

## Indication and Technique of Skin Grafting

- A. Immediate coverage of raw surface produced by trauma. If conditions for primary closure, obtain, and loss of tissue is too great to permit suture, a graft may be placed over area at primary operation.
1. Graft of intermediate thickness, if base is soft tissue.
  2. Pedunculated flap (or pocket) if bones, joints, tendons, great vessels are exposed.
- B. Treatment of granulating surfaces. Surface should be brought to healthy state by cleanly care and pressure dressing. Type of raw surfaces; abrasions, burns, ulcers following sloughing of skin, carbuncle, varicose veins, etc.
1. Grafting of intermediate thickness may be laid directly on surface or if much deep fibrosis is present, it should be excised and graft laid on healthy tissue.
  2. Thin split grafts, only when surface is to be eventually excised and replaced by pedunculated flap.
  3. Pinch or small deep graft, only on area left by excision of microaerophilic hemolytic streptococcal infections.
- C. Freshly dissected areas, elective surgery, type of graft used will depend on: base of defect, area to be covered, and condition surgeon seeks to correct.
1. Base of defect.
    - a. Soft tissue: Any graft or flap will take.
    - b. Bones, tendons, nerves and joints: A pedunculated flap is required over these structures.
  2. Areas to be covered.
    - a. Exposed to view and cosmetic appearance important.
      - (1) Free full-thickness, areas of soft tissue if depth is not too great.
      - (2) Pedunculated flap, if bone, etc. are exposed or if depth of defect must be filled.
      - (3) Graft of intermediate thickness will often replace free full-thickness graft over soft tissue with almost as good cosmetic result.
    - b. Exposed to friction.
      - (1) Free full-thickness graft excellent.
      - (2) Graft of intermediate thickness almost as good over soft tissue.
      - (3) Pedunculated flap, if hard tissue exposed.
    - c. Exposed to weight bearing.
      - (1) Must use pedunculated flap, even then, this is not 100 % satisfactory on sole of feet.
  3. Condition for which dissection was done.
    - a. To relieve contracture, type of graft depends on base.
    - b. To fill in depth of defects, usually pedunculated flap.
    - c. To prepare bed for subsequent nerve, tendon, and bone repair, pedunculated flap required to bring in fatty subcutaneous tissue.
    - d. To remove tumor, type of graft depends on defect left, and on base of defect.

## Principal of Skin Grafting

1. Free grafts depend on blood supply from base.
2. Pedunculated flaps carry in own blood supply.
3. The thinner the free graft, the more certain it is to take, the less adequately it covers, the more easily it breaks down, the more certain it is to contract.
4. The thicker the free graft, the more satisfactory.
5. Certain structures--tendons, nerves, blood vessels, bones, joints--require fat covering and will not support free grafts.
6. An infected surface will not support a pedunculated flap or a free full-thickness graft, but split graft will usually take unless the infection is active.



Indication and technique of skin grafting: - continued:

7. Firm, even, resilient pressure is an absolute necessity. Serum and blood collect beneath will separate graft from blood supply; flaps must be supported for several weeks to prevent venous congestion. Pressure must be evenly applied and constant. Failure to maintain pressure is the more frequent cause of failure in the first few days after grafting.

8. Exuberant granulation and fibrous bases should be removed to provide good blood supply.

Technique of Skin Grafting

A. Intermediate thickness graft.

1. Preparation of donor site: Wash with soap and water and drape.
2. Hold skin taut with hands, flat blocks of wood, or Blair-Brown suction box.
3. Watch border to prevent skin rolling up into knife edge.
4. Flat of blade kept against skin, desired thickness obtained by pressing downward with whole blade and not be tilting.
5. Judging thickness of graft.
  - a. Thin graft is almost transparent, rolls and folds like wet tissue paper.
  - b. Intermediate thickness graft is translucent or opaque, rolls rather than folds.
6. Preparation of Recipient site.
  - a. Soap and water preparation---first over recipient area and then over donor area.
  - b. If area is granulation tissue, it may be well to shave it off or even excise to a good vascular base.
7. Transfer skin over recipient area so that edges of graft overlies edges of defect.
  - a. Suture graft in place with loose basting stitches of silk or horse hair.
  - b. Suture to base if defect is very large.
  - c. Puncture graft with fine pointed knife.
8. Dressing of graft.
  - a. One or more thickness of vaseline gauze evenly applied.
  - b. Several thicknesses of saline moistened flat gauze molded to surface.
  - c. Large amount of fluff gauze over entire area.
  - d. Voluminous dressing of cotton waste or sea sponges if available. Bandage snugly with stockinet or elastic bandage.
9. After Care.
  - a. If surface was reasonably clean do not disturb for five to eight days.
  - b. If secretion is expected, first dressing at about fourth day.
  - c. First dressing done carefully to avoid disturbing graft, sutures are removed, overlapping skin excised, and pressure re-applied, omitting vaseline gauze. Moisten dressing in contact with wound.
  - d. Subsequent dressing every second day (oftener if much secretion) and pressure kept up for a minimum of two weeks or as long as loose surface persists.
  - e. If much secretion is expected, it is well to insert catheters or Carrell tubes into first dressing to keep them slightly moistened by two hourly installation of normal saline.
10. Dressing of donor site.
  - a. Cover with several layers of vaseline gauze, saline moistened sponges and over this, a voluminous pressure dressing.
  - b. Do not disturb for fourteen days or longer.
  - c. Area should heal and require no further dressing after fourteen to eighteen days.



## Technique of skin grafting - continued;

### B. Free full-thickness graft.

1. Preparation of donor site with soap and water.
2. Make exact pattern of defect with crinoline or lead foil.
3. Lay this pattern on donor site and outline it by scratching about it with a sharp pointed knife. CAUTION: Do not stretch the skin; otherwise, graft will be too small.
4. Remove pattern and cut graft, outline with sharp knife almost through corium.
5. Dissect flap of skin free by excising with a sharp knife at border between corium and subcutaneous tissues.
6. Assistants must keep whole area flat and taut at all times.
7. The donor area should be punctated and gray and there should be no subcutaneous fat showing. If fat has been taken up on graft, it must be removed.
8. Suture graft accurately into defect with fine silk or horse hair; avoid purse-string effect.
9. Graft should be punctured with a fine pointed knife or Hagedorn needle to permit escape of serum.
10. Dressing of graft.
  - a. Several thicknesses of vaseline gauze cut to exact size and shape.
  - b. Several thicknesses of saline moistened gauze molded carefully over graft.
  - c. Voluminous fluff dressing bandaged on snugly.
  - d. Splint is essential in practically every case.
11. After Care.
  - a. Watch carefully to see that resilient pressure is maintained. Do not dress for nine or ten days. First dressing, disturb as little as possible and re-apply pressure as before.
  - b. Suture may be partially removed at first dressing and others at subsequent dressings.
  - c. Dress every two or three days, depending on the character of healing.
  - d. Pressure is maintained for a minimum of three weeks and until area has entirely healed.

### C. Pedunculated flap.

1. Establish size and make pattern of flap and choose appropriate donor site.
  - a. Consideration: Type of skin desired and comfort of patient on swinging flap.
2. Place pattern on donor area in such a way that main blood supply is not interfered with.
3. Outline pattern on donor area.
4. Raising of flap; this may be done in one or several stages. If flap is large and conditions permit, the flap should be raised in several stages so as to insure adequate blood supply. If an immediate transfer is necessary, the pedicle of the flap must be large and thick or several pedicles must be provided to insure that the flap will survive.
5. After flap has been raised for transfer, cover defect by suture or by skin graft.
6. Transfer flap to recipient area and suture accurately to border. It is well to raise the edges of recipient area by undermining before suturing.
7. Dress raw surfaces of flap with vaseline gauze and cover the whole area widely with large pressure dressing and bandage snugly.
8. Provide for immobilization of parts during healing by plaster or splints.
9. After Care: Inspect frequently to be sure pressure is maintained. Do not disturb flap unless necessary for four or five days. First dressing on fourth or fifth day. Subsequent dressing every two or three days. Keep the area clean and free of secretion and maintain pressure for three or four weeks.
10. Separation of flap: Pedicle may be divided in three weeks; four weeks if flap is very large. It's best to divide the whole pedicle rather than piece-meal.



## Technique of skin grafting - continued;

Make every attempt to avoid contamination from granulation surface beneath flap by excising this first and then divide the pedicle. Suture flap down into place and apply pressure dressing.

11. Donor site covered with split graft or by suture.

### Tendon Repair

#### A. The successful repair of tendon injuries depends upon aseptic atraumatic surgery.

1. Gentle handling of tissues and absolute asepsis at all times. Masking.
2. Avoid bruising and crushing. Do not pick up tendons with hemostats or rub them with coarse gauze.
3. Vessels should be ligated with fine silk and ligatures cut at the knot.
4. Bloodless field.
5. Adequate exposure.
6. Frequent irrigation of wound with normal saline to keep tissue moistened and to wash out debris.
7. Instruments are simple, no gadgets. Needles--fine cambric type. Silk sutures of  $\frac{1}{8}$ , 1, 2, 4, 1b. tensile strength. Atraumatic sutures for fine appositional sutures.

#### B. Conditions under which primary repair is indicated.

1. The prognosis for primary healing of wound is good.
2. Time limits are not exceeded.
  - a. Extensor tendons where covered by paratenon--not over four hours.
  - b. Sheath inclose tendons (except volar surface of finger) not over three hours.
  - c. Flexor tendons on finger not over two hours.
3. Wound not contaminated from human sources. Take careful history to ascertain possible contamination.
  - a. Rule out at start certain types of wound, eg, mouth bites, operating instrument, autopsy knives, etc.
  - b. Was wound covered with steril dressing at once?
  - c. Following possible sources of such bacteria:
    - (1) Droplet contamination from numerous examination from first-aid, onlookers, emergency-room inspection of wound, etc.
    - (2) Soiled dressings, unsteril dressing instruments, and ligatures, hands and fingers.
    - (3) Wound examined without proper masking.
    - (4) Vessels clamped and ligated under poor conditions.
    - (5) Unsuccessful repair elsewhere.
4. No antiseptic has been put in wound.
5. The surface tissues are adequate for coverage.
6. The bones and joints are not injured.
7. Proper facilities for repair are available.
8. In wounds from high velocity projectiles surgeon must consider so-called concussion damage to tendons. Tissues damaged by high velocity projectiles evidence damage far away from area of evident gross injury. This damage may not cause neurosis provided other conditions are favorable; however, tendon (and nerve) suture in such wounds probably not advisable for this reason.
9. If conditions for primary repair do not obtain, ~~treat~~ treat the wound as any other open wound, close if conditions permit and plan on secondary repair under more favorable circumstances. Primary suture of tendon in war wound is possible when an injury is comparable to civilian wound, eg, glass and knife wound. When injury is due to high velocity projectile, primary suture of tendons and nerves is indicated.



### C. Diagnosis:

1. Do not pike around in the open wound looking for tendon ends in the examining room.
2. Make diagnosis of divided tendons from study of functions below site of injury.
3. It is essential to know the anatomy of the area so that the surgeon will know what tendons have been divided.

### D. Preparation.

1. Prepare part in the operating room as outlined in the Chapter on open wound.
  - a. Wash with soap and water about wound first.
  - b. With fresh set-up, wash the wound and irrigate it well.
  - c. Dress so as to allow large field above and below site of wound.
  - d. Work with bloodless field secured by means of blood pressure apparatus.
2. Start with wound excision.
  - a. Follow general principle of wound excision.
  - b. Tendon and nerve tissue must not be sacrificed needlessly.
  - c. Frayed tendon ends should be trimmed down to obtain good cross-section.
3. Identify tendons and nerves.
  - a. Enlarging incision are usually needed and principle of enlarging incision. Extended wound in one or both directions from ends of wound not by cutting across it at right angles. Plan that suture line does not run along line of tendon repair. Plan flaps with subcutaneous tissue to lie over site of repair. Avoid incisions in midline following skin creases as much as possible.
  - b. First identify the nerves: They are grayish yellow and more soft and vascular than tendon, and the longitudinal striations are visible. The divided nerve shows bundles of fibers. When the nerves are found, wrap them in cotton pledgets moistened with physiologic saline solution.
  - c. Then look for the tendons. The proximal stumps usually lie high up in the wound. Often best to seek the distal stumps first.
  - d. As soon as the extent of damage has been determined and nerves and tendons have been identified, plan the operative repair, see just what will need be done and determine if situation permits.
  - e. Then release the blood pressure cuff and control bleeder. As soon as bleeding has been taken care of, the cuff is to be re-inflated and repair performed. The cuff is not deflated again until after the pressure dressing has been applied.
  - f. Repair the tendons first. The tension suture should be of silk of 8ur to five lbs. tensile strength. The appositional sutures should be much finer, 000,000 or 0000,0000 ophthalmologic silk swaged on small needles (atraumatic).
  - g. Nerves are sutured with fine atraumatic sutures 000,000 or 0000,0000 silk similar to the ones for tendons appositional sutures. The sheath only should be sutured, no silk should pass through the substance of the nerve.
  - h. The wound should be accurately closed.
    - (1) Replace all tissues in proper relationship.
    - (2) Careful closure of deep fascia with fine silk; of superficial fascia with fine silk; of skin with horse hair or silk.
    - (3) Suture must not be so tight as to lead to necrosis.
  - i. Dress the part with a voluminous resilient pressure dressing. The dressing should be applied and bandaged on before blood pressure cuff is released.
  - j. The part is splinted to maintain relaxation of the sutured tendons.
    - (1) Two weeks without any motion.
    - (2) Two weeks with restricted use.
    - (3) Two further weeks with very guarded use.
  - k. Skin sutures may usually be removed about the twelfth to the fourteenth day, ie, at first dressing.



## Tendon repair - continued;

### E. Secondary Repair.

1. Prognosis is good provided the wound healed by primary intention.
2. When to undertake secondary repair.
  - a. Nature of healing.
    - (1) If without reaction in three to six weeks.
    - (2) If with mild reaction, wait from six to eight weeks.
    - (3) If there was frank infection, wait twelve to eighteen months.
  - b. Condition of soft tissue.
    - (1) Wait until all indication is gone, the joints are mobile and the skin is supple.
    - (2) If the site of repair is covered with dense scar replace the scar with a pedunculated flap.
3. Notes on technique of secondary repair.
  - a. Wide exposure above and below site of lesion.
  - b. Trace tendons from normal region into scar.
  - c. It is often best to start with distal stumps.
  - d. Isolate each stump and be sure that it glides freely.
    - (1) If stumps are adherent, free them by sharp dissection.
    - (2) If distal stump is adherent and reduced to scar replace it with tendon graft.
  - e. If freeing of stumps requires division of ligaments, replace these with fascial grafts.
  - f. Be sure that scar tissue is removed from tendon bed.
  - g. If a number of sutured tendons lie together, place a small fat graft about them.
  - h. Use tendon grafts if satisfactory end to end ~~xxxx~~ suture cannot be done.