

Global Experience and Use of CAD CAM Modeling for Facial Reconstruction

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Abstract

Background: Three dimensional (3D) facial analysis and virtual surgical simulation have begun to revolutionize how surgeons treat and reconstruct head and neck diseases and defects (1-3). We evaluated our series of 75 consecutive patients who underwent total Computer-Aided Design and Manufacturing (CAD-CAM) to plan maxillofacial reconstruction including oncologic, orthognathic, congenital and traumatic disorders. We have examined our preoperative plan versus our post-surgical results in order to determine if surgical outcomes were improved.

Methods: Retrospective chart and image analysis of our global experience with CAD-CAM techniques was performed. 3D scans were analyzed using imaging software to assess positional differences in bony alignment between preoperative virtual planning and final surgical results. We also examined outcomes including dental rehabilitation and TMJ function.

Results: Global accuracy of reconstruction was found to be within 3 mm of the targeted goal. Orthognathic results showed all patients reached the desired occlusal alignment. Between 70 and 80 percent of our patients who underwent ablation procedures are either fully dentally reconstructed or are in the process of being reconstructed. Patients undergoing complete joint reconstruction in general have mouth opening ranging from 2 to 4 cm with good function overall.

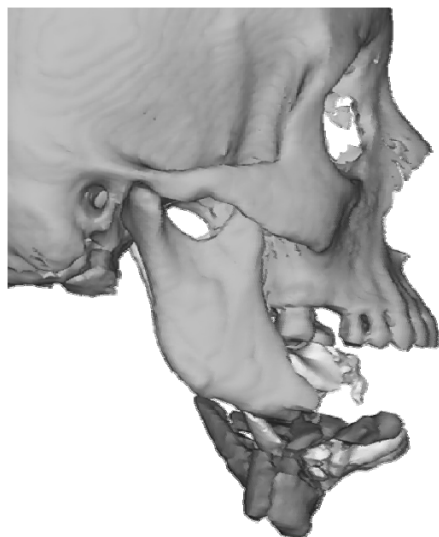


Figure 1. Preoperative 3D CT Scan of Facial Trauma

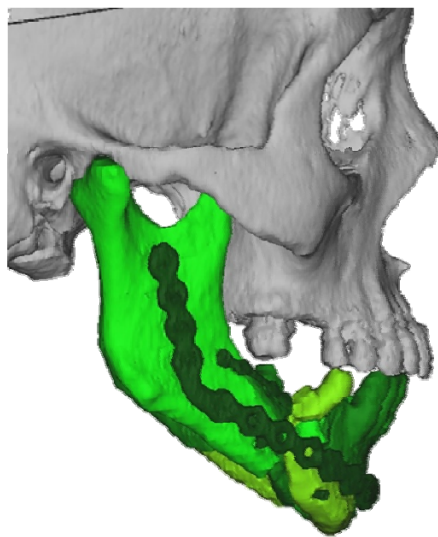


Figure 2. Virtual Planning for Fracture Reduction

Conclusions: Data from 75 patients demonstrates the use of this technology to correct precisely myriad disorders including orthognathic deformities, congenital anomalies, traumatic defects, and benign and malignant tumors. CAD-CAM modeling allows for an unparalleled 3D reconstructive accuracy, especially in areas that are difficult to visualize. Preoperative planning and modeling now represents the standard of care for these disorders in our institution. CAD-CAM modeling in maxillofacial surgery increases surgical accuracy even in the most complex bony injuries. We have also noted improved functional outcomes when compared to historic results. CAD-CAM technology allows for unparalleled surgical reliability and dramatically streamlined intraoperative decision making, representing the future of reconstruction for all maxillofacial disorders.

References

1. Hirsch DL, Garfein ES, Christensen AM, Weimer KA, Saadeh PB, Levine JP. Use of computer-aided design and computer-aided manufacturing to produce orthognathically ideal surgical outcomes: a paradigm shift in head and neck reconstruction. *J Oral Maxillofac Surg.* 2009 Oct;67(10):2115-22.

2. Sharaf B, Levine JP, Hirsch DL, Bastidas JA, Schiff BA, Garfein ES. Importance of computer-aided design and manufacturing technology in the multidisciplinary approach to head and neck reconstruction. *J Craniofac Surg*. 2010 Jul;21(4):1277-80.
3. Tepper OM, Sorice S, Hershman GN, Saadeh P, Levine JP, Hirsch D. Use of virtual 3-dimensional surgery in post-traumatic craniomaxillofacial reconstruction. *J Oral Maxillofac Surg*. 2011 Mar;69(3):733-41.