

# Speech Outcome in Oral Cancer Patients – Pre- and Post-operative Evaluation: A Cross-sectional Study

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## ABSTRACT

**Aim:** The tongue plays a major role in articulation. Speech outcome depends on the site of lesion, extent of resection, and flexibility of the remaining structures. The aim of this study is to evaluate the speech outcome measures such as sounds that are misarticulated and speech intelligibility and its connection to tumor site before and after surgery.

**Methodology:** Totally, 24 (12 pre- and 12 post-operative patients) patients who had buccal and tongue cancer underwent speech intelligibility rating and articulation screening.

**Result:** The results show that the speech outcome is worse in postoperative patients when compared to preoperative patients. The articulation errors produced by tongue cancer patients were more than the errors produced in buccal cancer patients. The type of reconstruction also affects the speech outcome.

**Conclusion:** The perceptual analysis of oral cancer patients showed specific articulation issues and reduced intelligibility of speech in regards to site of lesion and type of reconstruction surgery. To reduce the speech errors, effective rehabilitation is recommended. A comprehensive speech evaluation and analysis of error patterns would help us in planning the rehabilitative measures of speech which is the most important factor in re-establishing interpersonal communication and well-being of the individual.

**Key words:** Buccal cancer, Glossectomy, Oral cancer, Reconstruction surgery

## INTRODUCTION

Head and neck malignancy and its treatment might adversely influence the patient's activities of daily living. These patients have issues with regards to speech capacity, sustenance, and appearance (Deleyiannis, *et al*, 1997, Gellrich, *et al*, 2002).<sup>[1,2]</sup>

Longitudinal information uncovers personal satisfaction of treatment even when swallowing and speech troubles proceed to exist (Dholam *et al*, 2013, Mady *et al*, 2003).<sup>[3,4]</sup> Patients with oral and oropharyngeal malignancy are

particularly prone to speech difficulties. Speech outcome depends upon flexibility of structures in the oral cavity and oropharynx.<sup>[5]</sup>

Sufficient control of lips, tongue, and soft palate is important for production of speech. Any impairment in the range of movement, strength, and adaptability of these dynamic articulators might influence the capacity to make exact individual speech movements and coarticulations required in connected speech.

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The impacts of cancer on speech rely on the area and size of the growth. For instance, a sore or lump on the lips might restrict movement. This could bring about unclear production of speech sounds made with the lips, for example, p, b and m. Cancer of the tongue can bring about issues with many sounds, for example, if lesion is in the anterior portion of the tongue, or in the posterior aspect of the tongue, articulation is affected.

The outcomes after surgical treatment depends on the region and length of the cancerous growth. Other essential factors consist of quantity of tissue removed in surgical operation, frequency of speech/swallowing treatment, and initiative of the patient.<sup>[6,7]</sup>

The routines used for speech evaluation are heterogeneous, and they go from assessment of single phoneme<sup>[8]</sup> or word<sup>[9]</sup> on semiquantitative scales and identification of the spoken word by testing of communicative intelligibility in questions, descriptions,<sup>[10]</sup> or longer text passages.<sup>[8]</sup> They range from assessment of single phoneme or word on semiquantitative scales and communicative intelligibility of the spoken words are evaluated in questions, descriptions, or longer text passages.

Speech outcome is evaluated by the utilization of pointers of speech production (oral capacity and verbalization tests, air motion facilitating, and acoustical breaks down), speech recognition (coherence and adequacy), and self-reported speech adequacy in ordinary life circumstances (surveys). Various methodological contrasts exist between studies on speech nature of patients treated for oral or oropharyngeal malignancy. By and by, it can be reasoned that discourse challenges are exceedingly reliant on tumor size and site. Eagerly, patients experiencing resection of bigger tumors have more speech troubles. After resection of oral carcinomas, patients experience verbalization issues due to tissue misfortune, structure modification, or tongue mobility impairment. Target sounds may be misshaped, substituted, or discarded, prompting diminished comprehensibility. Speech production issues of patients with oropharyngeal deformities incorporate nasal reverberation issues in view of velopharyngeal insufficiency. On account of tissue misfortune or versatility disability, air will escape through the nose, vowels sound nasal, and inadequate weight can be developed in the oral cavity to deliver stops and fricatives. On account of proceeded with velopharyngeal conclusion, the air stream cannot escape through the nose, and the nasal consonants are denasalized.

Research has demonstrated that speech results can be a real determinant of the tolerant postoperative personal satisfaction (Radford, *et al.*, 2004).<sup>[11]</sup> In any case, the surgical variables focus postoperative speech and tongue capacity are not totally comprehended and not one or the other is the particular attribute of glossectomy speech (Bressmann, *et al.*, 2004).<sup>[12]</sup> Specialists have contended that degree of the resection, Rentschler 1980,<sup>[13]</sup> deformity site (Logemann *et al.*, 1993, Michiwaki, *et al.*, 1993),<sup>[14,15]</sup> and reproduction system for the imperfection (Konstantinovic and Dimic, 1998)<sup>[16]</sup> are the pivotal variables deciding the postoperative discourse results. There likewise has been exchange whether the leftover tongue ought to be kept adaptable, at the cost of lessening it in volume (Imai and Michi, 1992),<sup>[17]</sup> or whether cumbersome, raised folds ought to be utilized to supplant lost tissue (Yanai *et al.*, 2008,<sup>[18]</sup> Kimata *et al.*, 2003).<sup>[19]</sup> Pauloski *et al.*, 1998<sup>[20,21]</sup> evaluated the speech of 142 incomplete glossectomy patients and found that the degree of the resection related with the reduction in articulatory exactness.

Nicoletti *et al.*<sup>[22]</sup> utilized a robotized speech analyzer to survey the creation of select fricative sounds, for example, /s/, /ʃ/, /f/, and /θ/ in 196 patients. The results from the program analyzer were joined with a general measure of speech worthiness (“conversational understandability”). Bressmann *et al.*<sup>[23]</sup> said that the most frequently distorted target consonant was /g/, followed by /s/ in preoperatively; after surgery, the total number of articulatory distortions observed was increased and the most frequently distorted target consonant was /d/, followed by /k/, /r/, /s/, and /t/.

In a late study utilizing ultrasound imaging, Rastadmehr, *et al.*, 2008,<sup>[24]</sup> found that the inverse was the situation in a gathering of ten patients with little- to medium-sized deformities. In spite of desires, the glossectomy patients expanded the tallness and the pace of their midsagittal tongue development in the postoperative talking condition. This impact was seen in all patients, paying little heed to the system of imperfection recreation. It is conceivable that glossectomy patients energetically adjust for a loss of lingual tissue by making more extensive and quicker developments with the lingering tongue, Fletcher 1988.<sup>[25]</sup>

### Aim

The aim of this study was to examine speech outcome difficulties by method for a multidimensional speech evaluation in pre- and post-operative patients with oral cancer and speech challenges in connection to tumor site.

## METHODOLOGY

### Participants

Twelve pre- and post-operative patients (totally, 24) in the age range between 20 and 60 years with oral cancers (buccal and tongue cancer patients) were included in the study. In preoperative patients, five were with buccal cancers (buccal mucosa carcinoma) and seven were with tongue cancers (tongue lateral border carcinoma). In postoperative patients, five were with buccal cancers and seven were with tongue cancers. The buccal cancer patients were operated by composite resection and pectoralis major myocutaneous (PMMC) flap reconstruction. The tongue cancer patients were operated by hemiglossectomy (for five patients) and composite resection and PMMC flap reconstruction (for two patients).

### Assessment of phoneme production

For articulation evaluation, “Tamil articulation test” was used. The words that contain target phoneme were first presented by a clinician and the patient has to repeat the words. Each sound was marked as normal or as distorted, substituted, added, and omitted.

### Assessment of speech intelligibility

Overall, intelligibility was calculated by percentage of number of words perceived intelligible divided by total number of words spoken. For this, the patient has to speak about any general topic and his/her speech were recorded and analyzed by a clinician who has the same native language of patients.

## RESULTS

### Phoneme production

In buccal cancer patients, preoperatively, no articulatory errors were found. In postoperative evaluation of phonemes, substitution and distortion errors were observed in linguadental, linguopalatal, and linguavelar sounds. Most frequently distorted consonant was /t/, followed by /ʃ/, /tʃ/, /g/, and /r/. Furthermore, intraoral pressure was reduced in some postoperative patients.

In tongue cancer patients, preoperatively, substitution and distortion errors were noted in lingua-alveolar and linguopalatal sounds. In postoperative patients, substitution, distortion, and omission errors were noted in bilabial, lingua-alveolar, and linguopalatal sounds and also in patients who underwent hemiglossectomy have

less error than who underwent flap reconstruction. In tongue cancer patients prior to surgery, the most frequently distorted target consonant was /r/, /t/, followed by /s/, /tʃ/, /dʒ/, and /l/. Postoperatively, the most frequently distorted target consonant was /t/, followed by /d/, /tʃ/, /r/, and /b/. Some substitution errors are also noted for consonants /k/ and /ʃ/.

### Speech intelligibility

Preoperatively, speech intelligibility for buccal cancer patients is above 80% and up to 100%, with an average of 93.07%, and postoperatively, it ranges from 78–96%, with an average of 91.4%.

In tongue cancer patients, preoperatively, the intelligibility score ranges from 30% to 100%, an average of 74.28%, and postoperatively, it ranges from 20–96%, average of 73.42%.

## DISCUSSION

This study evaluated the speech characteristics of a small, convenience-sampled group of oral cancer patients. After surgery, voice quality and resonance are compromised because of changes in oral cavity volume, and articulation is affected because the tongue is unable to assume the normal position to provide valuing action needed for precise articulation. The results showed that the speech outcome depends on the site of lesion as tongue cancer patients have more articulation errors and less speech intelligibility. The observation showed that even before the surgery, patients had reduced speech intelligibility. In both groups, speech intelligibility worsened significantly after the surgery. It also was found that the patients with larger defects and flap reconstructions had poorer articulation ability than the patients with smaller defects and local reconstructions (hemiglossectomy).

Since there were relatively few consonant distortions observed, the hierarchy of consonant distortions may be of limited transferability to other groups of glossectomy patients. As reported by Bloomer and Hawk,<sup>[26]</sup> Kalfuss<sup>[27]</sup> evaluated the speech of 22 glossectomy patients and noted distortions of the vowel /i/ and of the consonants /l/, /v/, /k/, /g/, /θ/, /s/, /z/, /ʃ/, /tʃ/, and /dʒ/. Beck *et al.*<sup>(1998)[28]</sup> noted distortions of /r/, /l/, /s/, /z/, /ʃ/, /tʃ/, and /dʒ/ in five patients with floor of mouth resections and /r/, /j/, /l/, /s/, /k/, and /ʃ/ in five patients with resections of the dorsum of the tongue. The rank order found in our study slightly the same from these previous studies. The differences are probably explained by differences in the defect sizes

and locations as well as the reconstructive techniques employed by the surgeons.

The articulation intelligibility was better in patients not receiving flap than in those receiving flap. Reconstruction with flaps, which may additionally intrude with the flexibility and mobility of the tongue, may make contributions to articulatory impairment (Su WF *et al.*, 2002).<sup>[29]</sup>

Rehabilitation of speech is the most important aspect in preventing severe speech problems and re-establishing interpersonal communication. The rehabilitation for oral cancer patients depended upon the assessment of their postoperative articulation level, education, job, age, family, and motivation. In rehabilitation, one should consider the benefits with use of oral facilitative exercises, direct articulation techniques, compensatory techniques, surgical procedure, and prosthetic appliances (Kirita and Omura 2015).<sup>[30]</sup>

Oral facilitative exercises are generally prescribed to improve the strength and range of movement of the articulators. Direct articulation techniques are recommended mostly to improve the production of single or group of phonemes. Compensatory techniques may need to be considered when patient fails to make the correct placement of the target phoneme or group of sounds. Prosthetic procedures are preferred usually than surgical procedures. For example, velopharyngeal incompetence after surgery is generally treated with speech bulb or palatal lift than palatal reconstruction surgeries.

## CONCLUSION

The perceptual analysis of oral cancer patients showed specific articulation issues and reduced intelligibility of speech in regards to site of lesion and type of reconstruction surgery. However, there is no one to one correlation between articulatory errors in oral cancer patients. Because the ability of the articulation changes based on various factors such as compensatory ability and motivation of the patient, it also varies depend on type of surgery for removal of tumor. After free construction, the patient showed better articulation ability than flap construction. If speech is the outcome of interest, flap reconstruction may not be beneficial with hemiglossectomy or other partial (minor) glossectomy within the hemitongue. A comprehensive speech evaluation and analysis of error patterns would help us in planning the rehabilitative measures of speech which is the most important factor in re-establishing interpersonal communication and well-being of the individual.

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## Conflicts of interest

There are no conflicts of interest.

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