



**American Academy of Maxillofacial Prosthetics
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Program Speaker – Eduardo Arias-Amezquita

Title

Virtual Reality Planning in Reconstructive Surgery and Facial Prosthetics

Abstract

Purpose:

Virtual reality (VR) is emerging as an effective and intuitive surgical planning and 3D visualization tool. Digital surgical planning is the gold standard for planning the placement of implants in maxillofacial prosthetics, but the field lacks a platform exclusively designed to perform the task. Virtual reality planning (VRP) specific for maxillofacial prosthetics offers the clinician improved control of the presurgical planning and the potential to limit the need to adapt other advanced segmentation software. Furthermore, the virtual plan can be directly translated to the patient via custom 3D printed (3DP) surgical guides and visual aids. This study outlines the development of an original platform and workflow for segmentation, pre-op planning, and digital design within a VR environment and the clinical use in reconstructive surgery and anaplastology.

Method:

The workflow was applied to the management of 3 patients: two presenting with a total exenteration and one showing type IV microtia of the right face (n=3). A cone-beam CT was acquired for each patient, and their dataset was directly imported into the ImmersiveView VR environment (ImmersiveTouch Inc, Chicago, IL). The clinicians virtually selected appropriately sized craniofacial implants and placed the implants in the desired orientation. Various measurement tools are available to aid in clinical decision-making. The ideal location of craniofacial implants was set according to an orbital and auricular prosthetic reconstruction. The resultant VR plan was exported for 3DP. The patients were evaluated pre-op and post-op using the proposed VRP treatment. The workflow's data accuracy was validated post-operatively by comparing post-op CT data and the proposed VRP. Analysis was performed using Mimics software (Materialise, Leuven, Belgium).

Result:

It takes, on average, 10 minutes to place four implants in the virtual reality space. The 3DP files resulting from VRP take approximately 2 hours to print and are constructed with a biocompatible

resin appropriate for clinical use as surgical guides. Our user-friendly VRP workflow allows for an accurate simulation of surgical and non-surgical procedures with an average displacement in XYZ of .6mm and a standard deviation of .3mm. In addition, VRP is an excellent tool to simulate the craniofacial placement procedure and improves unsupervised self-learning teaching.

Conclusion:

VRP is an exciting tool for training clinicians and students in complex surgical procedures. This study shows the promising applicability and efficiency of VR in clinical planning and management of facial rehabilitation. Patients who are allowed to interact with VR have been engaged, which would aid their treatment acceptance and patient education. A valuable advantage of surgical simulation is the reduced costs associated with renting instruments, buying implant dummies, and surgical hardware. We will explore VR to plan and treat surgical and non-surgical reconstructive procedures and improve soft tissue manipulation.

Biography

Eduardo Arias is a Board-Certified Clinical Anaplastologist specializing in facial and ocular prosthetics rehabilitation, digital technologies, and innovation in medicine. He received his Bachelor of Fine Arts degree from the Pontificia Universidad Javeriana in Bogotá, Colombia. His education was followed by graduate clinical training in facial prosthetics at The Johns Hopkins University School of Medicine, Department of Art As Applied to Medicine in Baltimore, Maryland. Eduardo is a Master of Science (MSc) candidate in Maxillofacial Rehabilitation at King's College London in London, England, UK. He received further clinical experience at the JHU Facial Prosthetics Clinic, The Johns Hopkins Hospital and has worked in private practice at WCBL in Tampa, FL. He currently practices as a Clinical Anaplastologist and Ocularist at The Craniofacial Center, The University of Illinois at Chicago Department of Plastic, Cosmetic and Reconstructive Surgery. In addition, he is the director of the 3D Printing Lab at CFC and the Surgical Innovation Training Lab (SITL). Eduardo has been a member of the International Anaplastology Association since 2013. Also, he is a member of the International Society of Maxillofacial Rehabilitation, the International Academy of Ocularistry, and the Radiological Society of North America's 3D printing special interest group.