Plastic and reconstructive surgery

HISTORICAL CONTEXT

from the ancient Greek *word plastikē* (*tekhnē*), to mold or shape.
India in the sixth century BC*,* where Sushruta described using the forehead flap to reconstruct a nose.
Joseph Murray who performed the first successful renal transplant in identical twins in 1955

Reconstruction:

involves using various techniques to restore form and function to the body when tissues have been damaged by injury, cancer or congenital loss.
Aesthetic (Cosmetic):
performed to reshape or redefine normal structures of the body in order to improve the patient's appearance and self- esteem.

The scope of plastic surgery

- trauma:

soft-tissue loss (skin, tendons, nerves, muscle);
hand and lower limb injury;
faciomaxillary;

- burns;
- cancer:
- skin, head and neck, breast, soft tissue sarcoma;
- congenital:

clefts and craniofacial malformations;
skin, giant naevi, vascular malformations;
urogenital;

- hand and limb malformations;
- miscellaneous:

Bell's (facial) palsy;
pressure sores;
aesthetic surgery;
chest wall reconstruction.

Le Fort Fractures

Le Fort I : transverse fracture through the zygomaticomaxillary (ZM) and nasomaxillary buttresses.
Le Fort II: pyramidal fracture through the ZM buttresses, infraorbital rims, medial orbit, and nasofrontal (NF) junction.
Le Fort III: complete craniofacial disjunction with separation of the cranium from the face at the zygomaticofrontal sutures and the orbital and NF junction

Tissue reconstruction:

Definition of wound:
it is a separation or discontinuity of the skin. mucous membrane or underlying tissue caused by insult.

What are the tissues involved may need reconstruction by plastic surgeon?
Skin.
Subcutaneous fat.
Fascia.
Muscle.
Bone.

modes of wound healing:

1. Regeneration:

replacement of lost or discontinued tissue(ROLT) by the same lost tissue
Epithelium, Hepatocytes and bone.
ideal mode of healing with maximal functional and cosmetic recovery.

2. Fibrosis:

replacement of lost or discontinued tissue(ROLT) by fibrous tissue.
the fibrous tissue lacks the function and form of the lost tissue
takes long time

METHODS OF TISSUE CLOSURE (RECONSTRUCTION):
There are different methods of closure of wounds, which vary in complexity, depending on the defect, and whether there is tissue loss or not:
1.Direct closure.
2. Healing by secondary intention.
3.Tissue transfer: (grafts or flaps)
The (donor area) donates tissues to the defected area (recipient area).
Replace like with like: the transferred tissues should be as similar as possible to the lost tissues in the defect.
Maximum benefit to the recipient area.
Minimal donor site morbidity: minimal harm to donor area.
Tissue transfer should be safe to patient.

Tissue reconstruction (Reconstructive ladder):

Step 1 Healing by secondary intention:
wound is left open
This option is good for:
Small and superficial defects.
when the area is of no functional or cosmetic importance.
when other operative methods like grafts or flaps are not safe.

Dressing:
A. Protect the wound from the external environment and mechanical forces.
B. Absorb secretions/maintain a clean environment.
C. Promote granulation tissue formation and reepithelialization:
D. Optimize patient comfort.

Step 2: Primary (or delayed) closure:

- Primary immediate closure (appose + secure incised wound edges):

When the wound is clean (free of contamination, infection and dead tissue.)
when there is no or minimal tissue loss so we can approximate the wound edges without tension

- delayed closure:

when the wound is not clean (delay closure until become clean)

Step 3: Skin grafting
Definition:
Grafts are tissues that are transferred without their blood supply, which therefore have to revascularise once they are in a new site

Types of grafts:
1. Autograft: From same individual
2. Allograft: From another individual of same species (aka homograft/cadaver graft)
3. Xenograft: From another species (aka heterograft)

Skin graft survival and healing:
1. Imbibition (first 24 to 48 hours):
Plasma imbibition (diffusion) responsible for skin graft survival until angiogenesis occurs → thinner grafts more likely to survive.
2. Inosculation (48 to 72 hours):
Process of capillaries joining between skin graft and recipient bed.
3. Revascularization (4 to 7 days):
Ingrowth of capillaries into graft

Graft take: The process by which the graft is integrated in the recipient site and acquires new blood supply.

SIGNS OF SKIN GRAFT TAKE
▪The graft is adherent to the recipient site.
▪The graft is pink in color.
▪The graft blanches with pressure, denoting vascularity.

Factors affecting take:
Vascularity of the recipient site, this is the most important factor.

Bacterial load (contamination and infection) hinders graft take especially that is caused by streptococcus, group A.
Presence of barriers between the graft and the recipient area, as hematoma, seroma, debris, or foreign materials.
Immobilization, the graft should be fixed to the recipient site, as graft mobility hinders imbibition and neovasculaization.

Types of skin grafts:
Type 1) Split thickness skin grafts(STSG)

- Epidermis and part of the dermis
- Donor area heals by regeneration (similar to the healing of superficial second degree burn).
- The same donor area can be re-harvested after healing.
- Almost any area of the body may be used as a donor site, so large areas of skin defects may be covered with STSG.

Type2) Full thickness skin grafts (FTSG):

- Consists of the whole skin (epidermis and dermis)
- Taken from areas of loose skin as the donor area is closed by approximation of the edges (direct closure),
- due to this fact, only small areas could be covered by FTSG.

FTSG is superior to STSG from functional and cosmetic aspects:
Better texture,
better color matching with less pigmentation problems,
more durable,
less wound contraction;
they have better sweat and sebaceous glands function,
it grows with the child, and
they have better final innervation.
Although FTSG are better they have 2 drawbacks:
they are less available to cover large areas, and
they are more difficult to take.

The thicker the graft, the better. But: less available, and more difficult to take!!!!!!!

TABLE 3-1 Comparison Between Split-Thickness and Full-Thickness Skin Grafts

Split-thickness grafts	Full-thickness grafts
Include epidermis and part of dermis	Include epidermis and entire dermis
More robust (easier take)	Less robust, require more optimal recipient conditions for survival
Greater secondary contraction/less primary	Greater primary contraction/less secondary
Donor site heals by reepithelialization, reharvesting after healing possible	Donor site typically closed primarily
Greater quantity available, thus used to resurface larger wounds	Less quantity available, thus use is limited to smaller, cosmetic/functionally sensitive wounds
Hair growth through graft not possible	Hair growth through graft possible (growth assumes characteristics of donor site)
Limited ability to grow in pediatric patients	Retain ability to grow in pediatric patients

Primary contraction
a. Occurs at the time of graft harvest/application
b. Due to elastin fibers in dermis
c. Greater in FTSGs (>40%) compared with STSGs (<20%)

Secondary contraction
a. Occurs after graft take
b. During healing phase of graft over 6 to 18 months
c. greater in STSGs
d. Dermal components of FTSGs suppress myofibroblast activities responsible for secondary contraction

Flaps:(steps 4,5,6,7)
Definitions
Segment of tissue that is transferred with its own blood supply (in contrast to graft, which is revascularized from recipient bed).
Pedicled flap: Remains attached to native vascular supply
Free flap: Fully detached from vascular supply and reconnected to recipient vessels using microvascular technique.

Step 4: local flap
Reconstruction of the local defect with similar, adjacent tissue
Size limited to length-to-width ratio ~2:1 in lower extremity and up to 4:1 in head and neck.

Method of transfer: Advancement, pivotal, or hinge.

Step 5: regional flap:
Regional flap: located near the defect but are not at immediate proximity.

Step 6: distant flap:
Distant flap: harvested from different part of the body

Step 7: free flap:
(microsurgery)
tissue moved from area of the body to another with disconnection then re- anastomosis of their blood supply

Tissue expansion:
Definition
1. An artificial filling device is used to grow and expand local tissue to reconstruct an adjacent soft tissue defect when primary closure is not possible.
2. A silicone elastomer reservoir is placed beneath the donor tissue and slowly filled over time with saline, causing the overlying soft tissue envelope to stretch with a net increase in surface area per unit volume.

Tissue Expansion Advantages
• Reconstructed tissue is a similar color & texture to defect
• Allows reconstruction with sensate skin with appendages
• Limited donor site morbidity

Disadvantages:
• Painful
• Prolonged
• Multiple procedures and clinic attendances
• No role in acute injury

Contra-indications:
• Immature scars
• Presence of infection
• Use underneath skin grafts or irradiated tissues

PATHOLOGIC WOUND HEALING:
A. Acute wound failure (dehiscence):
B. Chronic wound failure (nonhealing wounds):
Failure to achieve anatomic/functional integrity over 3 months
C. Excessive Wound Healing:
HYPERTROPHIC SCAR

KELOIDS

Table 1. Differences between keloid and hypertrophic scars

	Hypertrophic	Keloid
Macroscopic	■ Remains within the boundaries of the original injury ■ May spontaneously involute ■ Tend not to re-occur if excised ■ Most often affect the skin overlying joints	■ Tend to re-occur if excised ■ Affect a variety of sites including the ear lobes, shoulders, anterior chest wall, upper back and the skin overlying joints
Microscopic	■ Inflammatory infiltrate falls with time ■ Larger number of myofibroblasts ■ Extracellular matrix composed of type III collagen in linear fibrils running parallel with the skin ■ Highly vascular	■ Inflammatory infiltrate persists ■ Fewer myofibroblasts ■ Extracellular matrix composed of type I collagen arranged chaotically in thick bundles that project under normal epidermis ■ Less vascular
Epidemiology	■ No predisposition to a particular Fitzpatrick skin type ■ Non-inheritable	■ More common in people with darker Fitzpatrick skin types ■ Inheritable
Aetiology	■ Only occur following injury	■ May occur without injury
Symptoms	■ Mild pruritis, tend not to be painful	■ Pruritic and painful

Adapted from Ghazawi et al (2018)