Authors: Georgina Papadopoulos, Jana Rieger, Johan Wolfaardt, Martin Osswald, Suresh Nayar, Hadi Seikaly

Title: Maxilla Reconstruction and Rehabilitation: The Impact of surgical planning and reconstruction guides on speech intelligibility and resonance outcomes

Introduction

Defects of the maxilla result in impaired function because the structures removed are essential for normal speech and swallowing. Historically, a prosthetic approach to rehabilitation has been used for patients who have undergone oncological treatment for maxillary cancer. This approach is fraught with outcomes that are unacceptable to patients, including their speech sounding substandard, food and liquid leaking into nasal cavity around the prosthesis, malodour associated with the prosthesis, and a lack of integration of the prosthesis into their self-image. With the advent of free-tissue transfer, reconstruction of the maxilla using the patient's own tissue became a possibility. While initial results of reconstruction looked promising, anatomical outcomes have not always been optimal. However, research has shown that the use of surgical planning and reconstruction guides can result in better anatomical outcomes. How this translates into functional outcomes is not clearly understood and was the objective of this research.

Objective

Speech and resonance outcomes were studied in three groups of patients: (1) those who had reconstruction using surgical simulation and patient-specific cutting guides; (2) those who had conventional reconstruction with no surgical simulation or guides; and (3) patients who had surgical resection and were rehabilitated with a maxillary obturator. Our hypothesis was that reconstruction with surgical planning and patient-specific cutting guides would result in improved functional outcomes, as compared to other techniques.

Methods

This retrospective study was approved by the Human Research Ethics Board at the University of Alberta. Ninety-two patients were included in the analyses: 46 patients with obturators; 29 patients with conventional maxillary reconstruction and 17 patients with surgical planning and reconstruction.

Speech outcome assessments were assessed via the Computerized Assessment of Intelligibility of Dysarthric Speech (CAIDS) (Pro-Ed, Austin, TX). Participants were given instructions to read a series of standard words or phrases and then the recordings were analyzed by unfamiliar listeners. The percentage of words and sentences correctly identified by listeners were recorded as a measure of intelligibility. Resonance outcomes were measured via the Nasometer (model 6200, KayPentax, Pine Brook, NJ) and aeromechanical measures of speech were measured via the PERCI-SARS (Microtronics Corporation, Chapel Hill, NC, 1999).

Results

Intelligibility results for all three groups were within normal limits. However, results for the resonance assessments were outside normal clinical levels for the obturator and conventional reconstruction groups. All speech assessments for patients reconstructed using surgical planning guides were within normal clinical limits. Outcomes for these patients were also less variable than those in the other two groups.

Conclusion

While speech intelligibility results were within normal limits for all three groups, resonance outcomes were less than optimal for patients who were treated with maxillary obturators or those who were reconstructed without the use of surgical planning and reconstruction guides. Abnormal resonance results, such as those reported in this study, have been found to correlate with listeners' perceptions of distorted speech. The results of this study reveal that these less-than-optimal speech outcomes can be averted through the use of surgical planning and reconstruction guides for maxillary reconstruction.