Soft Tissue Changes Measured with Three-Dimensional Software Provides New Insights for Surgical Predictions

Yu-Jen Chang, DDS, MS
Director, Craniofacial Orthodontic Department
Kaohsiung Chang Gung Memorial Hospital

Purpose: Although computer-aided craniofacial reconstructions allow for simulation of hard tissue changes, the prediction of the final soft tissue facial changes remains a challenge. The purpose of the present study was to evaluate the 3-dimensional (3D) soft tissue changes in patients undergoing 2-jaw orthognathic surgery.

Patients and Methods: For the present retrospective cohort study, 40 consecutive patients (11 men and 29 women; mean age 23.5 ± 4.9 years) who had undergone 2-jaw orthognathic surgery were selected. We obtained the medical and dental records from 3 weeks before surgery and 6 months after surgery. We used image processing software to segment, superimpose, and quantify the hard and soft tissue displacements in 3 dimensions before and after surgery at 15 paired locations. The soft tissue and hard tissue changes were determined through quantification of homologous landmark displacements between the preoperative and postoperative computed tomography data. We measured the 3D soft and hard tissue changes and the anteroposterior, inferosuperior, and transverse components of the changes. We quantified the ratios between the soft and hard tissue changes, tested Pearson’s correlation between these changes, and developed a predictive regression equation for the observations at each location.

Results: We found that soft tissue movement followed the hard tissue movement, with a correlation nearly equal to 0.9 (range 0.85 to 0.98), suggesting that in general the soft tissues of the maxillary and mandibular landmarks are affected similarly by the skeletal movements. The anteroposterior component of the soft tissue 3D displacements followed the hard tissue movement with a ratio greater than 0.9 and with high correlation (r > 0.9) in the mandible.

Conclusion: The results of the present study provide surgeons with a ratio of hard to soft tissue change and the strength of the correlations, which will allow for more accurate 3D predictions for both midline and lateral structures in bimaxillary orthognathic surgical cases. In addition, predictive equations for various landmarks were developed and can be used in computer-based prediction programs to aid in treatment planning of soft tissue changes.