

The expanding role of the anterolateral thigh free flap in head and neck reconstruction

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Purpose of review

To review the recent literature on the expanding use of the anterolateral thigh free flap for head and neck reconstruction.

Recent findings

The versatility of the anterolateral thigh free flap allows it to be raised as a subcutaneous, musculocutaneous, fasciocutaneous, or adipofascial flap. In recent years, it has been reported to reconstruct defects involving the scalp, skull base, pharynx, tracheal stoma, oral cavity, and oropharynx. Various techniques have also been described in its harvest and inset, including combination flaps in conjunction with other free flaps or bone grafts, chimeric flaps, double-paddled skin flaps, and sensate flaps. These reports confer good functional and aesthetic outcomes equal to or better than other fasciocutaneous free flaps.

Summary

The role of the anterolateral thigh free flap in reconstructing head and neck defects is ever expanding, with many novel harvesting and reconstructive techniques described in recent years. Because of the large surface area of the anterolateral thigh, as well as the ability to tailor variable amounts of skin, muscle, fat, or fascia associated with this flap, the reconstruction options are numerous. More importantly, good functional and aesthetic outcomes are achievable with an associated low morbidity of the donor site.

Keywords

anterolateral thigh flap, free flap reconstruction, free tissue transfer, head and neck reconstruction, microvascular

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Introduction

Significant morbidity continues to occur after surgical management of malignant diseases of the head and neck. Reconstruction of these defects has been revolutionized by free tissue transfer, which allows the reconstructive surgeon to restore form and function. Although surgical therapy for malignant disease results in the majority of these defects, additional causes such as benign tumors, traumatic injuries, and complicated wounds may also require free tissue transfer.

Free tissue transfer techniques for the reconstruction of soft tissue defects have provided reliable reconstruction for nearly 20 years. Although a variety of flaps are available, the anterolateral thigh (ALT) flap based on the musculocutaneous and septocutaneous perforators of the descending branch of the lateral circumflex femoral artery (Fig. 1) has enjoyed increasing popularity since first being described by Song *et al.* [1] in 1984. There are several reasons for the increasing popularity of the ALT for soft tissue reconstruction, namely, the advantage of

simultaneous harvest and excellent volume of tissue. The ALT flap has several variations and may be harvested as a subcutaneous, fasciocutaneous, musculocutaneous, or adipofascial flap resulting in multiple applications in head and neck reconstruction. This, coupled with acceptable donor site morbidity, highlights the advantages of the technique. Wei *et al.* [2] reported the largest series to date using this flap and demonstrated the reliability of the technique.

Recently, the versatility of this flap has been explored and has revealed a surprising creativity in the execution of the anterior lateral thigh free tissue transfer. As an understanding of the variability of the vascular anatomy of the lateral circumflex femoral artery system has been realized, several variations of the flap have been described and a more ‘free style’ approach adopted. Reported cases of an absent lateral descending branch of the LCFA being converted to free transfer based on a medial descending branch (anteromedial thigh flap) have been described [3,4]. The current advances in the use of this versatile reconstructive technique will be reviewed.

Laryngopharyngeal defect reconstruction

The use of the anterior lateral thigh for circumferential defects after total laryngectomy continues to provide an excellent reliable reconstruction. The bulk provided by the ALT flap can be useful in order to obliterate potential dead space and offers excellent bulk for the protection of the great vessels (Fig. 2). Yu *et al.* [5] in 2009 reported on 114 patients who underwent pharyngoesophageal reconstruction using an ALT free flap for laryngopharyngectomy. Indications included squamous cell carcinoma, pharyngocutaneous fistula after previous laryngectomy, benign stricture because of previous radiation, and thyroid cancer. Postoperatively, they found that 9% of their patients developed a pharyngocutaneous fistula and 6% developed stricture formation. Swallowing was adequate in 91% of patients, who were able to tolerate an oral diet without gastrostomy. The authors reported that 81% of patients who underwent secondary tracheoesophageal prosthesis (TEP) were able to achieve fluent speech in comparison to 41% of patients with primary TEP, indicating that secondary TEP may be superior to primary TEP in this setting. The authors confirm that ALT free flap for reconstruction of pharyngoesophageal defects can achieve excellent clinical and functional outcomes, with minimal donor site morbidity.

Technical advancements continue in the application of the ALT for pharyngeal reconstruction. Ho *et al.* [6] retrospectively reported the use of a two-layered closure using the ALT flap in 15 cases in which an ALT free flap

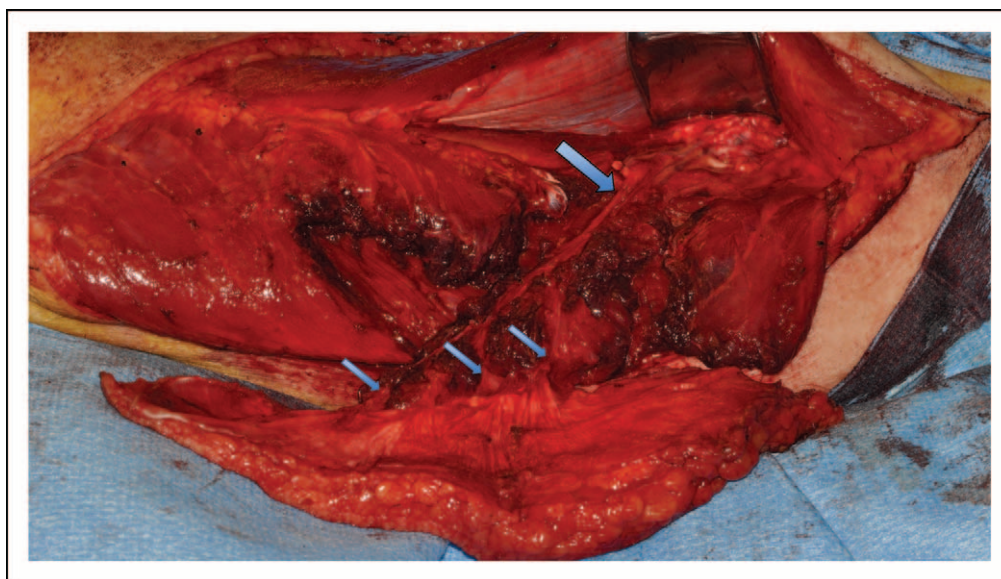
Key points

- The anterior lateral thigh flap is an extremely versatile flap for head and neck reconstruction.
- Excellent tissue quality and quantity as well as low donor site morbidity have resulted in markedly increased utilization and expanded applications.
- Several variations of the technique allow enhanced customization of the soft tissue elements relative to other soft tissue free tissue transfers in head and neck reconstruction.

reconstruction was performed after a pharyngolaryngectomy. In addition to the appropriate skin paddle, a wider cuff of fascia lata was harvested in order to supplement waterproofing of the suture line, particularly at the base of tongue (see Fig. 2). Laterally, this fascia was sutured to the prevertebral fascia. All flaps survived at 14.5 months with one postoperative pharyngocutaneous fistula. Interestingly, five required repeat balloon dilatations for late pharyngeal strictures attributed to postsurgical adjuvant radiotherapy.

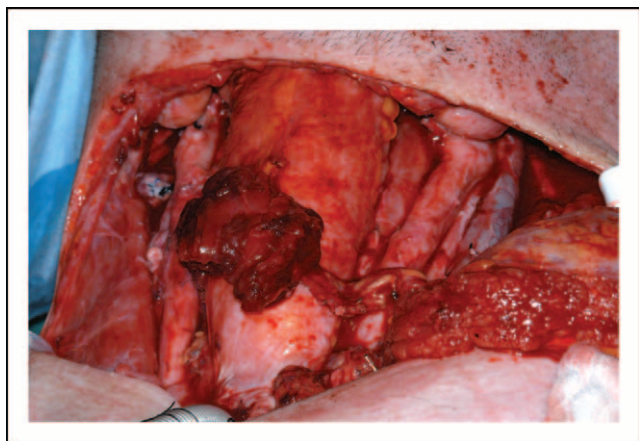
Regarding the difficult problem of reconstruction after resection of stomal recurrence after total laryngectomy, Caliceti *et al.* [7] published a case report on the use of the ALT flap for this application. After resection of the peristomal recurrence, an ALT flap was anastomosed to the remaining trachea with the proximal end shaped like a funnel to replace the stomal skin. The patient had an uneventful postoperative course and was decannulated 1 month after the reconstruction. This report offers a

Figure 1 Intraoperative photograph of anterolateral thigh free flap harvest



Note the descending branch of the lateral circumflex femoral artery (large blue arrow) and multiple fasciocutaneous perforators (small blue arrows).

Figure 2 Intraoperative photograph demonstrating tubed ALT free flap reconstruction for pharyngeal defect after total laryngopharyngectomy



Note the additional external fascia lata layered closure.

further example of the novel technical variations of the anterior lateral thigh free tissue transfer.

Oral cavity reconstruction

In recent years, several authors have reported the enhanced utility of the anterolateral thigh free tissue transfer, when harvested in a chimeric configuration. The ability to harvest multiple skin paddles with independent vascular perforators is especially useful for complex oral cavity reconstruction. Karonidis and Yao described the harvest of a chimeric ALT with vastus lateralis to reconstruct an extensive defect of the oral tongue and cervical soft tissue. Chimeric ALT harvest was provided for the reconstruction of the tongue and an additional proximal skin paddle for cervical cutaneous reconstruction. The separate vastus lateralis was used for the reconstruction of the exposed carotid artery. The authors pointed out that the chimeric ALT transfer may offer advantages in the vessel-depleted neck, as a single primary anastomosis is performed despite the complexity of the recipient site [8].

In addition to the chimeric ALT flap, it should be noted that simultaneous harvest of two separate flaps from an ipsilateral donor site is possible and has been reported.

Huang *et al.* [9[•]] reported their successful experience with 18 ALT flaps harvested from nine ipsilateral donor sites which were used for postrelease reconstruction of oral submucous fibrosis. Although one flap failure was reported because of hematoma, the authors reported excellent results overall using this technique. There are multiple advantages of harvesting two separate flaps from a single donor site and, in cases in which two soft

tissue flaps are required, the ALT offers a unique option in this regard. In yet another novel modification related to bilateral cheek reconstruction, Chen *et al.* [10] also described an alternative technique in which bilateral skin paddles with a palatal bridge were designed, as opposed to dividing the ALT flap into two separate flaps as previously described. This technique allows bilateral skin paddles for buccal reconstruction and a palatal skin bridge overlaid on the palate after denuding the mucosa, and permits a single vascular anastomosis.

Reconstruction with bone grafting

Despite the volume of versatility of soft tissue reconstructions using the ALT, the lack of osseous material has led to several recent approaches to take advantage of the soft tissue volume and donor site morbidity, but allow osseous reconstruction. In particular, extensive composite defects of the mandible may require more than a single free flap because of the need for bone, skin, and soft tissue bulk for adequate reconstruction. Recently, combination flaps have been used to reconstruct these large defects. As reported by Lee *et al.* [11], 10 patients with extensive composite mandibular defects were reconstructed using a fibular osteocutaneous free flap together with an ALT flap. All flaps survived and they reported only two minor complications, with seven of eight patients able to tolerate a soft diet. All patients were decannulated at 2 weeks postoperatively and were able to speak coherently. They concluded that the combination flap allows bony defect reconstruction as well as providing adequate bulk to provide contour for the complex nature of the defect.

In addition to the use of the fibular flap with the ALT flap, several authors have described the use of the ALT flap with a vascularized iliac crest free flap. Although the iliac crest provides excellent osseous structure for mandibular reconstruction, one problem that is frequently encountered is the short vascular pedicle length. Often an interposition graft is needed to bridge the recipient and donor vessels; however, this is fraught with disadvantages. To circumvent this issue, Bianchi *et al.* [12] reported a case in which they used the ALT flap pedicle as an interposition artery and vein graft to elongate the vascular pedicle of an iliac crest free flap. They argue that harvesting a segment of the descending branch of the lateral circumflex femoral artery and its two venae comitantes is superior to using a vein graft as a method of elongating a pedicle and avoids vessel mismatch. The authors noted data in the cardiac literature stating that cephalic and saphenous veins have a higher risk of acute thrombosis and hemorrhagic complications. Gaggl *et al.* [13] described using an iliac crest free flap in conjunction with an ALT free flap to reconstruct large soft tissue and osseous defects, while using the pedicle of the ALT flap

to elongate the vascular pedicle of the iliac crest simultaneously. After harvesting, the iliac flap was fashioned to the contour of the mandibular defect, and subsequently the distal part of the descending branch of the lateral circumflex femoral artery from the ALT free flap was anastomosed to the iliac crest's deep circumflex iliac artery in an end-to-end fashion. Then the proximal part of the descending branch of the lateral circumflex femoral artery was anastomosed to the recipient vessels in the neck. They reported their experience on 18 patients, achieving a vascular pedicle length of 13–18 cm when the two flaps were combined, which was much greater than the iliac crest flap pedicle alone (6–8 cm). There were no vein grafts used and all flaps survived. All patients were able to tolerate a soft diet and there were no severe speech issues reported. This technique is a creative reconstructive option when extensive soft tissue and osseous elements are needed during reconstruction or when vascular disease precludes the use of a fibular free flap.

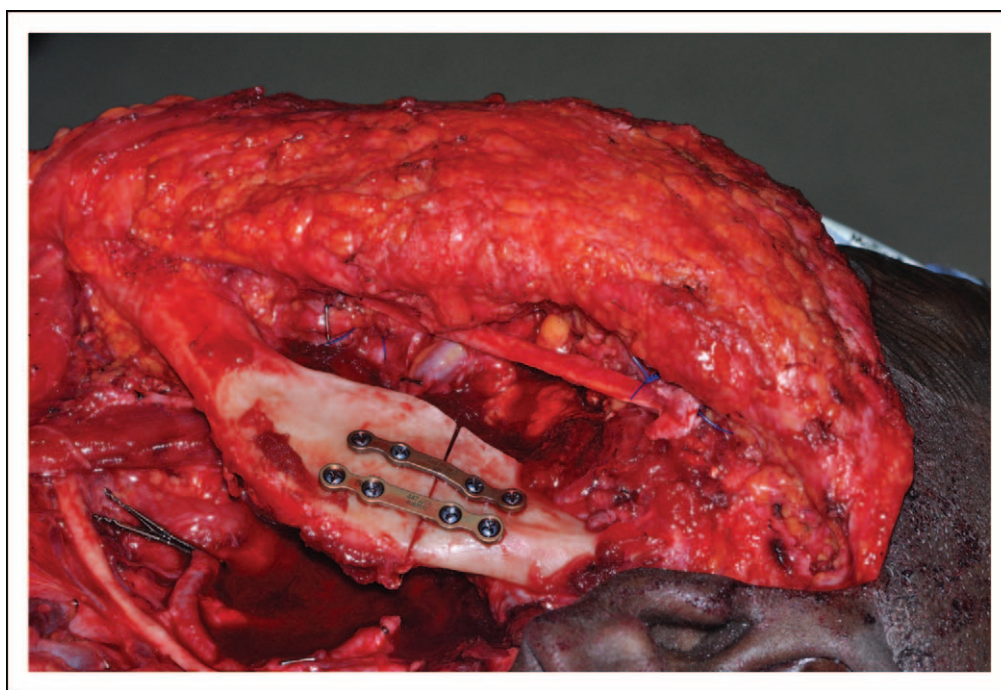
In addition to using combination flaps, Bianchi *et al.* [14] have reported using bone grafts in conjunction with the ALT free flap. They reported on eight patients who underwent maxillectomy with reconstruction using the ALT flap and nonvascularized bone graft. Bone grafts were obtained from the iliac crest in six patients and from the calvaria in two patients. All flaps were transplanted successfully and there were no major complications. One

flap had slight palatal dehiscence and partial skin flap necrosis. All patients underwent adjuvant radiation therapy and they reported two patients who developed diplopia and one patient who developed ectropion. Six patients were able to tolerate normal diets and two were restricted to a soft diet. Speech was deemed normal in five patients, understandable in two, and poor in one. Aesthetic evaluation by the patients themselves was reported to be good in five, acceptable in two, and poor in one because of unacceptable flap color match and ectropion. The authors concluded that the ALT flap with nonvascularized bone grafts is a useful technique for reconstructing maxillary defects that involve the orbital floor and zygomatic arch, providing both good function and adequate aesthetics.

Skull base reconstruction

Resection of tumors of the skull base often results in significant defects exposing critical structures, including dura, and neurovascular structures. Prevention of post-operative infection and cerebrospinal fluid leak while supporting the cranial vault remains paramount in successful skull base reconstruction. Although local flaps are used in many situations, free flap tissue reconstruction has become the preferred reconstructive option for extensive skull base defects, primarily because of the reduction of complications. Most of these defects have been reconstructed with the rectus abdominis free flap; however, the

Figure 3 Intraoperative photograph demonstrating ablative defect after total parotidectomy/neck dissection and mandibulotomy



Note the tensor fascia lata static facial nerve reanimation.

ALT has grown in popularity for this application. Hanasono *et al.* [15] recently reported on their experience using the ALT free flap for reconstructing skull base defects in 34 patients with cancers involving the skull base. There were no flap losses and they reported a complication rate of 29%. Six patients underwent nerve grafting and 14 underwent fascial slings with the lateral femoral cutaneous nerve and fascia lata, respectively. They stress that the ability to harvest additional muscle bulk, nerve grafts, and fascial grafts all from the same donor site, combined with a low complication rate, makes the ALT free flap a good option for skull base defects.

Parotid/cervical reconstruction

Extensive resection of the parotid bed often results in significant aesthetic defects and often results in facial nerve weakness/paralysis (Fig. 3). Quality-of-life questionnaires performed by Nitzan *et al.* [16] showed that 58% of patients complained of facial contour abnormalities after a parotidectomy. Free flap reconstruction is an ideal option for contour restoration, which local flaps and synthetics cannot achieve, to ameliorate the contour deformity when a total parotidectomy is combined with a selective neck dissection (Fig. 4). Cannady *et al.* [17**] recently described the use of the de-epithelialized buried ALT flap in 18 patients after a total parotidectomy in order to reestablish facial contour. Ten patients underwent adjuvant radiation and 14 cases required a concurrent neck dissection. They were also able to perform static facial reanimation in patients who underwent facial nerve sacrifice by utilizing the available tensor fascia lata. They concluded that the ALT flap is an ideal reconstructive option after a total parotidectomy with or without a neck dissection.

Figure 4 Intraoperative photograph of ALT free flap for reconstruction of defect in Fig. 3



Note the excellent soft tissue contour and bulk for obliteration of the defect.

There are numerous congenital and acquired defects of the craniofacial region that can result in hemifacial atrophy. Several authors have reported the use of various free flaps in order to provide facial contouring, such as the omental flap, the scapular and parascapular flap, and the deep inferior epigastric artery perforator flap. Recently, however, Agostini and Agostini [18] described the use of the buried de-epithelialized ALT free flap for this purpose. They reported the technique and commented on the ability to thin the ALT to suit the defect with minimal risk to the viability of the flap itself, in contrast to other free tissue transfers. The harvested fascia lata also allowed stable anchoring to surrounding periosteum, an additional advantage over other soft tissue flaps. The authors noted the use of the ALT flap also has very little donor site morbidity compared with a groin flap or an omental flap.

Conclusion

Reconstructing complex head and neck defects with the anterolateral free flap has become more popular in recent years as more surgeons report experience with harvesting techniques and clinical applications. The volume of soft tissue and availability of fascia, fat, and muscle render the ALT one of the most versatile flaps for head and neck reconstruction. Current literature indicates its low donor site morbidity along with good speech and swallowing outcomes with excellent aesthetic results. Future reports comparing this flap with other reconstructive options will undoubtedly reflect the unique role this flap will play in head and neck reconstruction.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 324).

- 1 Song YG, Chen GZ, Song YL. The free thigh flap: a new free flap concept based on the septocutaneous artery. *Br J Plast Surg* 1984; 37:149–159.
- 2 Wei FC, Jain V, Celik N, *et al.* Have we found an ideal soft-tissue flap? An experience with 672 anterolateral thigh flaps. *Plast Reconstr Surg* 2002; 109:2219–2226; discussion 2227–2230.
- 3 Hsieh CH, Yang JC, Chen CC, *et al.* Alternative reconstructive choices for anterolateral thigh flap dissection in cases in which no sizable skin perforator is available. *Head Neck* 2009; 31:571–575.
- Technical details on obtaining an anteromedial thigh free flap when lateral perforators are absent during harvest of the anterolateral thigh free flap.
- 4 Jin X, Teng L, Xu J, *et al.* Anterolateral thigh adipofascial flap for the restoration of facial contour deformities. *Microsurgery* 2010; 30:368–375.
- 5 Yu P, Hanasono MM, Skoracki RJ, *et al.* Pharyngoesophageal reconstruction with the anterolateral thigh flap after total laryngopharyngectomy. *Cancer* 2010; 116:1718–1724.
- 6 Ho MW, Houghton L, Gillmartin E, *et al.* Outcomes following pharyngolaryngectomy reconstruction with the anterolateral thigh (ALT) free flap. *Br J Oral Maxillofac Surg* 2010. [Epub ahead of print]
- 7 Caliceti U, Piccin O, Cavicchi O, *et al.* Anterolateral thigh free flap for tracheal reconstruction after parastomal recurrence. *Head Neck* 2009; 31:1107–1111.

- 8 Karonidis A, Yao SF. Chimeric anterolateral thigh free flap for head and neck reconstruction. *J Plast Reconstr Aesthet Surg* 2009; 62:e85–e86.
- 9 Huang JJ, Wallace C, Lin JY, *et al.* Two small flaps from one anterolateral thigh donor site for bilateral buccal mucosa reconstruction after release of submucous fibrosis and/or contracture. *J Plast Reconstr Aesthet Surg* 2010; 63:440–445.
- This study described the use of obtaining two separate flaps from an ipsilateral anterior lateral thigh donor site.
- 10 Chen CC, Wong TY, Ou CY, Lee JW. Using a cross-cheek anterolateral thigh flap for simultaneous correction of trismus and oral cancer. *J Plast Reconstr Aesthet Surg* 2010; 63:e28–e31.
- 11 Lee JT, Hsu H, Wang CH, *et al.* Reconstruction of extensive composite oromandibular defects with simultaneous free anterolateral thigh fasciocutaneous and fibular osteocutaneous flaps. *J Reconstr Microsurg* 2010; 26:145–151.
- 12 Bianchi B, Copelli C, Ferrari S, *et al.* Anterolateral thigh flap pedicle for interposition artery and vein grafts in head and neck reconstruction: a case report. *Microsurgery* 2009; 29:136–137.

- 13 Gaggl A, Burger H, Muller E, Chiari FM. A combined anterolateral thigh flap and vascularized iliac crest flap in the reconstruction of extended composite defects of the anterior mandible. *Int J Oral Maxillofac Surg* 2007; 36:849–853.
- 14 Bianchi B, Ferri A, Ferrari S, *et al.* Maxillary reconstruction using anterolateral thigh flap and bone grafts. *Microsurgery* 2009; 29:430–436.
- 15 Hanasono MM, Sacks JM, Goel N, *et al.* The anterolateral thigh free flap for skull base reconstruction. *Otolaryngol Head Neck Surg* 2009; 140:855–860.
- 16 Nitzan D, Kronenberg J, Horowitz Z, *et al.* Quality of life following parotidectomy for malignant and benign disease. *Plast Reconstr Surg* 2004; 114:1060–1067.
- 17 Cannady SB, Seth R, Fritz MA, *et al.* Total parotidectomy defect reconstruction using the buried free flap. *Otolaryngol Head Neck Surg* 2010; 143:637–643.
- An excellent study reviewing experience using the ALT free flap as a de-epithelialized flap for soft tissue contouring and static facial re-animation.
- 18 Agostini T, Agostini V. Adipofascial anterolateral thigh free flap for hemifacial atrophy. *Acta Otorhinolaryngol Ital* 2009; 29:103–107.