

Trial in Progress: Preliminary Data on Impact of a Virtual Reality 3D Modeling Protocol on Surgeon Task Load Burden

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Introduction

Objective: Determine the feasibility of implementing a novel VR/3D CEP and measure its impact on surgeon task load burden

Background

- Surgical margins are the single most important predictor of locoregional recurrence in head and neck squamous cell carcinoma and one of the most important prognosticating factors.
- VR may potentially improve conceptualization of complex 3-dimensional intraoperative wounds as well as intraoperative communication between surgeon and pathologist at no risk to patients.

Methods

Enrollment

N=40 Patients diagnosed with cancer of the head and neck who are eligible for definitive resection

Randomization
20 Patients in 3D/VR Arm
20 Patients in Standard Arm

Pre-Surgical Planning

VR/3D-Enhanced

- Pre-Op scans reviewed
- Virtually plan surgery in VR
- Post-VR survey administered

Standard Treatment

- Pre-Surgical scans are reviewed
- No Post-VR survey administered

Intra-Op

ALL CASES

- Tumor resected and intra-op communication with pathologist proceeds in typical fashion
- 3D model of main specimen generated

Post-Op

ALL CASES

- Post-Operative Surveys Administered
- Nasa-TLX Administered
- Surgeon "digitally annotates" surgical margins on 3D rendered tumor model
- Consulted pathologist asked to replicate digital annotations on the 3D rendered tumor model

Pre-Operative

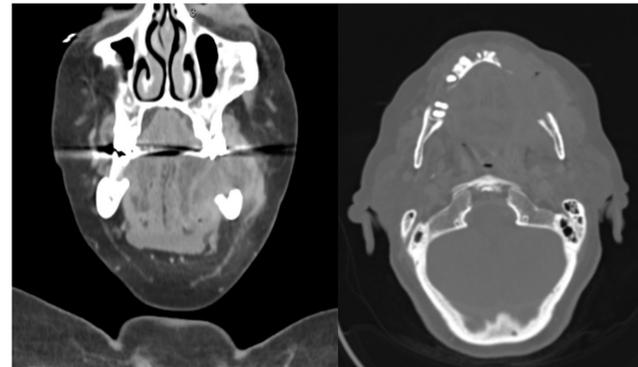


Figure 1a. Pre-Operative CT Neck with contrast of patient with SCC of L retromolar trigone eroding into mandible

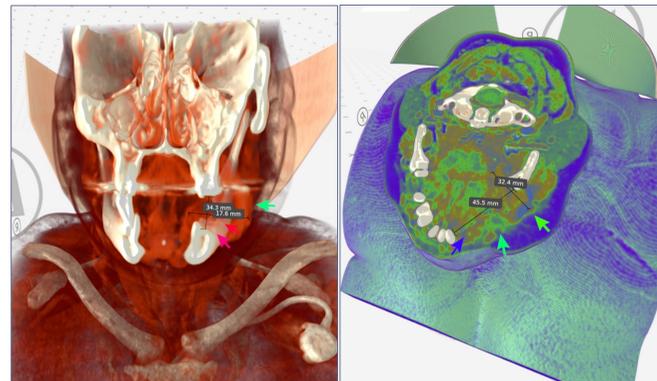


Figure 1b. Pre-Operative CT Neck of patient from Figure 1a rendered as 3D Segmented Model on Medical Holodeck Software

Intra-Operative

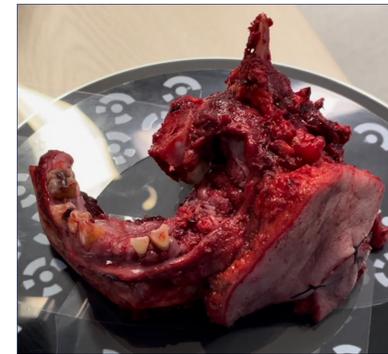


Figure 2a. Main specimen resected from the case of SCC of L retromolar trigone as shown in Figures 1a and 1b.

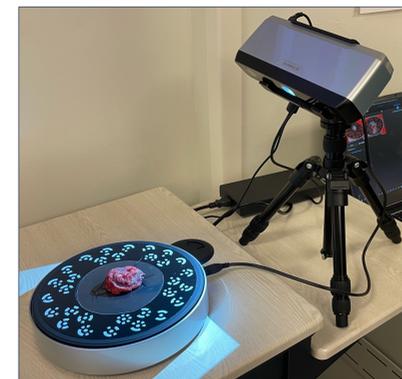


Figure 2b. Intraoperative EinScan 3D Scanner Setup (Different Specimen Pictured than in Figure 2a)

Post-Operative

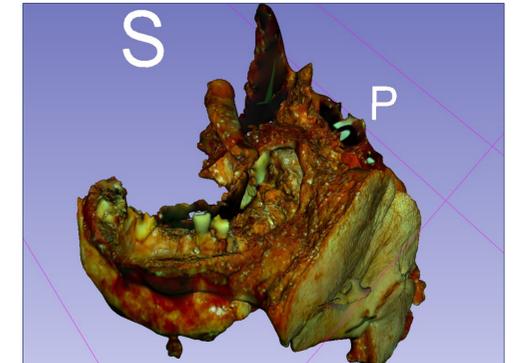


Figure 3a. Rendered 3D Model of main specimen on 3D Slicer software

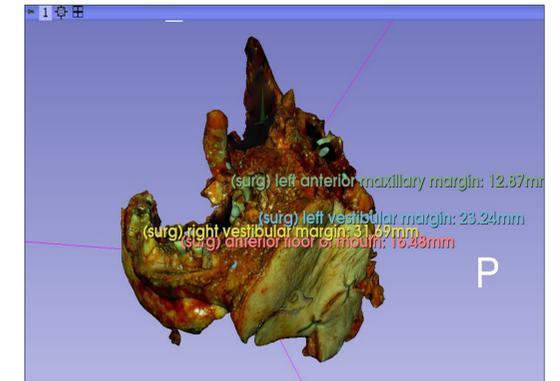


Figure 3b. Annotated model with surgical margins

Results

- Results from post-VR surveys (N=10) showed 100% of HNC surgeons found the VR planning to be useful and felt the protocol would be easily integrated into normal workflow.
- 80% of post-VR survey respondents were able to clearly visualize the tumor on Medical Holodeck.
- 30% of post-VR survey respondents indicated the VR protocol led to a change in surgical plan.
- Centroid calculation and data analysis from annotations of 3D scanned tumor models is still ongoing.

	VR/3D (N=10)	ST (N=10)
Subsite		
Oral cavity	3	7
Oropharynx	5	3
Larynx	1	0
Orbit	1	0
T Stage		
X	0	1
0	0	0
1	1	3
2	4	3
3	1	1
4	4	2
N Stage		
X	1	2
0	4	1
1	3	3
2	1	1
3	1	3
4	0	0

Table 1. Subsite and staging of participants

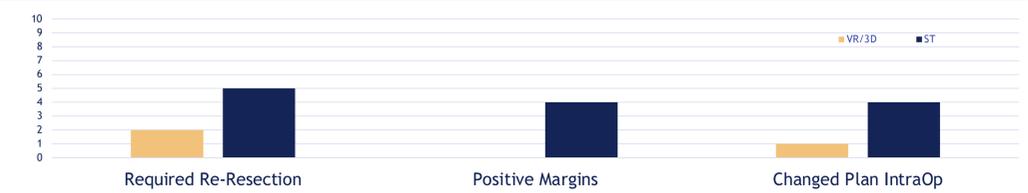


Figure 4. Intraoperative Events Reported from Post-Op Survey (N=20)

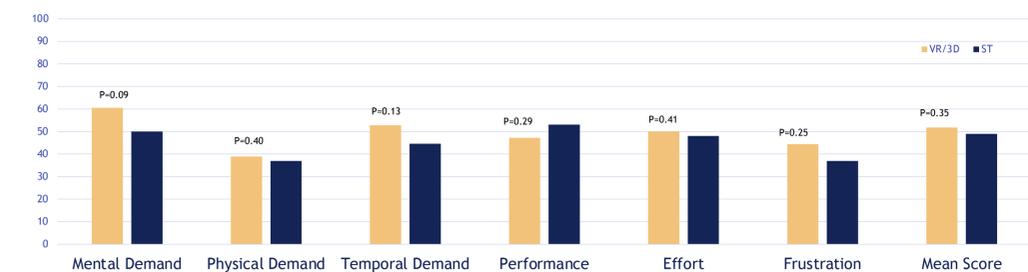


Figure 5. NASA-TLX Task Load Burden Assessment Tool Results Reported by Mean and Sub-Categories (N=20)

Conclusions

- The novel VR/3D Case Enhancement Protocol was successfully implemented to baseline HNC Surgeon workflow as all elements were successfully carried out for greater than 90 percent of cases enrolled.
- HNC Surgeon response to utility of VR application and 3D Scanning were primarily positive and there was a consensus on the feasibility of integrating the protocol into normal workflow.
- Improvements are still needed in the soft-tissue windowing and segmentation process of the suspected tumor in VR to optimize utility.

References

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