LOCAL FLAPS

Local flaps are defined as those derived from tissues immediately adjacent to the primary defect. Consequently, they almost always have a permanent pedicle and can be completed in one stage. In providing skin cover in the hand, local flaps have the following advantages over free grafts, some of which also make them superior to distant flaps.

Advantages

Blood Supply. Their intrinsic blood supply permits their use to cover bare tendon, cartilage, or bone, that is, structures that would not support a free graft or would do so only reluctantly and with troublesome adherence (Fig. 1). Such adherence may cause later problems in the form of pain, hyperesthesia, or ulceration on a fingertip or by making difficult or unsuccessful subsequent reconstructive procedures beneath the unsatisfactory skin cover. By using a flap such problems can be largely avoided. Local flaps, largely because of this blood supply, can be used to bridge defects and smooth contours with little or no later contracture. Nature abhors a vacuum, but a sturdy flap can tolerate one. Such a situation exists in skin defects of the first web space, for which local flaps are an ideal solution. In such a situation, free grafts would need to be applied to all the irregularities of the space; these convolutions would be best covered by a meshed split-skin graft with a resultant increase in the severity of the inevitable contracture. Likewise, but for different reasons, distant flaps impair the first web space, their sheer bulk consuming much of its essential depth.

Sensation. In many cases, the nerve supply can be transferred in large part intact with the flap. Even in those situations in which the nerve supply is divided, the recovery of sensibility is remarkably good and certainly superior to that in skin grafts.

Skin texture. Being of the hand, local flaps are superior in the matching of skin texture and are more appropriate in the bulk of subcutaneous tissue available, being neither too much nor too little.

Finally, with local flaps there is little need for prolonged immobilization.

Disadvantages

By contrast, local flaps have the following disadvantages:

Limited area. There is a self-evident shortage of skin in the hand, which prevents the use of local skin to cover large defects. In addition, there are regions of the hand that should not be used as donor sites, since coverage of the resultant secondary defect with a skin graft would be as inappropriate as using the graft on the primary defect. These areas are the web spaces and all of the palmar skin, excepting that part used in fingertip advancement flaps.

Limited mobility and elasticity. All hand skin
The merits of immediate flap cover are here illustrated. A. This young patient had sustained a severe grinder injury to the dorsum of the small finger with an associated wound on the ring finger. Immediate replacement of the extensor apparatus with a tendon graft taken from the extensor digiti minimi was only possible provided that immediate flap cover was available. B. A transposition flap has been elevated from the dorsum of the adjacent ring finger. The secondary defect was later covered with a full thickness skin graft taken from the groin. C. The healed digits have a satisfactory appearance and demonstrate full extension. D. Motion has been maintained with full flexion. Immediate replacement of lost extensor apparatus in the digits is almost mandatory if full function is to be maintained.

is less mobile because of its deep attachments than that of the abdomen or face and less elastic owing to its structure, the palmar skin being especially so. This means that flaps, however carefully designed, may not readily undergo the distortion necessary to move them into the primary defect.

Limited availability. There is virtually no “spare” skin on the hand. The looseness of the dorsal skin that is so beguiling in extension disappears entirely in the clenched fist. Some skin, but very little, can be obtained by suturing under acceptably increased tension both in the fingers and in the hand. Thus, advancement and rotation flaps, respectively, are possible, both leaving no secondary defects, but only to a very limited degree. For larger primary defects it follows that a secondary defect must be created to be covered with a free skin graft as in transposition flaps and larger advancement flaps. The merit, and it is a considerable one, in such local flaps therefore lies in moving the area to be grafted from a site where it is undesirable or impossible to one where it is acceptable.

Classification

Local flaps are classified as follows:

Transposition flaps, in which the flap is raised from its bed and moved laterally either to an immediately adjacent defect or over a peninsula of intervening skin. When the primary defect is adjacent to the flap, design often involves triangulation of that defect either in fact or in concept, the defect being covered by closing one of the angles of the triangle, that is, bringing two of the sides of the defect together. Such a flap covers the primary defect but never the secondary defect in its entirety. Grafting of the secondary defect is a necessary additional step in such “triangulated” transpositions. In other, “nontriangulated” transpositions the flap does not lie adjacent to the defect along the entire length of their common edge. Occasionally in such flaps the secondary defect can be closed directly. Thus, transposition flaps can be conveniently divided into triangulated and nontriangulated varieties.

Rotation flaps, in which the primary defect
is triangulated in similar fashion as in a transposition flap, but it is possible to obtain the necessary amount of skin by suturing the skin edges differentially so that no secondary defect remains. In all such rotation flaps the skin that is to cover the defect is contiguous with it.

**Advancement Flaps** are of two types. In one the skin is advanced in a V to Y fashion, leaving no secondary defect, and in the other the skin is advanced as a rectangular flap, the necessary skin availability being achieved either by flexing the involved digit or by creating a rectangular neurovascular island thereby leaving at the base of the flap a rectangular secondary defect that is subsequently grafted. The excision of so-called Burrow’s triangles for the purpose of advancement has little place in hand surgery. This paper concerns itself with only one of these, the transposition flap.

**DESIGNING A TRANPOSITION FLAP**

There are two basic tenets regarding triangulated transposition flaps, the second and more important of which applies also to the nontriangulated flap.

**Selection of the Flap.** In the surgeon’s planning the primary defect should be considered to be a triangle. For any triangle, a transposition flap with the shape of a parallelogram can be designed, in theory, on any of the three sides of the triangle (Fig. 2). One side of the parallelogram is formed by one side (XY) of the triangle (XYZ). The second (XW) is created by extending one of the adjacent sides of the triangle for a distance equal, if a strict 1:1 ratio is to be observed, to that of the first side chosen. The third side (WV) is parallel and equal to the first side, and the fourth side forms the base of the flap.

There are therefore six possible transposition flaps for any triangulated defect (Fig. 3, left). The choice is usually made on the basis of the following criteria:

1. **Shape of the triangle.** Few triangulated defects prove to be equilateral, one side being often significantly shorter than the other two. This reduces the alternatives to two, that is, a flap constructed with one or the other of the long sides of the triangle as the common border between flap and defect (Fig. 3, right).

2. **Skin availability.** Commonly, skin is not
available for any of the following reasons: anatomic reasons, such as the presence of the nailbed; reasons of the injury sustained; because it is not suitable in texture, as with palmar skin; or because it would inflict a functional deficit, for example, in instances in which the flap would have to be taken from a web space.

**Lengthening of the Critical Line.** The pivot point of the flap, that is, the point around which the flap swings to gain its new position is that point (V) at the base of the flap furthest from the triangular defect (see Fig. 2). This corresponds with the base end of the third cut in the foregoing description. Thus, if the corner (X) of the flap contralateral to the pivot point is to be moved, as it must be to cover the defect, to the far angle of the triangle (Z) that is, the only angle not contiguous with the flap, the skin between the pivot point and the contralateral corner must stretch to reach that far angle. For ease of expression this will be termed the "critical line" (VX). The amount of elasticity required can be realized by considering the design of an equilateral triangular defect with an equilateral transposition flap as in Figure 2. In such a situation the increase in length required in the critical line that is necessary to transpose the flap is 75 per cent. With almost any skin this would be impossible and is always so with the skin of the hand. Certain solutions are available.

**Make the Flap Wider.** Considering again the equilateral design, as one increases the width by factors of 2, 3, and 4 (XW, and W in Fig. 2), the amount of expansion required along the critical line (VX, V, and V in Fig. 2) falls from 75 per cent to 50, 33, and 25 per cent, respectively. Somewhat surprisingly, the latter two are within the elastic capabilities of most skin. This increase in width is the simplest means of insuring that a flap is sufficiently mobile, is the method most commonly used in other parts of the body, and falls within the general rule that to succeed flaps should be made as large as possible. Unfortunately, in the hand, and especially in the finger, it is often impossible to make flaps that much wider.

**Make the Flap Longer.** This is a method of making the critical line longer without moving the pivot point away from the defect and is the technique most commonly used in nontriangulated transposition flaps.

One way of lengthening the flap is to extend both side incisions of the flap distally away from the base (moving XW to X in Figure 4). This requires making the side of the flap adjacent to the defect (YX) considerably longer than the side (YZ) of the triangle to which it is to be sutured. This is more of a theoretical than a practical disadvantage, for the inequality can usually be accommodated by differential suturing or the incorporation of a dog-ear in the flap (Fig. 5).

Another way of lengthening the flap is to extend the side incision that is furthest from the primary defect through the pivot point in a proximal direction—this is called an extension cut (VU in Fig. 6). In the equilateral diagram considered earlier if the line WV were extended an equal distance to the point U, the new critical line XU would have to be stretched by only 16 per cent to close the defect. An extension cut is therefore a highly effective method of increasing the efficiency of a transposition flap. This effectiveness decreases rapidly as the primary defect narrows—a matter of no concern, as the standard transposition flap needs no aid to cover narrow defects.

Making a longer flap means transgressing the 1:1 rule. Although this can be done safely in the hand, in some instances to the point of exceeding a 2:1 ratio, it is necessary where possible to take certain precautions.

One precaution is to include an artery within the flap, thereby making it an axial pattern flap. Such arteries include the following:

- The dorsal digital branch of the proper digital
In a flexion contracture of the thumb, a defect measuring approximately 1.4 cm in width has been created on the palmar surface of the thumb. A dorsal transposition flap has been designed to close the defect. A, The flap is in place, and its tip just reaches the far ulnar side of the defect. This is only achieved by making the flap significantly longer than the width of the defect, thus creating a dog-ear, which is clearly seen in this figure. The proximal edge of the wound on the palmar surface of the thumb is identified by line WV, and the distal edge by line YZ. B, The flap has been sutured in position after release of the tourniquet, and circulation is good. The dog-ear is still very evident. C, The dog-ear has disappeared nine months after surgery. Full extension has been achieved.

Another precaution is to preserve with unusual care the venous return. If possible, such transposition flaps can be done solely based on the dorsal digital artery. This arises either from the proper digital artery at the level of the web space and runs along the margin of the lateral band of the extensor apparatus or from the dorsal metacarpal vessel. This artery, according to the dissections of Johnson and Cohen, progresses no further than the proximal interphalangeal joint in the fingers, and in the thumb it extends as far as the nail bed. This is the reason why the flap must be long enough to reach the nail bed. Although it is the lifeline of the standard neurovascular island flap, this is rarely used in a simple transposition flap. It is indicated only if no more simple means of cover is available, if a flap is essential, and if it can be taken from the non-weight-bearing side of the digit.
flaps should be based proximally with this in mind.

A third precaution is to avoid any torsion or tension in the flap. This requires that the longer the flap becomes relative to its width, the less should any stretching be demanded along the critical line. Thus, a precise measurement should be made from the proposed pivot point to the far corner of the defect to be reproduced in the critical line of the flap with increasing exactitude as the flap is lengthened. This is done most easily using a suture held between two fine hemostats (Fig. 7).

**Move the Pivot Point Toward the Defect.** This occurs in all flaps simply as a result of their transposition, the pivot point shifting toward the defect to a degree that varies with the laxity of the attachment of the skin to underlying tissue. This freedom of movement can be enhanced by undermining the base of the flap and the skin around the pivot point, but care must be taken not to devascularize the flap or to cause bleeding that is difficult to control through such limited access. The more formal method of moving the pivot point is to make a back-cut (VT)

![Diagram](Image)

**Figure 6.** If on the basic design seen in the top of Figure 2, the line WV is extended by its own length to a point U, a new critical line is created. This additional incision is referred to as an "extension cut" and is one of the most efficient ways of decreasing tension in a transposition flap, since the amount of stretch required in the critical line UX is approximately 16 per cent as opposed to the 75 per cent required in the line VX in a transposition flap of equilateral design throughout. Once again, however, the proportions of the flap exceed the 1:1 length: breadth ratio and undue tension should be avoided in closing this flap. In practice, the extension cut would be made progressively until the flap sat comfortably into the primary defect.

**Figure 5. Continued.** D, Full flexion is possible with good local skin on the contact surface of the digit. E, The secondary defect, which was covered with full thickness skin, has healed well, and the necessary original length of the flap is defined by the hyperpigmentation seen in the skin graft.
Figure 7. A, In resurfacing the ulcer over the proximal interphalangeal joint in a burn scar, increased length was used on the flap, as illustrated in Figure 4, and an extension cut is to be employed. In the presence of such demands on the vascularity of the flap, no tension whatsoever along the critical line should be permitted. For this reason, the distance from the pivot point to the far corner of the flap, the critical line, is made exactly equal to the distance from the pivot point to the far side of the defect. This is illustrated in B and C, where a fine suture between hemostats is employed to guarantee that this distance is equal.

Figure 8. A back-cut on the basic design shown at the top of Figure 2. A back-cut (VT) appreciably decreases the tension that will be required in the critical line, moving the pivot point nearer to point Z. This procedure can be done as a primary element in the design or, alternatively, can be done to "rescue" a flap that shows problems in transposition. The length-breadth ratio once again exceeds 1:1 because the breadth of the base of the flap has been narrowed. This is, however, preferable to increasing the tension along the critical line. (See Figures 9 and 14.)
excessive mobilization. This can be well illustrated in the situation here considered (Fig. 9).

In the face of a transposition flap that becomes partially avascular when sutured in place, if the surgeon incises from the pivot point part way along the base, an improvement in circulation will invariably be noted. Thus encouraged, the surgeon will find himself or herself using this maneuver with increasing frequency and to a greater degree, with good effect. While making such a relieving incision in the skin—best done under loupe magnification—the surgeon may encounter vessels or nerves in the subcutaneous tissue that may be preserved with benefit by gently spreading the skin edges apart with dissecting scissors. The tension is relieved by incising the skin, not the subcutaneous tissue. If such a back-cut is made formally as part of the flap design, the longer it becomes, the more the outline becomes that of a flag flap (Fig. 10). The flag flap, as described by Vilain, consists of the dorsal skin from the middle phalanx, the staff or pole being a narrow pedicle of skin taken from the dorsolateral border of the proximal phalanx. The narrow pedicle greatly increases the mobility of the flap, and its survival is guaranteed if a vessel can be incorporated in the staff.

Such a vessel exists for a flap of the dorsal skin of the proximal phalanx (Fig. 11) that being the dorsal digital artery, arising from the proper digital or the dorsal metacarpal artery. The veins are also well located in that region passing as they do to either side of the metacarpophalangeal joint. Thus, a robust axial pattern flap of considerable size, in the adult hand a maximum of 10 square cm, can be raised on a very narrow pedicle or even as an island, with the potential to cover a defect of like dimension (Fig. 12) in one of the following areas:

1. On the palmar surface of the donor digit from the middle digital crease to the distal palmar crease.
2. On the digit adjacent to the pedicle of the flap on the palmar surface over a similar area and on the dorsal side of that digit out to and including the proximal interphalangeal joint (Fig. 13).
3. Over the dorsal aspect of the metacarpophalangeal joint of either of the two digits.

When considering such a flap to cover a palmar defect, the surgeon should beware that the primary injury did not damage the vascular pedicle and would be well advised to dissect out the relevant digital artery before raising the flap.

RAISING AND APPLYING A TRANSPOSITION FLAP

Bearing the previously discussed considerations in mind, the surgeon should in the mind's eye or with a marking pencil triangulate the defect to be covered. In the traumatic defect there is no need whatsoever to formally excise a triangular area. Routine wound excision for debridement is all that is required, for the natural skin elasticity will cause the flap to conform to minor irregularities in the defect. Usually the triangle has one side shorter than the others, and in that situation the parallelogram of the flap should lie adjacent to one of the long sides of the triangle. The choice between these two potential flaps is made on the basis of skin availability, as already discussed. If the defect approaches an equilateral triangle, the surgeon must decide how to alleviate excessive tension along the critical line on the basis of the position of the flap and the relationship of the selected base to known vessels. The choices are, as stated earlier, a wide flap, a long flap, an extension cut, or a back-cut in the base of the flap at the pivot point.

All flaps on the dorsum of the hand should be raised just superficial to the paratenon, leaving it behind as a very satisfactory bed on which to place a graft. The flap confined to the dorsum should lift with ease, requiring only gentle strokes with the knife blade to ease its points of maximal tension. If a flap raised on a finger extends onto the side of the digit, dissection will be arrested by the strong skin ligaments. This skin anchorage system, as Landsmeer calls it in his exhaustive study of the subject, is complex, but it can be simplified into the ligaments of Cleland and of Grayson. The former lies dorsal to the neurovascular bundle, is best developed on the lateral aspects of the interphalangeal joints, and passes in a lateral-palmar direction to attach firmly to the skin. Grayson's ligament is less well developed than Cleland's, lies on the palmar aspect of the neurovascular bundle, and passes in a transverse manner from the fibrous flexor tendon sheath to the skin. In raising certain transposition flaps the surgeon can materially enhance their mobility and therefore their vas-
Figure 9. A defect is seen on the radial aspect of the index finger, a primary nerve graft having been placed in a sharply cut defect of the radial digital nerve. This area of skin loss is one of the more difficult to cover. B, A transposition flap has been designed on the dorsum of the digit, which on transposition (C) can be seen to create a significant dog-ear at the proximal end of the primary defect. D, After the flap is sutured into position and the secondary defect has been grafted, the dog-ear is still evident. E, The tip of the flap can be seen to be somewhat avascular at the far side of the primary defect, that is, point Z in Figures 2, 4, 6, and 8. F, This avascularity is even more pronounced on flexion of the digit. G and H, Full healing was achieved with a return of full motion to the digit. On examining C, D, and E it can be seen that the tension across this flap, which is not too great, could have been completely relieved by the employment of an extension or back-cut.
Figure 10. If the back-cut is extended even further across the base of the transposition flap, the design approaches that of the flag flap. The original French design, as described by Vilain, incorporated a staff in the flag flap and was designed primarily on the middle phalanx of the digit. There is an axial modification of the flag flap that incorporates the dorsal digital artery and is best constructed on the proximal phalanx.

French Original Axial Modification

Figure 11. The dorsal digital artery may arise either from the proximal digital artery or from the dorsal interosseous or metacarpal artery.

Figure 12. A, An axial flag flap, such as that described in Figure 11, can be transposed from the dorsum of the middle finger to the dorsum of the index or to the dorsum of either the middle or the index finger over the region of the metacarpophalangeal joint. B, It can also be rotated around to cover the palmar aspect of the middle or index fingers. If such a defect exists on the palmar surface, particularly of the donor digit, care should be taken to insure that the artery has not been damaged by the original injury. The distal margin of the flap in both A and B is marked with an X, and the position that the distal margin adopts in the various defects is indicated by the same marking.
transposition that could be rotated a staff in ed primarily on digit. There is an flap that internal artery and is proximal phalanx.

Figure 13. Application of an axial flag flap is illustrated. A, Following a severe crushing injury to the index finger, this patient presented with loss of skin on the palmar and ulnar aspects of that digit together with exposure of the proximal interphalangeal joint. B, The axial flag flap has been incised on all four margins leaving only a small skin bridge overlying the dorsal digital artery. The tourniquet has just been released, and refill of the flap can be clearly seen. C and D, The flap is shown in position and can be seen to cover the ulnar aspect and a portion of the palmar aspect of the proximal phalanx and the proximal interphalangeal joint. Such a closed flap could not be achieved by any other means. The patient went on to show uneventful healing, although developing fairly severe posttraumatic osteoarthritis of the proximal interphalangeal joint.

The flap can now be transposed into the primary defect. The sequence of events in moving a transposition flap follows a set pattern.

1. Define the primary defect, insuring that its margins and floor are viable and surgically clean. The defect should be made, by positioning of the digits, as large as possible. In this way the proper amount of skin is introduced to meet all requirements, and the configuration of the defect can better accommodate a wide, vasculatory secure flap. These considerations are, of course, of particular significance in the web space.

2. Determine the site of maximum tissue availability.

3. Mark out the base of the proposed flap.

4. Measure from the pivot point to the far point of the defect and transfer that measurement to the length of the flap from pivot point to tip.

5. Consider whether the length:breadth ratio of the proposed flap is acceptable. If not, redesign the flap with a wider base; if it is, proceed to the next step.

6. Raise and transpose the flap.

If all previous planning has been correct this should be achieved with relative ease. Remember that the flap will be more difficult to move the thicker or more rigid it is. Thus, palmar skin or edematous skin will move with more reluctance. If, despite these considerations, the surgeon feels that too much traction is being applied or indeed no reasonable traction carries the flap over
the defect, he or she must make appropriate adjustments (Fig. 14). No flap dragged unwillingly into position works efficiently—nothing does. What steps can be taken? Those concerned with the basic design of the flap, length and breadth, are forever gone and reconsidering the design will serve to help only future patients. There are six procedures open to the surgeon in this predicament.

1. Reconsider the needs of skin cover. The indications for the transposition flap may have been relative, concerned more with eventual function than immediate needs. The application of a free skin graft may then be the correct defense and is usually pursued with some reflection on why the more adventuresome gambit of the transposition flap had ever been chosen for an opening.

2. Undermining the flap base and pivot point. This gives limited gain and has the disadvantages already mentioned.

3. The back-cut, already discussed at length, is an incision across the base of the flap on the side away from the defect that moves the pivot point closer thereto and can often save the day. The cut is extended millimeter by millimeter until the flap fits, with preservation of the subcutaneous tissues and the neurovascular structures they contain if such preservation does not nullify the release. Hesitation at this juncture serves no purpose if the surgeon's judgment has been good with respect to skin cover indications, that is, the primary defect needs a flap, and the secondary defect can take a skin graft. It follows that the back-cut can be as bold as necessary, for the gamble is made with stakes that can at worst be lost without tragedy. But loss is rare, unless the original design was quite wrong.

Figure 14. This patient, operated upon some years ago, illustrates the hazards of adhering rigidly to set rules. A defect on the radial aspect of the index finger that exposed the proximal interphalangeal joint was covered with a transposition flap that employed much of the dorsal surface of the finger. The 1:1 ratio was carefully observed, and the distance from the pivot point to the far edge of the defect was made to equal almost exactly the critical line of the chosen transposition flap. A, Despite this care, it can be seen that extensive creasing across the flap has seriously jeopardized its vascularity. B, This is clearly shown by the relative avascularity of the tip of the flap, which overlies the exposed proximal interphalangeal joint. The entire design could have been made somewhat smaller, and certainly safer from a vascular point of view, by the employment of an extension cut or a back-cut. Such incisions would have relieved the lines of tension in this flap, thereby permitting good blood supply from the remaining base of the flap. This case also illustrates the need for care in transposition flap design when the flap is to pass around the convex surface of the cylindrical digit. The distances involved are significantly greater than one might first expect. The fact that the flap survived in its entirety with full function of the digit (C and D) is more testimony to the healing powers of the patient than to the design skills of the surgeon.
Transposition Flaps in the Hand

4. Raise another flap. To admit an error takes rare courage. If it is clear that the flap will not make it to the defect and the indications were correct, despite all that is written in the preceding paragraph, the first flap should be preserved, either to partly cover the defect—a clumsy solution at best—or to be returned to the bed from which it was raised. The second flap may be local, regional, or even distant. It is for this eventuality that the wise surgeon obtains informed consent for all possible procedures.

5. Add a free skin graft. Part of the primary defect may be suitable for free skin grafting. In such a case the combination of flap and graft may achieve the first goal, which is viable skin cover. Nonetheless, the surgeon will recognize that such a combination may be unsatisfactory from the point of view of wound healing—a free graft beside a flap over a traumatic defect is not an ideal situation since (1) wound effusions beneath the graft cannot be efficiently controlled by a firm bolus dressing, which perchance lifts the edge of the flap, creating a dead space beneath both flap and graft, and (2) the graft cannot easily be made to conform with the contours of the bed and still meet with the edge of the flap. The combination is also unsatisfactory from the point of view of future reconstruction and aesthetic appearance, not in the restricted sense of modern cosmetic practice, but in the broader sense, which might be termed—hopelessly without hubris—surgical elegance.

6. Return the flap to its bed for later use. This is mentioned only to be condemned, not outright, but with only rare reservations. To do so, first of all, leaves the primary defect uncovered—this may lead to desiccation and death of vital structures, to unwanted granulation and resultant fibrosis, or to the development of infection. Second, to do so causes the flap to become more stiff and less mobile. A delayed flap is certainly more resistant to vascular compromise but also, through edema in its substance and fibrosis on its undersurface, is much less pliable.

In the great majority of cases, the flap will fit. If the raising has been performed under tourniquet, this should now be released. Any vigorous bleeding should be controlled, but time should be allowed to play its valuable role. While the reactive hyperemia settles, the surgeon can take the appropriate graft with which to cover the secondary defect. The considerations of bed and function that usually dictate the choice between full- and split-thickness skin should apply here. Once hemostasis has been achieved by time and judicious cautery, the flap should be sutured into position. The graft should then be applied to the secondary defect with application of a bolus dressing where appropriate. The surgeon should now check the mobility of the joints adjacent to the flap, observing the effect on both the flap circulation and also on the position of the skin graft on its bed. Four to six days of immobilization are beneficial to the wound and do no harm to the joints, but motion thereafter is mandatory.

CONCLUSION

This paper is concerned entirely with the principles underlying the design of transposition flaps to cover skin defects. Many of these principles, having regard to skin availability, the pivot point, the critical line, extension and back-cuts, and the avoidance of undue tension, apply to all local and regional flaps in the hand and can be extrapolated to them with benefit.

REFERENCES


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