

Reconstruction of Head & Neck Bony Structure

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General Principle

1. Capillary Blood Circulation in Cortical Bone

1) Nutrient a. → Medullary a. → Cortical bone :

MAIN

2) Epiphyseal a.

3) Metaphyseal a.

4) Periosteal vascular network ← Intramuscular arteriole

Brookes, 1971 : Flow of blood through compact bone predominantly depends on an intact medullary blood supply, whereas the periosteal arteries play a negligible part in direct cortical nutrition.

Although the periosteal capillaries are in direct connection with those of the underlying bone cortex, there is normally no arterial blood passing centripetally from the periosteum into the cortex.

In only pathologic ischemic situations, the blood flow may be reversed, and a centripetal periosteal blood supply to the bone then assumes the role of a collateral blood route.

Clinical Application of Bone Graft in Head & Neck Reconstruction

1. Conventional Autogenous Bone Graft

Most of the cells in a conventional autogenous bone graft die, and the matrix of the graft serves merely as a scaffold for ingrowing host cells with osteogenic properties.

• 단 점 :

(1) Survival of graft cells depends entirely on the nourishment they receive from the surrounding bed.

(2) Majority of cells die because of mechanical barriers to the establishment of early nutrition, and this leads to absorption.

(3) Blood supply and vitality of the recipient bed is highly essential to the successful take. Infection or anoxia such as irradiated tissue usually leads to failure.

(4) Broad contact with recipient bone and functional stress are important factor for the maintenance of the size and form of a bone graft.

(5) Heterotropic bone grafts are absorbed and replaced by fibrous tissue.

(6) Onlay grafts are gradually reduced to small rudiments.

1) Possible Free Bone Graft for Head & Neck Reconstruction

(1) Splitted or whole Rib bone for Cranium, Orbit, Maxilla and Mandible

(2) Outer table of Calvarial bone for Cranium, Orbit and Maxilla

(3) Iliac bone for Maxilla and Mandible

(4) Long bones such as fibula, metatarsal

2. Composite Bone Flap Pedicled on Periosteal Vascular Network

1) TEMPOROPARIETAL CALVARIAL FLAP pedicled on the Temporal vessels for reconstruction of Calvarium, Orbit, Maxilla

2) CLAVICULAR OSTEO-MUSCULO-CUTANEOUS FLAP ; Conley, 1972, pedicled on Sternocleidomastoid muscle

3) 11TH RIB OSTEO-MYOCUTANEOUS FLAP ; Bernstein, 1984, pedicled on Latissimus dorsi muscle

4) 5TH RIB OSTEO-MYOCUTANEOUS FLAP

; Cuono. 1980, pedicled on Pectoralis major muscle
 5) 5TH RIB LATERAL PECTORAL OSTEOMY-
 OCUTANEOUS FLAP : Little, 1983 ; pedicled on
 Pectoralis major and minor muscles

3. Free Vascularized Bone Graft(생-유리골 이식)

1) IDEAL BONE GRAFT : Östrup, 1975

Live piece of autogenous whole bone that reliably remains organized and alive and which defies resorption and maintains its original size and structural strength.

In Vascularized Bone Graft, the osseous circulation is reconstituted by anastomosing the vessels supplying and draining the PRINCIPAL NUTRIENT SYSTEM to donor vessels in the recipient area and by including in the revascularized graft well-defined parts of the soft tissues surrounding the bone.

Consequently the whole bone remains organized and alive and defies resorption.

2) Free Vascularized Bone Graft의 특징과 Rationale

- (1) Independent of the local conditions in the recipient bed
- (2) Remains organized and alive following transfer
- (3) Keeping its original size and form
- (4) Linear bone formation rate is equal to that of unaffected bone
- (5) The graft participates actively in the repair processes

3) Free Vascularized. Bone Graft Pedicled on Nutrient Artery

(1) POSTERIOR RIB & CUTANEOUS FREE FLAP ; Östrup, 1975,

Pedicle : Posterior intercostal vessel

(2) ILIAC BONE & CUTANEOUS FREE FLAP ; Taylor. 1979,

Pedicle : Deep circumflex iliac vessel

• 장 점

- ① Vascular pedicle의 diameter가 크고 flow rate가 높다.
- ② Long vascular pedicle

③ Large block of bone graft

④ Mandible의 shape과 잘 match된다.

⑤ Rapid bone healing rate(graft to mandible healed in 6wks)

⑥ Large area of skin can be transferred

⑦ Soft tissues can be included(nerve, fascia, muscle)

⑧ Donor site morbidity is minimal

⑨ The operation is reproducible

• 단 점

① Operation time is long

② Bulge of the bone graft in the leg

③ Some resultant sensory loss in the leg

④ Profuse bleeding from the vascularized bone graft

(3) FIBULA FREE FLAP ; Hidalgo, 1987

Pedicle : Peroneal vessel, use for reconstruction of Mandible

• 장 점

① Stronger and longer than iliac crest.

② Possible osteotomy of the cortical bone

③ Rapid bone healing rate

④ Skin paddle can be transferred simultaneously.

⑤ Donor site morbidity is minimal

⑥ Operation is reproducible

• 단 점

① Operation time is long

② Occasionally bowing of the tibia, particularly in child

(4) SCAPULAR FREE FLAP for Mandible Reconstruction

Pedicle : Descending branch of circumflex scapular A.

(5) 2ND METATARSAL FREE FLAP ; O'Brien. 1979

Pedicle : Dorsalis pedis vessel can be used for reconstruction of anterior segment of Mandible

(6) Evaluating the Viability of Composite Bone Grafts Revascularized by Microvascular Anastomosis

A positive scintiscan using Tc-99m labeled methylene diphosphonate within the first week following

surgery indicates patent micro-vascular anastomosis.

A positive scintiscan one week after surgery or later does not necessarily indicate micro-vascular patency or bone survival, because new bone formed by creeping substitution on the surface of a dead bone graft can result in this finding : Berggren, Östrup, 1982

4. Synthetic Implant

- 1) Methylmetacrylate
- 2) Medpor
- 3) Hydroxyapatite

5. Combined Implant, Free Bone and/or Free Flap