

## CASE REPORT

# EFFICIENCY OF REPLACEMENT OF TONGUE DEFECTS AND RESTORATION OF CHEWING AND SWALLOWING FUNCTIONS

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### ABSTRACT

**Introduction.** Tongue cancer is the most common malignant neoplasm of the oral cavity. Malignant neoplasms of the tongue are one of the biggest problems of treatment for surgeons due to the adverse effect of treatment on the function of the oral cavity and pharynx, reduced quality of life and poor prognosis of advanced disease. With progress in microsurgical techniques, tongue reconstruction is aimed not only at replacing the tissue deficit, but also at restoring its functions.

**Case presentation.** The patient, 38 years old, diagnosed with cancer of the right lateral surface of the tongue with metastases in neck lymph nodes on both sides, stage IVa, clinical group II, was treated at the Podilskyi Oncology Centre, Vinnytsya, Ukraine. The patient underwent lower temporal tracheostomy, fascial-case dissection of the neck on the left, radical neck dissection on the right, hemiglossectomy on the right with reconstruction with a free radial flap of the forearm. The final outcome was favourable and the operation was functionally successful.

**Conclusions.** This case shows the effectiveness of replacing a tongue defect with a radial forearm free flap to restore chewing and swallowing function.

### RÉSUMÉ

**Efficacité du remplacement des défauts de la langue et la restauration des fonctions de la mastication et de la déglutition**

**Introduction.** Le cancer de la langue est la tumeur maligne la plus fréquente de la cavité buccale. Les néoplasmes malins de la langue sont l'un des plus grands problèmes de traitement pour les chirurgiens en raison de l'effet indésirable du traitement sur la fonction de la cavité buccale et du pharynx, de la réduction de la qualité de vie et du mauvais pronostic de la maladie avancée. Avec les progrès des techniques microchirurgicales, la reconstruction de la langue vise non seulement à combler le déficit tissulaire, mais aussi à restaurer ses fonctions.

**Présentation du cas.** Le patient, 38 ans, diagnostiqué avec un cancer de la surface latérale droite de la langue aux métastases dans les ganglions lymphatiques du cou des deux côtés, stade IVa, groupe clinique II, a été traité au Centre d'oncologie Podilskyi, Vinnytsya, Ukraine. Le patient a subi une trachéotomie temporale inférieure, un curage aponévrotique du cou à gauche, un curage cervical radical à droite,

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**Keywords:** cancer, radial forearm flap, chewing, swallowing, reconstruction.

## INTRODUCTION

The incidence of head and neck cancer is steadily increasing and is characterized by high aggressiveness. Although these are tumours easily to identify, over 70% of patients with newly detected squamous cell cancer of the head and neck are diagnosed with negligible forms of the disease. They are characterized by a significant tumour size, with spread to adjacent structures and 43% of them have regional and 10% distant metastases<sup>1,2</sup>.

Tongue cancer is the most common malignant neoplasm of the oral cavity. The incidence of tongue cancer has increased over the past 30 years and has three morphological forms of growth: exophytic, ulcerative, and infiltrative<sup>3</sup>.

Surgical treatment is preferred in the treatment of a tumour with T1-T2 local spread, without involvement of the regional lymph nodes. The treatment of a tumour in the stage T3-T4a is recommended to start with surgical treatment and continue with a postoperative course of radiation therapy or systemic treatment and radiation therapy<sup>4</sup>. Radical resections of tongue cancer often lead to volumetric defects and impaired function (chewing, swallowing, articulation, speech) and this affects the postoperative psychoemotional state of the patient<sup>5</sup>. The immediate reconstruction of the tongue after extensive operations is a key factor in achieving restoration of the functions of oral cavity organs. Tongue plays a central role in the function of chewing, swallowing, speech, protection of the respiratory tract and maintenance of oral hygiene<sup>6</sup>. Tongue defect reconstructions began with the widespread use of primary closure with local tissues, free skin grafts, and regional flaps on vascular pedicles, such as the submental myofascial flap, the musculocutaneous flap of the pectoralis major muscle, and the trapezius flap<sup>5,9</sup>. Such methods are limited in providing a good functional result with large defects. With microsurgery, it became possible to freely move the tissue to optimize reconstructive operations by ensuring sufficient tissue volume and flap mobility<sup>10-14</sup>. The variants of free tissue movement for tongue reconstruction

une hémiglossectomie à droite avec reconstruction par lambeau radial libre de l'avant-bras. Le résultat final a été favorable et l'opération a réussi fonctionnellement.

**Conclusions.** Ce cas montre l'efficacité du remplacement d'un défaut de la langue par un lambeau libre radial de l'avant-bras pour restaurer la fonction de mastication et de déglutition.

**Mots-clés:** cancer, lambeau radial de l'avant-bras, mastication, déglutition, reconstruction.

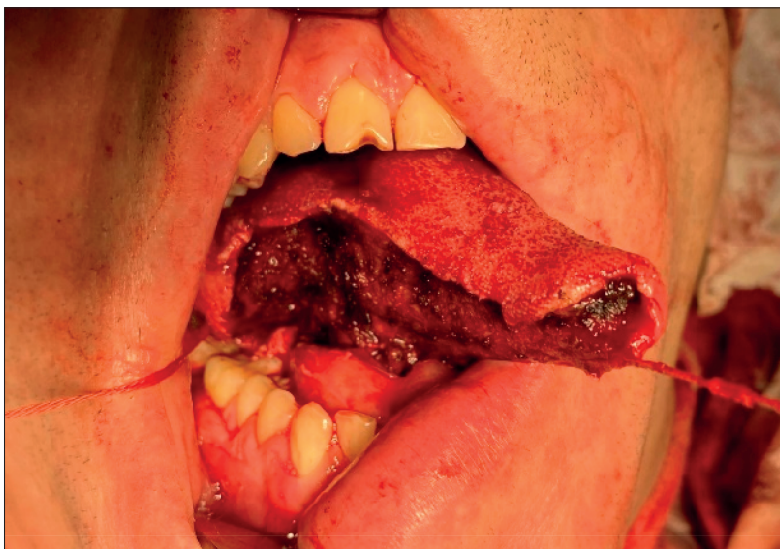
include rectus abdominis myocutaneous flap, latissimus dorsi myocutaneous flap, forearm skin-fascia radial flap, anterolateral thigh flap<sup>15-17</sup>.

Therefore, reconstruction after resection of the tongue is one of the most difficult problems in maxillofacial surgery. However, there is no consensus on the most appropriate method of partial glossectomy reconstruction<sup>18</sup>. With progress in microsurgical techniques, tongue reconstruction is aimed not only at replacing the tissue deficit, but also at restoring its functions. Although numerous factors influence the postoperative function, restoration of tongue volume and mobility is essential to achieve optimal results<sup>19,20</sup>. Patients with tongue cancer in whom the reconstruction with free flaps was performed have better functional outcomes than patients with pedicled myocutaneous flaps<sup>21</sup>. The first free flap to be transferred, based on the radial artery and a segment of the superficial branch of the radial nerve, was performed by Taylor in 1976<sup>22</sup>. However the radial forearm flap as a skin-fascial flap was first presented by Yang in 1981<sup>23</sup>.

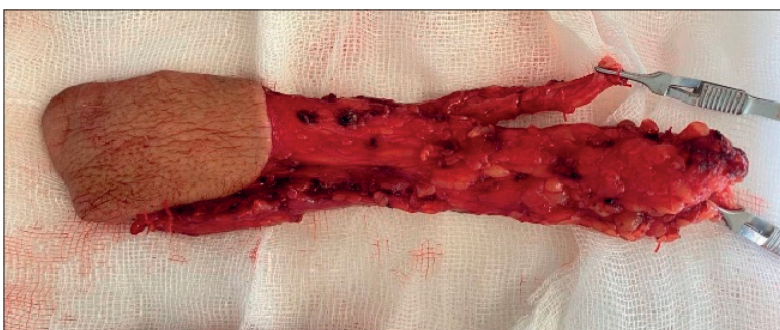
Based on the radial artery and cephalic vein or comitant vein, this flap can be transferred as a composite flap containing vascularized bone, vascularized tendon, brachioradialis muscle, vascularized nerve or sensory nerves<sup>24</sup>. All the advantages such as the easy release of the flap, thin and plastic tissue, a sufficiently long vascular «leg», make the radial forearm free flap the method of choice for replacing defects in the oral cavity. Therefore, the free radial forearm flap has become a frequent choice for the reconstruction of the tongue and other intraoral defects.

Also, among the entire complex of problems in the treatment and rehabilitation of patients with oral cavity tumours, postoperative anaesthesia of the affected area and correction of nutritional status should be considered.

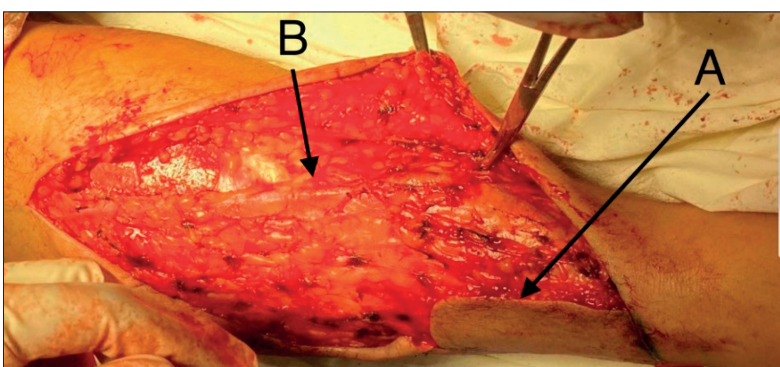
To evaluate the functionality of the radial forearm free flap, we investigated and described a clinical case with removal lateral surface tongue cancer and reconstruction with this flap. The patient's functional status and postoperative complications were studied.



**Figure 1.** Defect after hemiglossectomy.



**Figure 2.** Free radial flap with vessels.



**Figure 3.** Release of the radial forearm free flap: A – tissue flap; B – cephalic vein.

## CASE PRESENTATION

The patient, 38 years old, diagnosed with cancer of the right lateral surface of the tongue with metastases in the neck lymph nodes on both sides, stage IVa, clinical group II, was treated at the Podilskyi Oncology Center, Vinnytsia, Ukraine. The patient was provided with lower temporary tracheostomy, neck dissection on the left, radical neck dissection on

the right, hemiglossectomy on the right with reconstruction with a radial forearm free flap (Figures 1,2).

A flap from the non-dominant hand was chosen for tongue reconstruction. It is supplied with blood by the radial artery and the venous outflow passes through the cephalic and comitant veins (Fig. 3).

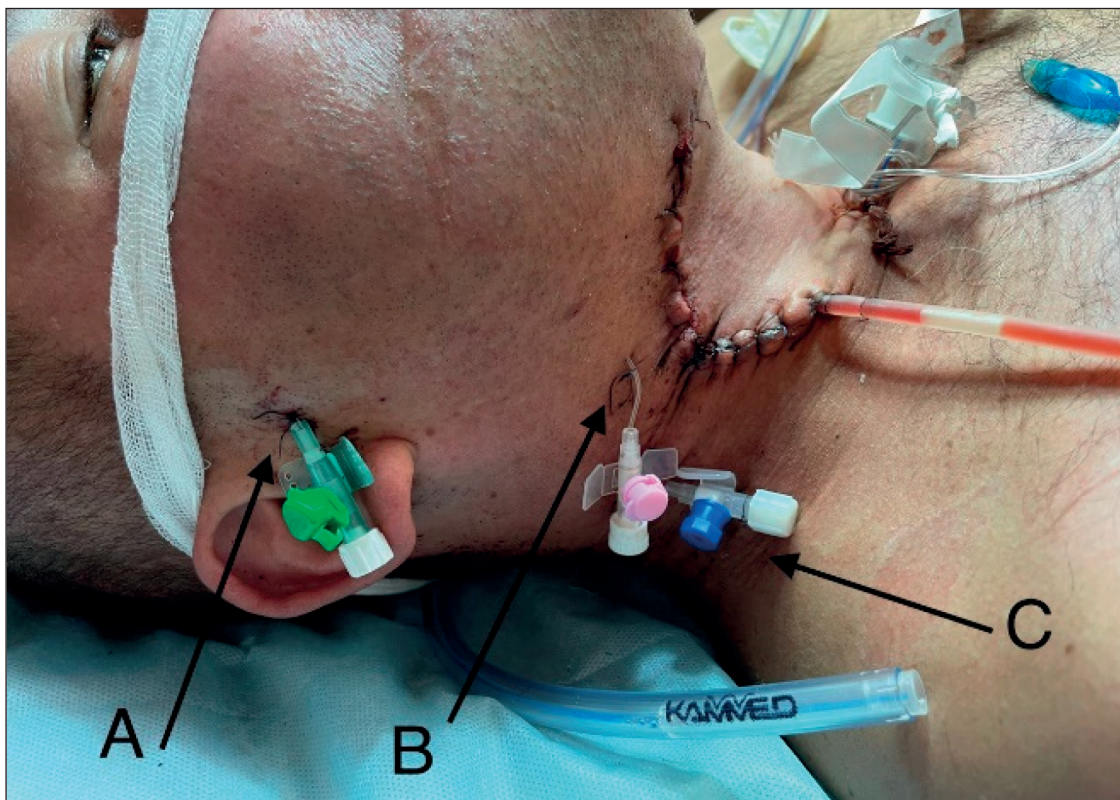
The flap was transferred to the area of the tongue defect by pulling it through the muscles of the diaphragm of the oral cavity floor. End-to-end



**Figure 4.** The result of plastic reconstruction of the tongue defect after hemiglossectomy.



**Figure 5.** Donor area of the forearm.



**Figure 6.** Long-term postoperative conductive analgesia: A – mandibular nerve block; B – glossopharyngeal nerve block; C – superficial cervical plexus block

microvascular anastomoses of the radial and facial arteries were performed. Venous anastomoses were formed between the cephalic, comitant and facial veins. The flap is sewn to the preserved part of the tongue (Fig. 4).

The defect in the area where the radial flap was taken is closed with a free dermal flap (Fig. 5).

Catheters for long-term postoperative conductive analgesia (LPCA) were installed near the foramen ovale (at the exit of the mandibular nerve) and at the root of the tongue (in the area where the glossopharyngeal nerve passes). Catheters are fixed to the skin (Fig. 6). For LPCA we used 2 ml of a 4% ultracaine solution in each catheter. The duration of anaesthesia was 4-5 hours.

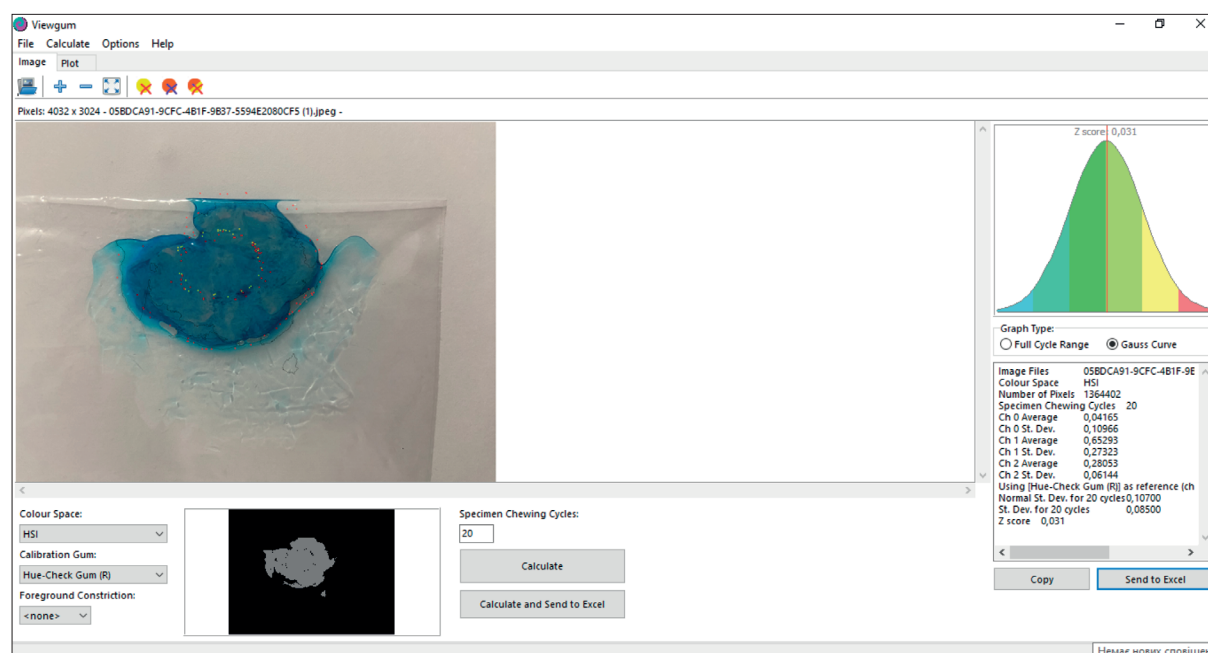


Figure 7. Mixed gums with selected research segments.

Table 1. The study of the act of swallowing.

| Period                     | Action  | Research indicators      |                                           |                                            |
|----------------------------|---------|--------------------------|-------------------------------------------|--------------------------------------------|
|                            |         | chin-hyoid distance (mm) | suprahyoid muscle group healthy side (mm) | suprahyoid muscle group affected side (mm) |
| Before operative treatment | rest    | 46.8                     | 10.3                                      | 9.1                                        |
|                            | swallow | 35.1                     | 10.7                                      | 9.9                                        |
| After operative treatment  | rest    | 46.8                     | 10.3                                      | 8.4                                        |
|                            | swallow | 41.6                     | 10.5                                      | 8.8                                        |

At the end of the surgical intervention, a feeding tube was installed. The patient received the nutritional mixture "Peptamen" and intravenous "Glutargin". The index of total protein and albumin before surgery was 61 g/L and 32 g/L, and after treatment 75 g/L and 37 g/L, respectively. Before surgical treatment and supportive therapy, BUN was 6.2 mmol/L, glucose 4.2 mmol/L, ketone bodies 1.1 mmol/L. After treatment, BUN was 5.5 mmol/L, glucose 4.5 mmol/L and ketone bodies 0.9 mmol/L.

The postoperative period passed without complications at the places of reconstruction and the donor area.

The patient was provided with tongue reconstruction with a radial forearm free flap. It recreates an almost normal tongue shape with a more prominent tip and vertical volume. The shape and mobility of the flap optimize the postoperative function of the oral cavity. A radial forearm free flap creates a mobile tip of the tongue with sufficient volume to provide acceptable swallowing function and cosmetic effect.

The neck drain was removed on the second day of the postoperative period. The nasogastric tube was removed on the 10<sup>th</sup> day.

To assess the functional status, a study of chewing efficiency, ultrasound diagnosis of the act of swallowing in the pre- and postoperative period was performed. Chewing efficiency was determined using two-colour Orophys Hue-chek gum (Switzerland). The chewing test is based on mixing gum of two colours in 20 chewing movements. Software and calculations included the Viewgum package and Excel (Fig. 7).

Using the k-means clustering method, masticatory efficiency was assessed for each food bolus by evaluating mixed and unmixed areas. Before surgery, the chewing efficiency of the composition was 0.83, which corresponds to good mixing of the food bolus. After the reconstruction of the tongue it was 0.67, moderate mixing of food bolus.

The act of swallowing was studied using ultrasound, where the following indicators were determined: chin-hyoid distance, suprahyoid muscle group on the right and left. Indicators were recorded at rest and during swallowing, before surgical treatment and after reconstruction (Table 1).

An ultrasound examination revealed a decrease in the amplitude of muscle contraction. Thus, the

difference in the contractions of the chin-hyoid muscles distance was 6.5 mm, of the suprahyoid muscle group on the affected side 1.1 mm and there were no changes on the healthy side.

The pain index was determined on the visual analog scale (VAS) for 1 day – 6 points, 3 days – 4 points, 5 days – 3 points, 7 days – 2 points, and 10 days – 0 points.

During the inpatient treatment, the results of surgery, analgesic therapy by the LPCA method and the use of supportive therapy on the quality of life were studied using the EORTC-QLQ-H&N35 questionnaire on the 3<sup>rd</sup>, 7<sup>th</sup>, and 10<sup>th</sup> postoperative days. Positive dynamics were observed on day 3 – 62 points, on day 7 – 53 and day 10 – 38 points.

The duration of the postoperative stay in the hospital was 10 days. This corresponds to the time of flap recovery and gastric tube removal. The results of the treatment were positive and the operation was functionally successful.

## DISCUSSION

In tongue cancer surgery, the goal is extensive removal of the tumour, but it is necessary to ensure its functioning after surgery. Preservation of the function of swallowing and speech is important to ensure the patient's quality of life in the future. The patient's swallowing and speech are normal after the operation.

Free flaps allow one-stage reconstruction and this is the main reason why the most sophisticated technique has become widely used in head and neck surgery. A patient with radial forearm free flap reconstruction in the early postoperative period develops a slight decrease in speech and swallowing function, but positive dynamics are observed after 3-5 days. Reconstruction of a large postoperative tongue defect is mandatory to restore adequate swallowing and speech. Free flaps provide the thin and flexible tissue that is needed to restore tongue shape and volume and improve functional outcomes.

## CONCLUSIONS

In tongue cancer surgery, the radial forearm free flap is a safe, effective material with a low complication rate. This is accompanied by good functional and aesthetic results. In addition, supportive therapy and adequate postoperative analgesia have a positive effect on the general and psychoemotional state of the patient. This technique has a high success rate and can be the surgical method of choice for replacing tongue defects.

## Author Contributions

Z.V.B. was responsible for the clinical diagnosis, treatment decisions, performed the surgery and wrote the manuscript. A.A.K. was responsible for the diagnostic procedures, treatment decisions, performed the surgery and wrote the manuscript.

## Compliance with Ethics Requirements:

"The authors declare no conflict of interest regarding this article."

"The authors declares that all the procedures and experiments of this study respect the ethical standards in the Helsinki Declaration of 1975, as revised in 2008(5), as well the national law. Informed consent was obtained from the patient included in the study."

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