

Optimierte 3D-Navigation in der HNO unter Verwendung des graphischen Evaluierungsmodells

Using a graphical evaluation tool for optimizing navigated ENT surgery

Florian Kral¹; Gunkel, Andreas¹; Diakov, Georgi¹; Freysinger, Wolfgang¹

¹Universitätsklinik für HNO, Medizinische Universität Innsbruck

Problem addressed

As we have started with navigated surgery in ENT very early, we have seen different referencing strategies come and go. They have all been evaluated and most of them have been presented afterwards by the root mean square. Only a few clinicians knew exactly the underlying mathematics of this value and therefore could state, that it was not suitable for clinical needs. Neither mean nor standard deviation gives any information about spatial relationships but this is essential for any clinical application. As a result different referencing strategies were around with no possibility to compare and as a result without relevance to surgeons, because they could not rely on others' data. Now a graphical tool is available which could help in this situation.

Material and Methods

Our measurements were done in a specially arranged operating room using cadavers to provide clinical settings, but without exercising sterile conditions. All cadavers were cut and afterwards prepared to allow direct measurements in the region of interest. For each application different strategies were defined according to our clinical experience and then each strategy was repeated ten times and each measurement point was measured in all spatial directions (x,y,z). A standard active optical navigation system was used. The evaluated referencing strategies included pair point matching, surface matching and different kinds of combinations. As radiologic data standard diagnostic imaging was used and for techniques, which acquired extra data sets (e.g. external referencing structures) clinical procedures were used. Several thousands of measurements were done for applications in sinus surgery and surgery of the latero- and frontobasis.

Results

Analyzing the data by the graphical evaluation tool led to following procedures:

Surgery in the petrous bone and beyond: the use of high resolution data sets with 0.5 mm slice thickness and referencing by mouthpiece, anatomical landmarks and patients fixation led to submillimetric application accuracy;

sinus surgery excluding the sphenoid sinus: referencing anatomical landmarks and surface matching without any mouthpiece and therefore additional imaging;

sinus surgery including surgical treatment within the sphenoid sinus, revision surgery or surgery of the frontobasis: landmarks fixed on the mouthpiece and anatomical structures are recommended.

As the referencing strategies had to be defined before starting the measurements, the results also reflect our clinical experience and workflow.

Discussion

By using this new tools it is now possible to compare our referencing strategies with others and as a result find the best application accuracy. The exchange of existing knowledge, experience and data comparison will improve navigated surgery in ENT.