Telemedicine Support of Diagnostics and Surgery of Human Eye Pathologies

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Many multiply challenged (infant) patients include within their pathology eye muscle anomalies leading to, e.g., nystagmus or strabismus. In such cases, corrective eye muscle surgery generally yields the best results when performed on patients three and younger. Prior to surgery, each patient has to be thoroughly examined whether his/her eye apparatus allows the oculomotor reflex properly, i.e. the patient is still able to trace moving objects. Whether this is being done consciously or unconsciously is of no matter here.

Because of their young age, our considered class of patients is very sensitive to clinical examinations and visits to the hospital in general. Moreover, repeated stays at the hospital add additional costs to the total bill, since nearly every patient is accompanied by its mother or father during their stay at the hospital.

We present (interim) results of our research projects to apply computer assistance and telemedicine concepts to, both, diagnostics and surgery/therapy of the above mentioned pathologies:

In the frame of *computer assisted diagnostics*, we present a computer-based medical diagnostics system developed by us that enables an ophthalmologist to automatically test the oculomotor reflex of a human person [1]. Our system creates 3D models using the images of two cameras and is, therefore, particularly suited for infants who cannot be forced to keep their head immobile during the examination. Since the physical presence of a human investigator in the same room severely disturbs the infant patient, we utilize a “telemedicine approach” even when the investigator could be collocated with the patient: The examining ophthalmologist sits on his/her own terminal in a room separated from the diagnostics room, where the infant patient is placed (generally on the lap of its parent). This approach holds even more for installations where the investigator is located remotely.

Based upon diagnostics results, eye muscle pathologies can be modeled using our eye motility *virtual surgery system* [2]. This system combines a 3D VR modeler for the human eye, its orbita and its muscles, with a simulator for the biomechanical eye apparatus to enable common surgical eye muscle operations (transposition, shortening, splitting, etc.) in a graphic interactive way that is familiar to an experienced surgeon. Additionally, the system can be used for education and training purposes, because by means of extensive possibilities for parameterization of the human eye model, every common pathological case of human eye motility can be modeled - and subsequently tried to correct [3]. Since our system relies on common standards for communication and visualization, it can be used jointly over the internet and thus enables medical teletraining and teleeducation, and additionally supports one aspect of internet medicine by enabling distance surgery to simultaneously support a real surgery.

References

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