The Ohio State University James Comprehensive Cancer Center The Ohio State University College of Medicine

A Comparison of Surgical Outcomes of Patient-Specific 3D Maxilla Models for Intraoperative Maxillectomy Use

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INTRODUCTION

Malignancies involving the maxilla present significant challenges to surgeons during tumor resection given the proximity of critical anatomy and the often-advanced stage of the tumors. The deep location of the posterior margin makes it particularly challenging to achieve complete tumor resection. 3D printing technology has the potential to assist surgeons visualize the tumor and assist with reconstruction by producing patientspecific models that can be used in the operating room. 3D printed anatomical models are rapidly gaining traction for head and neck cancers involving the mandible; however, its use for sinonasal malignancies requiring maxillectomy is new.

RESULTS

 Table 1. Comparison of Demographics and Outcomes

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| Variable | Model Group | Controls | Significance |
|---|-------------------|-------------------|--------------|
| | (n = 13) | (n = 18) | (p-value) |
| Age (years) | 61.4 ± 8.6 | 69.2 ± 10.4 | 0.034 |
| Gender | 72.2% | 81.8% | 0.856 |
| BMI | 26.1 ± 3.4 | 32.7 ± 6.5 | 0.002 |
| Tobacco Use, Alcohol Use, Race, Medical Comorbidities | | | >0.05 |
| Surgical Outcomes | | | |
| Positive Main Margins | 8 | 9 | 0.524 |
| Positive Additional Margins | 0 | 2 | 0.214 |
| Close Margins | 6 | 8 | 0.576 |
| Estimated Blood Loss (ml) | 408 ± 256 | 331 ± 277 | 0.204 |
| Ischemia Time (minutes) | 122 ± 59 | 109 ± 29 | 0.566 |
| Post Operative Outcomes | | | |
| Adjuvant Treatment | Chemotherapy: 0 | Chemotherapy: 2 | |
| | Radiation: 6 | Radiation: 6 | |
| | Chemoradiation: 6 | Chemoradiation: 6 | 0.512 |
| | Death: 0 | Death: 1 | |
| | No treatment: 1 | No treatment: 3 | |
| Length of stay (days) | 6.3 ± 5.3 | 9.6 ± 5.5 | 0.033 |
| Recurrence Rate | 1 | 4 | 0.856 |
| Metastasis Rate | 0 | 0 | 0.999 |

AIMS

Evaluate the impact of 3D-printed models on tumor ablation outcomes in patients undergoing maxillectomy

METHODS

A matched-control retrospective chart review at the Ohio State James Figure 2. Example of 2 colored 3D printed model with the tumor in purple



Cancer Hospital of patients who received a maxillectomy for squamous cell carcinoma between June 2021 and October 2023. Cohorts consisted of patients who received a 3D printed model and those who did not. Cases were controlled for tumor T stage. Categorical comparisons were made using a Chi-square test, and continuous variables were compared via Mann-Whitney T-tests. Statistically significant was set at p<0.05



CONCLUSIONS

The use of 3D-printed, patient-specific anatomical models yielded comparable surgical outcomes to a control group in this retrospective analysis. Potential bias may have negatively influenced the results for the model group since surgeons tended to request models for more complex cases involving challenging tumor anatomy. Additionally, the full benefits of these models for maxillectomy may not yet be realized as their design and application continue to be optimized with increased usage and experience. Therefore, 3D-printed anatomical models may be a useful adjunct to assist with complex ablation for these challenging tumors.

Figure 1. Overview of the model production process

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