New modification of flap design for total and near-total mobile tongue reconstruction using anterolateral thigh flap

Islam A. Amer

Department of General Surgery, Faculty of Medicine, Sohag University, Sohag, Egypt

Correspondence to Islam A. Amer, MD, PhD, Lecturer of Maxillofacial, Head and Neck Surgery, General Surgery Department, Faculty of Medicine, Sohag University, Sohag, 82524, Egypt Tel: +20 101 776 6441; Fax: 0934605754;
e-mail: dr.islamamer1981@gmail.com

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Introduction
The tongue is the most important organ involved in voice, bolus formation, and swallowing. As the tongue is a highly specialized tissue, restoring of the tongue is one of the major challenges facing oncological reconstructive surgeons.
Patient and methods
Since 2013, we have reconstructed 60 resections of the tongue using a free flap [radial forearm, anterolateral thigh (ALT)]. The complete mobile tongue resection (total and near-total tongue resection) represented a small group of 10 patients. We checked the records of the seven patients who had been reconstructed with an ALT flap with a cathedral design. The seven patients (five males and two females) underwent a complete mobile tongue reconstruction with an ALT free flap with a cathedral design.
Result
All flaps survived with no need for flap revision. All flaps had a natural shape and volume of the tongue, even after radiotherapy, allowing adequate dental and palatal contact.
Conclusion
This kind of shaping of the ALT flap has a good and direct effect on the quality of life o patients as regards swallowing, speech, and deglutition of our patients.

Keywords:
cathedral design, free anterolateral thigh flap, tongue cancer, tongue reconstruction

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Introduction

The tongue has many important functions and is involved in speech, swallowing mastication, and oral hygiene [1]. It is one of the most specialized organs, thus leading to nonsatisfactory reconstructive tongue surgeries if the goal was to recreate large tongue defects [2]. Tongue defects can be divided into many classes of defects, and one of the most widely used is that Urken and Biller [3] have suggested.

Restoration of tongue functions for patients having tongue defects is one of the great challenges facing head and neck reconstructive surgeons [4,5]. That is why, patients may experience severe dysarthria and dysphagia after total or partial glossectomy [6].

Reconstruction of tongue defects by primary closure or skin grafting may lead to a distorted tongue, leading to defective tongue functions [2]. This has led reconstructive surgeons to change their minds so that the first goal would be the preservation of as much as of the functions of the remaining part of the tongue [7].

The anterolateral thigh (ALT) flap was first described by Song *et al.* [8], and since that time, this technique has achieved progressive agreement and popularity in the field of reconstructive microsurgery. It is involved in many reconstructive techniques for different soft tissue defects all over the body and can be either free or pedicled flap [9].

Numerous modifications have been identified to the ALT flap techniques to increase their value for the customized reconstruction of complex soft tissue defects, particularly for small and complex organs such as soft tissue defects in the head and neck [10].

Based on its vascular anatomy, the ALT can be harvested with two or more separate skin paddles or as a chimeric flap, with a separate myofascial component [11,12]. This would provide flexibility for the reconstruction of composite defects, especially for complicated structures [13]. It also allows folding and shaping of the flap as a bilobed or cathedral triptych pattern for the delicate and complicated reconstruction of the surface, such as the tongue [7,14].

Aim

The goal of this study was to test the use of an ALT flap in a new modification design for total or near-total mobile tongue reconstruction.

Patients and methods

Location of data collection

Our work was conducted in the Maxillofacial, Head and Neck Surgery Unit in Surgery Department in Sohag University Hospitals in Sohag, between January 2013 and September of 2020 after the approval of the ethical committee and taken written informed consent of the patients.

Patients' characteristics

The total number of patients who had been collected for this research study was 10 patients.

Of these 10 patients, seven were eligible and agreed to participate in this study, as two patients were missing during the course of the study and did not come for continuous follow-up in our department and one patient died in the early postoperative period.

Consequently, this thesis included only seven patients who were eligible and agreed to participate in this study.

Seven patients were treated at the Maxillofacial, Head and Neck Surgery Unit in Surgery Department at Sohag University Hospitals in Sohag, Egypt.

Exclusion criteria

Patients with recurrent or second primary tongue cancer, metastatic cases, and patients not willing for such a lengthy technique were excluded from this work.

Study design

This study was conducted as a prospective study.

Patients

From January 2013 to January 2020, more than 60 tongue resections have been reconstructed using a free flap (ALT). A small group of seven patients demonstrated total or near-total mobile resection of the tongue.

Initial clinical assessment

All patients were subjected to full history taking, thorough clinical examination, and determination of primary site, the lymph node involvement, and staging. Details of previous treatment including radiotherapy and chemotherapy were reported. The presence of medical conditions such as respiratory disorders, atherosclerosis hypertension, coronary disease, peripheral vascular disease, diabetes, coagulation disorders, connective tissue disorders, and smoking, were also considered.

Pathological studies

The lesion only involved the oral tongue in five (71.42%) cases and extended to the oropharynx in two (28.57%) cases (Fig. 1). Overall, all patients were subjected to postoperative adjuvant radiotherapy or concomitant chemo-radiotherapy. All lesions were diagnosed as squamous cell carcinoma, tumor stage was assessed according to the latest edition of the TNM Staging System [4]. The patient category was as follows: T3 in six cases and T4a in one case. The surgical approach was a mandibular swing in all cases. Mandibular resection was performed in four (57.14%) cases patients (marginal in three cases and segmental in one case). All patients underwent bilateral neck dissection.

An incisional biopsy was taken from the primary site (tongue) for histopathological examination.

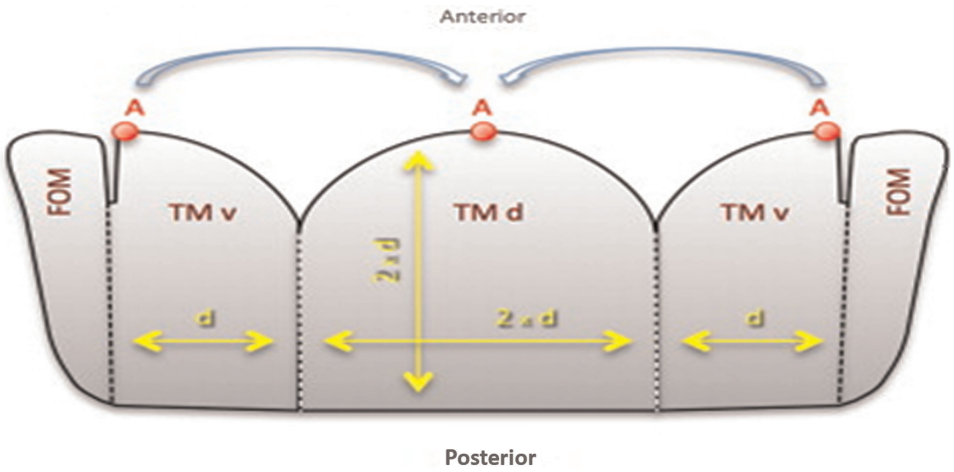
Methods

We reviewed the charts of seven patients who had been reconstructed with an ALT flap with a 'cathedral design.' The seven patients (five males and two females) underwent a mobile tongue reconstruction with an ALT free flap with a cathedral design (Fig. 2). All patients affected by cancer of the tongue underwent surgical treatment including primary tumor resection of the tongue pathology followed by reconstruction of the tongue and oral cavity defect with free ALT flap at the Maxillofacial, Head, and Neck Surgery Unit in General Surgery

Figure 1

Preoperative view of tongue cancer.

Figure 2



Divided part of the new modification of ALT, which is divided into dorsum surface, ventral surface of the tongue, and floor of mouth [7]. ALT, anterolateral thigh.

Department, Faculty of Medicine, Sohag University. The study was approved by the faculty of medicine review board and ethics committee of the Sohag University.

Patient recruitment

We use the University of Washington Quality-of-Life Questionnaire for patients with tongue cancer. We translated this questionnaire from English to Arabic. The final Arabic versions were tested on seven patients at the Maxillofacial, Head, and Neck Surgery Unit in Surgery Department in Sohag University Hospitals in Sohag, Egypt, from January 2013 until January 2020. The study included patients newly diagnosed as having head and neck cancer. Patients were required to speak the Arabic language. Eligible patients were invited to participate in the study. Age, sex, tumor site, TNM tumor stage, histological tumor type, and treatment data were recorded as the demographic and clinical characteristics of the study sample.

How we can use the University of Washington Quality-of-Life Questionnaire for patients with head and neck cancer?

We chose a specific domain of the University of Washington Quality-of-Life Questionnaire that related to tongue operation, which included pain–swallowing–chewing–speech. Patients were asked to complete five sets of questionnaires: the first set was given 1 day before beginning the treatment; the second set, 1 month after the completion of treatment, the third set, 3 months after the beginning of the surgical treatment; the fourth one after 6 months from starting the surgical treatment; and the last one was presented to the patients after 9 months of starting the surgical treatment. Because the acute effects of treatment typically diminish by 3 months, we administered the second set of questionnaires 1 month after completion of treatment to evaluate the effect of treatment. The third set was administered 2 months after the second set to measure test–retest reliability because 2-month period was considered a sufficient time interval to ensure that the patients would not remember their responses to the second set of questionnaires.

The statistical analysis of the collected data was undertaken using the SPSS statistical program, version 20 (IBM SPSS Statistics Free Download Latest Version setup for Windows. It is standalone version of IBM SPSS Statistics 32 bit 64 bit PC IN Egypt. IBM SPSS Statistics Overview: IBM SPSS Statistics 20 is the tool that can be used for managing your statistical data and research. It addresses the entire analytical process. It is useful in all the step of an effective analysis like from collecting data to analysis then reporting and at the end of the day deploying).

Surgical procedures

Ablation

Tumor resection was conducted by an oncological team, and tracheostomy was done before resection if the airway was likely to be compromised postoperatively. The resection process of the tongue includes total glossectomy or near-total glossectomy. After resection, the recipient vessels were localized, isolated, and prepared for microvascular anastomoses.

Flap harvesting

Harvesting the flap was done simultaneously by the reconstructive team during tumor ablation (Fig. 3–5). We used ALT flap using the ‘cathedral triptych technique’ according to Leymarie *et al.* [7] as follows:

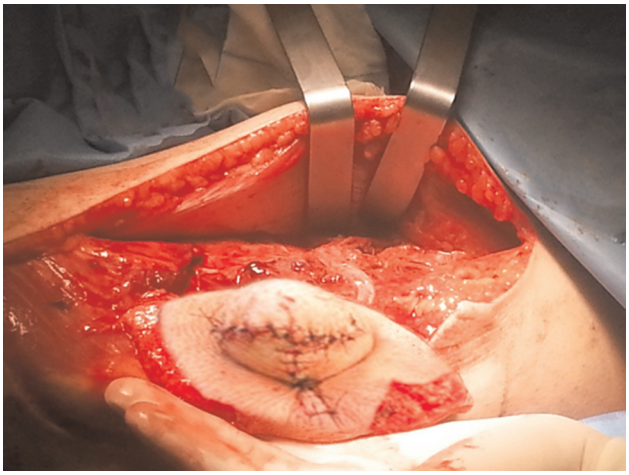
Figure 3

Drawing of cathedrals design on the right thigh of the patient.

Figure 4

Harvest of ALT flap by cathedral design. ALT, anterolateral thigh.

Figure 5



Modification of ALT flap to make a new tongue formation and we showed pedicle of ALT flap. ALT, anterolateral thigh.

Figure 6

Intraoperative specimen of the resected tongue.

the width of the flap is standardized from 5 to 6 cm (Fig. 16). The length of the flap was 6–8 cm. The central part of the flap formed the dorsum of the mobile tongue (Fig. 18), whereas the two side panels were folded underneath to form its ventral side. The floor of the mouth recreates two additional skin sleeves (Fig. 17). This flap design recreates the near-normal shape of the tongue with a more projected tip and a vertical mass that can be in contact with the palate and the upper lip. The perforators originated from the descending branches of the femoral lateral circumflex pedicle (Fig. 6). This flap is used to reconstruct total mobile tongue or near-total tongue resection or a case of hemiglossectomy, by dividing this flap into two symmetrical half and use this half for reconstructing near-total tongue or hemiglossectomy. The flap was marked and measured according to the defect size. Magnifying loupes (with magnification power ranging from ×2.5 to ×3.5) were used in raising the flaps.

Flap inset

The flap was secured by a few sutures to the defect until microvascular anastomoses were completed, and then final closure was done (Fig. 7 and 8).

Results

Age

The average age of patients in this study was 45 years (range, 33–58 years) (Fig. 11).

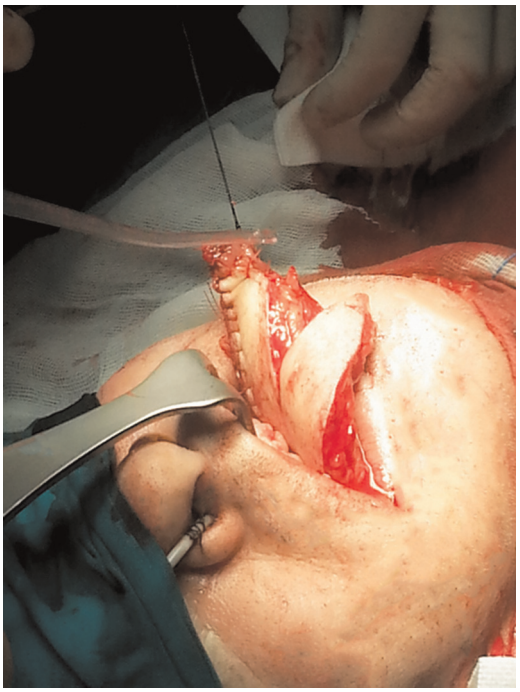
Sex

Five patients were males, with a percentage of 71.4%, and two patients were females, with a percentage of 28.6% (Fig. 12).

Patients

All lesions were diagnosed as squamous cell carcinoma. Tumor stage was assessed according to the latest

Figure 7



Near-total glossectomy done, and we sutured a central part of the flap in remaining tongue medially and lateral fold to make floor of mouth.

Figure 9

Postoperatively after 3 weeks of total tongue reconstruction using ALT. ALT, anterolateral thigh.

edition of the TNM Staging System [4]. The patient category was as follows: T3 in six cases and T4a in one case (Fig. 14).

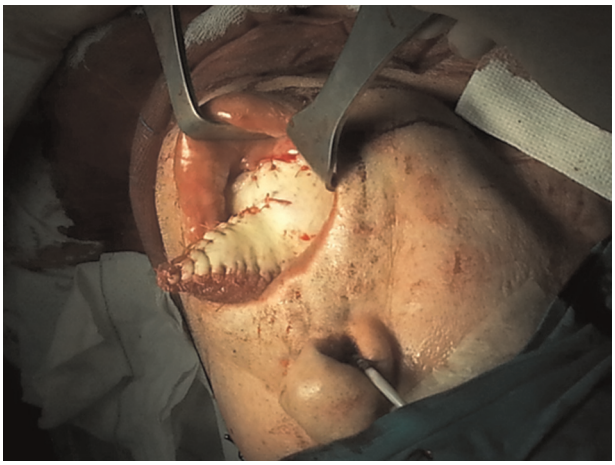
Type of neck dissection

All patients underwent bilateral functional neck dissection (Fig. 15).

Radiotherapy and chemotherapy

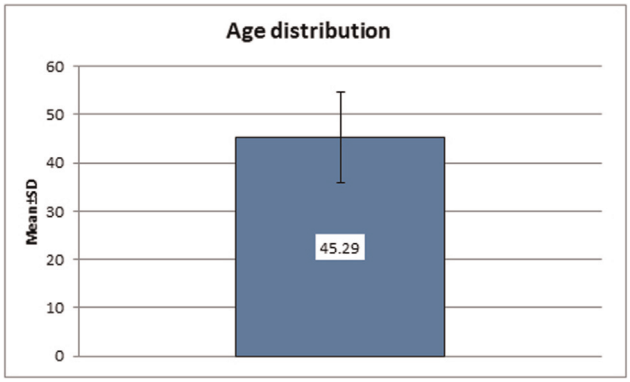
All patients underwent chemotherapy and radiotherapy postoperatively.

Figure 8



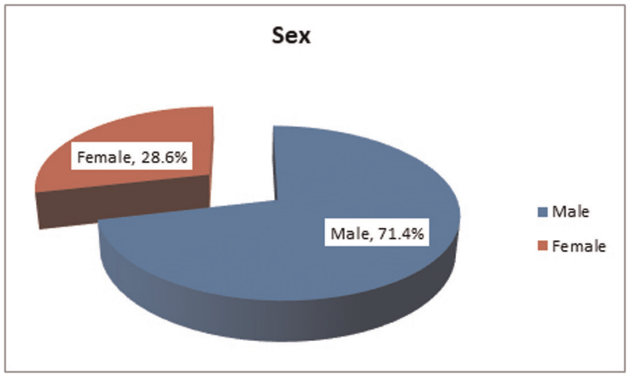
Near-total tongue reconstruction using ALT to reconstruct near-total tongue. ALT, anterolateral thigh.

Figure 10



Clustered column chart showing mean±SD of age distribution.

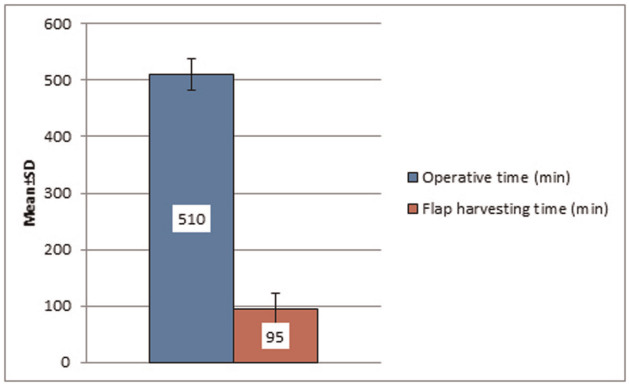
Figure 11



Exploded pie in a three-dimensional chart showing the percentage of sex types.

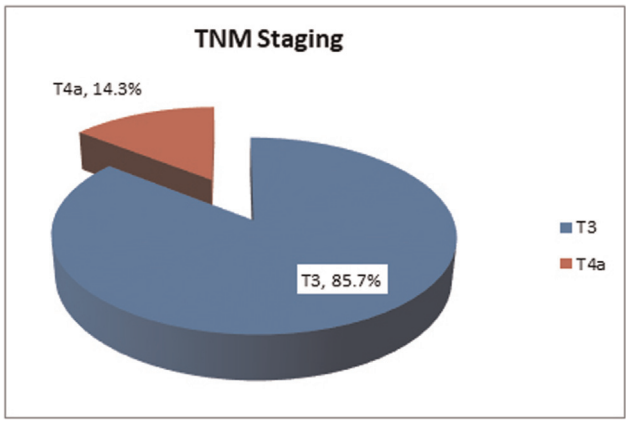
The median age of the included seven cases was 45 years (range, 33–58 years) (Fig. 13). The operative time ranged from 480 to 550 min (median, 510 min), whereas the flap harvesting time

Figure 12



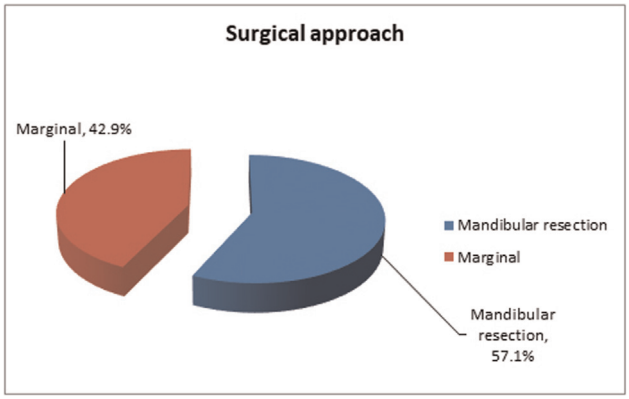
Clustered column chart showing mean±SD of operative time and flap harvesting distribution.

Figure 13



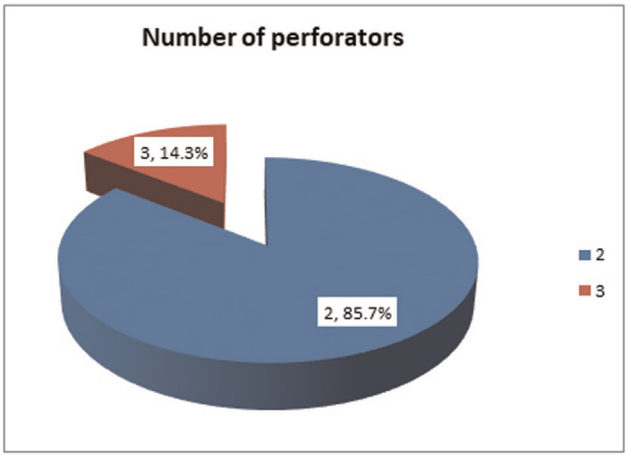
Exploded pie in the three-dimensional chart showing the percentage of TNM staging.

Figure 14



Exploded pie in the three-dimensional chart showing the percentage of surgical approach.

Figure 15



Exploded pie in the three-dimensional chart showing the percentage of a number of perforators.

ranged from 50 to 120 min with a median of 95 min.

The donor site defect in the thigh was closed by direct closure in six cases and using skin graft in the seventh case. The number of perforators was two in all of the cases, except one which had three perforators.

Regarding the early postoperative data, the hospital stay interval ranged from 8 to 11 days, with a median of 10 days (Fig. 19 and 20). The oral alimentation interval ranged from 11 to 15 days (median, 12 days). No postoperative complications were recorded for any of the seven cases.

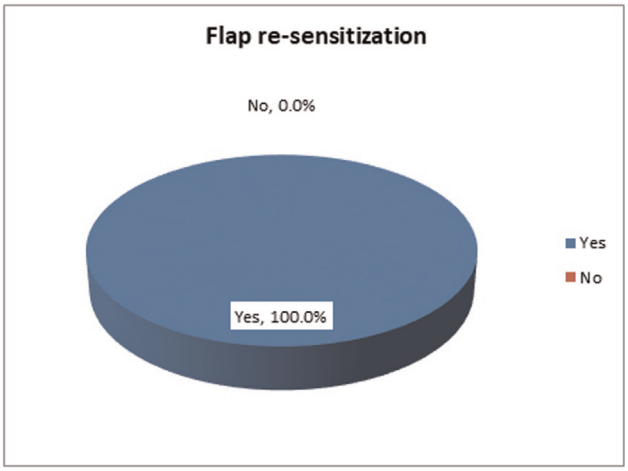
Regarding long-term outcome (Fig. 21), all flaps survived with no need for flap revision within 2 weeks postoperative stay in the hospital. All patients returned to an oral diet and could easily eat solid food (Fig. 9 and 10). Speech returned to normal or near-normal 'what is called (always unstable)' in four cases, and 'needing repetition' in the fifth case. All flaps had a normal shape and volume of the tongue, even after a period of radiotherapy which ranged from 1 to 9 months postoperatively, allowing satisfactory dental and palatal contact.

Analytical results

At 9-month postoperative follow-up, pain was improved (mean, 96.43±2.64) and was found to be statistically significantly difference from the preoperative result ($P<0.05$).

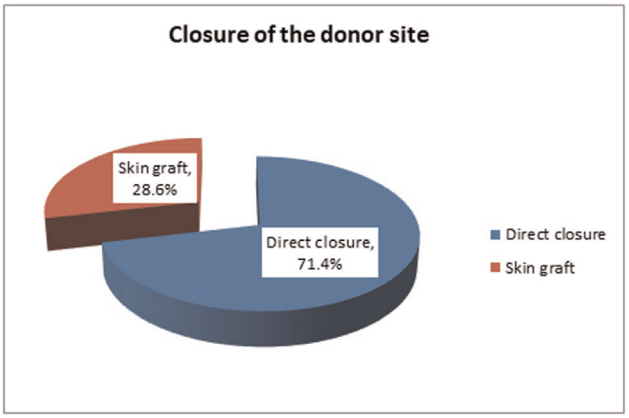
In Tables 1 and 2, we show the data obtained for 'pain,' and the important column is the one containing the significant value (Fig. 22).

Figure 16



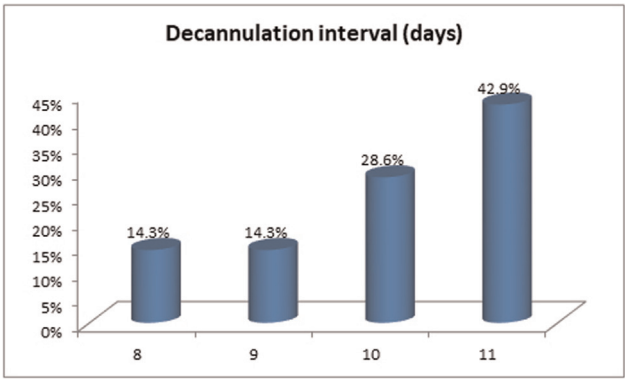
Exploded pie in the three-dimensional chart showing the percentage of flap resensitization.

Figure 17



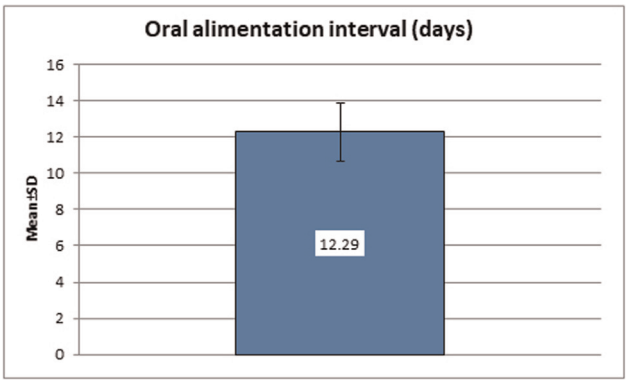
Exploded pie in the three-dimensional chart showing the percentage of the closure of the donor site.

Figure 18



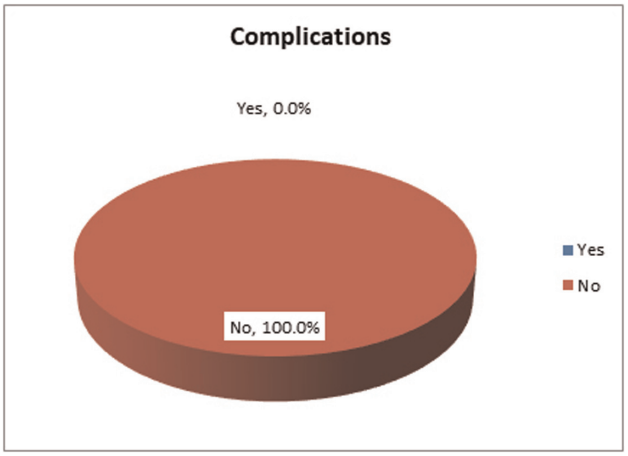
Clustered cylinder chart showing the percentage of decannulation interval distribution.

Figure 19



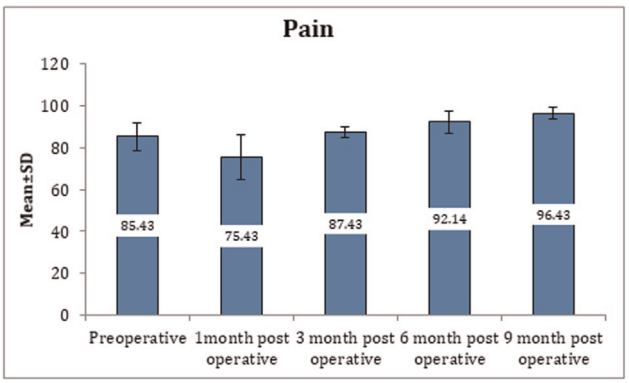
Clustered column chart showing mean±SD of oral alimentation interval distribution.

Figure 20



Clustered cylinder chart showing the percentage of complications distribution.

Figure 21



Clustered column chart showing mean±SD of pain distribution.

Table 3 shows the data for swallowing. There is a significant decrease of swallowing at 1-month postoperative follow-up compared with preoperative

Table 1 Demographic data

	N=7) [*n* (%)]
Age	
Range	33–58
Mean±SD	45.29±9.32
Sex	
Male	5 (71.4)
Female	2 (28.6)
Operative time	
Range	480–550
Mean±SD	510±27.08
Flap harvesting time	
Range	50–120
Mean±SD	95±21.98
TNM staging	
T3	6 (85.7)
T4a	1 (14.3)
Surgical approach	
Mandibular resection	4 (57.1)
Marginal	3 (42.9)
Number of perforators	
2	6 (85.7)
3	1 (14.3)
Flap resensitization	
Yes	7 (100.0)
No	0
Closure of the donor site	
Direct closure	5 (71.4)
Skin graft	2 (28.6)
Decannulation interval (days)	
8	1 (14.3)
9	1 (14.3)
10	2 (28.6)
11	3 (42.9)
Oral alimentation interval (days)	
Range	11–15
Mean±SD	12.29±1.6
Complications	
None	7 (100.0)

Table 3 Swallowing

	Range	Mean±SD
Preoperatively	69–97	87.57±9.36
1 month postoperatively	42–85	52.57±14.7
3 months postoperatively	50–72	59.57±7.14
6 months postoperatively	69–94	84.57±7.59
9 months postoperatively	75–93	86.57±5.91

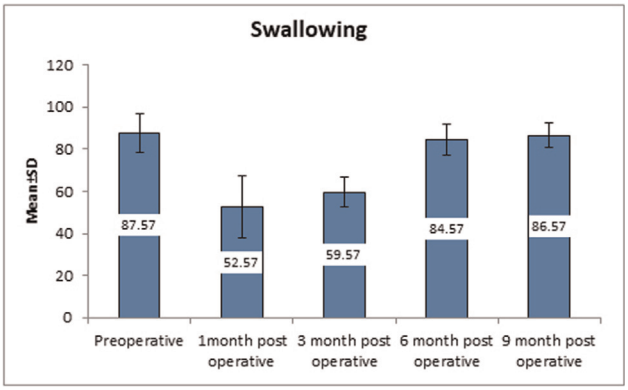
swallowing. So, there a statistically significant difference between 1 month and preoperative swallowing ($P<0.05$) (Fig. 23).

Moreover, there is a significant decrease of swallowing at 3-month postoperative follow-up compared with preoperative swallowing, So there a statistically significant difference between 3-month and preoperative swallowing ($P<0.05$).

Table 2 Pain

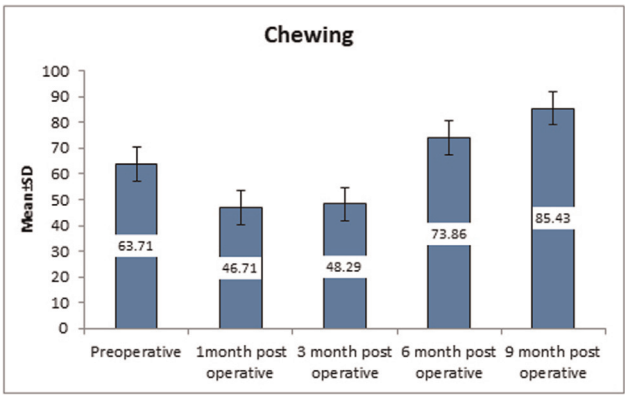
	Range	Mean±SD
Preoperatively	77–98	85.43±6.6
1 month postoperatively	58–95	75.43±10.97
3 months postoperatively	82–90	87.43±2.64
6 months postoperatively	80–95	92.14±5.4
9 months postoperatively	91–99	96.43±2.64

Figure 22



Clustered column chart showing mean±SD of swallowing distribution.

Figure 23



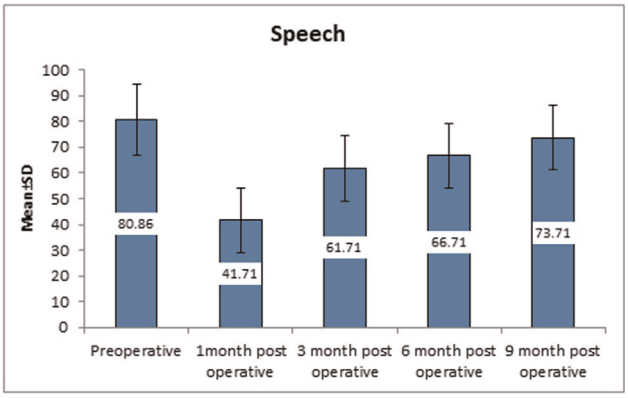
Clustered column chart showing mean±SD of chewing distribution.

Swallowing is more improved at 9 months postoperatively (86.57±5.91), and there is a statistically significant difference between 9-month and preoperative swallowing ($P>0.05$).

Table 3 shows the data obtained for 'swallowing' over a different period ranging from preoperative to 9 months postoperatively, and the important column is the one that gives a result of what was, in all of them, statistically significant ($P<0.0005$).

In Table 4, the data show a significant decrease of chewing at 1-month postoperative follow-up compared with preoperative chewing. So, there a

Figure 24



Clustered column chart showing mean±SD of speech distribution.

Table 4 Chewing

	Range	Mean±SD
Preoperatively	55–76	63.71±6.6
1 month postoperatively	38–59	46.71±6.6
3 months postoperatively	40–61	48.29±6.52
6 months postoperatively	65–86	73.86±6.67
9 months postoperatively	77–98	85.43±6.53

Table 5 Speech

	Range	Mean±SD
Preoperatively	50–90	80.86±13.78
1 month postoperatively	20–56	41.71±12.58
3 months postoperatively	40–76	61.71±12.58
6 months postoperatively	45–81	66.71±12.58
9 months postoperatively	52–88	73.71±12.58

statistically significant difference between 1-month and preoperative chewing ($P<0.05$) (Fig. 24).

The chewing is more improved at 9 months postoperatively, and there is a statistically significant difference between 9-month and preoperative chewing ($P<0.05$).

In Table 4, we show the data obtained for 'chewing' over a period ranging from preoperative to 9 months postoperatively, and the important column is the one that gives a result of what was, in all of them, statistically significant ($P<0.0005$). The significant value is less than 0.0005, which is less than 0.05.

In Table 5, the data shows a significant decrease of speech at 1-month postoperative follow-up compared with preoperative speech. There a statistically significant difference between 1-month and preoperative speech ($P<0.05$).

However, there was improvement in speech at 6 months postoperatively, and there is no statistically significant difference between 6-month and preoperative speech ($P>0.05$). The speech is more improved at 9 months postoperatively (73.71±12.58), and there is no statistically significant difference between 9-month and preoperative speech ($P>0.05$).

Table 5 shows the data obtained for 'speech' over a period ranging from preoperative to 9 months postoperatively, and the important column is the one that gives a result of what was, in all of them, statistically significant ($P<0.0005$) (Figs 1–24).

Discussion

Total mobile tongue defect is responsible for severe functional sequelae. Since it was first introduced by Song *et al.* [8], the ALT flap has gained more popularity in reconstructive microsurgery and has contributed to the development of perforator flaps. The use of the ALT flap, either as a free flap or a pedicle flap, has been extensively reported in the reconstruction of soft tissue defects from head to toe [7,9].

It was proposed that the ALT flap present interesting qualities, especially for the reconstruction of the tongue. Its location makes it easier for a two-team approach. It provides more volume than the radial forearm flap, especially in western patients and, unlike musculocutaneous flap, remains stable even after radiotherapy [7,15].

Wei *et al.* [16] invented the keyhole modification of the ALT flap, a technique based on the idea of a perforator flap vascular anatomy.

The ALT flap using the 'cathedral triptych' enhanced reconstruction performance. The ALT flap is a working horse technique in the reconstruction of the head and neck, and some find it to be the best flap available [17].

The 'cathedral triptych' design, was proposed by Leymarie *et al.* [7] to restore a near-normal mobile tongue shape and volume that improves neotongue interaction with the palate, cheek, and teeth. It has a direct effect on elocution and deglutition with increased food bolus and oral clearance.

Our study aimed to evaluate the use of ALT flap modification of the design of the flap for complete mobile tongue reconstruction among Upper Egyptian patients.

The median age of the five cases included in this study was 45 years, with three cases being male. Our cases were somewhat younger than those studied by Leymarie and colleagues, where the mean age was 54.4 years, with similar male predominance (70%). Moreover, the study by Chana *et al.* [18] and Paydarfar*et al.* [19] included 10 cases, with a mean age of 51 years, and a similar male predominance (70%). In the study by Longo *et al.* [20], the mean age was 54.8 years, and the male : female ratio was 9 : 5.

In this study, the mean operative time in this study was 6.5 h (510 min), whereas the median flap harvesting time was a little longer than 1.5 h (95 min). This was similar to the study of Leymarie *et al.* [7], where the mean operative time was 522 min and the mean flap harvesting time was 95 min. In the study by Longo *et al.* [19], the mean operative time was 425 min (375–515 min) and the mean flap harvest time was 90 min (65–110 min).

The donor site defect in the thigh was closed by direct closure in four cases and using skin graft in the fifth case. This was not well agreed by Leymarie *et al.* [7], where the donor site was closed primarily in five (50%) cases only, for two advance perforator flaps in two cases, and left for secondary closure in the remaining three cases.

Throughout our analysis, the number of perforators was two in all cases, except one with three perforators. The majority of cases in the study by Leymarie *et al.* [7] had also two (60%) perforators, with only two cases had three perforators and two cases had only one perforator. Moreover, in the study by Longo *et al.* [19], the number of perforators was two in nine of their 13 cases, three in three cases, and only one in the last case. For both cases, flap resensitization has been accomplished. This was similar to the study done by Paydarfar *et al.* [18]. This was also the condition reported by Longo *et al.* [19].

For this analysis, the median decay period was 10 days and the mean oral diet period was 12 days. Our study showed some differences from the study of Longo *et al.* [19] who stated that the mean decannulation time was only 6.1 days among their study, and the mean oral alimentation time was 9.3 days.

In this study, no postoperative complications were recorded for any of the five cases. Moreover, in the study by Paydarfar *et al.* [18], there were no flap-related complications.

So far as the long-term result is concerned, both flaps survived without the need for a flap revision. All patients have returned to an oral diet and can comfortably consume solid food. Speech returned to normal or near-normal in four cases and was mildly affected in the fifth case. Both cases recovered the strength of the restored tongue. Both flaps had a natural shape and volume of the tongue, even after radiotherapy. According to Leymarie *et al.* [7], the success rate of their study was also 100%, and all the flaps survived in their study.

Pain

In pain score, we showed significant P value (below 0.005), which shows an effect of a time-independent variable, which is the pain. The test shows a significant interaction between pain and time level; this mean that level of pain that occurred over 9 months had a significant correlation.

Our patients' results show similar results regarding the domain of the pain with other works like the work of Herce *et al.* [21] in 2007 published on a sample of 23 patients, which found that high scores also correspond to the pain, and also in the work of Rogers *et al.* [22] and Hammerlid and Taft [23], although they found a statistically significant correlation of the pain regarding time.

Swallowing

In the swallowing score, we showed a significant effect of time in the dependent variable swallowing. The test shows a significant interaction between swallowing and time level. This means that level of swallowing that occurred over 9 months had a significant correlation with time, and among patients, with time, we noted improvement of swallowing near the normal activity.

The swallowing problem associated with the treatment of cancer tongue in our study was that all patients had most or all of their nutrition through a Ryle feeding tube in the first 10 days and then after 10 days, 55% of patients had a normal diet, whereas 45% had pureed food. These outcomes are better than other published reports. Pauloski *et al.* [24] reported more than 50% of patients with tongue cancer as having a non-normal diet and 13% feeding tube dependence at 1 year after radiation with or without chemotherapy. In the study by Mowry *et al.* [25] of patients with chemoradiation for stages 2–4 tongue cancer and a mean follow-up of 11 months, six of 14 patients scored 30% or less in the swallowing domain of UW-QOL. In another study, the feeding tube dependence for patients with stages 3–4 tongue cancer who had surgical excision with free

flap reconstruction and postoperative radiotherapy was 50%.

We also did not find any correlation between swallowing function and age, sex, or nodal status, and this result is similar to Thomas *et al.* [26].

Chewing

Here we showed a significant effect of time in the dependent variable chewing, and we showed the patient effects reflected repeated measures. The test shows significant interaction between chewing and time level; this means that level of chewing that occurred over 9 months had a significant correlation with time, and among patients, with time, we noted very little improvement of chewing near the normal activity.

In this study, chewing is the worst result, and this correlated with the results of Hassanein *et al.* [27] and Kazi *et al.* [28]. However, Vickery *et al.* [29] found chewing (48%) and speech (44%) to be the most prevalent complaints at the time of treatment, and chewing (60%) and swallowing (24%) at the 1-year follow-up. In their study, chewing was the QOL domain, which exhibited the largest reduction in rating, from 74.0 at baseline to 34.0 1 year after surgery. It is interesting that Thomas *et al.* [26] found no trouble with chewing in 45% of the patients in their study group.

Speech

Here we show a significant effect of time in the dependent variable speech, and we showed the patient effect reflected repeated measures. The test shows significant interaction between speech and time level; this means that level of speech that occurred over 9 months had a significant correlation with time, and among patients, with time, we note very little improvement of speech near the normal activity.

In our study, we found that patients treated for tongue cancer had speech difficulties. This was observed by speaking with the patients postoperatively, and we noted the voice and speech quality was altered, and this affection showed mild improvement with the time but did not regain to normal function or near-normal.

We report in our study that all patients were T3–4 tumors and had a worse voice, speech intelligibility, and dysarthria severity results due to wide area of resection and wide reconstruction flap, and a high dose of radiotherapy. Worse outcomes with increasing T stage have been reported with Brown *et al.* [30], Pauloski *et al.* [24], and Zuydam *et al.* [31]. It has been seen from our UW-QOL results that only 25% of the patients have near-normal speech after resection and reconstruction with free flap for oral cancer, especially in cancer of the tongue and floor of the mouth. The majority, about 63%, have only mild speech and articulation impairment. However, 12% had a major speech impairment.

Free-flap reconstruction affected all aspects of speech and voice. Thomas *et al.* [26] reported that speech domain mean scores on UW-QOL were worse by about 20–25 points for those who had radiotherapy, late-stage disease, and free-flap reconstruction. Another study identified the only extent of resection and use of free-flap as significantly related to posttreatment speech intelligibility. Few reports reported speech outcomes in oncological patients reconstructed with free-flap. Radiotherapy did not affect speech intelligibility or articulation in other reports [32,33].

From our point of view, the four-point scale for speech in UW-QOL may not be enough for detailed speech assessment and rehabilitation. Thus, UW-QOL seems to be quite sensitive and an appropriate screening tool for assessment of speech disability in this group of patients. It is quick and easy to complete and does not add a major financial or manpower burden to administration. For this reason, we need well-developed voice assessment tools to study the assessment and rehabilitation of speech and voice after oral and oropharyngeal cancer resection and reconstruction with free flaps.

Conclusion

The cathedral triptych technique modification of ALT flap has a good and direct effect on the quality of swallowing, speech, and deglutition after total or near-total tongue resection and reconstruction with ALT.

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Conflicts of interest

There are no conflicts of interest.

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