

Vergleich verschiedener Registrierungsmethoden bei der Navigation im Bereich der Kraniofazialen Chirurgie

Comparison of different registration methods for navigation in craniomaxillofacial surgery.

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INTRODUCTION

The correlation between the surgical site and the corresponding image data set in the operating room is the most time-consuming non-operative process for the surgeon.

Recent innovations in laser scanning technology provide a potentially useful tool for three-dimensional surface registration in image-guided surgery. The purpose of this study is to evaluate the clinical reliability of this technique in comparison with the conventional registration tools headset and skin markers in craniomaxillofacial procedures using image-guided navigation.

METHODS

In an experimental setting, a stable anthropomorphic skull model (fig.1) with prelabeled markers was scanned and registered with laser surface scanning (Z-touch, Brain LAB) and marker- based algorithms (skin markers and head-set). The registration protocol was then repeated 60 times.

Registration errors as well as accuracy were calculated.

In a clinical setting, totally seventy-two patients with different indications for oral and craniomaxillofacial surgery were planned for image-guided surgery using the same passive infrared surgical navigation system (Vector Vision, Brain LAB) and marker based algorithms (skin-markers and head-set).

Registration errors were noted. The clinical application accuracy was determined for anatomical landmark (teeth) localization deviation.

RESULTS

In the experimental protocol registration with head-set shows the most reliable results with deviation less than 1 mm in 74% versus the skin markers in 42% and the laser scanning (Z-touch) in 40%. Within 2 mm deviation rate a accuracy of 94% with the head-set, 92% with the skin-markers and 86% with the z-touch scanning could be achieved.

During various clinical procedures involving oral and craniomaxillofacial surgery, the best results were shown when registrations were taken with the headset. The headset showed a deviation of less than 2mm in 94%, versus skin markers in 80% and laser-scanner (Z-touch) in 68%.

CONCLUSION

The results show a significant difference between the external registration tools (headset and skin markers) compared to the laser scanning technique used in this study. The three-dimensional laser surface scanning technique may be an interesting and useful approach to register the patient for image-guided procedures in the future.



