Journal of Carcinogenesis
Covering Genesis to Therapeutics

Journal of Carcinogenesis, ISSN: 1477-3163
2026; Vol 25: Issue 1, https://carcinogenesis.com/

Speech and Swallowing Following Tongue Cancer Surgery and Free Flap Reconstruction-A Systematic Review

Tripta Agarwal,[1] Rakesh Nagaraju,[2] Ajay Kumar Jagdish,[3] Sanjoy Dutta,[4] Indira Priyadarshini,[5] Kumar Ankit,[6] Nikhil Kumar Gautam[6]

[1]Senior Resident, Department of Dentistry, Nandkumar Singh Chauhan Government Medical College, Khandwa, Madhya Pradesh

[2]Professor, Department of Oral Medicine and Radiology, Faculty of Dental Sciences, Ramaiah University of Applied Sciences

[3]Head of the Department, Department of Oral and Maxillofacial Surgery, Asan Memorial Dental College and Hospital

[4]Professor & Head of the Department, Department of Oral and Maxillofacial Surgery, North Bengal Dental College and Hospital

[5]Department of Oral and Maxillofacial Surgery, Career Dental College, Lucknow

[6]Assistant Professor, Department of Oral Medicine and Radiology, Maharana Pratap College of Dentistry &

Research Centre, Gwalior

[6]Graduate, I Institute of Dental Sciences, Bareilly

ABSTRACT

Introduction-Tongue restoration presents a number of difficulties, including pedicle or free flaps, with variances resulting from the creation of the entire neotongue or the remaining native tongue tissue. Methods: Research on functional outcomes following tongue restoration with flaps was found using a thorough search of Embase, PubMed, the Cochrane Library, and Web of Science. 42 of the 782 articles were reviewed. The Critical Appraisal Skills Program instrument was used by four independent researchers to evaluate bias risk. Results: While free flaps like the radial forearm and anterolateral thigh were commonly utilised, the submental flap was the most common pedicle flap. Rebuilding type, postoperative radiation, and the extent of resection all affected functional results. In terms of functionality, neo-tongue reconstruction was different from oral tongue reconstruction. Speech results were comparable across pedicle and free flaps, while swallow outcomes were better with sensory or motor- innervated flaps. Conclusions: The study's findings are limited by inconsistent data, retrospective designs, and lack of standardized methods, necessitating cautious interpretation. Free flaps consistently offer better functional outcomes for tongue reconstruction, improving over time with rehabilitation.

How to Cite: Tripta Agarwal, Rakesh Nagaraju, Ajay Kumar Jagdish,3 Sanjoy Dutta, Indira Priyadarshini, Kumar Ankit, Nikhil Kumar Gautam, (2026) Speech and Swallowing Following Tongue Cancer Surgery and Free Flap Reconstruction-A Systematic Review, *Journal of Carcinogenesis*, *Vol.25, No.1*, 438-442

1. INTRODUCTION

Fixing speech and swallowing requires a complicated head-and-neck procedure called tongue reconstruction. Standard post-tumor reconstruction options include pedicled and free flaps, each of which has advantages and disadvantages. Yet, there is little agreement regarding their superiority, and the absence of standardised assessments makes it difficult to assess functional outcomes.[1,2] Innovative methods are used to meet challenges such as complex anatomy, functional requirements, and aesthetic results. Defect size, location, patient comorbidities, and surgeon skill all play a role in flap selection.[3-6]

Operational outcomes research have assessed the effects of free flap repair and tongue cancer resection on speech and swallowing abilities both objectively and subjectively.[7, 8, 9, 10, 11] The location and extent of resection, the reconstruction technique, sensory reinnervation, and postoperative radiation (PORT) are some of the elements that have been the subject of recent research on postoperative speech and swallowing.[15, 16]

The purpose of this systematic review is to evaluate current literature on speech and swallowing following immediate free flap tongue reconstruction according to the guidelines from the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[16] The research questions were (1) what are the speech and swallowing outcomes of primary resection of tongue cancer and immediate free flap reconstruction with or without adjuvant therapy and (2) what factors affect speech and swallowing outcomes in these patients.

2. METHODOLOGY

To find pertinent papers for this systematic review on tongue reconstruction using standard techniques, an in-depth search was carried out utilising the PubMed, Web of Science, Cochrane Library, and CINAHL databases. Important terms like "head and neck malignancies patients," "tongue carcinoma," "glossectomy," and other ((("tongue neoplasms"[Mesh]) OR ("head and neck neoplasms"[Mesh])) AND (\"glossectomy"[Mesh]) OR ("functional tongue") OR ("free flaps for tongue") OR ("glossectomy reconstruction") OR ("sensate tongue reconstruction") OR ("total tongue reconstruction"))). The search produced hundreds of articles between 2010 and May 14, 2025. 42 papers were chosen as references after filtering based

on age (>19 years), human studies, study type, and language were applied.

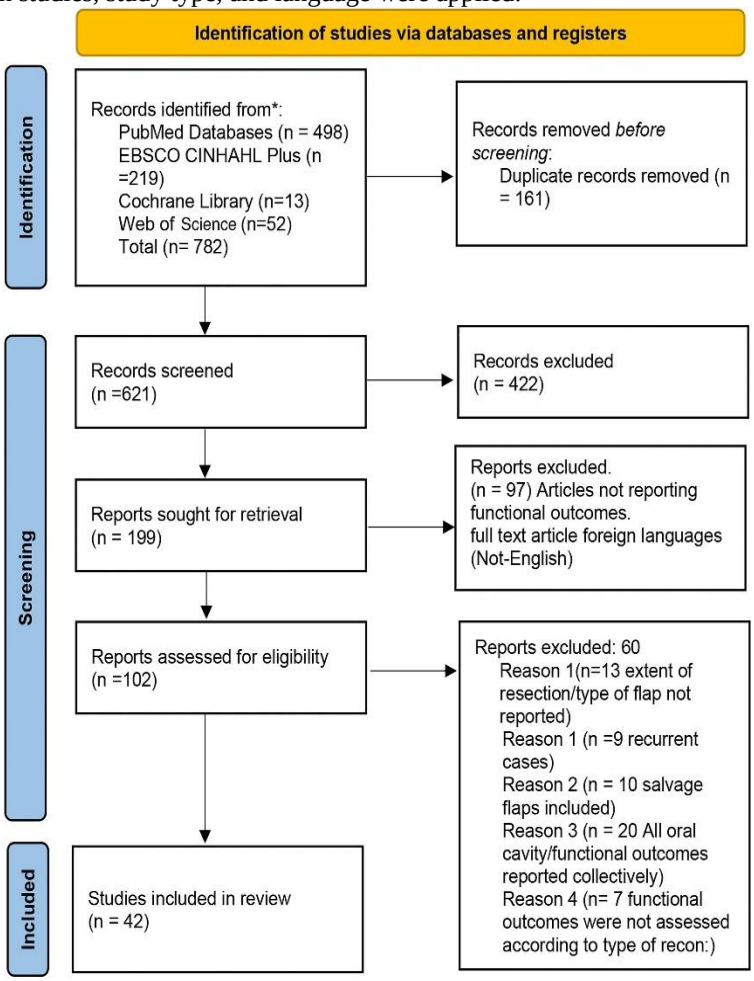

Fig. 1.: The flow chart of article selection (as adopted from PRISMA 2020, 14).

Inclusion Criteria

- Publications reviewed were limited to those published between January 2009 and May 14, 2023.
- Peer-reviewed articles with sample sizes more than 5, focusing on bias reduction, and evaluating QoL, speech, and swallowing outcomes in cancer patients after tongue reconstruction were selected.
- Only full-text English articles.

Exclusion Criteria

- Case reports, review reports, systematic reviews, and letters to the editor.
- All articles lacked information on reconstruction or functional outcomes.
- Articles published in languages other than English, even if meeting the criteria.

3. RESULTS

The search yielded 782 articles: PubMed (498), EBSCO CINHAHL Plus (219), Web of Science (52), and Cochrane Library (13). After removing 161 duplicates and screening 199 titles and abstracts, 113 articles were considered. Ultimately, 42 articles were included in the review (Fig. 1).

Twenty-four retrospectives and eighteen prospective trials with 1844 patients and 1776 flaps (1452 free flaps) were analysed in the final evaluation. Radial forearm (RFF) (676), anterolateral thigh flap (647), lateral arm (67), vertical rectus abdominis muscle/transverse rectus abdominis muscle (33), profunda femoris artery (21), gracilis (18), medial sural artery perforator (10), superficial circumflex iliac artery perforator (9), gastro-omental apex (9), and latissimus dorsi (3) were notable free flap types. Pedicled flaps included submental flaps (151), pectoralis major (65), supraclavicular flaps (55), facial artery musculomucosal flaps (FAMM 42), and buccinator flaps (11) (Surgical resections included hemiglossectomy (515), partial glossectomy (496), subtotal glossectomy (393), total glossectomy (222), muscle anatomy tongue surgery (100), compartmental tongue surgery (48), base of tongue and floor of mouth (40), marginal tongue resections (6), and 23 cases under "others."

To guarantee trustworthiness, only studies with a low-to-moderate risk of bias were included in the Critical Appraisal Skills Program tool for quality assessment. The evaluated research found that factors such defect dimensions and placement, neoadjuvant/adjuvant therapy, flap choice, type, and innervation were reliable markers. 718 individuals had adjunct therapies, including brachytherapy (4), chemotherapy (71), radiation (502), and chemoradiotherapy (141). Brachytherapy (1), radiation (19), chemotherapy (11), and neoadjuvant treatment (31). 17.7 months was the average follow-up duration.

Speech

With RFF serving as the main repair flap, hemiglossectomy is the most frequent defect in speech studies, followed by partial glossectomy. The duration of follow-up varied from instantaneous to 52.2 months. The main techniques employed were the authors' perceptual and clinical evaluations. The majority of patients were able to develop comprehensible speech after reconstruction, according to the research.[17,18,19] Patients having free flap reconstruction, particularly those with RFF, had improved speech comprehension. Nevertheless, individuals who had received adjuvant treatment—particularly radiotherapy—were seen as having less intelligible speech.[21]

Swallowing

Questionnaires were used to assess swallowing extensively. The MD Anderson Dysphagia Inventory, the University of Washington Quality of Life, the Functional Oral Intake Scale, the European Organization for Research and Treatment of Cancer (EORTC), and the swallowing capacity scale were the greatest often used measures. Five investigations used videofluoroscopy (VFS) for the goal assessment. Grammatica et al.[21] found satisfactory swallowing following tongue restoration using both evaluation techniques (VFS and EORTC). Hemiglossectomy a typically rebuilt defect, and RFF frequently produced better outcomes. Elfring et al.[22] observed that whereas nerve repair or preservation produced less problems, transecting lingual and hypoglossal nerves caused swallowing difficulty, dry mouth, and social hurdles.

It has significant effect on the "trouble with social eating" domain ($P = 0.040$ and $P = 0.028$, respectively).[22] A majority of the studies consistently reported delayed swallowing in postoperative radiotherapy (PORT) groups.[23,24,25] The minimum follow-up period for assessment was 3 months, and the maximum was 64 months.

4. DISCUSSION

Therapies for tongue cancer have significantly improved recently, with a growing focus on reconstructing the tongue to produce functional and cosmetic results. In order to improve functionality and quality of life, extensive rehabilitation and interdisciplinary cooperation are necessary. The oral cavity, tongue, epiglottis, larynx, and throat must all work in unison to produce speech, a complex function that promotes proper communication. Optimising the mobility of the residual tongue is the major goal of tongue restoration, which can be accomplished with patient motivation, robust social support, and intensive therapy. More frequently than objective methods like computerised acoustic analysis or diadochokinetic processes, clinicians employed perceptual evaluation and clinical assessments.[26,27] 62 patients—40 with partial glossectomy and 22 with subtotal or whole glossectomy repaired with free ALTF/vertical rectus abdominis muscle—were subjected to a mechanical acoustic examination by Takatsu et al. According to the study's findings, rehabilitation following repair can restore speech functionality by activating the residual tongue tissue and other speech parts. [26]

Several investigators have focused on 3-dimensional flap construction to improve functional results following subtotal/total glossectomy. In ten patients of tongue resection in a prospective investigation, revised RFFs showed better speech intelligibility ratings (mean 8 SD) than pedicled pectoralis major flaps ($P < 0.01$). Zhou et al[27] evaluated free ALTF sushi roll and conventional designs in 60 individuals postsubtotal (52), total glossectomy (8) and testified that the sushi roll

technique yielded superior speech and swallowing scores compared with the conventional group.[13–15,28,29,30]

To route food and lower the likelihood of aspiration, swallowing needs exact tongue muscle control. The planning process can reduce issues like aspiration and malnutrition, even though replicating these mechanisms is difficult. While the posterior tongue performs swallowing, the anterior tongue retains and moves the bolus. Because excess native tissue affects multiple-directional actions essential for oral intake, resections involving the base or rear tongue had worse results. Although complete tongue resections are more difficult than partial ones, functional results can be greatly enhanced by planned rebuilding. The second most often assessed result was swallowing, and self-reported polls were mostly used for subjective evaluations. Although VFS is the gold standard for impartial evaluation, its use is constrained by factors including cost, apparatus, and experience. Vidhyadharan et al demonstrated that partial glossectomy cases (n = 4) showed minimal residue and no aspiration/penetration, whereas subtotal glossectomy patients had significant residue despite repeated swallows.[31]

5. CONCLUSION

Although free flaps exhibit a tendency toward superiority, this comprehensive study concludes that there is not enough data to conclusively choose one form of flap over another in tongue restoration. Furthermore, custom flaps with sushi or pentagonal designs perform better than those with traditional designs. The fact that speech is the functional outcome that is evaluated the most frequently emphasises its significance. However, consistent comparisons are hampered by the absence of a standardised evaluation tool. Rehabilitation improves postoperative functional outcomes despite limitations, highlighting the beneficial effects of time after treatment. In order to better understand the best methods for tongue reconstruction and functional results, future study should address methodological discrepancies and improve assessment instruments.

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