Comparison of Functional and Survival Outcomes in Pedicled and Microsurgical Flap Reconstruction for Near-Total and Total Glossectomies

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Abstract

Introduction: Patients with advanced carcinoma tongue end up with near-total/total glossectomy (NTG/TG). We intended to compare functional, oncological, and survival outcomes of patients undergoing pedicled and microsurgical flap reconstruction in NTG/TG patients at our hospital.

Methodology: A prospective study was conducted for 7 years on 91 patients with carcinoma tongue who underwent NTG/TG at our institute. Patients underwent anterolateral thigh (ALT), free radial artery forearm flap (FRAFF), and pectoralis major myocutaneous (PMMC) flap reconstruction and were followed up for immediate complications and functional outcomes for speech, swallowing, and decannulation after completion of adjuvant treatment and then for survival rates for a period of 60 months and statistically analysed with log rank test and Fisher’s exact test for correlation.

Results: Ninety-one (42.85%) patients underwent NTG, while 57.14% underwent TG. 85% of patients had >5 mm margin, 14% had ≤ of 5 mm, and none were positive. 57% of patients did not have postoperative complications and 10% underwent re-exploration. During follow-up, 85.7% of patients were able to take orally: 52% soft diet and 32% liquid diet. Multivariate analysis of individual flaps, swallowing, and speech intelligibility values were significant.

Discussion: Morbidity and functional outcome depends on the extent of resection. PMMC flaps can be done on lack of expertise. FRAFF has better functional outcomes owing to pliability of flap. ALT and other bulky flaps require expertise and are prone to flap-related complications. Planning of reconstruction should be based on the defect size together with counseling of patients regarding the risk of complications and delay in adjuvant therapy.

Keywords: Anterolateral thigh flap, free radial forearm flap, near-total and total glossectomies, pectoralis major myocutaneous flap, speech intelligibility

Introduction

Carcinoma tongue is one of the common oral cavity malignancies and requires various degrees of resection. In India, most of the patients present with advanced stage and end up with either subtotal/near-total glossectomy (STG/NTG) or total glossectomy (TG). Such surgeries can lead to dramatic impairment of speech and swallowing function and thereby compromised quality of life (QOL). Due to impaired swallowing efforts, some patients have lifetime dependency on the tracheostomy tube. Literature suggests that the functional impairment and QOL depends on the extent of resection, with poorer results in patients who have undergone STG/NTG or TG when compared to partial or hemiglossectomy. However, with adequate reconstruction, these impairments can be reduced and QOL can be improved.

Initially, pectoralis major myocutaneous (PMMC) flap was used for the reconstruction of the tongue, and at present, due to the refinement of techniques, microsurgical flap reconstruction has gained importance. Various studies have quoted that final functional outcome depends on the volume of the reconstructed tongue. Hence, in this study,
we intended to compare the functional outcomes of pedicled and microsurgical flaps used in reconstruction for patients undergoing STG/NTG or TG along with its oncological outcome and 5-year survival.

**Methodology**

Between June 2013 and June 2020, 91 carcinoma tongue patients consenting for the study underwent STG/NTG or TG at the Department of Surgical Oncology, Sri Aurobindo Institute of Medical Sciences, Indore. Institutional ethical clearance (SAIMS/IEC/2021/28) was obtained and all procedures performed in the study were conducted in accordance with the ethics standards given in 1964 Declaration of Helsinki, as revised in 2013. Patients underwent clinical and radiological examination and those included were (1) biopsy proven primary tumour located in the tongue or the floor of the mouth (FOM); (2) preoperative magnetic resonance imaging (MRI) showed invasion in the tongue, FOM (3) no distant metastasis, and (4) general condition suitable for surgery. Patients with metastatic disease and those undergoing partial and hemiglossectomy were excluded from the study.

Before ablation of primary tumour, all cases underwent ipsilateral or bilateral neck dissection. According to the literature, we defined TG as Type V glossectomy where the whole mobile tongue including the base of the tongue (BOT) was removed and STG/NTG where the whole tongue was removed with retention of either whole or contralateral BOT.[5] If the mandible was invaded by a tumour, segmental resection with the primary tumour was planned; if the tumour had merely spread to the FOM, marginal mandibulectomy was done to achieve R0 margin. There was no pathological evidence of tumour spread to the larynx; therefore, the larynx was preserved in all cases.

**Reconstruction with flap tissue**

In the cases where free flap was planned, surgical oncology team was divided and two teams operated synchronously: one team resected the primary and performed neck dissection, whereas the other harvested the flap and reconstructed tongue. Pedicled and free flaps were harvested by surgical oncology team. Three types of flap were used for reconstruction: anterolateral thigh (ALT)[4] flap, free radial artery forearm flap (FRAFF),[5] and pedicled PMMC flap.[5] Flap size was determined intraoperatively and was based on the oral cavity defect. The flaps were harvested a bit larger with 30% overcorrection and if required the subcutaneous layer was deepithelialised to add on to the bulk so as to create a dome shape, the dome thus created remains closely in contact with the palate and anteriorly a triangular-shaped protuberance was created [Figure 1]. There was no pathological involvement of larynx and none of the patients required a laryngectomy, hyoid was hitched to the mandible so as to avoid the fall back of the larynx.

**Postoperative follow-up**

Patients were in close follow-up for documenting surgical site infection, orocutaneous fistula (OCF), flap status, length of hospital stay, removal of tracheostomy and nasogastric (NG) tube. Patients continued jaw stretching exercises in the wards. Post discharge, patients were followed up based on the NCCN guidelines. Three months after completion of surgery and adjuvant radiotherapy/chemotherapy, all of the 91 patients were referred to the department of rehabilitation for the evaluation and management of swallowing and speech therapy department to assess phonetic functions. Six months after the cancer treatment, swallowing function was assessed by defining the consistency of the diet (soft, liquid, and tube-feeding); the patients could sustain without significant laryngeal leakage or choking. Speech intelligibility was rated on a trinary scale of good, fair, or poor and was evaluated by speech therapists after listening to standardised sentences repeated by the patients. Decannulation of tracheostomy was planned when the patient was able to tolerate liquids after giving a trial. If any signs of aspiration or cough were noted, they were cannulated. Patients were followed up for 5 years to assess the survival and QOL. Speech intelligibility, swallowing, and oncological outcomes were our primary variables, while decannulation and

![Figure 1: Intraoperative procedure. (a-c) Pull-through technique for glossectomy. (d) Close opposition of (PMMC, FRAFF, and ALT) flap to the palate with anterior triangular shape protuberance. (e) Hyoidolaryngeal suspension. PMMC = Pectoralis major myocutaneous, FRAFF = Free radial artery forearm flap, ALT = Anterolateral thigh](image-url)
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Postoperative complications affecting QOL were secondary variables.

Statistical analysis
All the flaps used for the reconstruction of glossectomy defect were grouped into PMMC, FRAFF, and ALT and were compared to assess the functional outcomes and their individual complications. Correlation was derived with Fisher’s exact test and \( P < 0.05 \) was considered statistically significant. Log-rank test was used to compare the survival between the groups of STG/NTG with TG and primary with salvage surgery.

RESULTS
Of 91 patients, 64 of them were male and 27 were female with a mean age of 48.1 years (ranged 30–76). In our study subjects, the lesion was found to be evenly distributed in different parts of the tongue with no specific predominance on any part of the tongue [Table 1]. Patients were followed up for a period of 60 months, and 60 (65.93%) patients underwent primary surgery and 31 (34%) underwent postneoadjuvant chemoradiotherapy salvage surgery. Patients underwent metastatic workup, regional contrast-enhanced MRI scan and were staged [Figure 2], 20 patients were of Stage \( T_1 N_0 M_0 \) and 17 patients were \( T_4 N_1 M_0 \).

Based on histopathological examination (HPE), 79 patients had squamous cell carcinoma while 12 (13%) adenoid cystic carcinoma with 85% patients having margins of \( >5 \) mm, 14% had margins of \( \leq 5 \) mm and none of the margins were involved. Since all the flaps were harvested by surgical oncology team, owing to the learning curve, majority of our flaps were PMMC about 53% and as the finesse improved, based on the remnant volume of the native tongue, FRAFF and ALT flap coverage was done which contributed to 34% and 12% respectively. 52 (57%) patients did not have any postoperative complications, whereas 10 (10%) had to undergo re-exploration owing to kinking of the arterial vessel, and venous thrombosis was seen in 6 and 4 cases of FRAFF and ALT flap, respectively. Four flaps could be salvaged during re-exploration, while two and four flaps had undergone partial necrosis and complete necrosis, respectively, and had to undergo PMMC reconstruction on a later setting. Nine patients had OCF, which did not require any surgical intervention, were managed conservatively with regular dressings and antibiotic cover which resulted in increase in their hospital stay, morbidity, delayed decannulation and dependency on NG feeds [Table 2]. Of the 91 subjects, 13 and 9 patients were dependent on NG tube and tracheostomy tube, respectively, for more than 21 days, while 14 patients required inpatient care for more than 21 days [Table 3]. This was due to flap-induced morbidity. However, none of the patients had donor site morbidity and there was no mortality. During follow-up, patients were assessed for the functional outcomes and 85.7% (78/91) of patients were able to take orally, 48 (52%) patients were able to take soft diet and 30 (32%) patients were able to tolerate liquid diet. Based on the Fisher’s exact test, when compared with individual flaps, swallowing (\( P < 0.0001 \)) and speech intelligibility (\( P = 0.015 \)) values were found to be significant. 83.87% (26/31) FRAFF, 54.54% (6/11) ALT, and 32.65% (16/49) PMMC patients constituted 85.7% of patients who tolerate soft diet while 51% (25/49) PMMC, 13% (4/31) FRAFF and 9% (1/11) ALT were among the 32% patients who could tolerate liquid diet. 14% of total patients were dependent on tube feeds where 16% (8/49), 36% (4/11), 3% (1/31) were of PMMC, ALT and FRAFF respectively. On speech intelligibility score, 90% (82/91) of patients were able to communicate. 55% (50/91) of patients had good speech intelligibility, of which 77% (24/31) FRAFF, 54% (6/11) ALT and were 40% (20/49) PMMC respectively. 35% (32/91) had an acceptable speech of which 46% (23/49) PMMC, 27% (3/11) [Figure 2: Clinical Staging]

### Table 1: Clinical feature of patients

| Patient Characteristics | Number (%) |
|-------------------------|------------|
| Age                     |            |
| \( \leq 50 \)            | 55 (60.43) |
| \( >50 \)                | 36 (39.56) |
| Sex                      |            |
| Male                    | 64 (70.32) |
| Female                  | 27 (29.67) |
| Location                |            |
| Anterior two third       | 15 (16.48) |
| Anterior two third + post third | 23 (25.27) |
| Anterior two third + FOM | 15 (16.48) |
| Post third + extending to BOT | 17 (18.68) |
| Whole tongue + FOM extending to BOT | 19 (20.87) |
| Treatment given          |            |
| Primary surgery          | 60 (65.93) |
| Salvage surgery          | 31 (34.06) |
| Histology                |            |
| SCC                     | 79 (86.81) |
| Adenoid cystic           | 12 (13.18) |

FOM: Floor of the mouth, BOT: Base of the tongue, SCC: Squamous cell carcinoma
Excision of the adjacent structures in the oral cavity is a significant factor in swallowing disturbances. This includes excision of more than 25% of the root of the tongue, which can lead to profound impact on swallowing, particularly on thicker consistency boluses, greater pharyngeal residue, lower oropharyngeal swallow efficiency, and shorter duration of cricopharyngeal opening [11]. The latter effects are the end result of radiation-induced fibrosis of the oropharyngeal musculature, leading to significant reduction in glossoptalatal and glossoptalaryngeal seal [12]. All these findings are also seen in patients who have undergone primary chemoradiation, and due to extensive fibrosis and induration, it increases the risk for complications such as poor wound healing, wound dehiscence, and OCF when presented for salvage surgery [13].

In our centre, patients underwent pull-through approach for NTG or TG taking care not to disturb the mandibular integrity, to avoid postoperative pain or any interference in mastication. None of the patients required to undergo segmental mandibulotectomy for margin clearance. As the reconstruction was done by surgical oncology team, patients [Table 2]. Postadjuvant therapy, patients were followed up for 5 years, 76% patients were asymptomatic while 11% had local recurrence and 12% had regional recurrence.

### Discussion

Tongue is a dynamic organ in the oral cavity and involves itself in articulation, mastication, and propulsive function of food in buccal phase of swallowing which is followed by gentle compression of food bolus so as to stretch the receptors in the BOT and pharynx to initiate the involuntary pharyngeal stage of swallowing where uvula contracts and blocks the nasal passage along with contraction of laryngeal muscles closing glottis which is superimposed by closure of epiglottis. This allows the food bolus to be divided into lateral channels to pass through either valleculae and pass down into the oesophagus. Due to its multifunctional role, tongue has a pertinent function in speech and swallowing in humans.

Excision of a part or the whole of the tongue due to oral cancer disturbs its close-knit mechanism in swallowing and speech as the tongue losses its attachments over mandible and pharynx. Intensity of swallowing disturbances due to glossectomy depends on the extent of tissue excision [6]. Excision of oral tongue, BOT with or without laryngectomy have the most unfavourable impact on swallowing [6]. The most common disturbance occurs in oral stage by limited tongue mobility to form a bolus, impaired glossoptalatal seal, and weak glossoptaryngeal seal. However, profound impact is seen when there is excision of over 25% of the root of tongue leading to delay of initiation and impaired clearance of residue in pharyngeal stage leading to massive refractory postsurgical aspiration [13]. Excision of the adjacent structures in the oral cavity like segmental mandibulotectomy affects mastication and increases oral transit time and impairs swallowing [8,9]. Supranyloid muscle excision done in isolation or with segmental mandibulotectomy displaces the larynx downward and leads to food retention in pyriform sinus and aspiration [10].

The effects are doubled when these patients are subjected to postoperative radiation. Radiation leads to severe mucositis and xerostomia, which further worsens oral and pharyngeal transit time, especially on thicker consistency boluses, greater pharyngeal residue, lower oropharyngeal swallow efficiency, and shorter duration of cricopharyngeal opening [11]. The latter effects are the end result of radiation-induced fibrosis of the oropharyngeal musculature, leading to significant reduction in glossoptalatal and glossoptaryngeal seal [12]. All these findings are also seen in patients who have undergone primary chemoradiation, and due to extensive fibrosis and induration, it increases the risk for complications such as poor wound healing, wound dehiscence, and OCF when presented for salvage surgery [13].

### Table 2: Complications and functional outcomes

| Complications       | Total (%) | PMMC | FRAFF | ALT | P     |
|---------------------|-----------|------|-------|-----|-------|
| Decannulation       |           |      |       |     |       |
| Yes                 | 82 (94.10)| 45   | 30    | 7   | 0.017 |
| No                  | 9 (9.89)  | 4    | 1     | 4   |       |
| Swallowing capacity |           |      |       |     |       |
| Soft diet           | 48 (52.74)| 16   | 26    | 6   | <0.0001|
| Liquid diet         | 30 (32.96)| 25   | 4     | 1   |       |
| Tube feed           | 13 (14.28)| 8    | 1     | 4   |       |
| Speech intelligibility |       |      |       |     |       |
| Good                | 50 (54.94)| 20   | 24    | 6   | 0.015 |
| Acceptable          | 32 (35.16)| 23   | 6     | 3   |       |
| Poor                | 9 (9.89)  | 6    | 1     | 2   |       |

SSI: Surgical site infection, OCF: Orocutaneous fistula, PMMC: Pectoralis major myocutaneous, FRAFF: Free radial artery forearm flap, ALT: Anterolateral thigh

### Table 3: Surgery and reconstruction performed

| Surgical features and post-op characteristics | Number (%) |
|-----------------------------------------------|------------|
| Subtotal/near-total                           | 39 (42.85) |
| Total                                         | 52 (57.14) |
| Margins                                       |           |
| ≤5 mm                                         | 13 (14.28) |
| >5 mm                                         | 78 (85.71) |
| Involved                                      | Nil       |
| Reconstruction                                |           |
| PMMC                                          | 49 (53.84) |
| FRAFF                                         | 31 (34.06) |
| ALT                                           | 11 (12.08) |
| Complications                                 |           |
| SSI                                           | 13 (14.28) |
| OCF                                           | 9 (9.89)  |
| Re-exploration                                | 10 (10.98) |
| Flap necrosis                                 | 7 (7.79)  |
| None                                          | 52 (57.14) |
| Length of stay (days)                         |           |
| ≤21                                           | 79 (86.81) |
| >21                                           | 14 (15.38) |
| Duration of NG tube (days)                    |           |
| ≤21                                           | 78 (77.92) |
| >21                                           | 13 (14.28) |
| Locoregional recurrence                       |           |
| Local                                         | 10 (10.98) |
| Regional                                      | 11 (12.08) |
| None                                          | 70 (76.92) |

PMMC: Pectoralis major myocutaneous, FRAFF: Free radial artery forearm flap, ALT: Anterolateral thigh, SSI: Surgical site infection, OCF: Orocutaneous fistula, NG: Nasogastric

ALT and 19 (6/31) PMMC while 9% (9/91) had poor speech intelligibility, while 18% (2/11) ALT, 12% (6/49) PMMC and 3% (1/31) FRAFF had local recurrence and 12% had regional recurrence.

ALT and 19 (6/31) PMMC while 9% (9/91) had poor speech intelligibility, while 18% (2/11) ALT, 12% (6/49) PMMC and 3% (1/31) FRAFF had local recurrence and 12% had regional recurrence.
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Kaplan–Meier overall survival (OS) curves for the patients for the period of 60 months showed reduced proportion of OS in salvage surgery subgroup and TG subgroup when compared with primary surgery and near-total subgroup, respectively [Figures 3 and 4], probably due to aggressive disease pathology coupled with recurrence and second surgery. None of our patients required total laryngectomy for the margin clearance. Probably, the functional assessment and techniques involved in various flaps for reconstruction would be better if there would have been subgroups with segmental/hemimandibulectomy and laryngectomy. These were the limitations of our study and also we would suggest for future studies comparing the functional outcomes before and after the surgery along with various flap reconstructions, which would give a better understanding in the modifying reconstruction techniques and its outcomes based on the comparision with the premorbid state. Subgroup analysis with laryngectomy and in case of salvage surgery would help understand functional outcomes better with various flaps.

Conclusion

Morbidity and functional outcome in glossectomy depends on the extent of resection and remainder of native attachments. Pedicled and free flaps can be used for the reconstruction of the defects. PMMC flaps can be done if there is lack of expertise. FRAFF has better functional outcomes owing to pliability of the flap together with flap inset technique followed in the reconstruction. ALT and other bulky flaps require expertise and are prone to flap related complications, thereby prolonging the morbidity and delay in adjuvant therapy. Planning of reconstruction should be based on the defect size together with better counseling of patients regarding the acceptance of risk of complications and delay in adjuvant therapy based on the expertise offered.

Figure 3: Overall survival between primary and salvage surgery group in months
Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

REFERENCES
1. Vincent A, Kohlert S, Lee TS, Inman J, Ducic Y. Free-flap reconstruction of the tongue. Semin Plast Surg 2019;33:38-45.
2. Lender JJ, Evans GR. Oral cavity reconstruction. In: Mathes SJ, editor. Plastic Surgery. 2nd ed. Philadelphia: Elsevier Inc.; 2005. p. 924.
3. Dzioba A, Aalto D, Papadopoulos-Nydam G, Seikaly H, Rieger J, Lenert JJ, Evans GR. Oral cavity reconstruction. In: Mathes SJ, editor. Plastic Surgery. 2nd ed. Philadelphia: Elsevier Inc.; 2005. p. 924.
4. Manrique OJ, Leland HA, Langevin CJ, Wong A, Carey JN, Ciudad P, et al. Optimizing outcomes following total and subtotal tongue reconstruction: A systematic review of the contemporary literature. J Reconstr Microsurg 2017;33:103-11.
5. Ansarin M, Bruschini R, Navach V, Giugliano G, Calabrese L, Chiesa F, et al. Classification of glossectomies: Proposal for tongue cancer resections. Head Neck 2019;41:821-7.
6. Takatsu J, Hanai N, Suzuki H, Yoshida M, Tanaka Y, Tanaka S, et al. Phonologic and acoustic analysis of speech following glossectomy and the effect of rehabilitation on speech outcomes. J Oral Maxillofac Surg 2017;75:1530-41.
7. Ji YB, Cho YH, Song CM, Kim YH, Kim JT, Ahn HC, et al. Long-term functional outcomes after resection of tongue cancer: Determining the optimal reconstruction method. Eur Arch Otorhinolaryngol 2017;274:3751-6.
8. Jagtap M, Karnad M. Swallowing skills and aspiration risk following treatment of head and neck cancers. Indian J Surg Oncol 2019;10:402-5.
9. Mehta S, Kuriakose MA. Principles of surgical management of oral cancer. In: Bonanthaya K, Panneerselvam E, Manuel S, Kumar VV, Rai A, editors. Oral and Maxillofacial Surgery for the Clinician. Singapore: Springer; 2021.
10. Hara K, Tohara H, Minakuchi S. Treatment and evaluation of dysphagia rehabilitation especially on suprahypoid muscles as jaw-opening muscles. Jpn Dent Sci Rev 2018;54:151-9.
11. Alterio D, Gerardi MA, Cella L, Spoto R, Zurlo V, Sabbatini A, et al. Radiation-induced acute dysphagia: Prospective observational study on 42 head and neck cancer patients. Strahlenther Onkol 2017;193:971-81.
12. Mogadas S, Busch CJ, Pflug C, Hanken H, Krüll A, Petersen C, et al. Influence of radiation dose to pharyngeal constrictor muscles on late dysphagia and quality of life in patients with locally advanced oropharyngeal carcinoma. Strahlenther Onkol 2020;196:522-9.
13. Kumarasiri A, Liu C, Kamal M, Fraser C, Brown S, Chetty JJ, et al. Changes in pharyngeal constrictor volumes during head and neck radiation therapy: Implications for dose delivery. J Cancer Res Ther 2017;13:218-23.
14. Sroussi HY, Epstein JB, Bensadoun RJ, Saunders DP, Lalla R, Migliorati CA, et al. Common oral complications of head and neck cancer radiation therapy: Mucositis, infections, saliva change, fibrosis, sensory dysfunctions, dental caries, periodontal disease, and osteoradionecrosis. Cancer Med 2017;6:2918-31.
15. Kiyokawa K, Tai Y, Inoue Y, Yanaga H, Mori K, Nakashima T. Functional reconstruction of swallowing and articulation after total glossectomy without laryngectomy: Money pouch-like reconstruction method using rectus abdominis myocutaneous flap. Plast Reconstr Surg 1999;104:2015-20.
16. Kimata Y, Sakuraba M, Hishinuma S, Ebihara S, Hayashi R, Asakage T, et al. Analysis of the relations between the shape of the reconstructed tongue and postoperative functions after subtotal or total glossectomy. Laryngoscope 2003;113:905-9.
17. Sakuraba M, Asano T, Miyamoto S, Hayashi R, Yamazaki M, Miyazaki M, et al. A new flap design for tongue reconstruction after total or subtotal glossectomy in thin patients. J Plast Reconstr Aesthet Surg 2009;62:795-9.
18. Yu P, Robb GL. Reconstruction for total and near-total glossectomy defects. Clin Plast Surg 2005;32:411-9.
19. Vega C, León X, Cervelli D, Pons G, López S, Fernández M, et al. Total or subtotal glossectomy with microsurgical reconstruction: Functional and oncological results. Microsurgery 2011;31:517-23.
20. Saldanha E, Desai SM, Patel DG, Dhakad V, Joseph B, Ghosh S. Outcome evaluation of mandibular pull-through approach for glossectomy defects. Indian J Surg Oncol 2021;12:722-8.
21. Kimata Y, Sakuraba M, Namba Y, Hayashi R, Ebihara S. Functional reconstruction with free flaps following ablation of oropharyngeal cancer. Int J Clin Oncol 2005;10:229-33.
22. Yun IS, Lee DW, Lee WJ, Lew DH, Choi EC, Rah DK. Correlation of neotongue volume changes with functional outcomes after long-term follow-up of total glossectomy. J Craniofac Surg 2010;21:111-6.
23. Gangiti KK, Gondi JT, Nemade H, Sampathirao LM, Raju KV, Rao TS. Modified pectoralis major myocutaneous flap for the total glossectomy and oncological results. Microsurgery 2011;33:103-11.
24. Saldanha E, Desai SM, Patel DG, Dhakad V, Joseph B, Ghosh S. Outcome evaluation of mandibular pull-through approach for glossectomy defects. Indian J Surg Oncol 2021;12:722-8.
25. Kimata Y, Sakuraba M, Namba Y, Hayashi R, Ebihara S. Functional reconstruction with free flaps following ablation of oropharyngeal cancer. Int J Clin Oncol 2005;10:229-33.
26. Yu P, Robb GL. Reconstruction for total and near-total glossectomy defects. Clin Plast Surg 2005;32:411-9.
27. Vega C, León X, Cervelli D, Pons G, López S, Fernández M, et al. Total or subtotal glossectomy with microsurgical reconstruction: Functional and oncological results. Microsurgery 2011;31:517-23.
28. Saldanha E, Desai SM, Patel DG, Dhakad V, Joseph B, Ghosh S. Outcome evaluation of mandibular pull-through approach for glossectomy defects. Indian J Surg Oncol 2021;12:722-8.
29. Kimata Y, Sakuraba M, Namba Y, Hayashi R, Ebihara S. Functional reconstruction with free flaps following ablation of oropharyngeal cancer. Int J Clin Oncol 2005;10:229-33.
30. Yun IS, Lee DW, Lee WJ, Lew DH, Choi EC, Rah DK. Correlation of neotongue volume changes with functional outcomes after long-term follow-up of total glossectomy. J Craniofac Surg 2010;21:111-6.
31. Gangiti KK, Gondi JT, Nemade H, Sampathirao LM, Raju KV, Rao TS. Modified pectoralis major myocutaneous flap for the total glossectomy and oncological results. Microsurgery 2011;33:103-11.
32. Saldanha E, Desai SM, Patel DG, Dhakad V, Joseph B, Ghosh S. Outcome evaluation of mandibular pull-through approach for glossectomy defects. Indian J Surg Oncol 2021;12:722-8.
33. Kimata Y, Sakuraba M, Namba Y, Hayashi R, Ebihara S. Functional reconstruction with free flaps following ablation of oropharyngeal cancer. Int J Clin Oncol 2005;10:229-33.
34. Yun IS, Lee DW, Lee WJ, Lew DH, Choi EC, Rah DK. Correlation of neotongue volume changes with functional outcomes after long-term follow-up of total glossectomy. J Craniofac Surg 2010;21:111-6.
35. Gangiti KK, Gondi JT, Nemade H, Sampathirao LM, Raju KV, Rao TS. Modified pectoralis major myocutaneous flap for the total glossectomy and oncological results. Microsurgery 2011;33:103-11.
36. Saldanha E, Desai SM, Patel DG, Dhakad V, Joseph B, Ghosh S. Outcome evaluation of mandibular pull-through approach for glossectomy defects. Indian J Surg Oncol 2021;12:722-8.
37. Kimata Y, Sakuraba M, Namba Y, Hayashi R, Ebihara S. Functional reconstruction with free flaps following ablation of oropharyngeal cancer. Int J Clin Oncol 2005;10:229-33.
38. Yun IS, Lee DW, Lee WJ, Lew DH, Choi EC, Rah DK. Correlation of neotongue volume changes with functional outcomes after long-term follow-up of total glossectomy. J Craniofac Surg 2010;21:111-6.