THESES

1. I produced a measurement guide in Hungarian for spine tests to be performed with the CMS-HS system, as the measurement guides issued by the manufacturer were not published in Hungarian and those in English and German proved to be incomplete in a number of cases. The guides by the manufacturer do not clearly present test procedures and do not discuss the technical background of measurements. Based on the literature and our measurements I demonstrated that the system database does not correspond either to literature data or to the measurements I performed. I created a modern database. Based on the tests performed, reference databases were produced for patients suffering from the *Scheuermann-disease* and *Scoliosis,* respectively, covering both posture and motion parameters, thereby making up for system deficiencies in this area and corresponding to international literature. There are a number of default differences between the CMS-HS system and traditional spine diagnostics. I produced a data processing and evaluation software to ensure a transition between test principles. Test results are processed more rapidly and accurately than in the case of traditional tests. The software produced is also suitable for preparing personal data sheets, which play an important role in tracking and rehabilitation. Measurement guides, evaluation softwares, and databases are of great importance in daily tests as the system already forms part of everyday clinical practice. With the research I completed I participated in the introduction of the system in clinical applications.

2. I developed spine test methods for situations characterizing the most frequent load cases of the spine:
   A: I performed load tests for diseased children of school age (with a schoolbag of 3 kg) and I demonstrated the impact of various load cases to the state of the spine. Based on test results, recommendations can be given on how to wear the bag properly and on where and in which hand should the bag be carried in order to eliminate the harmful impacts of the bag to the spine.
   B: I tested and defined the characteristic features of the spine both in the sitting and lying positions. Based on the tests, clear answers can be provided for patients on how to position themselves in these two frequent bodily positions and not to further deteriorate the health status of the spine with the wrong posture.
   C: I developed a procedure for spine tests while targeting with a gun, and I determined the relation between changes in the shape of the spine, the characteristics of bodily balance, and sole pressure distribution. I presented some possible military applications of ultrasound-based tests.
   D: I developed a measurement method to specify more precisely the input database of the software - used at the department for years - for determining the moments of inertia and the center of gravity of the human body and bodily segments. Earlier on, data for the input database were specified on the basis of video recordings. I developed a more accurate and faster database using the data recorded by the ultrasound-based system. The software provides more accurate data for inverse dynamic calculations.
   E: By determining the lines characterizing the state of equilibrium of the human body, I made the spine test system suitable for performing balance tests. Such tests can be used for detecting and numerically characterizing the impacts of spine diseases to the lower limb and the defects of bodily posture.

3. There are no methods in practice to characterize, with specific numerical figures, the parameters of corsets, such as the motion range, the degree of spine correction, and the impact of the corset on various bodily segments. I developed a method for examining corrective corsets. This measurement method can be used for testing the characteristics of corsets and their impacts on the spine faster and more accurately than in the case of traditional tests. I demonstrated the impact of corsets on the activity of surface dorsal muscles and I produced specific figures to evidence that corsets considerably decrease muscle activity differences due to illnesses on both sides of the body. The procedure developed can be used for examining both the shape of the spine and the mobility of the spine, that is the range of motion ensured by the corset. The test method provides opportunities for the objective analysis of the effectiveness of rehabilitation, tracking, and follow-up treatment and aftercare.

4. In the course of mobility and motion range tests, a demand arose for performing muscle activity tests (Electro-myography, EMG) as well. Based on my proposals, the manufacturer expanded its spine test system, catering for muscle activity tests as well. Therefore, in the course of tests, it is also possible to examine connections between spine mobility characteristics, the motion ranges of segments, the activity of specific surface dorsal muscles, and movements and spine deformation. In the course of measurements, differences in symmetry between the two sides of the musculature, spine deformities, and the effects of illnesses on the musculature can be clearly specified. Characteristics of surface dorsal muscles as well as the impact of spine deformations to the musculature can be described by specific numerical figures. Based on muscle activity tests performed while wearing a corset, I established that properly shaped corrective corsets not only correct the pathological curvatures of the spine and ensure an adequate range of motion, but also reduce muscle activity differences caused by illnesses between the two sides of the body. The measurement protocol is structured in a flexible manner. Supplementary bipolar electrodes, possible to be extended individually by patient, can also be fixed onto muscle groups where particularly demanded because of the nature or severity of the disease. A data processing and evaluation software was produced for processing test results, which was applied in daily medical diagnostics at the Buda Children's Hospital and Outpatient Clinic after the testing phase.

5. Examination of the characteristics of the cervical spine section is a special research area within spine tests. Two traditional diagnostic procedures can be selected for the status survey of the cervical section in clinical practice:
   - examination of posture parameters based on X-ray images
   - readings of geometry data based on digital photos of the cervical spine section

   A disadvantage of these methods is that the production of recordings requires great care and attention; the data required for specifying posture characteristics must be determined on the basis of the focal distance used for making the recording and by reading geometrical data. Therefore the accuracy of tests may be greatly influenced by the accuracy of readings and the professional routine and skills of the person performing the measurement. Further deficiencies and disadvantages of these methods include the time required for evaluating measurement results. The CMS system can only be used for examining the motion and motion range of the cervical spine section. I developed a test procedure for investigating the posture characteristics of the cervical spine section and for performing muscle activity tests. I used the bases of ultrasound-based pointer measurements to specify posture characteristics, ensuring the compliance of tests with accuracy criteria. The comprehensive survey of the health status of the cervical spine

section is made complete by surface cervical muscle activity tests. Standard measurements were therefore also extended by muscle activity tests. The complex measurement method I developed as well as the data processing software produced are suitable for characterizing, by numerical figures, the impacts on the spine of rehabilitation devices applied in clinical practice, such as the Glisson-type drawing device.