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Double Free Flaps in Head and Neck Reconstruction

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The extensive composite oromandibular defects involve the bone, oral lining, external skin, and soft tissue. These extensive composite defects are usually the result of surgical treatment of T3 and T4 tumors. Reconstruction of such defects to a satisfactory functional and aesthetic outcome continues to challenge the reconstructive surgeon. If these composite oromandibular defects are inadequately reconstructed, the patient will have difficulties in eating, speaking, respiration, and retaining saliva, in addition to an undesired cosmetic result [1].

Immediate reconstruction of head and neck defects was first advocated by Edgerton [2] in 1951. For this purpose, several local and regional flaps were developed. Among these, the deltopectoral flap [3], the pectoralis major musculocutaneous flap [4], and the latissimus dorsi island musculocutaneous flap [5] have been most commonly used. Although these flaps are easy to harvest, they may have a poor blood supply in the most critical part. Furthermore, these pedicled regional flaps may require multiple surgical procedures and may not contain necessary tissue components. Hence, the final aesthetic and functional results are usually unsatisfactory.

A significant revolution in head and neck reconstruction occurred with the advent of free tissue transfers. Seidenberg et al [6] in 1959 were the first to report the use of a segment of jejunum as a free flap for restoring upper esophageal continuity. In 1976, the free skin flaps were used for reconstruction of defects in the head and neck region [7,8]. The fibula osteoseptocutaneous flap was first described by Taylor et al [9] in 1975 and first used by Hidalgo [10] in 1989. Following confirmation of skin reliability based on cutaneous vessels by Wei et al [11] in 1986, it has become an indispensable tool for reconstruction of mandibular defects. In the past 2 decades, free tissue transfers have been used to reconstruct single or composite tissue defects in the head and neck region and have achieved superior functional and aesthetic results in one-stage procedures [10–14].

With further advances in instrumentation, techniques, and knowledge of vascular anatomy, free tissue transfers have taken the lead in head and neck

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reconstruction. Recently, perforator flaps were introduced. These flaps can be elevated without sacrificing muscle function at the donor site [15,16].

Although free flap varieties have increased in practice, it has been recognized that any single free flap may not give the optimum aesthetic and functional result in extensive composite head and neck defects, because of inadequate tissue components, dimensions, and volume [17]. Several solutions have been proposed to overcome these problems, including simultaneous use of a second free flap.

In 1970, McGregor and Reid [18] were the first to reconstruct full-thickness cheek defects using simultaneous rotation of the temporal and deltopectoral flaps in an attempt to provide adequate soft tissue coverage in a reduced number of operative stages. Recently, with the development of more flap selections, chimera principles, and piggy-backing techniques, simultaneous double free-flap procedures have been introduced for management of extensive composite head and neck defects. In most of these reports, the radial forearm flap has been used for intraoral lining, and the distal end of its pedicle has provided distal run-off for second-flap revascularization. The second flaps were usually osteocutaneous flaps used for mandibular bone defect reconstruction [17,19–21]. In 1999, the authors demonstrated the efficiency and good results achieved with two simultaneous free flap transfers [22]. In the earlier days, the preference was to use the fibula or iliac osteocutaneous flap as the inner flap and the radial forearm flap or rectus abdominis myocutaneous flap as the external flap. In recent years, the external flap has been replaced largely by the anterolateral thigh flap [23]. A pedicled pectoralis major myocutaneous flap combined with a fibula osteoseptocutaneous free flap can be a technically less demanding alternative [24].

This article discusses the indications for, advantages of, and principles of flap combinations and the selection of two pairs of recipient vessels for double free-flap transfers in reconstruction of extensive composite head and neck defects.

Indications

The authors' indications for a double free-flap procedure are as follows: (1) extensive composite defects involving bone, oral mucosa, external skin, and soft tissue, which cannot be adequately reconstructed with one composite flap; (2) huge coverage and intraoral lining defects that cannot adequately be resurfaced with one large cutaneous or myocutaneous flap; (3) difficult insetting with a single free flap because of extent and tridimensional nature of the defect.

A compound oromandibular defect is usually less extensive than a composite oromandibular defect and can often be reconstructed with an osteocutaneous flap [10–14]. Although the skin island of the osteocutaneous flaps may be adequate for the coverage of both the inner lining and outer face in composite oromandibular defects, it is often inadequate for replacement of soft tissue volume. Soft tissue reconstruction in composite oromandibular defects has an equal or even greater significance for the functional result than does the bony reconstruction [25]. Soft tissue volume deficiencies are poorly tolerated in the head and neck region. The dead space left by the extirpated masticator muscles, buccal fat, and the parotid gland, if not obliterated, usually accumulates fluids that may cause secondary infection, threatening the flap survival [24]. Even when the dead space seals itself and the flap survives completely, it may become contracted, leading to a sunken appearance and trismus, which causes difficulties in swallowing, speaking, and chewing [26]. Contraction may even distort the reconstructed bony arch if it is not already accommodated by the soft tissue displacement. Appropriate soft tissue reconstruction is also important in the prevention of the bone and plate exposure.

In recent years, double free-flap transfers have become the authors' choice for reconstruction of extensive composite oromandibular defects, particularly for the management of primary cancer.

Recipient vessel selection

For the microvascular anastomosis, four types of recipient vessels may be used: (1) two separate pairs of ipsilateral neck or temporal vessels, (2) one ipsilateral and one contralateral pair of neck or temporal vessels, (3) one pair of ipsilateral neck or temporal vessels and the distal run-off of the first free flap vessels, or (4) one pair of contralateral neck vessels and the distal run-off of the first free flap vessels. In the authors' recent study of 130 patients with 262 double free-flap reconstructions, 61.8% of the recipient vessels were type 1 (n = 81), 27.5% were type 2 (n = 36), 7.6% were type 3 (n = 10), and 3.1% were type 4 (n = 4) [27].

During an earlier developmental stage of the authors' work, they considered the sequentially linked flaps (distal run-off free flaps) as a solution for double free-flap transfers. Currently, they prefer not to use the sequentially linked flaps in their double free-flap transfers when possible, because of higher complication rates [20–22].

A history of previous surgery or radiotherapy to the neck does not prevent ipsilateral vessel exploration and successful anastomosis [28–31]. In previously irradiated neck, the recipient vessel