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Microsurgical Flap Reconstruction of Soft Tissue Defects of the Head and Neck Following Cancer Ablation

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ABSTRACT

This study was conducted in Al-Babtain center for burns & plastic surgery, Ministry of Health, Kuwait, during the period from February 2009 to September 2014. The aim of this study was to report a case series of 55 patients (46 males and 9 females) with soft tissue defects of different anatomical areas in the head and neck region including tongue, gums, floor of the mouth, cheek mucosa, tonsilar fossa, palate and lower lip. These defects were created following surgical resection of malignancies. The surgical defect involved different anatomical structures including mucosa, skin or both. These defects were reconstructed by either free radial forearm flap or free Anterolateral thigh flap. The patients' ages ranged from 30 to 72 years (average 56.2 years). The malignant disease was primary in 50 patients, second primary in 2 patients and recurrent in 3 patients. Three patients had preoperative radiotherapy. The flaps survived completely in 54 patients. Following 6 months of rehabilitation, all patients were able to swallow solid food. In 5 patients flap debulking was needed to restore swallowing. Forty five patients achieved intelligible speech with no errors while 10 patients had some sound errors. The aesthetic outcome varied according to the anatomical site of the defect. Male patients were unhappy about hair growth in unwanted areas especially in cases of free Anterolateral thigh flap reconstruction.

Key Words: *Flap reconstruction – Soft tissue defects – Cancer ablation – Head & neck.*

INTRODUCTION

Head and neck cancers can lead to severe deformity and devastating effect on the cosmetic appearance and function of the patient that can lead him to be socially isolated and can negatively affect his quality of life. Surgery remains the mainstay in the management of most head and neck cancers offering a big chance of cure and survival with radical tumor resection. Reconstruction of soft tissue defects of the head and neck region represents a major challenge to reconstructive surgeons because of the complex anatomical, functional and aesthetic interactions in this region and because the aim of the reconstructive procedure is always to restore both form and function **[1,2,3]**.

There are many techniques for reconstruction of such defects including pedicled and free flaps. Pedicled flaps include; muscle flaps as pectoralis major, latissimus dorsi and trapezius and skin flaps such as deltopectoral and supraclavicular flaps. These flaps, although still have their role in the armamentarium of the reconstructive surgeon, they have their limitations especially regarding the functional and cosmetic outcome **[4,5,6]**.

The use of free tissue transfer in head and neck reconstruction has become the standard technique for reconstruction of head and neck surgical defects. It avoids the limitations of the pedicled flaps and allows for reconstruction of extensive complex defects in a single stage maximizing the functional and aesthetic outcome and improving rehabilitation and quality of life in those patients **[7,8]**.

The FRFF (free radial forearm flap) has been considered the first choice for soft tissue reconstruction in the head and neck region. Recently, the free ALT flap (Anterolateral thigh flap) has been introduced and gained popularity in head and neck reconstruction especially that it carries the advantage of not sacrificing a major artery and the high potentiality of direct closure of the donor site **[9,10]**.

The aim of this study was to report a case series of 55 patients with large head and neck soft tissue defects, following malignant tumor resection, reconstructed by FRFF and free ALT flap. Functional and aesthetic outcomes were evaluated in these patients during the follow-up period.

PATIENTS AND METHODS

This study was conducted in Al-Babtain centre for burns & Plastic Surgery, Ministry of Health, Kuwait during the period from February 2009 to September 2014 and included 55 patients; 46 males (83.6%) and 9 females (16.4%) with 55 free microsurgical flap reconstruction. Their ages ranged from 30 to 72 years (average 56.2 years). All of them suffered extensive soft tissue defects of the head and neck region following surgical resection of malignant tumors.

Table (1) shows patients' criteria recorded, including presence of co-morbidities like diabetes, hypertension, cardiac diseases or history of smoking.

The disease was primary cancer in 50 patients (90.9%), second primary cancer in 2 patients (3.6%) and recurrent cancer in 3 patients (5.5%). Three patients (5.5%) had pre-operative radiotherapy. The locations of the defects in the head and neck and their types are summarized in Table (2). Types of free flaps used for reconstruction in such patients are shown in Table (3).

Immediate reconstruction was done in all cases. The recipient vessels selected for revascularization of these flaps are listed in Table (4).

The flap selected for reconstruction was harvested at the same time the head and neck surgeons were resecting the tumor and doing cervical lymphadenectomy. The vessels used for revascularization of the flaps were also identified and prepared during neck dissection, working simultaneously to save time. All FRFF donor sites were closed by split thickness skin grafts. All cases of free ALT flap donor sites were closed primarily.

Post-operatively, the patients spent one night in the ICU (intensive care unit), then transferred to an intermediate care unit for another one night, then transferred to the surgical ward.

Routine use of postoperative anticoagulation regimen was not practiced in this study, only prophylactic regimen against DVT (deep venous thrombosis). Full heparinization protocol was adopted only when revision of the vascular anastomoses was needed.

Patients were evaluated post-operatively for flap survival, vascular complications, non vascular complications, donor site morbidity, functional and aesthetic outcome.

Cases of the upper aerodigestive tract, which in our study included cancers of the lower lip, tongue, gums, floor of the mouth, tonsils, oropharynx and palate, were evaluated functionally for the ability to swallow solid food and speech intelligibility according to the scale shown on Table (5).

Table (1): Patients' criteria.

	No. of patients (%)
Sex:	
Male	46 (83.6)
Female	9 (16.4)
Co-morbidity:	
Diabetus	9 (16.4)
Hypertension	8 (14.5)
Cardiac disease	4 (7.3)
Smoking	15 (27.3)
Disease type:	
Primary	50 (90.9)
Second primary	2 (3.6)
Recurrent	3 (5.5)
Previous radiotherapy:	
Positive	3 (5.5)
Negative	52 (94.5)

Table (2): Characteristics of the surgical defects.

	No. of patients (%)
Anatomical location:	
Tongue	23 (41.8)
Gums	8 (14.5)
Floor of the mouth	6 (10.9)
Cheek mucosa	6 (10.9)
Tonsilar fossa	5 (9.1)
Palate	4 (7.3)
Lower lip	3 (5.5)
Defect type:	
Mucosa	50 (90.9)
Mucosa & skin	5 (9.1)

Table (3): Types of free flaps.

	No. of patients (%)
ALT	25 (45.5)
RFF	30 (54.5)

Table (4): Recipient vessels used for flap revascularization.

	No. of patients (%)
Arteries:	
Facial	25 (45.5)
Superior thyroid	15 (27.3)
External carotid	9 (16.4)
Lingual	4 (7.3)
Transverse cervical	2 (3.6)
Veins:	
Internal jugular	29 (52.7)
Facial	17 (30.9)
External jugular	9 (16.4)

Table (5): Functional outcome scale.

	Score	Outcome
Swallowing	4	Solid diet
	3	Semisolid diet
	2	Semiliquid diet
	1	Liquid diet
	0	Tube feeding
Speech Intelligibility	3	Intelligible speech
	2	Intelligible with some sound errors
	1	Intelligible on careful listening
	0	Unintelligible

Table (6): Postoperative complications.

	No. of patients (%)
Recipient site:	
Total flap loss	1 (1.8)
Partial flap loss	0
Wound dehiscence	3 (5.5)
Hematoma	2 (3.6)
Fistula	0
Wound infection	4 (7.3)
Donor site:	
Skin graft loss	2 (3.6)
Nerve injury	2 (3.6)
Scar hypertrophy	1 (1.8)

RESULTS

In this study, 54 flaps (98.2%) survived completely while 1 FRFF (1.8%) was lost completely and the patient required another free tissue transfer for reconstruction of the defect. Three patients (5.5%) were taken to the operative theatre to check on the vascular anastomosis in the first 48 hours postoperatively because of flap vascular compromise. Two of these flaps were FRFF suffered venous insufficiency, one of them was salvaged after revising the venous anastomoses and the other 1 failed. The third case was a free ALT flap and it was taken to the operative theatre on post operative day 1 because of flap ischemia, the vascular anastomoses was checked and arterial spasm was found and responded well to local application of vasodilators.

Two cases (3.6%) developed hematoma underneath the flap on the postoperative day 2 and was evacuated without flap compromise. Four patients (7.3%) developed infection at the flap recipient site and treated conservatively.

Partial neck wound dehiscence occurred in 3 cases (5.5%) and were treated conservatively without exposure of vital neck structures.

Flap donor site complications were encountered in 5 patients (9.1%), this included 2 cases of FRFF with partial skin graft loss and exposure of part of the flexor carpi radialis tendon that was treated conservatively, 2 cases of FRFF with numbness on the hand dorsal first metacarpal area which improved with time and 1 case of free ALT flap with donor site scar hypertrophy and was treated by scar massage and silicone topicals, Table (6) shows the postoperative complications. We did not have any mortality cases related to the procedure in this series during the follow-up period which ranged from 8 months to 40 months post–operatively (average 21.6 months).

Following rehabilitation, all patients were able to swallow solid food. In 5 cases (9.1%) swallowing was restored following flap debulking.

Fourty five patients (81.8%) achieved score 3 on speech intelligibility scale while 10 patients (18.2%) achieved score 2.

The aesthetic outcome varied according to the site of the defect especially where a cutaneous element was involved in the resection with a through-and-through defect.

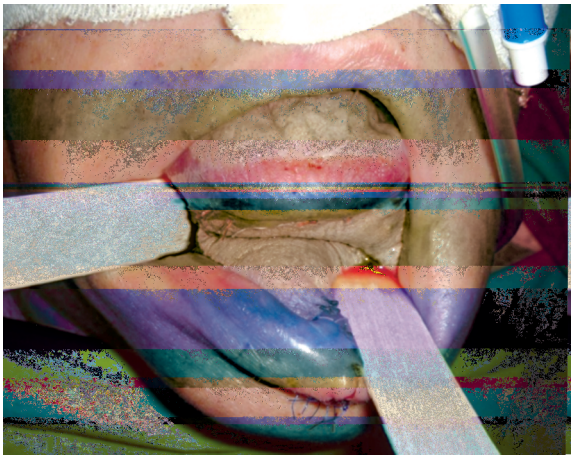
Male patients were not happy about hair growth in unwanted areas especially in cases of the ALT flap.

Case 1: A 60 years old female patient with squamous cell carcinoma of the mucosa of the floor of the mouth. The lesion was resected and bilateral cervical lymphadenectomy was done. The defect was reconstructed by FRFF part of it de-epithelialised to fill the hollowness in the submental area. Successful reconstruction with free tongue mobility and good aesthetic outcome were achieved at 2 years of follow-up (Fig. 1).

Case 2: A 54 years old female patient with squamous cell carcinoma of the left side of the tongue, the surgical defect following tumour resection involved partial glossectomy and part of the adjacent floor of the mouth. Reconstruction was achieved by FRFF designed to fit both the tongue and floor of the mouth defects (Fig. 2).

Case 3: A 72 years old male patient with squamous cell carcinoma of the left alveolar margin. The tumor resected en-bloc with split mandibulectomy, the defect was reconstructed by free ALT flap (Fig. 3).

(A)



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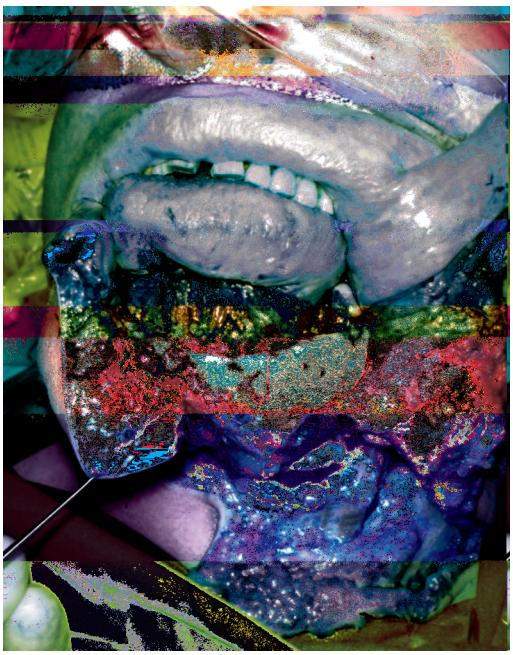

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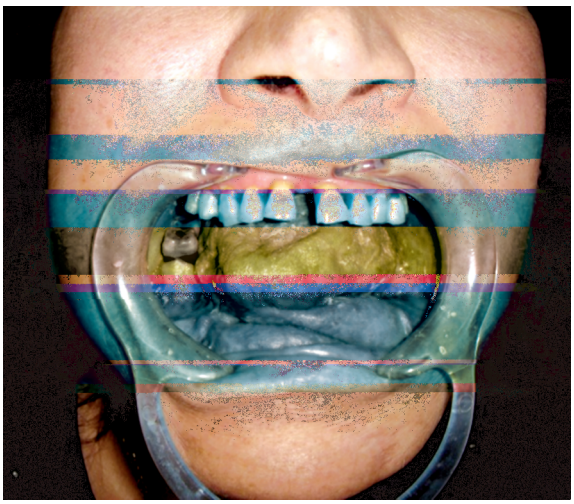

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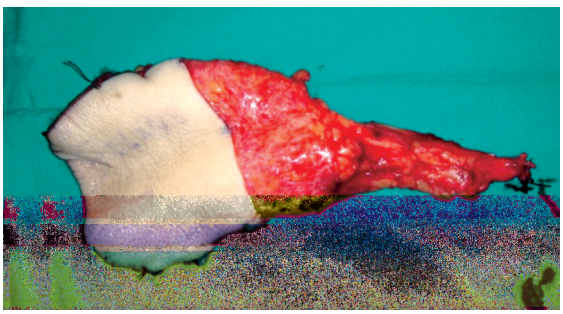

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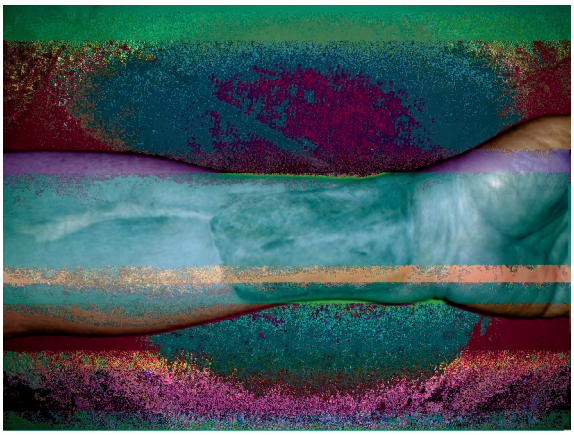
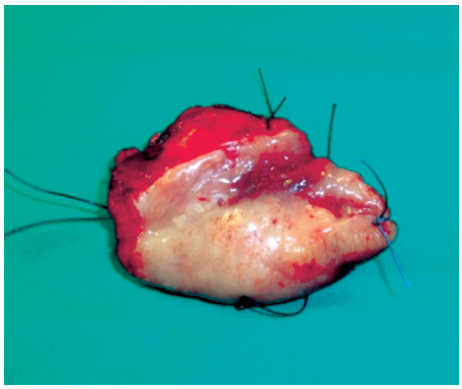


(F)

Fig. (1): A- Preoperative view. B- Surgical defect. C- FRFF separated. D- Day 2 postoperative. E- 2 years postoperative. F- Donor site after 2 postoperative years.

(A)

(B)



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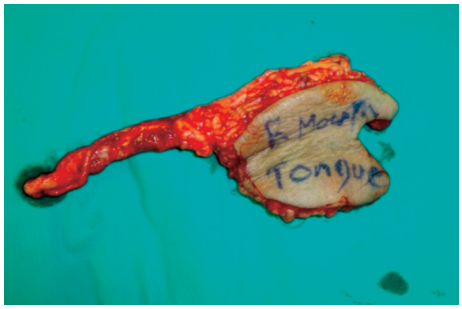

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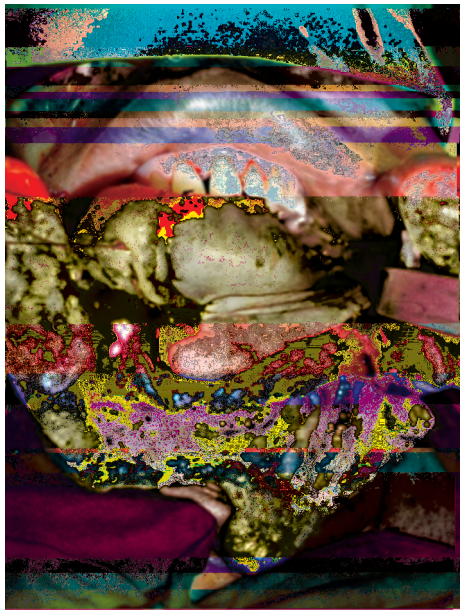

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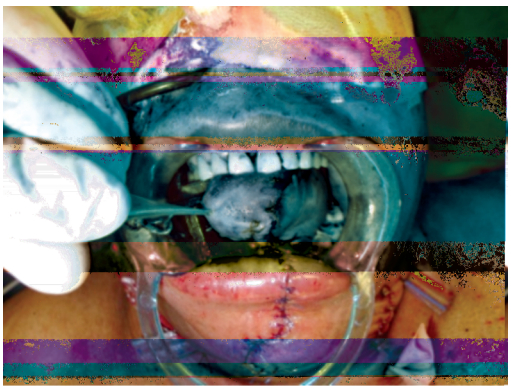


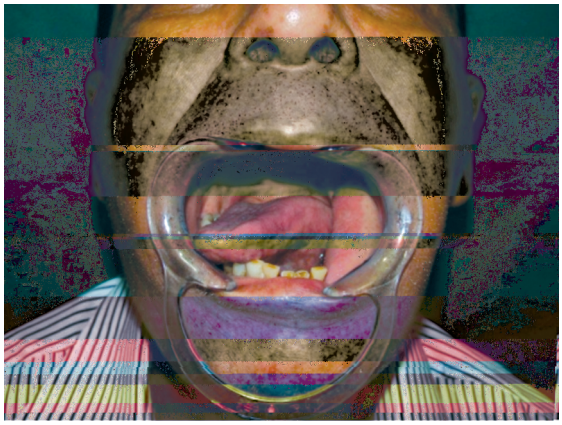
(F)

(G)

Fig. (2): A- Preoperative view. B- Excised specimen. C- Surgical defect. D- Flap design. E- Flap insetting. F- Immediate postoperative. G- 3 months postoperative view.

(A)

(E)



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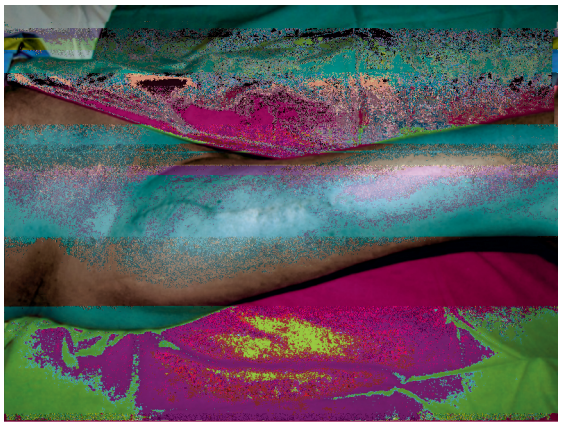

(G)

(D)

Fig. (3): A- Preoperative view. B- Excised specimen. C- Surgical defect. D- Flap insetting. E- Intraoperative view. F-2 months postoperative. G- Donor site view.

DISCUSSION

Head and neck cancers are mostly squamous cell carcinomas, frequently aggressive in behavior and many patients present with advanced disease. Immediate reconstruction should follow complete surgical excision of the tumor to restore form and function. The aim of reconstruction is always to achieve wound healing, try to preserve the function of speech and swallowing with maximum aesthetics and least morbidity **[3,11,12]**.

Free tissue transfer is now the standard procedure for reconstruction of major post ablative head and neck defects with high success rates reported by many authors to be reaching up to 100% **[12,13]**. High success rates were also reported in cases of subsequent free tissue transfer; Hanasono et al. **[14]** performed 273 free flaps on 117 patients and reported success rate of 98.7% of subsequent free flaps compared to 99.15% for initial free flaps in the same patient. In this study, an overall success rate of 98.2% is reported which is comparable with other authors, we had three cases of recurrent malignant disease for which subsequent free flaps were used for reconstruction and they were all successful. We had 3 cases who received preoperative radiotherapy and they were all successful. We had 1 flap loss; it was a FRFF that suffered resistant venous thrombosis. Kesting et al. **[15]** and Loreti et al. **[16]** had comparable results. Kesting et al. **[15]** had a comparative study between the use of the ALTF flap and the FRFF in reconstruction of the oral cavity; they reported that venous congestion was the commonest cause of flap failure in case of FRFF and they referred this and the less salvage rates in this group of patients to the less diameter of veins accompanying the radial artery compared to venae comitantes of the descending branch of the circumflex femoral artery in cases of ALT flap. In our series, we did anastomoses of both the cephalic vein and one of the venae comitantes of the radial artery to enhance the venous drainage of the FRFF and reduce the incidence of venous congestion.

All our patients were able to swallow solid food after rehabilitation. Five patients, all of them had tongue squamous cell carcinoma, required flap debulking before they could take solid diet; Farace et al. **[8]** had comparable results. Khariwala et al. **[17]** in their prospective study to evaluate the swallowing outcomes in 191 cases with microvascular head and neck reconstructions, they reported that patients who had tongue resection and reconstruction had the worst swallowing outcome. They found out that the type of the flap used and the size of the defect did not really affect the swallowing outcome. In our study speech was found comprehensible in 85% of cases without sound errors; this is comparable with other authors **[8,14]**. Comparing between the FRFF and the free ALT flaps was beyond the aim of this study so we evaluated the functional outcome of the microsurgically reconstructed patients regardless of the flap type. Farace et al. **[8]** compared the functional results of the free ALT and the FRFF used in oral reconstruction and they found no statistically significant difference between the two groups of patients. They reported that the two flaps share common characteristics like being potentially large sized, soft pliable tissue and long large caliber pedicle; however we believe that the ALT flap is more thick and bulky especially when used for reconstruction of through-and-through defects where the flap needs to be folded upon itself to provide an inner and outer coverage.

Farace et al. **[8]** concluded that the donor site morbidity was the only variable between the two flaps. None of our patients with FRFF suffered hand ischemia following flap harvest. Haerle et al. **[18]** stated that the radial artery is a major source of blood supply to the hand and that the ulnar artery is only dominant at the elbow level before giving off the collaterals. Manabe et al. **[19]** reported decrease tissue oxygenation of the hand after sacrificing the radial artery during hand grip exercise despite the compensatory dilatation of the ulnar artery. We always harvested the FRFF from the side of the non dominant hand. We agree with many authors **[20,21]** that the donor site morbidity of the FRFF is generally minimal especially when objectively assessed. All donor sites of the free ALT flaps were closed directly; only one case only developed scar hypertrophy. We agree with many authors about the minimal and limited donor site complications of the ALT flap especially where the donor site is closed primarily as in most cases of head and neck reconstruction **[10,16,22]**.

Conclusion:

From the results of this study and literature review we conclude that free tissue transfer provides the standard of care of reconstruction of head and neck defects following major ablative surgery. This improves the aesthetic and functional outcome in those patients which in turn helps to improve their rehabilitation and quality of life. Both the FRFF and the free ALT flap provide good option for soft tissue reconstruction of the head and neck defects; they provide amble, thin and pliable tissue. They also have long, large caliber pedicle for easy vascular anastomoses.

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