OPEN ACCESS
Saudi Journal of Oral and Dental Research
Abbreviated Key Title: Saudi J Oral Dent Res
ISSN 2518-1300 (Print) |ISSN 2518-1297 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: http://scholarsmepub.com/sjodr/

Review Article

Flaps and Its Classification in Head and Neck Reconstructive Procedures- A Review

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| **Received:** 15.05.2019 | **Accepted:** 25.05.2019 | **Published:** 30.05.2019
DOI:10.21276/sjodr.2019.4.5.12

Abstract

Flap design in facial reconstruction is particularly delicate given the face is the most visible structure of the body and has some of the most complex three-dimensional topography. The goals of facial reconstruction center on closing defects in an inconspicuous manner. Fortunately, the robust vascular supply of the face allows for many reconstructive options using flaps that are localized to the face.

Keywords: Flap, Classification of flap, Blood supply of flap.

INTRODUCTION

A flap is a unit of tissue that is transferred from one site (donor site) to another (recipient site) while maintaining its own blood supply. A flap is transferred with its intact blood supply while graft is a transfer of tissue without its own blood supply. Therefore, survival of the graft depends entirely on the blood supply from the recipient site. Flaps can be harvested in many different forms and shapes, ranging from simple advancement flap to composite flaps. Composite flaps consist of skin, muscle, bone, fat or fascia.

Purpose of flap

To provide skin coverage

- Exposed important structures
- Joints
- Contractures
- Pressure areas
- Areas to be irradiated
- Infected cavities
- Better aesthetic result
- To re-establish the anatomical and physiological integrity of a part
- To assist healing of long standing infected wounds and cavities

Uses in General surgery and other indications (Creating tubular structures, Omental flaps, Pilonidal sinus) [1].

History of flap surgery

In 16th century from the dutch word Flappe, the term flap is coined, which means something that hung broad and loose, fastened only by one side. The history of flap surgery dates as far back as 600 BC, when Sushruta Samita described nasal reconstruction using a cheek flap. The origins of forehead rhinoplasty may be traced back to approximately 1440 AD in India. Some reports suggest flap surgeries were being performed before the birth of Christ.

The surgical procedures described during the early years involved the use of pivotal flaps, which transport skin to an adjacent area while rotating the skin about its pedicle (blood supply). The French were the first to describe advancement flaps, which transfer skin from an adjacent area without rotation. Distant pedicle flaps, which transfer tissue to a remote site, also were reported in Italian literature during the Renaissance period.

Subsequent surgical flap evolution occurred in phases. During the First and Second World Wars, pedicled flaps were used extensively. The next period occurred in the 1950s and 1960s, when surgeons reported using axial pattern flaps (flaps with named blood supplies). In the 1970s, a distinction was made between axial and random flaps (unnamed blood supply) and muscle and musculocutaneous (muscle and skin) flaps. This was a breakthrough in the understanding of flap surgery that eventually led to the birth of free tissue transfer.

In the 1980s, the number of different tissue types used increased significantly with the development of fasciocutaneous (fascia and skin) flaps (which are less bulky than muscle flaps), osseous (bone) flaps, and osseocutaneous (bone and skin) flaps.

The most recent advancement in flap surgery came in the 1990s with the introduction of perforator flaps. These flaps are supplied by small vessels (previously thought too small to sustain a flap) that typically arise from a named blood supply and penetrate muscle, muscle septae, or both to supply the overlying tissue. An example of this is the deep inferior epigastric perforator (DIEP) flap, which has now become the criterion standard in breast reconstruction.

Terminology associated with flap

- Flap Base:- Proximal part when the whole flap inset into defect.
- Flap Pedicle:-Proximal part when the only distal part of flap inset into defect.
- Flap Bridge:-Central part when the only distal part of flap inset into defect
- Penninsular Flap:- Flap passes in whole into defect
- Island Flap:- Pedicle is deepithelialized and tunneled to reach defect
- Delayed flaps:- Delaying of the flap by Incising outline but not elevating the flap.
- Expanded flaps:- Delaying of the flap by tissue expanders inserted under the flap.
- Prefabricated flaps:- Formation of a composite flap prior to transfer.

Classification of flap

Many different methods have been used to classify flaps. Furthermore, these classification systems are often complex and varied in principle.

Flaps can be classified into 3 simplified categories:

- Type of blood supply,
- Type of tissue to be transferred, and
- location of donor site [2]

Type of blood supply

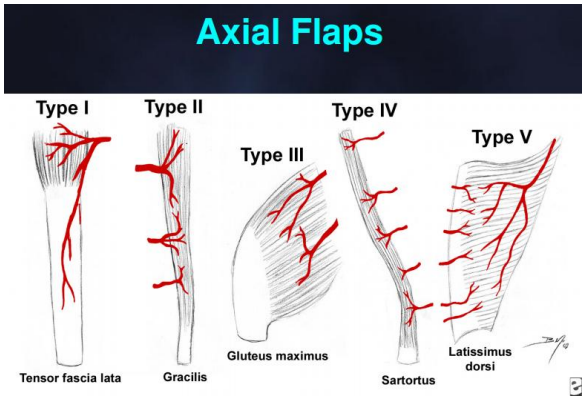
Like any living tissue, flaps must receive adequate blood flow to survive. A flap can maintain its blood supply in 2 main ways.

- If the blood supply is not derived from a recognized artery but, rather, comes from many little unnamed vessels, the flap is referred to as a random flap. Many local cutaneous (skin) flaps fall into this category [3].
- If the blood supply comes from a recognized artery or group of arteries, it is referred to as an axial flap. Most muscle flaps have axial blood supplies [4].

Mathes and Nahai has observed the complexity and variation in axial blood supply and further given the subclassification (axial types I-V).

Random (no named blood vessel)
Axial (named blood vessel) Mathes and Nahai classification

- One vascular pedicle (eg, tensor fascia lata)
- Dominant pedicle(s) and minor pedicle(s) (eg, gracilis)
- Two dominant pedicles (eg, gluteus maximus)
- Segmental vascular pedicles (eg, sartorius)
- One dominant pedicle and secondary segmental pedicles (eg, latissimus dorsi)



Tissue to Be Transferred

In general, flaps may comprise in part or in whole almost any component of the human body, as long as an adequate blood supply to the flap can be ensured once the tissue has been transferred.

- Flaps may be composed of just one type of tissue or several different types of tissue.
- Flaps composed of one type of tissue include skin (cutaneous), fascia, muscle, bone, and visceral (eg, colon, small intestine, omentum) flaps.
- Composite flaps include
- Fasciocutaneous (eg, radial forearm flap),

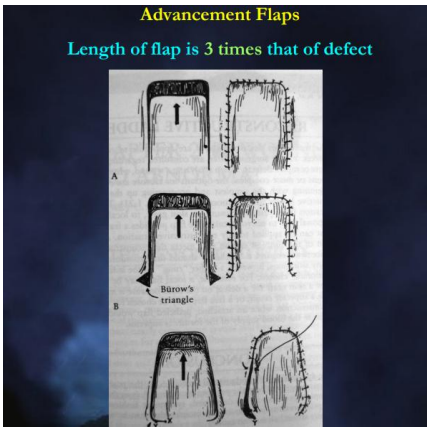
- Myocutaneous (eg, transverse rectus abdominis muscle [TRAM] flap),
- Osseocutaneous (eg, fibula flap),
- Tendocutaneous (eg, dorsalis pedis flap), and
- Sensory/innervated flaps (eg, dorsalis pedis flap with deep peroneal nerve).

Therefore, another way of classifying flaps is by describing the different types of tissue that are being used in the flap.

Location of donor site-Tissue may be transferred from an area adjacent to the defect. This is known as a local flap. It may be described based on its geometric design, be advanced, or both.

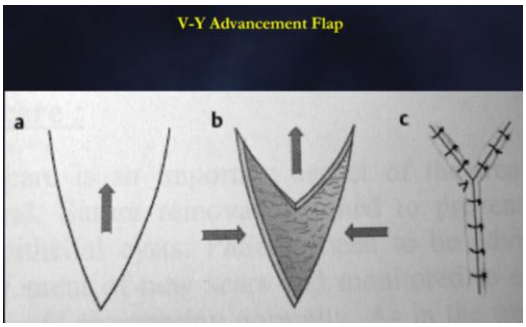
Advancement flaps depend on the advancement of the surrounding tissue along a linear axis to close a defect. The advancement of two skin edges from a fusiform skin excision represents the simplest of advancement flap design. Classically, advancement flaps have a length-to-width ratio of 1:1 or 2:1 [5, 6]. Advancement flaps often create standing cutaneous deformities or "dog-ear" deformities, which must also be addressed as part of the reconstruction plan.

Advancement flaps include single pedicle, bipedicle, and V-Y flaps

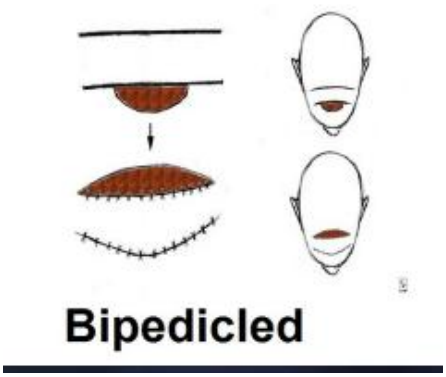


Advanced flap [1]

V-Y Advancement flap



V-Y Advancement flap [1]



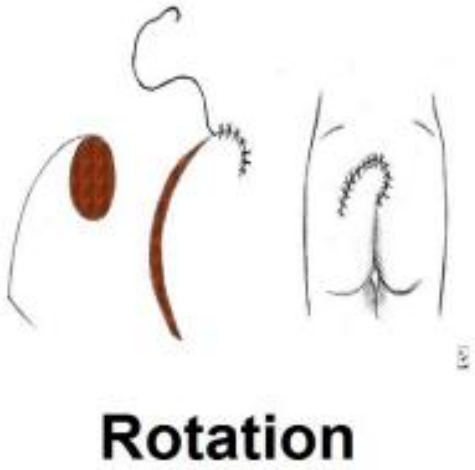
Bipedicled [1]

Pivotal (geometric) flaps include rotation, transposition, and interpolation.

Rotational Flap

Rotational flaps are pivoted around a fixed point at the base of the flap and rotated along an arc toward the defect. Classically, rotation flaps are designed to move along an arc of 30 degrees or less with the radius approximately two to three times the diameter of the defect and the arc length approximately four to five times the width of the defect [6]. Most rotational flaps possess a component of advancement and thus are more accurately labeled rotation advancement flaps [7].

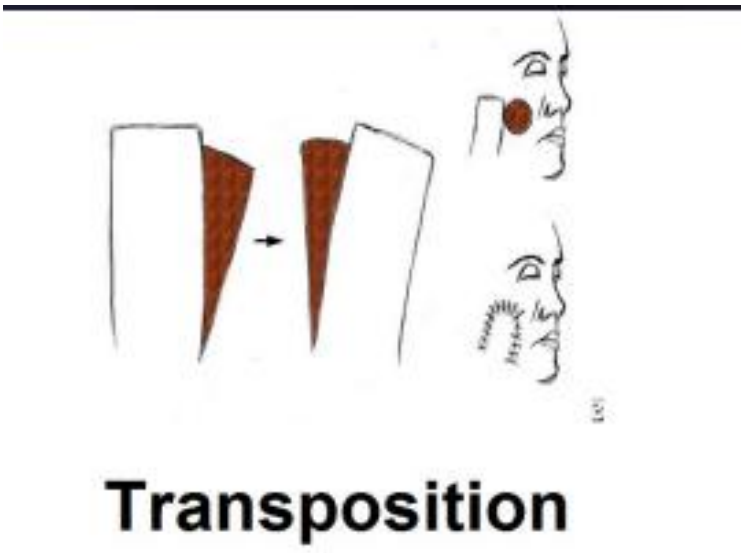
Rotation



Rotational flap [1]

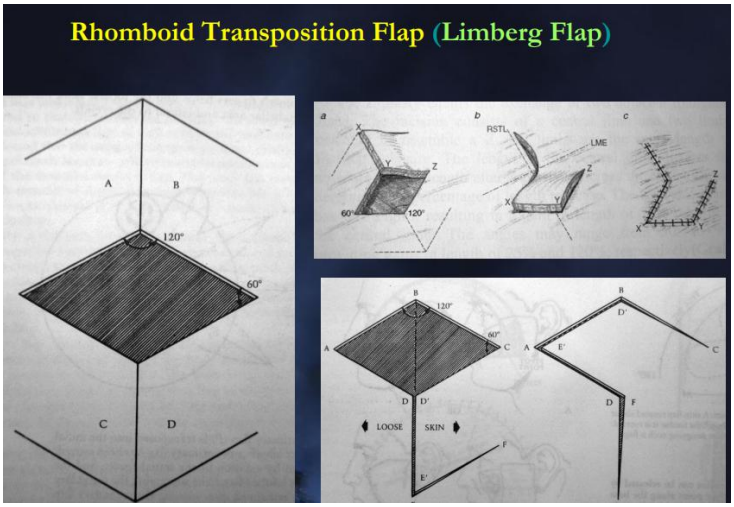
Transposition

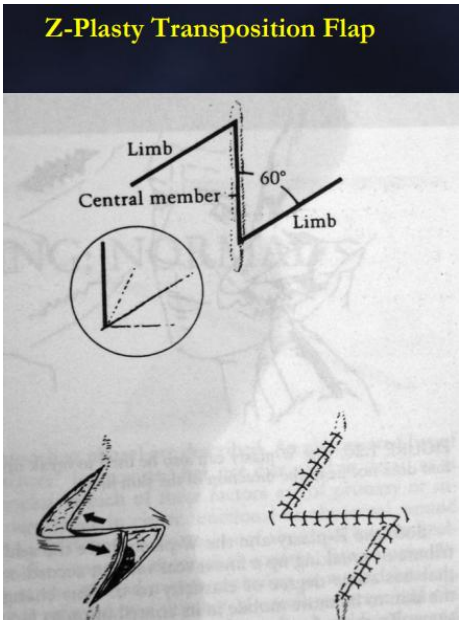
Transposition flaps are versatile flaps whose design creates a second defect. The flap is raised from a donor site and rotated over an incomplete bridge of skin to be placed into the defect site. The donor site must also be closed as part of the design. The three classic transposition flaps include the rhombic flap, bilobed flap, and Z-plasty [6, 8, 9].



Transpositional flap [1]

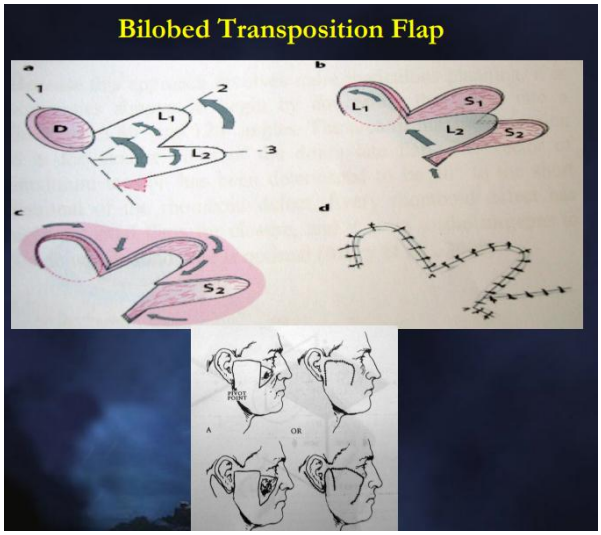
There are different types of transposition flap
Romboid transposition flap





Z-Y Transposition flap [1]

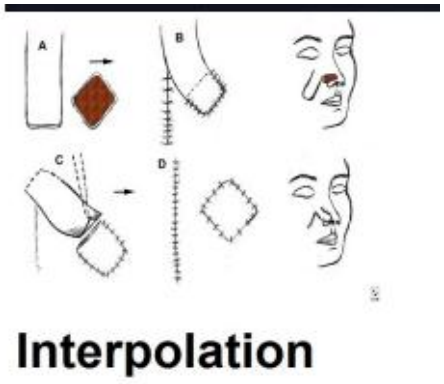
Bilobed transposition flap



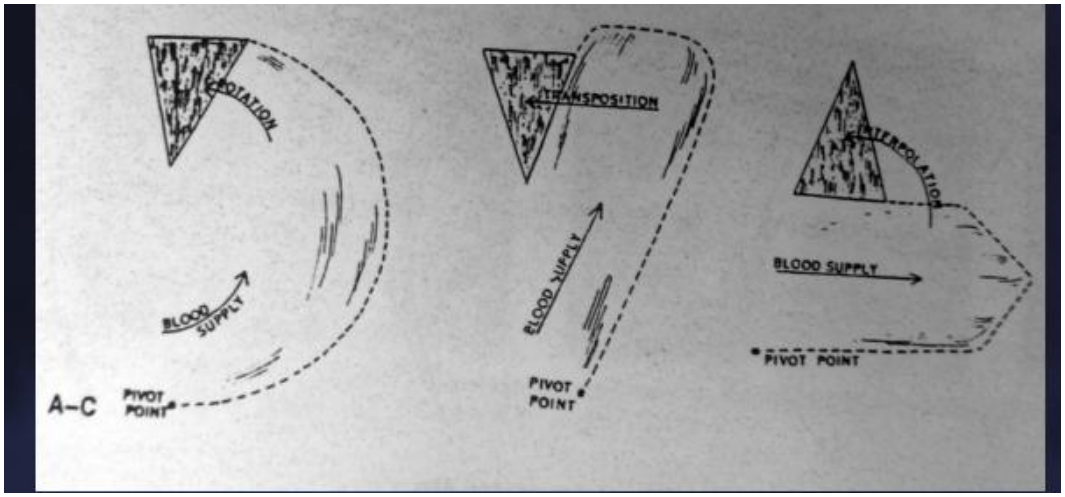
Bilobed transposition flap [1]

Interpolation

Interpolated flaps are pedicled flaps that cross over or under intervening intact tissue. If the flap passes over intact skin, the flap must be divided and inset in a second stage of reconstruction. In contrast to transposition flaps, the base of interpolated flaps is not contiguous with the defect base. Interpolated flaps are often dependent on an axial blood supply. The most classic facial interpolated flap is the paramedian forehead flap, which receives blood supply from the supratrochlear artery.



Interpolation flap[1]



Tissue transferred from an noncontiguous anatomic site (ie, from a different part of the body) is referred to as a distant flap.

Distant flaps may be either pedicled (transferred while still attached to their original blood supply) or *free*.

Free flaps are physically detached from their native blood supply and then reattached to vessels at the recipient site. This anastomosis typically is performed using a microscope, thus is known as a *microsurgical anastomosis*.

Classification of flaps provides a clear understanding of the flap properties. However, with so many reconstructive options, choosing the correct reconstructive plan relies on a systematic approach to analyzing the patient and facial defect [10].

In summary, facial reconstruction relies on the creativity of surgeons as well as a clear understanding in the properties of local flaps. Choosing the correct procedure begins with thorough analysis of the defect. Multiple reconstructive options often exist, which can then be narrowed and refined based on the specific qualities of the defect and the history of the patient. Careful planning ultimately leads to an excellent functional and esthetic reconstructive outcome.

REFERENCES

1. Principles of Flaps By Dr. Tarek Ahmed Said Professor of Plastic Surgery Cairo University 2014.
2. Baker, S. R. (1994). Local cutaneous flaps. *Otolaryngologic clinics of North America*, *27*(1), 139-159.
3. Cutting, C. (1982). Critical closing and perfusion pressures in flap survival. *Annals of plastic surgery*, *9*(6), 524.

4. Baker, S. (2007). Local Flaps in Facial Reconstruction (ed 2). St Louis, MO, Mosby, Elsevier.
5. Murakami, C. S., & Nishioka, G. J. (1996). Essential concepts in the design of local skin flaps. *Facial Plastic Surgery Clinics of North America*, *4*, 455-468.
6. Papel I: Facial Plastic and Reconstructive Surgery (ed 2). New York, Thieme Medical Publishers, 2002
7. Bar-dach, J. (1992). Local flaps and free skin grafts in head and neck reconstruction. *Plastic and Reconstructive Surgery*, *90*(6), 1117.
8. Limberg, A. A. (1946). Mathematical principles of local plastic procedures on the surface of the human body. *Leningrad: Medgis*.
9. Zimany A. (1953). A bilobed flap. Plastic Reconstr Surgery, 11:424.
10. Calhoun, K. H., Seikaly, H., & Quinn, F. B. (1998). Teaching paradigm for decision making in facial skin defect reconstructions. *Archives of Otolaryngology–Head & Neck Surgery*, *124*(1), 60-66.