

# **Osteoradionecrosis Following Adjuvant Radiation to Free Fibula Flaps with Customized Titanium Plates**

Presenter: David A. Daar, MD, MBA

David J Byun, MD, Radiation Oncology, NYU Langone Health; Karl Spuhler, PhD, Radiation Oncology, NYU Langone Health, NY; Lavinia Anzai, MD, Hansjorg Wyss Department of Plastic Surgery, NYU Langone Health, New York, NY; Lukasz Witek, MSci, PhD, Department of Biomaterials and Biomimetics, NYU College of Dentistry, New York, NY; David Barbee, MD, Plastic Surgery, NYU Langone Health, NY; Kenneth S Hu, MD, Radiation Oncology, NYU Langone Health, NY; Adam S Jacobson, MD, Department of Otolaryngology, NYU Langone Health, New York, NY; Jamie P Levine, MD, Hansjorg Wyss Department of Plastic Surgery, NYU Langone Health, New York, NY

Co-Authors: Hansjorg Wyss Department of Plastic Surgery, NYU Langone Health, New York, NY

## **BACKGROUND**

Computerized surgical planning (CSP) in osseous reconstruction of head and neck cancer defects has become a mainstay of treatment. While CSP-designed titanium plates are proven to be more accurate, their variable shape and high burden of radiodense material have made complex adjuvant intensity modulated radiation therapy (IMRT) using advanced volumetric-modulated arc techniques (VMAT) more difficult to plan. There is a paucity of literature on the extent of radiation interaction with these novel CSP-based titanium plates, which may not be optimally planned based on conventional treatment planning algorithms.

## **METHODS**

A total of 16 cases of fibula reconstruction for head and neck cancers were identified during the period from January 1, 2019 to January 1, 2020. Two patients were identified as having osteoradionecrosis (ORN) after reconstruction and adjuvant IMRT.

## **RESULTS**

In case #1, the patient underwent left mandibular reconstruction with a CSP-designed 3-segment, double-barrel fibula flap and titanium plate and immediate dental implant placement, followed by adjuvant VMAT 6 weeks postoperatively with 32 fractions totaling 6400cGy. The patient subsequently developed ORN at 4.3 months postoperatively and 5 weeks from his last radiation fraction at the double-barrel site, requiring reoperation and a second fibula flap reconstruction. In case #2, the patient underwent right maxillary reconstruction with a CSP-designed 2-segment fibula flap and titanium plate, as well as dental implant placement. The patient underwent adjuvant VMAT at 10 weeks postoperatively with 33 fractions totaling 6996 cGy. At 6.9 months postoperatively and 2.8 months following completion of radiation the patient was noted to have severe ORN requiring debridement of the entire fibula flap and soft tissue coverage with a radial

forearm free flap. Adjacent to the site of ORN, pathology was notable for persistence of her maxillary SCC in the high dose treatment field within the explanted fibula bone. In both cases, these CSP-designed reconstruction plates may have contributed to inaccurate IMRT dosing most notably in areas of greatest titanium burden, e.g., at the double-barrel fixation area in Case 1 and the T-point of osteotomy site and fixation to native maxilla in Case 2.

## **CONCLUSION**

Despite proven benefits of CSP-designed plates in osseous free flap reconstruction, there may be an underreported risk to adjuvant IMRT treatment planning leading to ORN and/or local recurrence. Future study should investigate alternative plating methods and materials to mitigate this debilitating outcome.