Outcome assessment of composite Oro-Mandibular Defect Reconstruction with Double Skin Paddle Free Fibula Osteocutaneous Flap

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Abstract— *Free fibular flap is the most favored free flap for composite defects of oro-mandibular region. Composite defects involving mucosa, mandible and skin often require two free flaps for the reconstruction. A technique of harvesting two separate cutaneous paddles of free fibular flap each based on a definite peroneal artery perforator was presented in this study. Reconstruction of composite oro-mandibular defect was done with two independent cutaneous paddles (proximal skin paddle based on musculo-cutaneous perforator and distal skin paddle based on septo-cutaneous perforator) in 12 patients. Post operative outcome was good, with 11 cases having no loss of skin paddle. There was an outer skin paddle necrosis in one patient for which cover was given with pectoralis major myocutanous flap. A double paddle free fibula flap can be used to reconstruct composite defects providing inner lining as well as skin cover with good flap success rates and better functional and aesthetic patient outcomes, thus avoiding an additional free or regional flap morbidity and decreased operative time.*

Keywords: Oro-Mandibular Reconstruction, Free Fibula Flap.

I. INTRODUCTION

Reconstruction of composite oro-mandibular defects continues to pose a challenge to the reconstructive surgeon. Large and composite defects in the head and neck region have better results with free flaps.[1] Microsurgical reconstruction of composite through-and-through defects of the oral cavity involving mucosa, bone and external skin often requires two free flaps or de-epithelialization of the single cutaneous paddle of free fibular flap for successful functional and aesthetic outcomes.[2] A safe, reliable technique using a double-skin paddle osteocutaneous free fibula flap to restore the intraoral lining, bony defect and external skin is described in literature.[2,3] The skin defect was reconstructed by a separate cutaneous paddle based on a consistent musculocutaneous perforator near the fibular head. An independent skin paddle allows better contouring and ease of insetting without any wastage of flap due to de- epithelialization. [2,3,4]

This study was conducted to find out result of reconstruction of composite oro-mandibular defect was done with two independent cutaneous paddles in a tertiary care hospital of Rajasthan.

II. METHODOLOGY

This study was done in a tertiary care hospital center, from February 2016 to January 2017. Oro-mandibular reconstructions with free fibula flap were done in 58 cases and reconstructions of composite oro-mandibular defects (Figure 1) with two independent cutaneous paddles were done in 12 patients.

Figure 1
Composite defect after excision

Figure 2
Marking of double skin paddle

Before harvesting double skin paddle, the presence of the proximal musculocutaneous perforator from soleus muscle and conventional distal septocutaneous perforators was established using a hand held Doppler preoperatively. (Figure 2)

The length of the fibula was the same as that used with a single paddle free fibular flap. After taking dimensions of intraoral, bone and skin defect, two independent cutaneous paddles were harvested. (Figure 3)

Figure 3
Harvested free fibule double skin paddle osteocutaneous flap

Figure 4

Post operative photograph after flap insetting

De-epithelialization was not required as both the flaps were harvested independently. During tumor excision, precautions were taken to keep extra length of facial artery and vein for satisfactory anastomosis considering the restricted length of the proximal myocutaneous pedicle.

Inner lining (mucosal defect) was reconstructed by the conventional distal cutaneous paddle of the free fibula flap whereas the skin defect was reconstructed by a separate cutaneous paddle based on a

consistent musculocutaneous perforator near the fibular head. (Figure 4)

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

III. RESULTS

In this study, age of the patients ranged from 37 to 68 years with mean age 52.92 years and standard deviation 9.69 years. Male female ratio was observed 2:1 with male predominance.

Among 12 patients with double skin paddle free fibula reconstruction, only one patient develop complications. Proceedure was found satisfactory in all patients except in one in whom complication was developed. (Table 1)

Table 1
Distribution of Study Population

S. No.	Age (Yrs)	Sex	Diagnosis	Complications	Result
1	37	Male	Ca Rt. Lower Alveolus and RMT	Nil	Satisfactory
2	54	Male	Ca Lt. Lower Alveolus	Nil	Satisfactory
3	43	Male	Ca Rt. Cheek	Nil	Satisfactory
4	57	Female	Ca Rt. Lower Alveolus	Nil	Satisfactory
5	49	Male	Ca Lt. Cheek and GB Sulcus	Nil	Satisfactory
6	59	Female	Ca Lt. Mandible	Nil	Satisfactory
7	68	Male	Ca Rt. Lower Alveolus and RMT	Partial necrosis of outer skin paddle	PMMC for skin defect
8	40	Male	Ca Rt. Cheek	Nil	Satisfactory
9	64	Male	Ca Lt. Alveolus and Floor of Mouth	Nil	Satisfactory
10	61	Female	Ca Rt. Alveolus	Nil	Satisfactory
11	55	Male	Ca Rt. Alveolus	Nil	Satisfactory
12	48	Female	Ca Lt. Cheek and GB Sulcus	Nil	Satisfactory

All tumors belonged to the T4 stage with N0-N3 nodes (Figure 1) with involvement of mucosa, mandible and skin. All 12 patients had a double paddle free fibula flap done for the composite defect involving skin, bone, and mucosa. (Table 2)

Table 2
Size and Location of the composite defects

S. No.	Bone defect		Lining defect		Skin defect	
	Dimension (cm)	Location	Dimension (cm)	Location	Dimension (cm)	Location
1	12	Ramus to Symphysis	8×6	Intraoral	10×10	Rt cheek to chin
2	8	Angle to Parasymphysis	10×7	Intraoral	10×9	Lt cheek
3	6	Angle to Parasymphysis	7×4	Intraoral	8×6	Rt cheek
4	9	Ramus to Symphysis	9×7	Intraoral	10×9	Rt cheek till chin
5	6	Angle to Parasymphysis	8×6	Intraoral	10×8	Lt cheek
6	7	Angle to Parasymphysis	9×7	Intraoral	10×9	Lt chin and cheek
7	9	Ramus to Parasymphysis	10×8	Intraoral	10×10	Rt cheek to chin
8	5	Angle to Parasymphysis	7×4	Intraoral	8×6	Rt cheek
9	6	Angle to Parasymphysis	8×6	Intraoral	10×8	Lt cheek
10	6	Angle to Parasymphysis	9×7	Intraoral	10×9	Rt cheek
11	8	Angle to Parasymphysis	9×6	Intraoral	10×9	Rt chin and cheek
12	7	Angle to Parasymphysis	9×6	Intraoral	8×8	Lt cheek

The distance of the origin of the perforator from the bifurcation and the beginning of the peroneal artery was 8-10cm. The length of theintramuscular part of the perforator was the actual length i.e. 4-6cm. The distance between the origins of the two perforators was 4-6cm.

The bone defect was in the range of 5-12cm or hemi-mandible and was reconstructed by the fibular bone. The intraoral lining defect had the dimensions in the range of 4-6cm width and 8-10cm length which was reconstructed by the osteo-cutaneous distal paddle. The skin defect was in the range of 10-10cm and was reconstructed by the proximal cutaneous paddle based on the musculocutaneous perforator.

Out of twelve cases, eleven patients had an uneventful recovery. One case developed partial necrosis of the outer skin paddle with an intact inner paddle and bone graft. The outer skin paddle was debrided and the skin defect was covered with pectoralis major myocutaneous flap.

IV. DISCUSSION

Literature describe this double-skin paddle osteocutaneous free fibula flap to restore the intraoral lining, bony defect and external skin, a safe & reliable technique.[2,3] The free fibula flap first described by Ian Taylor et al,[5] pioneered by Wei et al[2,6,7] and later popularized by Hidalgo[3,8] has emerged as the ideal flap in the reconstruction of complex oro-mandibular defects because of its versatile characters.[6] The skin paddle overlying the osteo-myocutaneous flap receives its vascular supply from the musculo-cutaneous and septocutaneous perforators. The number of septo-cutaneous perforators varies from 1 to 7. Based on these perforators, Yang et al.[7] introduced the concept of two skin paddles from the same flap based on two perforators or two branches of one perforator to line Intra and extra oral defects. However, there were contrasting reports about the reliability of the skin paddle. Hidalgo 1 first reported that the skin overlying the fibula flap is unreliable but after 10yr follow up study concluded that reconstruction of the mandible with free fibula osteocutaneous flap is functionally and aesthetically durable.[9]

Wei et al al[2,6,7,10] pioneered the concept of using double free flaps in reconstructing the extensive soft tissue defects associated with mandibular defects owing to the unreliability of the skin paddle. The commonly used second free flaps were radial artery flaps, rectus abdominismyocutaneous flaps, and the antero-lateral thigh flaps. Jones et al. al[11] made extensive study of the vasculature of the lateral leg both in cadavers and in clinical applications and reported that the vascularity of the lateral leg skin is reliable and large skin paddles can be used to line Intra and extra oral defects with a segment of de-epithelialized skin in between so as not to disturb the sub dermal vascular plexus.

In their clinical study, Jones et al. al[12] used de-epithelized skin paddle in 16 cases and was 100% successful in reconstructing complex oro-mandibular defects. They used skin paddles transverse to the long axis of the bone but were not clearly mentioned whether simultaneous two team approach were adopted.

In a study by Ahmad et al,[1] 307 cases were reconstructed with de-epithelialized double skin paddles to provide the outer and inner lining with good success. Skin paddle designed was de-epithelialized which led to wastage of flap and restricted pliability compromising the quality of inset.

In the study by Yadav P.S. et al,[13] double free flaps requiring separate anastomoses from a single free fibular flap were done to reconstruct a similar defect.

A double paddle free fibula flap based on a reliable proximal musculocutaneous perforator and a distal septocutaneous perforator can be safely harvested for reconstruction of a complex oromandibular defect requiring a single anastomosis thus giving a better functional and aesthetic outcome. This technique avoids de-epithelialization thus facilitating better contouring and insetting of the flap.

In this study, complex defects of the cheek region requiring reconstruction of skin, bone and mucosa using double skin paddles free fibula flap was there. In this technique, a second free flap or second loco-regional flap for reconstruction of complex oromandibular defects is not required.

Advantages of this technique are that it doesn't need a second anastomosis, no need of de-epithelialization, it makes the surgery less tedious and time consuming in a composite defect. The independent proximal paddle allows for ease of inset and better contouring compared to a de-epithelized paddle with restricted mobility. A paddle of size 10-13cm may be comfortably harvested.

Disadvantage of this technique is a restriction of the pedicle length to around 4-6cm as compared to 10-12cm in conventional cases due to the incorporation of the proximal pedicle. So the operating surgeon has to plan accordingly and prepare the recipient's vessels.

V. CONCLUSION

A consistent and reliable musculocutaneous perforator is present at approx. 12-14cm from the head of the fibula. An independent cutaneous paddle based on this perforator can be safely harvested along with the conventional skin paddle based on lower septocutaneous perforators. A double paddle free fibula flap can be used to reconstruct composite defects providing inner lining as well as skin cover with good flap success rates and better functional and aesthetic patient outcomes, thus avoiding an additional free or regional flap morbidity and thereby decreasing operative time.

CONFLICT OF INTEREST

None declared till now.

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