to characterize the individual in detail (i.e., anxiety level, temperament traits). It was possible to extract five distinct groups using machine learning algorithms. The number of obtained features of physiological signals and the complexity of subsequent analysis determined the necessity of performing the dimensionality reduction. From all the features, eight parameters were selected for further discussion, validation, and testing. The key parameters were two physiological parameters – the mean heart rate of the subject, the time to reach the plateau point based on the EDA signal (T_{EDA}), and one psychological parameter – the level of anxiety currently experienced. From the exercise physiology approach, the following parameters were identified as important – adjusting the timing parameters of the warm-up itself, the adaptation time (number of introductory sessions), and the actual exercises. A correctly performed warm-up, an appropriately timed pre-workout, and the need for meticulous attention to the individual will contribute to better performance in a shorter time.

In a formal sense, the main contribution of the dissertation is the author's mathematical model, used to predict therapy parameters, validated based on the author's concept of simulated therapy situations, and evaluated by a qualified and experienced expert.

Key words: behavioral and physiological profile; emotional state analysis; engineering aided physiotherapy; prediction of therapy parameters; mathematical modeling;

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