

Using free radial forearm flap in the repair of different soft tissue defects in the head and neck region

 Ensar Zafer Barin¹,  Hakan Cinal²

¹Ataturk University, Faculty of Medicine, Department of Plastic, Reconstructive and Aesthetic Surgery, Erzurum, Turkey

²Bulent Ecevit University, Faculty of Medicine, Department of Plastic, Reconstructive and Aesthetic Surgery, Zonguldak, Turkey

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Abstract

Aim: Radial forearm flap (RFF) is a reliable flap that can be easily used to repair tissue defects in all parts of the body, especially in the areas such as the oral cavity, cheek mucosa and the tongue. It is used for the repair of soft tissue defects as a fasciocutaneous flap, and it is also used as osteo- fasciocutaneous flap, with the radius bone being split into the flap. In this study, we retrospectively examined the cases in which tissue defect repair was performed with free radial forearm flaps in our clinic between the years of 2008 and 2018. The purpose of this study; is the determination of the results of the use of the radial forearm flap in the reconstruction of different soft tissue defects belonging to the head and neck region.

Material and Methods: RFF repair was conducted in 24 patients who were included in our study. 15 of the patients were male and 9 were female. The mean age of the patients was 49. The cause of tissue defect was tumoral invasion in 17 patients, trauma (traffic accident, fall) in 6 patients and gunshot wound in 1 patient.

Results: Total flap loss was observed in 1 patient and partial flap loss was seen in 1 patient. No post-operative infection, bleeding or similar complications were observed. Donor site problems were observed in 4 patients, while the donor area of 2 patients recovered after secondary treatment, while the donor area of the other 2 patients was repaired with additional partial thickness skin grafts.

Conclusion: Radial forearm flap with free transfer is an option that has been used safely for many years in many regions, especially in intraoral soft tissue defects such as tongue, inner cheek, and the floor of the mouth. Although harvesting of this flap is slightly easier than other flaps, it is a procedure that requires meticulousness and patience similar to every area where microsurgery exists. Although sacrificing one of the main vessels of the upper limb with this flap is a serious disadvantage, the advantages it offers, especially in the intraoral defects, still keeps the radial forearm flap popular over the years.

Keywords: Free radial forearm flap; head and neck; intraoral soft tissue defects; microsurgery

INTRODUCTION

The head and neck region have the feature of containing vital structures as well as being an identity center. For this reason, repairs of tissue defects in this region are also of special importance. Many options are used to repair soft tissue defects of this region. Local flap options can be planned as randomly or axially. While random flaps have advantages such as short operation time and relatively more harmonious skin color, there are very limited usage areas due to the limited movement of the skin belonging to the head and neck region. Alternatively, another local flap option, pedicular local flaps, provides a relatively short operation time and partially compatible skin color; but their use in the repair of head and neck defects is limited due to the fewer options available as well as due to the problems in closing the donor area. Pedicular pectoralis major flap and pedicle submental island flap are among

the most popular local flap options (1). Reconstruction with local flaps can be considered less risky in terms of morbidity and mortality with shorter surgery time.

Although free flap options as well as local flap options have long operating times and relatively long patient recovery times (2), they provide great freedom to the reconstructive team. Free flaps are very useful in planning three-dimensional reconstruction of larger defects. The anterolateral thigh flap has been used in many areas for reconstruction since the first day it was defined, and it has been used safely for many years with many advantages in repairing soft tissue defects in the head and neck region (3). Being able to modify the flap thickness according to the defect's condition is one of the important advantages in choosing this flap (4).

Also known as the Chinese flap, the Radial forearm flap was introduced in 1981 by Yang et al (5) and it has been

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Corresponding Author: Ensar Zafer Barin, Ataturk University, Faculty of Medicine, Department of Plastic, Reconstructive and Aesthetic Surgery, Erzurum, Turkey **E-mail:** ensarzafer@gmail.com

used numerous times to repair soft tissue defects, after it was described by them in their study. In the defects of the head, neck, especially the oral mucosa, and the cheek mucosa; it is one of the first options that come to mind in reconstruction due to the thinness of the flap and its elasticity and the advantage of a long vascular pedicle; which can reach distant recipient vessels by using subcutaneous tunnels, as well as the relatively easy flap elevation. (6)

In this study, we retrospectively analyzed 24 RFF cases performed in our clinic between 2008 and 2018. The purpose of this study: The determination of the results of the use of the radial forearm flap in the reconstruction of different soft tissue defects belonging to the head and neck region.

MATERIAL and METHODS

Between the years of 2008 and 2018, 24 patients (17 males and 7 females) were operated in the head and neck region for soft tissue defects in the Atatürk University Faculty of Medicine, Department of Plastic, Reconstructive

and Aesthetic Surgery. The mean age of the patients was 49,24. Ethics committee approval (information of ethics committee approval) was obtained from Atatürk University, Medical Faculty Clinical Research Ethics Committee. Some of the existing surgeries in the study were performed by one author and the other surgeries were performed by the other author; and the data were collected and authored by the corresponding author. The patients reconstructed with RFF flaps in the head and neck soft tissue defect for any reason were included in the study, and reconstructions of tissue defects including simultaneous bone component were not included in the study.

RESULTS

Among 24 patients who underwent soft tissue defect repair with RFF, 1 patient's flap was totally lost, and 1 patient's flap was observed to have partial loss. This loss was repaired with additional partial thickness skin graft (STSG). No postoperative infection or bleeding-like complications were observed.

Table 1. Patient – Defect – Flap Data

Patient No	Age	Gender	Etiology	Defect Location	Defect Size (cm)	Flap Size (cm)	Pedicle Length (cm)	Flap Survival (0-1-2)
1	27	M	SCC	Lower Lip	9x4	9X5	10	2
2	59	M	SCC	Lower Lip	11x6	12x7	13	2
3	39	M	TRAUMA	Upper Lip	9x5	10x6	13	2
4	45	F	SCC	Nasal	10x7	11x7	11	2
5	56	M	SCC	Neck	8x6	9x7	8	2
6	34	F	SCC	Palate	10x10	12x14	8	2
7	74	F	SCC	Malar	7X6	7x6	9	2
8	69	F	SCC	Tongue	8x5	11x5	12	2
9	25	M	TRAUMA	Ear	3x3	5x4	7	2
10	45	M	SCC	Nasal	13x5	14x5	10	2
11	35	M	TRAUMA	Ear	4x3	6x5	7	2
12	56	M	SCC	Lower Lip	12x5	14x7	9	2
13	68	M	SCC	Lower Lip	10x8	11x8	8	2
14	29	M	TRAUMA	Ear	6x4	7x4	7	2
15	41	F	TRAUMA	Palate	5x3	6x5	10	1
16	47	F	SCC	Tongue	10x4	11x5	12	2
17	21	M	GSI	Nasal	6x5	8x8	12	2
18	27	M	TRAUMA	Ear	5x4	6x5	9	2
19	67	M	SCC	Nasal	10x5	11x5	10	2
20	71	F	SCC	Malar	10x9	12x9	9	2
21	73	F	SCC	Malar	7x7	8x7	12	2
22	75	M	SCC	Malar	8x5	9x6	9	2
23	62	M	SCC	Tongue	9x5	10x7	8	2
24	32	F	SCC	Tongue	8x4	9x6	9	0

M: Male; F: Female; SCC: Squamous Cell Carcinoma; GSI: Gun Shot Injury

Soft tissue defects were repaired with free radial forearm flaps (Table 1). All of the flaps were planned as fasciocutaneous. 4 of these repairs were on the tongue, (Figure 1, 4, 5 and 6) 4 on the nose wings, 4 on the ear, 4 on the lower lip, 4 on the malar region, 2 on the palate, 1 on the upper lip and 1 on the neck. All of the flaps were planned as fasciocutaneous and harvested (Figure 2 and 3). While 17 of the tissue defects occurred after tumor excision, 6 of them were caused by trauma, 1 of the tissue defects was due to a gunshot wound. The average pedicle length was 9.6 cm.

All anastomoses were performed under surgery microscopy with 24 arteries, and 38 veins to recipient vessels with 8-0 and 9-0 nylon sutures. 1 artery anastomosis was made to all flaps, a total of 24 arterial anastomoses were conducted, while 38 vein anastomoses were performed with 2 vein anastomoses in 14 patients and 1 vein anastomosis in 10 patients. The average operation time was determined as 6 hours, antibiotic and analgesic were started routinely as a drug treatment in the postoperative period for patients with an average of 8 days of hospital stay. Low molecular weight heparin was given to 10 patients. The patients were followed up for an average of 12 months.



Figure 1. After tumor resection of tongue



Figure 4. Early post-operative view

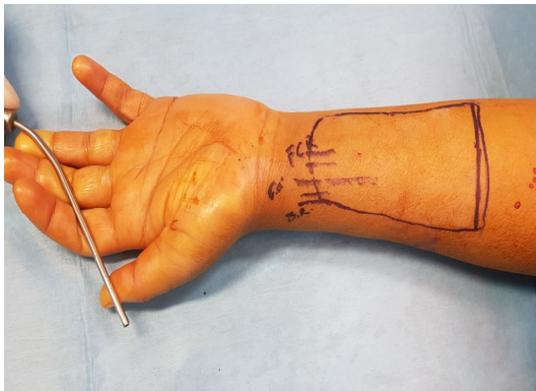


Figure 2. Design of the flap



Figure 5. Late post-operative view

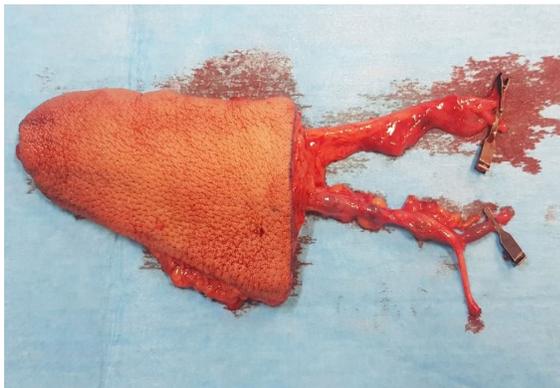


Figure 3. Harvested flap



Figure 6. Late post-operative view 2

DISCUSSION

Head and neck soft tissue reconstructions need repair with viable, versatile and reliable flaps as in any soft tissue repair (7). Functional reconstruction of different types of tissues in the head and neck region is a difficult process (8). For this reason, although free tissue transfer has been reported as the gold standard in post-excision repair in head and neck cancers (9), in some cases as an alternative, locoregional and pedicled flaps are also used successfully (10).

Many local flap options have been reported in the literature by different authors. Perhaps the first of these options is the Pectoralis Major Myocutaneous flap, described in 1979 (11). Trapezius muscle island flap is another local flap option used in the repair of head and neck defects, as its pedicle and blood supply from the nearby region does not come from the thoracoacromial artery, but from the transverse cervical artery (12,13). The Thoracoacromial artery perforator flap, which has been designed as a perforator flap, though it receives its blood from thoracoacromial artery, has also been reported as another alternative (14). In addition to these options, Submental island flap is now more preferred, since it has a less bulky and more flexible structure as compared to the pectoralis major flap (15). Fascial Artery Musculomucosal Flap, which can be designed as random or island flap, can also be considered as another alternative in repairing small and medium size defects (16).

In addition to the local regional pedicle flap options, free flaps are indispensable alternatives in the repair of head and neck region defects. Three dimensional and functional reconstruction can be planned by moving many tissues to the head and neck region with free transfer. Many areas of the body can be preferred as a donor site. Free flaps with or without a bone component originating from the thoracodorsal artery have been used many times in head and neck repairs (17). In the free tissue transfers performed using this artery system, the necessity to give the patient an intraoperative position in the form of lying on their side appears as a disadvantage (18).

In the repair of head and neck defects, subcutaneous and lower extremity tissues have also been reported as a donor area in many studies. Hung et al. in their study have performed reconstruction using Groin Flap and Anterolateral Thigh Flap (ALT) in the elderly population. They reported that since the patient group was older, they performed these surgeries under local anesthesia (19). In another study, ALT flap was successfully applied in reconstruction using many different variations (4). The ALT flap, which can be used safely in many centers around the world in head and neck reconstruction, may be relatively thick in the region where it is transferred in some cases, which can change according to the structural features of the person. After a certain period after free flap surgery and also as shown in new studies, ultrasound guided flap is thinned simultaneously with free flap surgery to lead to positive results which are obtained in 3D reconstruction (20).

Medial Sural Artery Perforator flap harvested from lower extremities (21), Lateral upper arm free flaps (22), and Deep inferior epigastric artery perforator flaps (23) have also been used in head and neck reconstructions.

The radial forearm flap has been used successfully in head and neck tissue defect reconstructions since its designation. In addition to soft tissue repairs, RFF allows reconstruction of bone structures such as mandible and maxilla, which can be included in the flap (24,25). Another advantage of the radial forearm flap is that it can be designed in different ways and provides solutions in different areas (6,26). We have designed the flap with different drawings by making use of the flexible structure of RFF in various areas that we have used in our study. Perhaps the only disadvantage to the use of RFF can be shown as donor site morbidity. In order to prevent the tissue defect that can occur in the donor area, different solution suggestions have been reported in the literature. Mashrah et al. described using a bilobed flap to directly close the RFF donor site (26), while Halama et al. used the vacuum-assisted-closure wound therapy (VAC) method comparatively and reported the idea that RFF is superior to the conventional dressing method in donor site healing (27). In our series, we experienced problems with the donor site in four cases, while recovery in two cases improved with dressings, and in two cases, we overcame the problem with the solutions reported in the literature.

Even though this flap has been described in the literature many years ago, with the satisfactory results we obtained in our study; the idea that it is a flap that can be preferred without hesitation, especially in the head and neck region may make an additional contribution to the literature. The reliability and preferability of the flap can be shown more clearly with a series with a higher number of cases compared to our study, as well as with series in which the flap is used in 3 dimensions in different areas than the areas we normally use.

CONCLUSION

Radial forearm flap is an option that can be used for years in reconstruction of soft tissue defects of the head and neck, it can be designed as desired, thanks to its flexible and thin structure, especially in the mucosal reconstructions such as the mouth, cheeks, and it can be applied easily in terms of surgical technique. Thanks to these advantages, we think that it will continue to be one of the safe free flaps that can be used without any problems in the future and we can easily recommend it to the reconstructive surgeons who are planning a head and neck repair.

Competing interests: The authors declare that they have no competing interest.

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REFERENCES

1. Sittitrai P, Reunmakkaew D, Srivanitchapoom C. Submental island flap versus radial forearm free flap for oral tongue reconstruction: a comparison of complications and functional outcomes. *J Laryngol Otol* 2019;133:413-8.
2. Gao RW, Nuyen BA, Divi V, et al. Outcomes in Head and Neck Resections That Require Multiple-Flap Reconstructions: A Systematic Review. *JAMA Otolaryngol Head Neck Surg* 2018;144:746-52.
3. Song YG, Chen GZ, Song YL. The free thigh flap: a new free flap concept based on the septocutaneous artery. *British J Plastic Surg* 1984;37:149-59.
4. De Virgilio A, Iocca O, Di Maio P, et al. Head and neck soft tissue reconstruction with anterolateral thigh flaps with various components: Development of an algorithm for flap selection in different clinical scenarios. *Microsurgery* 2019;39:590-7.
5. Yang GF, Chen PJ, Gao YZ, et al. Forearm free skin flap transplantation: a report of 56 cases. 1981. *British J Plastic Surg* 1997;50:162-5.
6. Garg RK, Wieland AM, Poore SO, et al. The radial forearm snake flap: A novel approach to oral cavity and oropharyngeal reconstruction that reduces forearm donor site morbidity. *Microsurgery* 2017;37:6-11.
7. Jorgensen MG, Tabatabaeifar S, Toyserkani NM, et al. Submental Island Flap versus Free Flap Reconstruction for Complex Head and Neck Defects. *Otolaryngology-head and neck surgery : Otolaryngol Head Neck Surg* 2019;161:946-53.
8. Hsieh WC, Tee R, Chang KP, et al. Aesthetic single-stage vermilion reconstruction using facial artery musculomucosal flap and radial forearm free flap following cancer resection: A case report. *Microsurgery* 2019.
9. Urken ML, Weinberg H, Buchbinder D, et al. Microvascular Free Flaps in Head and Neck Reconstruction: Report of 200 Cases and Review of Complications. *Otolaryngol Head Neck Surg* 1994;120:633-40.
10. Sugrue CM, Rooney G, Sugrue RM. Trapezius flaps for reconstruction of head and neck defects following oncological resection - A systematic review. *Journal of cranio-maxillo-facial surgery : Maxillo-Facial Surg* 2017;45:2115-9.
11. Ariyan S. The pectoralis major myocutaneous flap. A versatile flap for reconstruction in the head and neck. *Plastic and Reconstructive Surg* 1979;63:73-81.
12. Chen W-L, Wang Y-Y, Zhang D-M, et al. Extended vertical lower trapezius island myocutaneous flap versus pectoralis major myocutaneous flap for reconstruction in recurrent oral and oropharyngeal cancer. *Head & Neck* 2016;38:159-64.
13. Chen W, Yang Z, Zhang D, et al. Second salvage surgery with extended vertical lower trapezius island myocutaneous flap reconstruction for advanced re-recurrent oral and oropharyngeal squamous cell carcinoma. *Int J Oral Maxillofac Surg* 2014;43:531-8.
14. Li Z, Cui J, Zhang YX, et al. Versatility of the thoracoacromial artery perforator flap in head and neck reconstruction. *J Reconstr Microsurg* 2014;30:497-503.
15. Cheng A, Bui T. Submental island flap. *Oral Maxillofac Surg Clin North Am* 2014;26:371-9.
16. Ayad T, Xie L. Facial artery musculomucosal flap in head and neck reconstruction: Head & Neck 2015;37:1375-86.
17. O'Connell JE, Bajwa MS, Schache AG, et al. Head and neck reconstruction with free flaps based on the thoracodorsal system. *Oral Oncology* 2017;75:46-53.
18. Guerra AB, Lyons GD, Dupin CL, et al. *Ear Nose Throat J* 2005;84:441-7.
19. Hung WY, Tung CC, Fang WY, et al. Free Flap Transfer for Head and Neck Reconstruction Using Local Anesthesia in Elderly Patients. *Ann Plast Surg* 2018;80:30-5.
20. Ince B, Yarar S, Dadaci M. Simultaneous flap thinning with ultrasound-assisted liposuction during free flap surgery: Preliminary results. *Microsurgery* 2019;39:144-9.
21. Yang XD, Zhao SF, Wang YX, et al. Use of Extended Lateral Upper Arm Free Flap for Tongue Reconstruction After Radical Glossectomy for Tongue Cancer. *Aesthetic Plast Surg* 2015;39:562-9.
22. Masià J, Sommarino M, Cervelli D, et al. Extended deep inferior epigastric artery perforator flap for head and neck reconstruction: a clinical experience with 100 patients. *Head & Neck* 2011;33:1328-34.
23. Ahmad FI, Means C, Labby AB, et al. Osteocutaneous radial forearm free flap in nonmandible head and neck reconstruction. *Head & Neck* 2017;39:1888-93.
24. Gurunluoglu R, Gatherwright J. Microsurgical reconstruction of complex maxillofacial gunshot wounds: Outcomes analysis and algorithm. *Microsurgery* 2019;39:384-94.
25. Spaulding SL, Yue LE, O'Malley QF, et al. A novel radial forearm free flap design to treat pharyngoesophageal stenosis in combination with the posterior wall of the trachea. *J Surg Oncol* 2019;120:1446-9.
26. Mashrah MA, Lingjian Y, Handley TP, et al. Novel technique for the direct closure of the radial forearm flap donor site defect with a local bilobed flap. *Head & Neck* 2019;41:3282-9.
27. Halama D, Dreilich R, Lethaus B, et al. Donor-site morbidity after harvesting of radial forearm free flaps-comparison of vacuum-assisted closure with conventional wound care: A randomized controlled trial. *Journal of cranio-maxillo-facial surgery : Maxillo-Facial Surg* 2019;47:1980-5.