Computer-Assisted Orthognathic Surgery for Patients with Cleft Lip/Palate: From Traditional Planning to Three-Dimensional Surgical Simulation

Daniel Lonic, MD; Betty Chien-Jung Pai, DDS; Kazuaki Yamaguchi, MD; Peerasak Chortrakarnkij, MD; Hsiu-Hsia Lin, PhD; Lun-Jou Lo, MD

Disclosure/Financial Support: Supported by grants from Chang Gung Memorial Hospital, CMRPG381601-3 and CMRPG3B0291-3. None of the authors has any financial interest in any of the products, devices, or drugs mentioned in this manuscript.

Introduction: While traditional two-dimensional (2D) planning is still widely used for orthognathic surgery, three-dimensional (3D) simulation has constantly gained popularity in recent years[1]. Planning accuracy is increased due to the expanded information yield of 3D simulation, and can subsequently improve the surgical outcome in patients with craniomaxillofacial deformities[2]. We therefore examined the most commonly changed parameters after the treatment plan data transfer. Furthermore, we analyzed which planning aspects profit from the transfer in terms of more precise evaluation.

Materials and Methods: Thirty consecutive patients with cleft lip and/or cleft palate planned for two-jaw single-splint orthognathic surgery were enrolled. After the transfer of the 2D orthodontic surgery plan, the maxillo-mandibular complex position was assessed in the 3D simulation and possibly changed to improve function and aesthetic appearance and correct severe bony collisions in the ramus area. Pitch, roll, yaw, midline and genioplasty repositioning after 3D assessment was documented as well as the prevalence of such changes within the total patient group, bilateral, unilateral cleft lip/palate and isolated cleft palate subgroups.

Results: While the majority of 2D plans were modified, yaw and midline adjustments were the most common in the overall patient group. The highest mean values in the total patient group and all subgroups were also reached by yaw alternations. The problems of severe bony collisions and residual facial asymmetry after 2D treatment planning were successfully addressed using the additional information of the 3D simulation to modify the initial assessment.

Conclusion: Our data strongly suggests that 3D simulation improves the planning process for orthognathic surgery in cleft lip/palate cases. Important details like severe bony collisions in the ramus area can be highlighted which are otherwise underrepresented in traditional 2D treatment planning. Especially yaw and midline discrepancies are reliably detected so that residual facial asymmetry can be more effectively uncovered. Altering the 2D treatment plan in the 3D simulation is therefore more the rule than the exception in our patient group.

References:

1. Haas Jr OL, Becker OE and de Oliveira RB. Computer-aided planning in orthognathic surgery-systematic review. *International journal of oral and maxillofacial surgery*. 2014.

2. Xia JJ, Shevchenko L, Gateno J, et al. Outcome study of computer-aided surgical simulation in the treatment of patients with craniomaxillofacial deformities. *Journal of oral and maxillofacial surgery : official journal of the American Association of Oral and Maxillofacial Surgeons*. 2011; 69: 2014-24.