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Reconstruction of Oromandibular Defects by Vascularized Free Flaps: The Radial Forearm Free Flap and Fibular Free Flap as Major Donor Sites

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Abstract

Restoration of good morphology and function are primary goals in the reconstruction of oral cavity defects. Several free flaps have been used in the reconstruction of bone and soft tissue defects in the oral cavity. We are reporting our experience inoromandibular defect reconstruction using radial forearm freeflap (RFFF) and vascularized fibular free flap (VFFF). Of 228total patients who had free flap reconstruction, 106 patients required reconstruction of oral soft tissue with an RFFF, and122 patients required reconstruction of mandibular defects with a VFFF. Predictable results in terms of function and esthetics with minor donor site complications can be expected with the use of RFFF and VFFF for defects of the oral cavity.

Keywords

Fibular free flap, Free flaps, Oral cancer, Oromandibular defects, Plastic reconstruction, Radial forearm free flap.

Introduction

In today's era, restoring good morphology and function are primary goals in the reconstruction of oral

cavity defects along with good oncologic outcome. Several free flaps have been used in there construction of bone and soft tissues in the oral cavity, including the RFFF,[1,2]VFFF,[3] free deltoid flap,[4] scapular osteocutaneous flap,[5] brachioradialis forearm flap,[6] lateral arm free flap,[7] iliaccrestfree flap,[8] rectus abdominis musculocutaneous flap,[9]and anterolateral thigh flap.[10]Although all of these flaps are of potential interest in covering defects within the oral cavity, the RFFF and VFFF are the preferred vascularized free flaps for intraoral soft and hard tissue reconstruction. Yang et al[1]first described the RFFF in 1981. It was described as an optimal method for intraoral reconstruction by Soutaret al. [11] The RFFF provides an excellent soft tissue covering because of its pliability and thickness. Moreover, multiple skin islands can be included, if needed, on a single pedicle. Various refinements, including the use of the palmaris longus tendon to confer oral continence in labial defects[12] and the creation of a sensate RFFF by means of the lateral antebrachial cutaneous nerve,[13]have been reported. Use of free osteocutaneous flaps becomes necessary for optimum cosmetic and functional outcome, when large mandibular defects are present. There are a range of osseous donor sites that can be used forthe mandibular defects reconstruction. It may include the scapula, radius, iliac crest, and rib.[12-14] The VFFF is a more reliable reconstruction method after mandibular resection. It was first described in the literature by Taylor et al.[15]Several advantages of the VFFF have been reported, such as the possibility of several osteotomies, low donor sitemorbidity rate, possibility of combination with skin flaps, greater bone length, and suitability for osseointegrated dental implants. In this article, we are reporting our experience inoromandibular defects reconstruction by using the RFFF and VFFF, after surgical ablation.

Materials and Methods

Between January 2010 and May 2012, a total of 228 patients were treated in our department for oral cancer and underwent reconstruction of oral defects with micro vascularizedfree flaps. The patients had reconstruction with either RFFF or free fibular flap based on the need for mandibular reconstruction. Demographic data, including gender, age, personal medical history, and habits, were obtained retrospectively from case files. The patients included 142 men and 86 women, with a mean age of52 years (22–80 years). Surgical complications were evaluated and classified as general complications (like infection and wound dehiscence), complications of the flap (need for re exploration due to either arterial or venous block, hemorrhage, etc.), donor site complications, or recipient site complications. Totally, in 106 patients, oral soft tissue reconstruction was done by using RFFF, and 122 patients required VFFF for mandibular defects reconstruction. The patients underwent resection as primary treatment for squamous cell carcinoma (n = 215), verrucous carcinoma (n = 11), and minor salivary gland tumor (n = 2). For the RFFF, no dominant arm was selected for harvesting the flap as described by Yang et al.1 For the VFFF, all flaps were raised from left leg. Standard lateral approach, as described by Gilbert, was used for harvesting the VFFF. In this group, all patients had complex bone and soft tissue defects. The number of osteotomies ranged from 0 to 3 for better cosmetic and functional alignment. Reconstruction plates and bicortical screws were used in all cases for osteosynthesis. In both groups, facial artery was used for arterialanastomosis (end–end) in most cases (n = 218). Superior thyroid artery was used

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when adequate length of facial artery stump was not available (n = 10). For venous anastomosis, thyrolinguofacial trunk or one of its tributary was used with end-to-end anastomosis (n = 98). Internaljugular vein with end-to-side anastomosis was also used as frequently (n = 120), and less often external jugular vein was used (n = 10). Postoperatively, flaps were monitored by color change, temperature, and pin prick method2 hourly for first 48 hours and then less frequently.

Results

Of 228 total patients who had free flap reconstruction, 106 patients required reconstruction of oral soft tissue with an RFFF, and 122 patients required reconstruction of mandibular defects with a VFFF. Of 228 total patients,108 patients had buccal mucosal lesion, 29 patients had retromolartrigone lesion, 63 had lower alveolus lesion, 17had tongue/floor of mouth lesion, 4 patients had palate and 7 patients had upper or lower lip lesion (Table 1).Of the total 228 patients, 117 patients had T4 tumor, 25patients had T3 tumor, and 67 and 19 patients had T2 andT1 tumors respectively (Table 1).

Reexploration was done in 24 (10.5%) patients for various reasons. Hemorrhage (n = 5), venous thrombosis (n = 13), arterial thrombosis (n = 4), and vascular kink(n = 2) were the main reasons. Totally, 11 (73%) flaps were salvaged, out of 15 reexplorations which were done within 48 hours. Three cases of reexploration were done after 48hours, but before 120 hours, of which 2 (66%) were salvaged. Six patients were reexplored after 5 days and only1 (16%) was salvaged. Thus, of 24 reexplorations, 14 flaps were salvaged, while 10 flaps underwent necrosis and further salvaged by pectoral is major flap. So, the overall success rate was 95.6% as 218 flaps survived (Table 2).Of 106 radial free flaps, 10 (9.4%) patients under wentreexploration. Among them, 6 flaps were salvaged, while 4 flaps underwent necrosis. Thus, overall 102 flaps survived with a success rate of 96.2%. Complications in the recipient site occurred in 20 patients (18.8%); these ranged from wound infection to seroma formation. Wound dehiscence occurred in 7 patients (6.6%). Wound infection occurred in 8 patients (7.5%), and delayed hematoma occurred in 3 patients (2.8%). Seroma occurred in9 patients (8.4%). Donor site complications occurred in21 (19%) patients in the form of graft loss (Table 2). Of 122 fibular free flaps, 14 (11.4%) patient's underwentreexploration. In these 14 reexplorations, 8 flaps were salvaged while 6 flaps underwent necrosis and further salvaged by pectoral is major flap. Thus, overall 116 flaps survived with a success rate of 95%. Complications in the recipient site occurred in 28 patients (22.9%) including wound dehiscence (7%), wound infection (7.8%), delayed hematoma (4.1%), and seroma (8.5%). Donor site complications occurred in 27 (22%) patients in the form of graft loss, infection, and hematoma. Delayed plate exposureoccurred in three patients all requiring adjuvant radiotherapy and these required plate removal after an average 6 months postoperatively without any significant morbidity (Table 2).

Table 1: Patient Characteristics

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	Radialfree flap	Fibularfree flap	Total no. of patients	%
Sex				
Male	66	76	142	62.3
Female	40	46	86	37.7
Site of lesion				
Buccal mucosa	72	36	108	47.3
Retromolartrigone	17	12	29	12.7
Lower alveolus	0	63	63	27.6
Tongue/floor of mouth	6	11	17	7.4
Palate	4	0	4	1.8
Lip	7	0	7	3.0
Stage of lesion				
T1	19	0	19	8.3
T2	48	19	67	29.3
T3	12	13	25	10.9
T4	27	90	117	51.3
Histological type Squamous cell				
Carcinoma	95	120	215	94.2
Verrucous carcinoma	9	2	11	4.3
Minor salivary gland				
Tumour	2	0	2	0.8

Table 2: Surgical outcome and complication of procedure

	Radial free flap	Fibular free flap
No. of reexplorations (%)	10 (9.4)	14 (11.4)
No. of salvage (%)	6	8
Success rate (%)	96.2%	95%
Wound dehiscence (%)	7 (6.6)	8 (7)
Wound infection (%)	8 (7.5)	9 (7.8)
Seroma (%)	9 (8.4)	10 (8.5)
Hematoma (%)	3 (2.8)	5 (4.1)
Donor site complication (%)	21 (19)	27 (22)

Discussion

Whenever there is substantial removal of tissue intraorally as well as the overlying skin following oral cavity cancer surgery, primary reconstruction seems to be mandatory in most of these cases. Several advantages provided by primary reconstruction can be expected, including the absence of fibrosis in the surgical bed in comparison to when it is left for secondary healing or skin grafting is used. The selection of the suitable flap depends on the ease of access to the donor arterial and venous vessels, and lack of significant functional disability at the donor site. The use of vascularized free flaps has become a routine practice in oncosurgery, with the advent of microsurgery. It avoided the need for regional pedicled flapsrequiring multiple stages. A wider spectrum for reconstruction is available with the use of different

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vascularized free flaps. Among these flaps, the RFFF and VFFF are two of the most popular for the reconstruction of oral soft tissue and oromandibular defects. A long adequate vascular pedicle could be obtained in most of our cases. The RFFF has proven to be reliable option for reconstructing a range of oral cavity defects. It provides a very pliable tissue, which results in adequate mobility of the tongue and the floor of the mouth. Its suitable thickness is helpful for inner buccalmucosal covering and overlying cheek skin defect with folded flap. Total flap failure was observed in only 4/106cases; our flap failure rate of 4% is in concordance with the rates reported for overall free flap reconstruction of the head and neck.[15-18] A very similar failure rate (4.9%) was obtained with use of the VFFF in our series. This is lower than the flap failure rates obtained with the use of other osseous free flaps. The use of a simplified approach employing a small number of well-established flaps, which was popularized by Disa and Cordeiro, [19] can lead to more reliable surgical outcomes with lower complication rates. We advocate the use of a standard radial forearm fasciocutaneous flap in cases involving large amounts of mobile soft tissue, such as the tongue, floor of the mouth, or buccal mucosa. The advantage of a complete fasciocutaneous graft is to provide sufficient bulk and adequate mobility. Different reconstructive options, such as VFFF were used, in those cases where involvement of bone was present. Use of radius to repair mandibular defects is controversial because of the elevated number of donor site complications. The scapula has limited width and the radius has limited length for bone replacement. Due to flexibility in harvesting, the fibula is ideally suited for the reconstruction of all types of mandibular defects, including large defects.[20] Precision graft shaping can be possible in VFFF where the number and location of osteotomies are not restricted.[21] Those cases in which moderate-to-large bone defects were present underwent reconstruction with the VFFF, with overall good results. The VFFF has several advantages over other osseous free flaps: (1) a sufficient amount of bone can be obtained; (2) it provides a uniform shape; (3) its blood supply favors performance of several osteotomies; (4) it has a convenient location, allowing a team-team approach; (5) adjacent soft tissue is available; (6) a reliable skin flap can be obtained in more than 90% of patients; (7) it is indicated for all anteriormandibular defects and most lateral defects; and (8) donor site morbidity is low. Our clinical experience indicates that a skin paddle can be safely transferred within the bone, and we have obtained good results using a skin paddle for covering mucosal defect. Low height of the bone is one of the main disadvantages of the flap. This could pose a problem, especially in dentulous patients, in whom nonatrophied mandibles may be encountered. However, as previously reported by Guerra et al,[22]this condition may be attenuated by using a partial double-barrel fibular flap or further vertical distraction of the fibula. However, we usually did not require any double-barrel flap without compromising functional or cosmetic outcome. This flap is considered easier to harvest and is associated with lessmorbidity than the ilium, radius, or scapula. In relation to vascular anastomoses, large-diameter vessels with adequate length are obtained using this technique, and vein grafts usually are not needed.[21] The cross-sectional dimensions of the fibula are adequate for implants,[23] and thus, adequate esthetic results can be obtained through dental rehabilitation. At the end of the follow-up period, no long-term functional complications in the lower leg were observed except for a few who

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developed chronic pain. To ensure adequate healing of the donor site, the skin graft should be secured using the tie over bolster technique for 1 week.

Conclusion

Due to adequate bulkiness and pliability of the skin, along vascular pedicle with large diameters, relatively easy harvesting, and few donor site complications, the RFFF has become our preferred method for reconstructing soft tissue defects involving the oral cavity. The VFFF is a reliable method for reconstructing mandibular defects. It has an acceptably low morbidity rate. Good results in relation to survival of the skin paddle have been obtained at the end of the follow-up period. Predictable results interms of function and esthetics with minor donor site complications can be expected with use of the RFFF and VFFF for defects of the oral cavity.

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