ORIGINAL ARTICLE

CAN THE ANTEROLATERAL THIGH FLAP REPLACE THE RECTUS ABDOMINIS FREE FLAP IN THE RECONSTRUCTION OF COMPLEX MAXILLARY DEFECTS?

Farhan Ahmed Eitezaz, Mamoon Rashid, Shumaila Yousaf, Ishtiaq-Ur-Rehman, Samia Fatima, Mehreen Masud, Aamna Sanober, Adeela Hussain Khan, Haroon Ur Rashid

Department of Plastic and Reconstructive Surgery, Shifa International Hospital, Islamabad-Pakistan

Background: Maxilla is perhaps the most essential and visible part of the mid-face. It is a three-dimensional structure and when reconstructing maxillectomy defects the principles of aesthetics as well as the best functional outcomes are taken into account. The aim of this study is to compare the Anterolateral Thigh Flap (ALTF) to the standard option like the Rectus Abdominis Free Flap (RAMFF) for the reconstruction of complex maxillary defects. **Methods:** This descriptive case series was conducted at the Department of Plastic and Reconstructive Surgery, Shifa International Hospital Islamabad, Pakistan from 2009 to 2016. Patients of all age groups with complex maxillectomy defects, (Type III and IV according to Cordeiro classification) resulting from tumour resection, trauma, osteoradionecrosis or infection, underwent reconstruction with the free anterolateral thigh flap and the rectus abdominis free flap. **Results:** Over a period of 8 years, 49 Rectus Abdominis free flaps and 32 Anterolateral thigh free flaps were performed for reconstruction of Type III and IV maxillectomy defects. The follow up was weekly for 1 month and then 3 monthly for the 1st year, 6 monthly for 2nd year and then yearly. All the patients had an uneventful immediate recovery. **Conclusion:** ALTF has advantages over the RAMFF in terms of the donor site morbidity, operative time and postoperative recovery in the reconstruction of complex maxillectomy defects.

Keywords: Microvascular maxillary reconstruction; Cordeiro Type III Maxillary defect; Cordeiro Type IV Maxillary defect; Free flaps Complications; Anterolateral Thigh free flap; Rectus Abdominis free flap.

Citation: Eitezaz FA, Rashid M, Yousaf S, Rehman IU, Fatima S, Masud M, Sanober A, Khan AH, Rashid HU. Can the anterolateral thigh flap replace the rectus abdominis free flap in the reconstruction of complex maxillary defects? J Ayub Med Coll Abbottabad 2018;30(1):74–7.

INTRODUCTION

Maxilla is perhaps the most essential and visible part of the mid-face. It is a three-dimensional structure and when reconstructing maxillectomy defects the principles of aesthetics as well as the best functional outcomes must be taken into account. Each maxilla supports overlying structures and contributes much to the appearance of the face and also to critical functions of chewing, speech, and deglutition.[1]

Most maxillary defects result from resection of tumours of the maxilla and those of adjacent structures. Others causes are trauma including penetrating or blunt injuries to the mid face. Tumours of the maxilla involve two main sites: the palate (oral cavity) and the maxillary sinus.[2] The resulting defects are complex and deep with the requirement for multiple tissue elements for reconstruction.[3] They are more complex when vital structures such as the orbit, globe, and the base of skull are involved and reconstruction therefore demands free tissue transfer.[4]

The classification described by Cordeiro *et al*, is one of the most widely used classification particularly among Plastic and Reconstructive surgeons. Every defect has its own requirement of type and size of flap, larger defects require large skin paddles whereas deep defects require muscle or bulky flaps to fill the dead space and to provide necessary and enough volume. An essential consideration in maxillary reconstruction with free flaps is the availability of a recipient vessel. The pedicle has to be long enough to reach the vessels of the neck. The strength of the Cordeiro's classification is in the treatment algorithm provided for various defects.[5] Various free flaps including the radial forearm, the rectus abdominis, the latissimus dorsi and more recently the anterolateral thigh flap has been used for reconstructing maxillary defects. Cordeiro has described the Rectus abdominis free flap (RAMFF) as the preferred flap for the reconstruction of type III and IV maxillectomy defects.[1] Hanasono *et al* have described both the rectus abdominis free flap and the anterolateral thigh flap (ALTF) as options for the reconstruction of these maxillectomy defects.[6] The ALTF is pliable enough to be folded, thinned or filled into cavities. The anterolateral thigh flap also provides bulk with addition of the vastus lateralis muscle to reconstitute the soft tissue defect, and the de-epithelialized flap or adipo-fascial flap can be used to fill the deep cavities and/or to

separate the compartments.[3] At the same time ALTF eludes the problems of abdominal donor site complications including hematoma/seroma formation, abdominal wall weakness leading to hernia formation, chronic postoperative pain, wound infection and abdominal wound dehiscence when myocutaneous flaps are required.

The purpose of this study is to compare the ALTF to RAMFF for the reconstruction of complex maxillary defects in terms of less donor site morbidity leading to improved recovery and better functional and aesthetic outcome.

MATERIAL AND METHODS

This descriptive case series was conducted in the Plastic and Reconstructive Surgery Department of Shifa International Hospital, Pakistan from 2009 to 2016. Patients of all age groups with complex maxillectomy defects produced after tumour resection, trauma, infection and osteoradionecrosis were included in the study. CT scans were used to determine the extent of local disease as well as to rule out loco-regional metastatic disease in the neck and distant metastases to the chest and abdomen. Baseline haematological and biochemical investigations were done and the co-morbid illnesses were managed accordingly.

All the patients with tumours were discussed in multidisciplinary head and neck clinic. All the patients were counselled in detail about the management plan and after approval from the joint panel were scheduled for surgery. Patients with a previously failed free flap, severe co-morbidities and patients with presence of distant metastatic disease were excluded from the study.

Patients were distributed into two groups: Group "1" patients underwent RAMFF reconstruction and group "2" patients had a ALTF transfer.

They were followed up weekly for 1 month and then 3 monthly for the first year, 6 monthly for second year and then yearly. Data was analysed by IBM SPSS Version 21.

RESULTS

Over a period of 8 years between 2009 to 2016, 82 maxillary reconstructions were done. Out of these 49 patients underwent reconstruction with the RAMFF whereas the ALTF was used in 32 patients.

In group 1 (n=49), there were 36 (74%) females and 13 (26%) males. Their ages ranged from 18 to 71 years with a mean age of 48 years. Thirty-eight patients underwent reconstruction after tumour resection (78%), 6 were acute trauma defects (12%) and 5 defects resulted from mucormycosis (12%).

The commonest type of maxillectomy defect encountered in this series was type IIIA in 23 (46.9%) cases, type IIIB in 19 (38.8%) cases and type IV in 7 (14.3%) cases. All the flaps were raised as myocutaneous flaps on the inferior epigastric pedicle. The pedicle length ranged from 5.5 to 10 cm (mean 9.5cm, SD±0.8954). Average time required to harvest the flap was 53 minutes with a range between 35–68 minutes. The inferior epigastric artery was anastomosed with the facial artery in 20 cases and the superior thyroid artery in 29 cases. Only one venous anastomosis was done in each case.

All donor defects were closed primarily with the repair of the rectus sheath. There were no recipient site complications and no donor site complications in 36 (73.5%) patients. Mesh was not used in any of the RAMFF donor site closure. The donor site complications included 4 (8.2%)patients who developed abdominal wall bulge which was noticeable in 2 patients and was prominent in 2 patients, 2 (4.1%)patients with wound infection, 2 (4.1%) with wound dehiscence, 2 (4.1%) with donor site haematoma, 1 (2%) with seroma and 1 (2%) patient had recurrence. The haematoma and the seroma were drained and all wound related complications were managed conservatively in outpatient clinic and healing was satisfactory. There was 1 (2%) flap loss within this group. There was one re-exploration due to venous thrombosis of the flap vein. The flap could not be saved. This patient subsequently underwent reconstruction with ALTF. There was no mortality during the hospital stay.

Group 2 (n=32) included 25(78.1%) females and 7(21.9%) males. Their ages ranged from 6 to 80 years with a mean age of 47.9 years. Twenty-seven patients underwent reconstruction after tumour resection (84.4%) and 5 after excision of mucormycosis (15.6%).

All ALTFs were raised on the perforators of the descending branch of the lateral circumflex femoral artery. Majority of the flaps were based on two perforators. The pedicle length ranged from 7 to 14 cm (mean 11.4cm, SD±1.7051). The average time required to harvest the anterolateral thigh flap was 56.8 minutes (SD±9.6177) with a range between 45–87 minutes. Addition of more than two perforators in the flap, mainly the musculocutaneous perforators led to prolonged elevation times. The lateral circumflex femoral artery was anastomosed with the facial artery in 14 cases and the superior thyroid artery in 18 cases. One venous anastomosis was done in each case with either the external jugular vein or the tributary of the internal jugular vein.

The commonest type of maxillectomy defect encountered in this series was type IIIA in 17 (53.1%) cases, type IIIB in 8 (25%) cases and type IV in 7 (21.9%) cases.

Nine (28.1%) donor defects were closed primarily. No seroma/hematoma collection or wound dehiscence was seen in these patients. The rest 23 (71.9%) were closed with combination of partial closure

and skin grafts. Postoperatively all patients had an uneventful recovery as far as the recipient sites and flaps are concerned. However, there were few complications regarding donor sites. There was partial graft loss in 3 (9.4%) case, total graft loss in 1 (3.1%) case, wound infection in 1 (3.1%) patient. All were managed conservatively in outpatient clinic and healing was satisfactory. There were no complications in 27 (84.4%) cases. There were no flap losses in this group. There was no mortality during the hospital stay.

DISCUSSION

Pennington and Pelly are credited for the first clinical applications of the RAMFF.[7] The RAMFF is considered the best option by many and Cordeiro has advocated its use for the reconstruction of type III and IV maxillectomy defects.[1,5] The ALTF is a truly adaptable flap which can be harvested for the reconstruction of broad range of defects involving the head and neck and especially the maxilla. It was first described by Song *et al* in 1984.[8] Koshima *et al* described the application of the ALTF in head and neck reconstruction[9–11] in 1993 and by Kimata *et al*[12] in 1997.

The anterolateral thigh flap can be harvested in the form of many components of adequate amount of tissues including skin ,subcutaneous fat , fascia and muscle.[13–15] This flap include has many advantages including permitting simultaneous flap elevation , no patient repositioning, a long and large pedicle for vascular anastomosis, multiple flap designs, and decreased donor site morbidity.[13,15–17] The mean pedicle length of the anterolateral flap was 12 cm which is comparable to Shyh-Jou Shieh *et al*[18] who in their series had a pedicle length of 12.01cm, Tamimy *et al*[19] with a pedicle length of 11.5 cm. Whereas the mean pedicle length of the RAMFF was 9.5 cm. Cordierro also highlights that the pedicle length of the rectus is short and needs to be extended[1] which is not a problem with ALTF. The flap elevation time of the ALTF was 56.8 minutes which is comparable to the RAMFF with a mean time of 53 minutes, however the mean donor site closure time of the ALTF was 26 minutes which was less as compared to the mean time of 53 minutes required to close the donor site of the RAMFF.

There have been no flap losses in the ALTF group with a 100% survival rate which is comparable to Tamimy *et al*[19], Mureau[20] and Hanasono *et al*[21] who had 99% survival rate. In ALTF group the donor site was closed primarily in 9 (28.1%) cases as compared with 56–97% in other studies.[22–24] The donor site morbidity including graft loss, wound infection and wound dehiscence are also low in this which is comparable to Mureau *et al.*[20] The overall donor site complications of the ALTF (15.6%) are less as compared to the RAMFF (26%) in this series.

The ALTF is considered an excellent option for reconstruction of superficial and deep defects as in the maxillary defects.[25] This is the only flap that can be compared to the RAMFF in terms of yield of tissue for harvest and the thickness of the components of the flap.[26] The anterolateral flap has the advantage that it can be thinned per-operatively as per the requirement but the RAMFF can only be thinned by subsequent debulking procedures.[24] Where bulk is required to fill the cavity of the maxilla the vastus lateralis muscle can be harvested with flap.[27–29] None of the ALTFs in this study required thinning whereas 20 RAMFF flaps required secondary thinning. The vastus lateralis muscle was harvested with the ALTFs in 16 cases. There was no effect on lower limb function in all cases.[15] Hernias and bulges are considered limitations of lower abdominal flaps. The use of RAMFF and has led to development of hernias[30,31] and the incidence hematoma formation is also increased[32].There were 4 patients in the RAMFF group who developed abdominal wall bulge which was noticeable in 2 patients and prominent in 2 cases. There were 2 cases of wound infection and dehiscence each which is comparable with certain studies.[32–34]

CONCLUSION

The ALTF offers all the advantages of other free flaps in head and neck reconstruction and has been termed as a workhorse flap.[35] The option of being able to use any component of tissue during the harvest of this flap helps us to construct the three-dimensional defects created after maxillectomy and allows the reconstructive surgeon to achieve near normal aesthetic as well as functional results. We recommend in our series that the ALTF be considered a regular option in the reconstruction of complex maxillectomy defects in addition to the option of the RAMFF.

AUTHORS' CONTRIBUTION

MR: Conceptualization of study, idea, final proof reading. FAE: Write-up, initial proof reading, analysis, interpretation. SY, IUR, SF, AS, AHK, HUR: Data collection. MM: Literature search, formatting of manuscript.

REFERENCES

1. Cordeiro PG, Santamaria E. A classification system and algorithm for reconstruction of maxillectomy and midfacial defects. Plast Reconstr Surg 2000;105(7):2331–46.
2. Triana RJ Jr, Uglesic V, Virag M, Varga SG, Knezevic P, Milenovic A, *et al*. Microvascular free flap reconstructive options in patients with partial and total maxillectomy defects. Arch Facial Plast Surg 2000;2(2):91–101.
3. Ali RS, Bluebond-Langner R, Rodriguez ED, Cheng MH. The versatility of the anterolateral thigh flap. Plast Reconstr Surg 2009;124(6 Suppl):e395–407.
4. Santamaria E, Cordeiro PG. Reconstruction of maxillectomy and midfacial defects with free tissue transfer. J Surg Oncol 2006;94(6):522–31.
5. Cordeiro PG, Chen CM. A 15-year review of midface reconstruction after total and subtotal maxillectomy: part I.

Algorithm and outcomes. Plast Reconstr Surg 2012;129(1):124–36.
6. Hanasono MM, Silva AK, Yu P, Skoracki RJ. A comprehensive algorithm for oncologic maxillary reconstruction. Plast Reconstr Surg 2013;131(1):47–60.
7. Pennington DG, Pelly A. The rectus abdominis myocutaneous free flap. Br J Plast Surg 1980;33(2):277–82.
8. 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(2):149–59.
9. Koshima I, Yamamoto H, Hosoda M, Moriguchi T, Orita Y, Nagayama H. Free combined composite flaps using the lateral circumflex femoral system for repair of massive defects of the head and neck regions: an introduction to the chimeric flap principle. Plast Reconstr Surg 1993;92(3):411–20.
10. Koshima I, Fukuda H, Yamamoto H, Moriguchi T, Soeda S, Ohta S. Free anterolateral thigh flaps for reconstruction of head and neck defects. Plast Reconstr Surg 1993;92(3):421–8.
11. Koshima I, Hosoda M, Moriguchi T, Hamanaka T, Kawata S, Hata T. A combined anterolateral thigh flap, anteromedial thigh flap, and vascularized iliac bone graft for a full-thickness defect of the mental region. Ann Plast Surg 1993;31(2):175–80.
12. Kimata Y, Uchiyama K, Ebihara S, Yoshizumi T, Asai M, Saikawa M, *et al*. Versatility of the free anterolateral thigh flap for reconstruction of head and neck defects. Arch Otolaryngol Head Neck Surg 1997;123(12):1325–31.
13. Lutz BS, Wei FC. Microsurgical workhorse flaps in head and neck reconstruction. Clin Plast Surg 2005;32(3):421–30.
14. Yu P. Characteristics of the anterolateral thigh flap in a Western population and its application in head and neck reconstruction. Head Neck 2004;26(9):759–69.
15. Wei FC, Jain V, Celik N, Chen HC, Chuang DC, Lin CH. Have we found an ideal soft-tissue flap? An experience with 672 anterolateral thigh flaps. Plast Reconstr Surg 2002;109(7):2219–26.
16. Pribaz JJ, Orgill DP, Epstein MD, Sampson CE, Hergrueter CA. Anterolateral thigh free flap. Ann Plast Surg 1995;34(6):585–92.
17. Huang CH, Chen HC, Huang YL, Mardini S, Feng GM. Comparison of the radial forearm flap and the thinned anterolateral thigh cutaneous flap for reconstruction of tongue defects: an evaluation of donor-site morbidity. Plast Reconstr Surg 2004;114(7):1704–10.
18. Shieh SJ, Chiu HY, Yu JC, Pan SC, Tsai ST, Shen CL. Free anterolateral thigh flap for reconstruction of head and neck defects following cancer ablation. Plast Reconstr Surg 2000;105(7):2349–57.
19. Tamimy MS, Rashid M, Islam MZ, Aman S, Aslam A. A comparison of free transfer of radial forearm and anterolateral thigh flaps for head and neck reconstruction. Eur J Plast Surg 2009;32(2):95–102.
20. Mureau MA, Posch NA, Meeuwis CA, Hofer SO. Anterolateral thigh flap reconstruction of large external facial skin defects: a follow-up study on functional and aesthetic recipient-and donor-site outcome. Plast Reconstr Surg 2005;115(4):1077–86.
21. Hanasono MM, Skoracki RJ, Yu P. A prospective study of donor-site morbidity after anterolateral thigh fasciocutaneous and myocutaneous free flap harvest in 220 patients. Plast Reconstr Surg 2010;125(1):209–14.
22. Mäkitie AA, Beasley NJ, Neligan PC, Lipa J, Gullane PJ, Gilbert RW. Head and neck reconstruction with anterolateral thigh flap. Otolaryngol Head Neck Surg 2003;129(5):547–55.
23. Huang WC, Chen HC, Jain V, Kilda M, Lin YD, Cheng MH, *et al*. Reconstruction of through-and-through cheek defects involving the oral commissure, using chimeric flaps from the thigh lateral femoral circumflex system. Plast Reconstr Surg 2002;109(2):433–41.
24. Demirkan F, Chen HC, Wei FC, Chen HH, Jung SG, Hau SP, *et al*. The versatile anterolateral thigh flap: a musculocutaneous flap in disguise in head and neck reconstruction. Br J Plast Surg 2000;53(1):30–6.
25. Lutz BS. Aesthetic and functional advantages of the anterolateral thigh flap in reconstruction of tumor-related scalp defects. Microsurgery 2002;22(6):258–64.
26. Nakayama B, Hyodo I, Hasegawa Y, Fujimoto Y, Matsuura H, Yatsuya H, et al. Role of the anterolateral thigh flap in head and neck reconstruction: Advantages of moderate skin and subcutaneous thickness. J Reconstr Microsurg 2002;18(03):141–6.
27. Posch N, Mureau MA, Flood SJ, Hofer SO. The combined free partial vastus lateralis with anterolateral thigh perforator flap reconstruction of extensive composite defects. Br J Plast Surg 2005;58(8):1095–103.
28. Nakatsuka T, Harii K, Yamada A, Asato H, Ebihara S. Versatility of a free inferior rectus abdominis flap for head and neck reconstruction: analysis of 200 cases. Plast Reconstr Surg 1994;93(4):762–9.
29. Zenn MR, Jones GE. Reconstructive surgery: anatomy, technique, and clinical applications. 1st Ed. St. Louis, Mo: Quality Medical Pub; 2012. p.911.
30. Scheflan M, Dinner MI. The transverse abdominal island flap: part I. Indications, contraindications, results, and complications. Ann Plast Surg 1983;10(1):24–35.
31. Hartrampf CR Jr. Abdominal wall competence in transverse abdominal island flap operations. Ann Plast Surg 1984;12(2):139–46.
32. Kroll SS, Baldwin BJ. Head and neck reconstruction with the rectus abdominis free flap. Clin Plast Surg 1994;21(1):97–105.
33. Slavin SA, Goldwyn RM. The midabdominal rectus abdominis myocutaneous flap: review of 236 flaps. Plast Reconstr Surg 1988;81(2):189–97.
34. Scheer AS, Novak CB, Neligan PC, Lipa JE. Complications associated with breast reconstruction using a perforator flap compared with a free TRAM flap. Ann Plast Surg 2006;56(4):355–8.
35. Chana JS, Wei FC. A review of the advantages of the anterolateral thigh flap in head and neck reconstruction. Br J Plast Surg 2004;57(7):603–9.

Received: 1 March, 2017	*Revised: 27 April, 2017*	*Accepted: 7 May, 2017*

Address for Correspondence:

Dr. Farhan Ahmed Eitezaz, House No.11, Street-15, Sector-E, Defence Housing Authority Phase-1 (DHA-1) Islamabad-Pakistan
Cell: +92 345 512 5875
Email: farhaneitezaz@hotmail.com