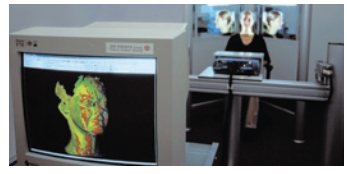
3D Measurement Technology

Facilitates more than just esthetic surgery

Computer-aided operations, virtual views into human body, visual representations of the internal organs of a live person are part of the medical day-to-day, or such is the image projected by the media. Actually, computer-based hardware and software solutions are no longer to be separated from the medical field, no more than assorted imaging procedures.



However, the precise variety of different techniques and methods hiding behind that designation is often unknown both to medical professionals and lay people. The possibilities offered to the medical field by 3D surface measurement techniques are very often not known either.

The specialization of 3D-Shape GmbH lies here, even when the field of application stretches beyond the realm of medical and technological use. 3D-Shape is an offshoot of the Institute for Optics, Information and Photonics of the University of Erlangen-Nuremberg working with the team of Prof. Haeusler in the development of optical 3D-sensors, which are used in various types of surgery, but above all in facial surgery, orthopedics and the dental technology.

Using the fringe projection procedure, bodily contours can be measured accurately and three dimensionally – noses, entire faces and much more. The measurement results provide important indicators to the surgeons regarding the approach to the operation, or to its results – with cosmetic surgery, for example.

Exact measurements of jaw models can also be carried out in this manner. These serve in acquiring precise characteristic extractions for the preparation, execution and long term follow-up of the treatment of cleft palates. By a point comparison of the physician's coordinates from recording to recording over a period of years a quantifiable process profile can be created. Denture castings can also be precisely rendered using the same measurement technique and among other things, enter as an important parameter into surgical planning in the simulation of profile changes before jaw surgery. In this manner, the 3D-castings deliver crucial data concerning the changeable and unchangeable portions of the face.

3D-data acquisition is becoming routine with facial operations in German hospitals. As part of a research initiative for the Erlangen Clinic for Oral and Maxillofacial Surgery and in cooperation with the above mentioned institute, applications of this scanning technology for biometry are becoming practicable within the field of the facial surgery. This can be used for the correction of cleft palates, as previously mentioned. Symmetry measurements assist surgeons even further with the correction of eyeball dislocation, after accidents or tumor operations. The goal in the course of this is to place the eyeball precisely in all three dimensions within the eye socket. The rapid 3D measurement and evaluation procedure, which can be accomplished on the spot, facilitates process control during this type of operation and promptly supplies crucial data for the remainder of the process. The goal of the procedure is also the creation of symmetry.

Following this type of globe operation, a long-term tendency towards relapse in the millimeter range can be ascertained, which must be taken into account for the future. Furthermore, missing data proves problematic in facial operations with regard to the behavior of the soft tissue, which does not always follow the operative adjustment of the bone. Further research projects are currently underway here at the University Clinic in Erlangen. The same profile sections can be compared with one another before and after the operation using the 3D-data, so that the actual change achieved is precisely quantifiable.

A further application is the precise rendering of an ear cast, which might serve as the basis for the production of hearing aids. An accurate model of the auricles, for instance, enables the creation of a highly exact complete model of the inner ear.

Beyond the applications mentioned, back measurements can be performed for the control of growth disturbances, and likewise forensic cranial measurements, which can be used for the identification of missing persons. And with these still, the spectrum of applications within medical technology alone are not yet exhausted. It is therefore still a vast, open frontier, whose exact boundaries will only be more closely defined with further years of research and development.

Emeka Nkenke, MD, PMD, PhD
Associate Professor of the Department of Oral and Maxillofacial Surgery University of Erlangen-Nuremberg, Germany
nkenke@mkg.imed.uni-erlangen.de