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# Perforator based rectus free tissue transfer for head and neck reconstruction: New reconstructive advantages from an old friend

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ABSTRACT

*Objectives:* To demonstrate three reconstructive advantages of the perforator based rectus free tissue transfer: long pedicle, customizable adipose tissue, and volume reconstruction without muscle atrophy within a contained space.
*Materials and methods:* Thirty patients with defects of the head and neck were reconstructed with the perforator based rectus free tissue transfer.
*Results:* Transplant success was 93%. Mean pedicle length was 13.4 cm. Eleven patients (37%) had vessel-poor necks and the long pedicle provided by this transplant avoided the need for vein grafts in these patients. Adipose tissue was molded in 17 patients (57%). Twenty-five patients (83%) had defects within a contained space, such as the orbit, where it was critical to have a transplant that avoided muscle atrophy.
*Conclusions:* The perforator based rectus free tissue transfer provides a long pedicle, moldable fat for flap customization, and is useful in reconstruction of defects within a contained space where volume loss due to muscle atrophy is prevented.



## Introduction

Many donor sites are used for autogenous transplantation to reconstruct soft tissue defects in the head and neck [1]. The ideal soft tissue donor site would have a long vascular pedicle, be accompanied by adipose tissue that is highly moldable so that the volume of adipose within the transplant can be customized, and would not contain muscle, so that the volume of the transplant is not affected by muscle atrophy.

While the rectus donor site has been well described in the literature [2–23], the majority of publications utilizing the rectus donor site in head and neck reconstruction describe the use of a musculocutaneous transplant (Table 1). The perforator based rectus transplant provides three critical reconstructive advantages over its musculocutaneous counterpart. The perforator based rectus transplant provides excellent pedicle length, which is useful in patients who have previously treated, vessel-poor necks and/or defects that are distant from recipient vessels. Another advantage of this transplant is the ability to mold the adipose tissue. Because the perforators are identified, the adipose tissue can be safely trimmed and customized based upon the defect and the thickness of the transplant. This level of customization and control of the volume that is transplanted into the defect cannot be performed in a transplant where the perforators are embedded within muscle. Finally, the perforator based rectus transplant leaves the rectus abdominis muscle in situ and thus, there is not muscle in the donor tissue that will undergo atrophy and result in loss of the volume which that affects the long term reconstructive result [24,25]. The prevention of muscle atrophy and subsequent transplant volume loss is particularly important when reconstructing a contained space such as the orbit, for example. The combination of all three reconstructive advantages makes the perforator based rectus transplant an ideal donor site for many complex head and neck defects.

We evaluated the use of the perforator based rectus transplant in patients with previously treated, vessel-poor necks, patients that required customization of the transplanted adipose tissue based upon body habitus and the dimensions of the defect, and patients with defects within a contained space in which transplanting

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**Table 1**
Literature review of the utilization of the rectus donor site in head and neck reconstruction.

| Author | Year | Total # of Rectus | # Musculocutaneous | # Perforator-based |
|---|---|---|---|---|
| Allensworth [2] | 2016 | 2 | 2 | 0 |
| Low [11] | 2015 | 5 | 5 | 0 |
| Joseph [10] | 2014 | 9 | 9 | 0 |
| Frederick [8] | 2013 | 120 | 120 | 0 |
| Cappiello [33] | 2012 | 24 | 0 | 24 |
| Cordeiro [7] | 2012 | 74 | 74 | 0 |
| O'Connell [15] | 2011 | 11 | 11 | 0 |
| Masia [32] | 2011 | 100 | 0 | 100 |
| Zhang [23] | 2009 | 12 | 0 | 12 |
| Clemens [34] | 2009 | 6 | 0 | 6 |
| Cinar [6] | 2006 | 1 | 1 | 0 |
| Woodworth [21] | 2006 | 16 | 0 | 16 |
| Pryor [16] | 2005 | 13 | 13 | 0 |
| Butler [5] | 2004 | 7 | 7 | 0 |
| Beausang [3] | 2003 | 13 | 0 | 13 |
| Uusitalo[20] | 2001 | 2 | 2 | 0 |
| Browne [4] | 1999 | 12 | 12 | 0 |
| Lyos [12] | 1999 | 14 | 14 | 0 |
| Nishimoto [14] | 1997 | 55 | 55 | 0 |
| Schliephake [17] | 1996 | 11 | 11 | 0 |
| Yamamoto [22] | 1995 | 13 | 13 | 0 |
| Hasegawa [9] | 1994 | 16 | 16 | 0 |
| Nakatsuka [13] | 1994 | 200 | 200 | 0 |
| Urken [18] | 1993 | 16 | 16 | 0 |
| Urken [19] | 1991 | 15 | 15 | 0 |

muscle is not a viable option for long-term volume of the reconstruction.

## Materials and methods

### *Study design*

This retrospective case series included 30 patients with major defects of the head and neck reconstructed at the University of Michigan Health System, Ann Arbor, from May 2011 to September 2016.

### *Reconstructive advantages*

The perforator based rectus transplant was indicated if at least one of the following three reconstructive advantages were required. First, the long pedicle of the transplant would be required because vascular access was limited adjacent to the defect; second, the adipose tissue could be molded by trimming the adipose between the perforators in patients whose defect and/or body habitus required transplant customization; the third advantage was the ability to harvest a transplant that did not contain muscle so that the volume of the transplant was not affected by subsequent muscle atrophy. This third advantage was valuable for reconstructing in contained spaces were subsequent muscle atrophy would affect the function or appearance of the reconstruction.

### *Patient population*

Patients were eligible if they had a defect of the head and neck that was reconstructed with a perforator based rectus transplant. There were 30 patients who met inclusion criteria for the study, 24 were male (80%) and 6 were female (20%). Mean age was 61 (5–96) years and mean follow-up was 16 (1–40) months. The indications for reconstruction were tumor ablation in 26 (86%), osteoradionecrosis (ORN) in 2 (7%), and secondary reconstruction in 2 (7%). The perforator based rectus transplant was used to reconstruct the oral cavity in 21 patients (70%), skull base/orbit in 4 (13%), maxilla in 2 (7%), tongue base in 2 patients (7%) and facial and neck skin in 1 patient (3%). There were 12 patients (40%) who had a previously dissected neck, 10 patients (33%) who had previously underwent chemoradiation treatment (CRT), and 3 patients (10%) that had previously underwent radiation treatment (RT). There were 12 patients (40%) who received postoperative CRT and 7 patients (23%) who received postoperative RT. The mean preoperative body-mass index (BMI) was 24 (17.6–31.8).

### *Surgical technique*

Periumbilical perforators were identified with a Doppler probe in all 30 patients. The three dominant cutaneous perforators were chosen. The key steps of the transplant harvest are illustrated in Fig. 1. The skin paddle is designed to capture periumbilical perforators, which provides the greatest thickness of adipose tissue and also maximizes pedicle length (Fig. 1a). The skin island was incised down to rectus fascia. The areolar tissue between the subcutaneous adipose and the rectus fascia was used as a surgical plane to elevate the skin paddle and locate the perforators (Fig. 1b). A Stevens tenotomy scissor or the spatulated end of a number 9 periosteal elevator was used for this dissection. Once the dominant perforators were identified, they were dissected from distal to proximal by first opening the rectus fascia around the perforator (Fig. 1c) and then incising the rectus fascia with a single tine of Stevens tenotomy scissors. The rectus muscle fibers were spread apart and cut to join the perforator branches. The pedicle was followed inferiorly, continuing to separate the rectus fibers and dividing the overlying anterior rectus sheath (Fig. 1d). The lateral aspect of the rectus muscle was retracted and left intact. Below the arcuate line, the pedicle is located on the deep side of the rectus muscle, and as a result the muscle fibers were separated but not transected to continue pedicle dissection. The pedicle was followed inferiorly toward the iliac artery and vein (Fig. 1e). Fig. 2 shows the elevation of the skin paddle, perforator identification, and incision of the anterior rectus sheath.

If the patient had a low BMI, a larger paddle was elevated. If the patient had a high BMI, the paddle was contoured around the perforators to match the recipient defect. Adipose tissue was contoured by removing the adipose adjacent to the rectus sheath

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