

Behaviour of Skin Grafts as Regards Changes in its Linear Dimensions

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WE reported our preliminary observations on contracture of skin grafts in 1971 (Sawhney 1971). Since then we have followed our grafts for longer periods and observed that besides contracting the skin grafts relax as well as stretch, and that this behaviour is affected by external influences. This aspect has received little attention so far and it is our intention to discuss them in this paper.

Material and Methods :

Sixty intermediate thickness split skin grafts (.0015 to .0020 inch in thickness) placed on different regions of the body in young adults under the age of thirty have been followed for periods varying from 6 months to 5 years. Impressions of these grafts were taken (as described by Sawhney, 1971) on the 6th postoperative day and repeated at varying intervals until grafts were completely settled. The length of the graft in different directions and the surface was measured using a planimeter. Rates of contractures, relaxation and stretching per unit area were determined by using the following formula :

$$\text{Contractur per unit area} = \frac{\text{Decrease in surface area over a given period}}{\text{Initial grafts size.}}$$

(C)

$$\text{Relaxation or (Stretching)} = \frac{\text{Increase in surface area after achieving contraction}}{\text{Initial grafts size.}}$$

(Re) (St)

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A settled graft denotes a stage in the life of a graft when left to itself, it does not change its dimensions.

Observations :

The skin graft pass through following stages :

- (1) Stage of apparent graft contraction
- (2) Stage of relaxation
- (3) Stage of settling of the graft.

(1) Stage of Apparent Graft Contraction:

During this stage, which follows immediately after the take, there is rapid and

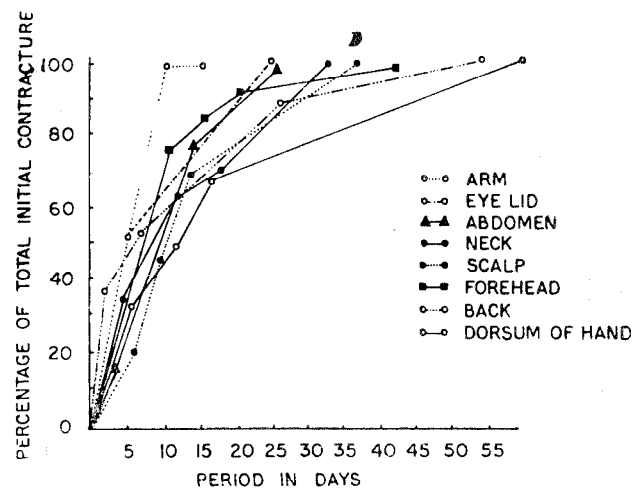


Fig. 1—The degree of initial contracture (expressed as percentage of total initial contracture) in skin grafts in relation to period of observation in various regions of the body.

progressive contraction of skin grafts and maximum contraction generally occurs in the first two weeks (Fig.1). This is then followed by slower contraction until the grafts are fully contracted. This period varies from 11 to 62 days in different regions. The rates of contraction differs in various regions i.e. 0.115 to 0.802 per unit area in the arm and dorsum of hand respectively (Sawhney, 1971) (Fig. 2). The skin graft during this period is adherent to its bed and is thrown into wrinkles which suggests that the grafts is adjusting to the rapidly contracting graft bed (Fig. 3). This contraction of the graft therefore is only apparent.

(2) Stage of Relaxation :

During this phase the surface area of the graft increases. The increase in size is gradual and spread over a long period. Relaxation begins after maximum contraction has occurred and can be seen to con-

tinue upto 8 to 10 months (Fig. 4). The relaxation varies widely in different regions. The rates of relaxation are highest i.e. 0.112 to 0.228 per unit area in regions where skin is tightly draped i.e scalp, chest, back arm, forearm, inguinal region, legs and front of knee. Whereas they vary from 0.02 to 0.024 per unit area in areas of skin laxity i.e. eye lids, neck, elbow, palm and flexor surfaces of fingers. The differences in rates of relaxation in two regions are significant ($p < 0.01$). In abdomen where the skin is subjected to periodic distension exerting undue tension on the grafts for variable periods, the graft stretches significantly, so much so that the skin grafts regain their original size seen at primary dressing or even stretch further. The rate of stretching in such instances has varied from 0.560 to 0.720 per unit area.

When relaxation occurs the grafts expands centrifugally in all directions. The rates of relaxation vary in different direction, and seem to be influenced by cleavage lines of skin (Fig.6). The rates of relaxation are higher

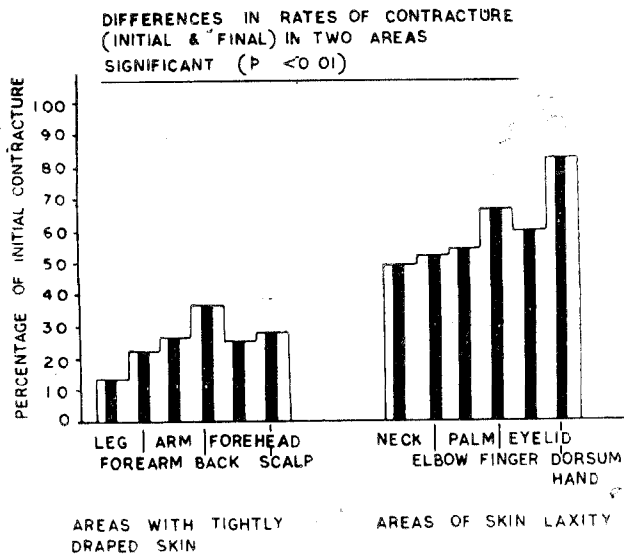


Fig. 2—The differences in rates of contracture of skin grafts in different regions.

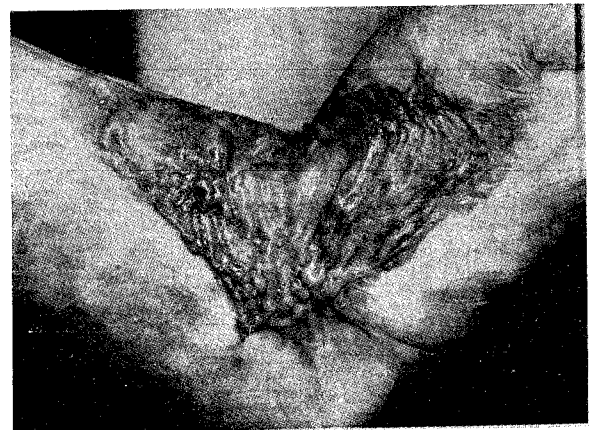


Fig. 3—Wrinkling of skin graft during the phase of initial apparent contraction.

along cleavage of skin as compared to those obtained in directions opposed to them. Significant differences can be seen by applying the paired test ($p < 0.05$).

During this phase the wrinkles in skin graft become less prominent, gradually get flattened and ultimately disappear. The skin graft now becomes soft and pliable.

(3) Stage of Settlement of Graft :

After relaxation is complete, the graft

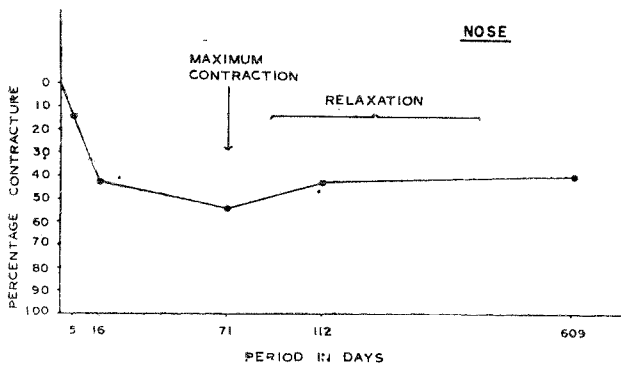


Fig. 4—Graph showing behaviour of skin graft over a long period.

gradually settles in its new surroundings and does not change its dimensions (Fig. 7). A closer examination reveals that graft at this stage has not only improved its texture but has also developed creases which exhibit the same arrangement as would have existed in the normal skin at that site. The residual shortage in the surface area of the graft forms the true and final contraction.

Discussion :

When a skin graft is removed it immediately shrinks. The degree of contraction is directly proportional to the thickness of the dermis. However, when the graft is placed on a recipient area and it takes, its contraction is inversely proportional to the thickness of the dermis (Sawhney, 1970). It may therefore be assumed that the degree of the so called contraction of the graft is determined largely by the behaviour of wound bed on which it is laid.

The graft on settling becomes soft and

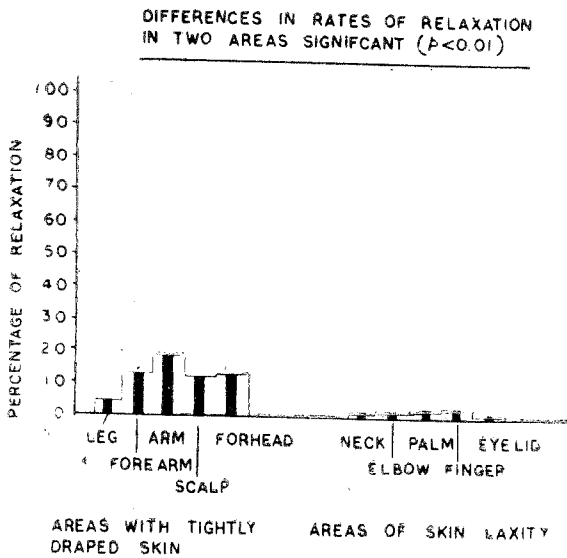


Fig. 5—Difference in rates of relaxation in different regions of the body.

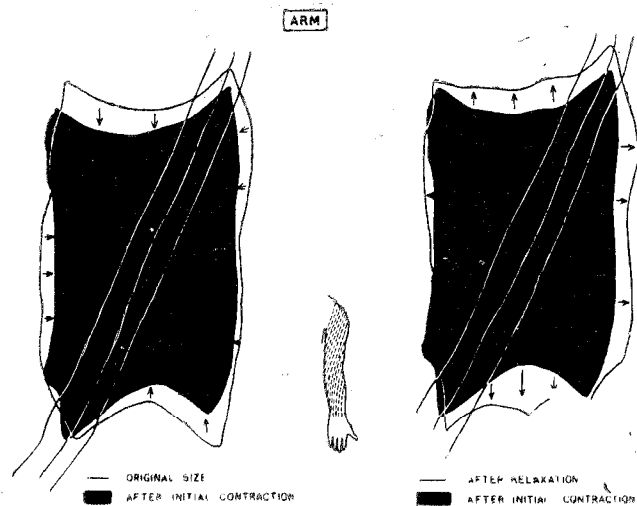


Fig. 6—Contracture and relaxation of skin graft and relation to cleavage lines of skin.

pliable and begins to move on the underlying bed, with the resolution and softening of scar of the recipient bed. It is at this stage that it responds to normal stresses at that particular site due to bodily activity. These stresses would necessitate changes in the microarchitecture of dermal collagen (Gibson, 1965) thereby realigning the collagen bundles along these lines. The changes in dermal architecture would be reflected in the arrangement of crease lines in the skin grafts which would therefore show the same arrangement as would be present in the normal skin at that site.



Fig. 7—The appearance of a skin graft when it is finally settled.

Summary and Conclusion :

(1) Behaviour of 60 split skin grafts from various representative regions of the body have been studied by obser-

vations extending over a period of upto 5 years.

(2) The skin grafts pass through three stages during their life :

(i) Stage of apparent graft contraction which lasts from 2 weeks to 2 months.

(ii) Stage of slow and prolonged relaxation which last upto 10 months.

(iii) Stage of settlement when the graft finally adjusts to its new surroundings and left to itself does not change its dimensions afterwards.

(3) Finally the graft is smaller than its original size but this true contraction is less than the earlier apparent contraction.

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