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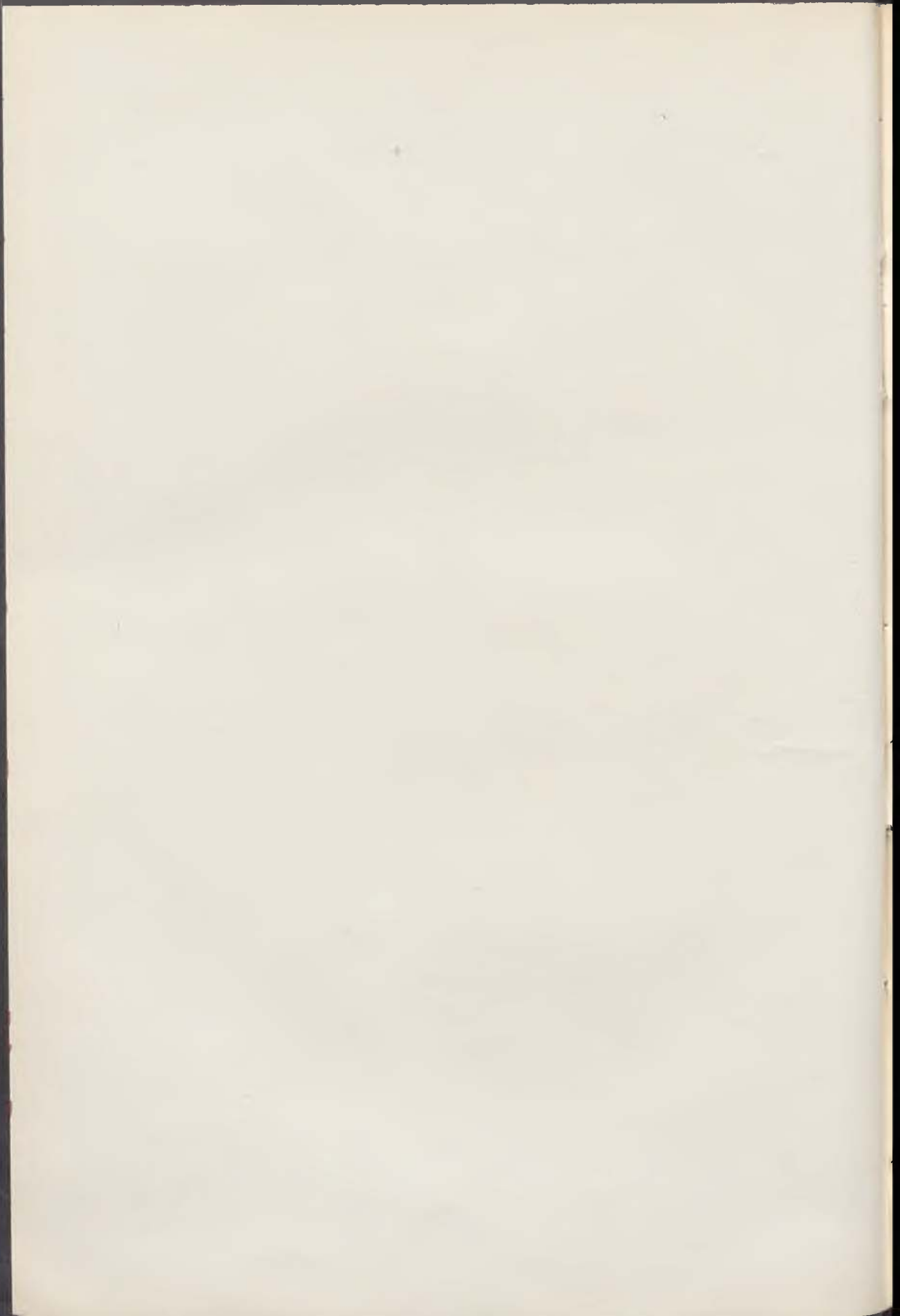
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STANDARD NON-CONTACT BURN (VASCULAR CHANGES)



Fig. 1. Periphery of burned area: a — zone of undamaged skin, b — zone of stasis c — coagulation zone. First day after exposure. Total specimen of skin in view from below,  $\times 8$

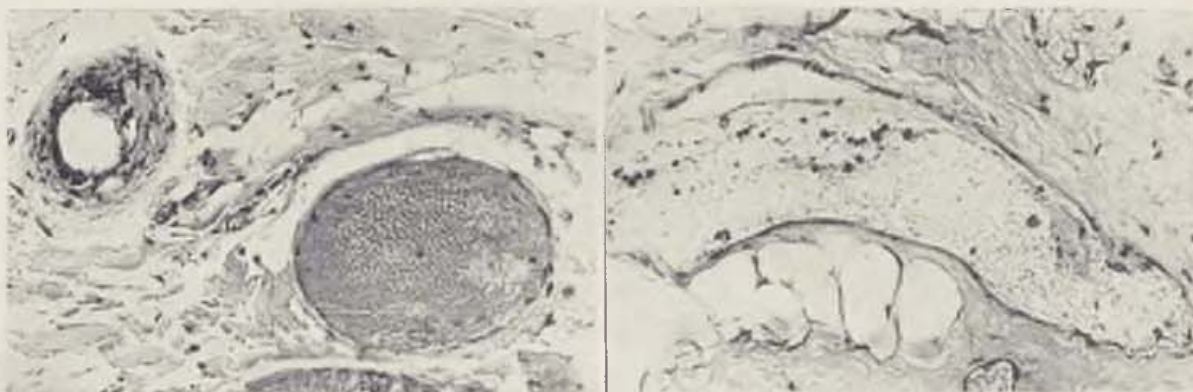


Fig. 2. Zone of stasis. Artery and vein at border between dermis and skin muscle. First day after exposure. Histological section stained with HES,  $\times 150$ . — Fig. 3. Vein in deep layer of the zone of stasis. Third day after exposure. Histological section stained with HES,  $\times 200$



Fig. 4. Degeneration of venous wall in the zone of stasis. Third day after exposure. Histological section stained with HES,  $\times 500$



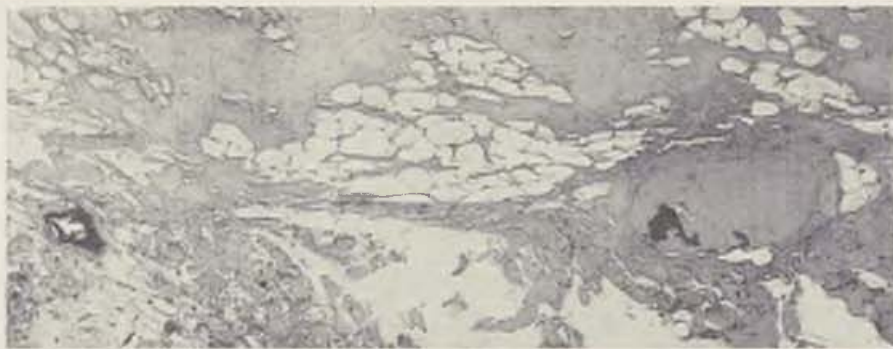


Fig. 5. Artery and vein at margin of the zone of stasis. Third day after exposure.  
Histological section stained with HE,  $\times 60$

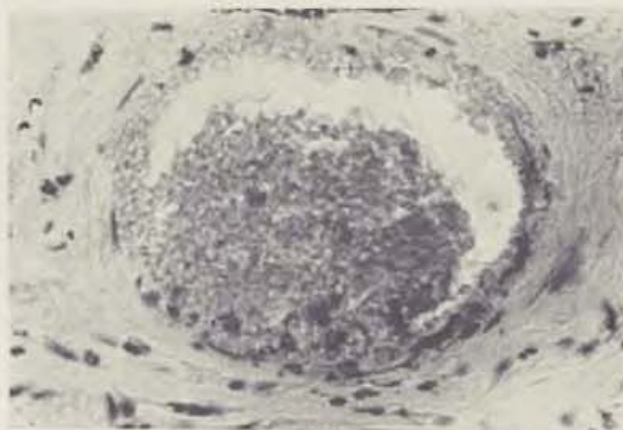


Fig. 6. Recanalization of vessel in the zone of stasis. Seven days after exposure.  
Histological section stained with HES,  $\times 320$



Fig. 7. Development of vascular tree at margin of burned area. Six days after exposure.  
Total specimen of skin in view from below,  $\times 15$

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## TREATMENT OF BARRAQUER-SIMONS'S DISEASE AND OF PROGRESSIVE HEMIATROPHY OF THE FACE

L. A. BRUSOVA, I. K. TEBLOYEV

Barraquer-Simons's disease and progressive hemiatrophy of the face belong to the group of diseases which are most probably based on a disorder of the hypothalamic region leading to dystrophic disturbances (Lyubashevskii et Erman, 1969; Shefer, 1971; Tikhonova, 1973).

Barraquer-Simons's disease is characterized by a disorder of the fat metabolism with a peculiar redistribution of the subcutaneous fatty tissue from the region of the face, the arms and the upper half of the trunk to the region of the buttocks, the pelvic girdle and the proximal parts of the lower limbs. A similar clinical picture is presented by fully developed lipodystrophy. However, two incomplete forms that of upper lipohypotrophy and lower lipohypertrophy (Sapelkina et Isakova, 1971) are distinguished.

The basic clinical sign of progressive hemiatrophy of the face is the continuous wasting of one half of the face chiefly due to dystrophic changes in the subcutaneous fatty tissue and the skin. Not infrequently, also the muscles, the cartilage and bone of the face are involved in the process. Trophic changes are also observed in various parts of the trunk and limbs with ipsilateral or contralateral location with regard to the disorder in the face. This made it possible to distinguish various forms of the disease, such as hemiatrophy of the face, hemiatrophia facioscapulohumerothoracica, hemiatrophia totalis and hemiatrophia cruciata.

Barraquer-Simons's disease and progressive hemiatrophy of the face have a number of identical clinical signs: They usually start in children at the school age, they have an active and a stationary stage, they develop dystrophic changes in the face with subsequent gross cosmetic defects which may give rise to an astheno-neurotic syndrome. Up to the present days, no effective patho-

genetic treatment of these diseases exists, which could normalize the trophic processes and rid the patient of his cosmetic blemish.

After the observation of twelve patients with Barraquer-Simons's disease and 22 patients with progressive hemiatrophy of the face which had lasted for a considerable time, the authors carried out a complex treatment consisting of administration of anabolic hormones, phosphren, vitamins B<sub>1</sub>, B<sub>12</sub> and B<sub>6</sub>, aloe,

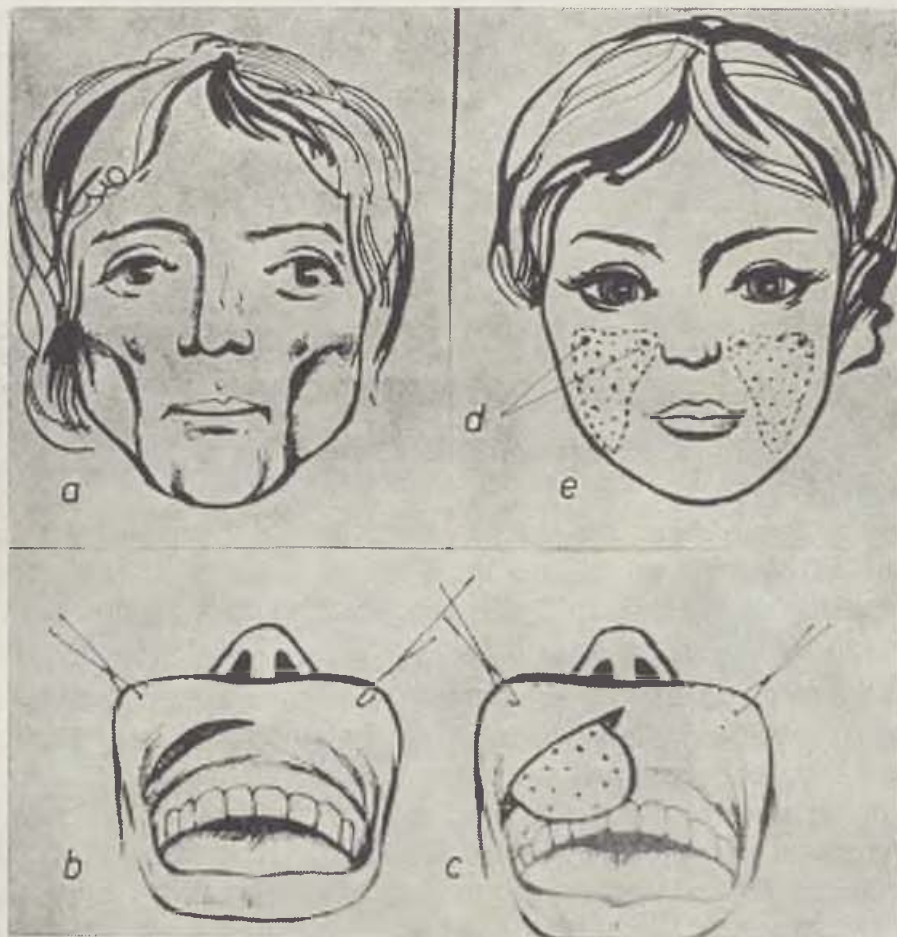


Fig. 1. Diagram of surgical method in operation for bilateral lipodystrophy (Barraquer-Simons's disease) a — appearance of deformation; b — incision; c — introduction of implant; d — lay-out of implants; e — points of implant fixation to periosteum

lidase, hyaloid, ATP, nicotinic acid, pachycarpine, ganglerone, seduxen, etc. Such treatment improved the general condition of the patients, normalized sleep, diminished excitability and headache. The dynamics of signs indicating the condition of the vegetative nervous system [sweating, skin temperature] were registered. However, in these patients, restoration of the atrophic tissues in the face could usually not be observed. This was the reason why in some of them surgical treatment was eventually resorted to.

For correction of deformations and defects in the face, which had developed as a result of Barraquer-Simons's disease and of progressive hemiatrophy of the face, surgical procedures have at present been employed which consist



of free transplantation of fatty tissue and adipodermal grafts, as well as of the fatty tissue of Filatov flaps (Pešková, 1971; Shandalova, 1972; Mukhin, 1974). In connection with the above it should be said that in a number of patients who had undergone such operations, irregular atrophy developed and the transplanted fatty grafts underwent cicatrization which interfered with the restoration of symmetry of the face (Dmitriyeva et Kovaleva, 1971; Gubaidulina et Bashilova, 1972).

Taking into account these facts and the duration of treatment in connection with the stages of plasty using a Filatov flap, the authors preferred to use implants of monolithic silicon rubber introduced into clinical practice at the Central Scientific-Research Institute of Stomatology in 1965 by Gruzdkova. Si-

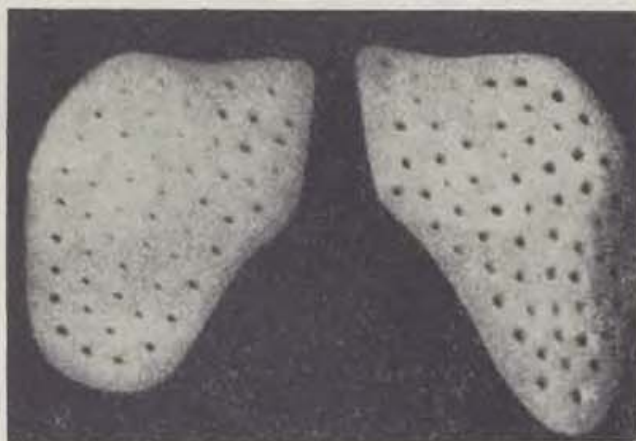


Fig. 2. Bandage applied for postoperative period. — Fig. 3. Silicon implants used for correction of facial deformation in Barraquer-Simons's disease

licon implants are biologically inert, possess a stable elasticity and pliability. This makes it possible not only to correct deformations of the facial skeleton, but also defects in the soft tissues of the face. The first operations with employment of silicon rubber in two patients with Barraquer-Simons's disease were carried out in 1967 by Gruzdkova who implanted individually prepared grafts in the region of the hollowed cheeks through incisions along the nasolabial grooves and by formation of a bed underneath the superficial layer of facial muscles after severance of the zygomaticus and subperiosteal fixation of the upper edge of the implant.

In order to avoid additional scars in the face, the authors recommended to implant the grafts through incisions made intraorally in the mucous lining



of the upper lip (Brusova, 1971). A total of 18 patients (16 women and two men) at ages of 17 to 43 were thus operated on. Their disorder had lasted between three and 16 years. Eight of them suffered from Barraquer-Simons's disease and ten of progressive hemiatrophy of the face. The disorder was stationary in all cases, which is an obligatory condition when resorting to surgical treatment.



Fig. 4. Woman F. (prior and after operation). Diagnosis: Bilateral lipodystrophy (Barraquer-Simons's disease)

The surgical method of implanting individually prepared silicon grafts to patients with Barraquer-Simons's disease is described below.

The contour of the implant and the points of fixation are marked on the skin of the face with brilliant green, the oral cavity is painted with a solution of furacillin and the teeth are covered with gauze pads soaked in furacillin. In local anaesthesia silk stitches are laid in one corner of the mouth and the middle third of the upper lip. Incisions are made in the mucous lining along the projected outline of the outer fibres of the circularis oris from the corner of the mouth towards the columella of the nose. The wound edges are mobilized and the skin is separated from the muscle by blunt dissection (because the layer of subcutaneous fat is completely missing) over an area corresponding to the drawn outlines on the skin of the cheek overlapping them by 0.5 cm. Bleeding is then controlled by packing and electrocoagulation. At the marked points of fixation in the suborbito-zygomatic region two lavsan stitches are



laid with a bent needle and led out through the marked points on the silicon implant, then the latter is introduced into the prepared pocket. The wounds are sutured in two rows of catgut stitches and the mucous membrane with an uninterrupted suture (Fig. 1). The operation is carried out in one stage on both sides. In order to procure drainage of the operational field, the skin may be punctured about 0.5 cm below the lower edge of the implant using a narrow



Fig. 5. Woman V. (prior and after operation). Diagnosis: Hemiatrophy of face on left side. Four silicon implants were grafted to correct deformation of face: in region of body and angle of mandible {1}, upper lip {2}, cheek {3}, in nasolabial groove {4}.

scalpel or a needle. Through this puncture hole a polyethelene or silicon catheter is introduced. The tube is left for 24 hours. This kind of drainage was carried out in five patients. In three patients sero-haemorrhagic fluid accumulated up to 3 ml and had to be removed by puncture. The extracted fluid was subjected to microscopical examination, yet microflora was not detected. In order to prevent bleeding, secure rest and fixation of the implants, the authors applied a bandage dressing during the postoperative period (Fig. 2). The shapes of implants are shown in Fig. 3; their upper edge, earmarked for filling the orbitozygomatic region, is slightly thickened (0.5 to 0.8 cm); the remaining edge amounts to 0.2 to 0.3 cm thickness; the largest dimension is 9x3.5 cm; the weight of the implant is 1.5 to 6.9 g. For illustration of the results of the operation, photographs of a patient (woman) prior to and after operation are shown in Fig. 4.

In operations for progressive hemiatrophy of the face, the authors usually made the adopted incisions along the existing skin grooves in front of the auricle, in the region of the lower eyelid, along the edge of the eyelash and on the mucous lining of the oral cavity by the method described above. Afterwards they separated the skin from the adjacent muscles by blunt dissection. In atrophy of bone in the cranium, the maxilla, mandible, and the periosteum. With respect to the location and extent of atrophy one to four implants were introduced. The authors consider it rational to use several implants rather than a single large one in a plasty of the face, because this better preserves the function of facial and masticatory muscles and avoids difficulty in opening the mouth. For illustration of the results achieved, the photograph of a woman prior to and after operation is shown in Fig. 5.

In all patients operated on by the authors for Barraquer-Simons's disease and progressive hemiatrophy of the face, the postoperative period was uneventful, the wounds healed by first intention, the implants took well, the function of facial and masticatory muscles remained undisturbed, and the cosmetic effect was good.

Catamnestic observations over a period of four years of the eight patients operated on for Barraquer-Simons's disease and the ten patients treated for progressive hemiatrophy of the face have shown that silicon implants give a stable results in reconstruction of a regular facial relief preserving, at the same time, the function of facial and masticatory muscles. All patients are satisfied with the results of the operation and have not complained of the presence of implants in their tissues.

The results so far achieved permit the authors to recommend employment of implants made of monolithic silicon rubber for correction of defects in the face in patients suffering from Barraquer-Simons's disease and progressive hemiatrophy of the face provided the condition has reached the stage of stabilization.

B. K.

#### S U M M A R Y

Implants made of monolithic silicon rubber used for correction of defects in soft tissues of the face in operations on 18 patients with Barraquer-Simons's disease (eight) and progressive hemiatrophy of the face (ten) gave good results. Silicon implants due to their biological inertness, elasticity and pliability permit to achieve good cosmetic results without disturbing the function of facial and masticatory muscles. Intraoral incisions hidden in the mucous lining of the oral cavity and incisions hidden in the existing skin grooves make it possible to avoid conspicuous scars in the face. A positive effect of concomitant conservative treatment with anabolic hormones, phosphren, vitamins of the B group, aloe, lidase, etc. on the general condition of patients and some of the functions of the vegetative nervous system was observed. The operation is indicated in stabilization of both Barraquer-Simons's disease and progressive hemiatrophy of the face.



## R É S U M É

### **Traitement de la maladie de Barraquer-Simons et de l'hémiatrophie progressive de la face**

L. A. Brusova, I. K. Tebloyev

L'application des implants en caoutchouc monolithique de silicone faite avec le but de corriger les défauts des parties molles de la face avait de bons résultats dans les opérations de 18 malades avec la maladie de Barraquer-Simons (8) et avec l'hémiatrophie progressive de la face (10). L'utilisation des implants de silicone rendait possible — grâce à leur élasticité et flexibilité — d'obtenir un bon résultat cosmétique sans altération de la fonction des muscles mimiques et masticateurs. Les incisions intra-orales faites dans la muqueuse de l'épithélium de la bouche et celles-ci qui sont cachées dans les rides déjà existant de la peau ont permis d'éviter la cicatrisation visible de la face. On a constaté que c'était le traitement conservatif par les hormones anaboliques, phosphren, vitamines du groupe B, aloès, lidase etc. qui avait une bonne influence sur l'état général des malades et sur quelques indices de la fonction des nerf végétatifs. On recommande cette opération, si la maladie de Barraquer-Simons est stabilisée et dans l'hémiatrophie progressive de la face.

## Z U S A M M E N F A S S U N G

### **Behandlung der Barraquer-Simonsschen Krankheit und der progressiven Gesichtshemiatrophie**

L. A. Brusowa, I. K. Teblojew

Die Applikation von Implantaten aus Monolithsilikongummi zur Korrektur von Defekten der weichen Gesichtsteile bei Operation an 18 Kranken mit der Barraquer-Simonsschen Krankheit (8) und mit progressiver Gesichtshemiatrophie (10) hatte gute Ergebnisse. Die Anwendung der Silikonimplantate ermöglichte, dank ihren biologisch inerten Eigenschaften, Elastizität und Biegsamkeit ein gutes kosmetisches Ergebnis ohne Funktionsstörung der mimischen und Kaumuskeln zu erreichen. Intraorale Inzisionen in der Schleimhaut des Mundepithels und die in den bestehenden Hautfalten verdeckten Inzisionen machten es möglich, sichtbare Narben im Gesicht zu vermeiden. Es wurde festgestellt eine positive Einwirkung der konservativen Behandlung mit anabolischen Hormonen, Phosphren, Vitaminen der Gruppe B, Aloe, Lidase u.ä. auf den Allgemeinzustand der Kranken und auf einige Parameter der Funktion des vegetativen Nervensystems. Die Operation wird bei der Stabilisierung der Barraquer-Simonsschen Krankheit sowie bei der progressiven Gesichtshemiatrophie empfohlen.

## R E S U M E N

### **Tratamiento de la enfermedad Barraquer - Simons y de la hemiatrofia facial**

L. A. Brusova, I. K. Tebloyev

Aplicación de implantes de goma monolítica de silikon para corregir defectos de las partes blandas de la cara en las operaciones de 18 enfermos con la enfermedad Barraquer-Simons (8) y con la hemiatrofia facial progresiva (10) tuvo buenos resultados. El empleo de implantes de silikon, gracias a su inercia biológica, la elasticidad y flexibilidad hizo posible un buen resultado cosmético sin alteración alguna de la función de los músculos mímicos o masticatorios. Incisión intraoral en la mucosa del

epitelio oral e incisiones encubiertas en las arrugas ya existentes de la piel hicieron posible evitar cicatrices visibles en la cara. Fue comprobado efecto positivo del tratamiento conservativo con hormonas anabolizantes, fosfren, vitaminas del grupo B, áloes, lidase, etc. para el estado general de los enfermos y en cuanto a algunos índices de la función de los nervios vegetativos.

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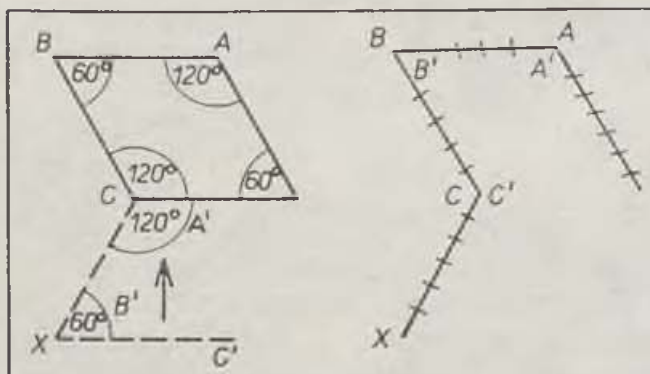
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Regional Hospital, Ústí nad Labem {Czechoslovakia}, Deputy Head M. Kalina, M.D.  
Department of Traumatology, Unit of Plastic Surgery

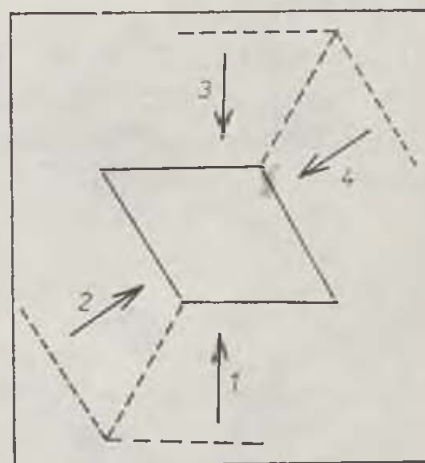
## COVERACE OF AREAL DEFECTS USING LIMBERG FLAPS

J. RUS

Physicians as well as non-medical people believe predominantly that a plastic surgeon should be endowed with the talent of a painter. Although this is frequently the case, we rather believe that plano-spatial imagination is required. The latter may be, however, also mathematico-geometrical, even though it is probably less frequent. It is also probable that people gifted with this type of imagination, will decide upon other disciplines than medicine, when choosing their profession. Even if they do select it after all, there is a small probability that they become plastic surgeons. Even then, the education they are afforded in this discipline, may suppress their talent unintentionally in the sense of the school tradition, or they may not be given a chance to make full use of it. Only thus it is possible to explain the fact that the majority of plastic surgeons, already after the introductory pages, lay aside the book by Alexander Limberg: "Planning of Plastic Oeprations" with absolute lack of understanding. The plastic surgeon is almost frightened to plan, count, transsect, elevate, shift and suture, lines, angles and exact dimensions of defined areas on the human body. He much rather favours performances in the shape of curves, arches and rounded areas, because this is more "physiological". Is this opinion correct, however? I do not believe it is, the reason



Drawing 1



Drawing 2



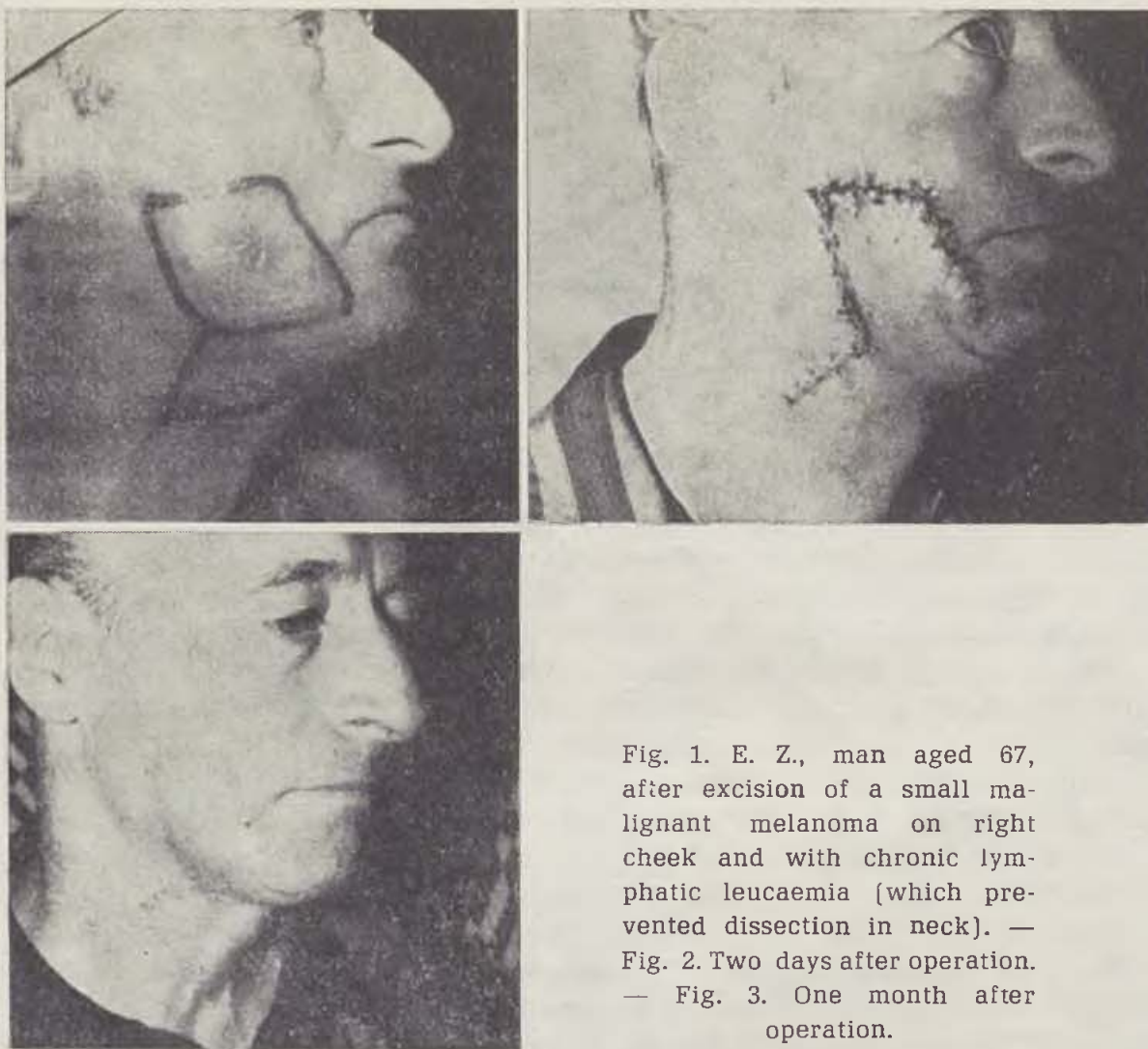


Fig. 1. E. Z., man aged 67, after excision of a small malignant melanoma on right cheek and with chronic lymphatic leucaemia [which prevented dissection in neck]. — Fig. 2. Two days after operation. — Fig. 3. One month after operation.

for it is rather partly tradition and partly custom. As a matter of fact I do not know any plastic surgeon who would not use and acknowledge ZS plasty. And it is here that lines and angles are applied, without anybody doubting the effectiveness of ZS plasty.

It ought to be said, however, after this introduction that it is not possible of course to solve everything globally according to the diagrams proposed by A. Limberg. It is rather correct and necessary, to select and use from the great number of his ideas all that brings to us and our patients too, better results than other methods.

#### A theoretical consideration:

We often meet in our practice with the necessity to cover skin defects which we mostly created ourselves, when removing a malignant tumour. The methods may vary from simple suture under tension of different intensity, suture after mobilization of wound edges, various shifts and incisions, with excisions or without, up to grafts. After the operation there remain scars of



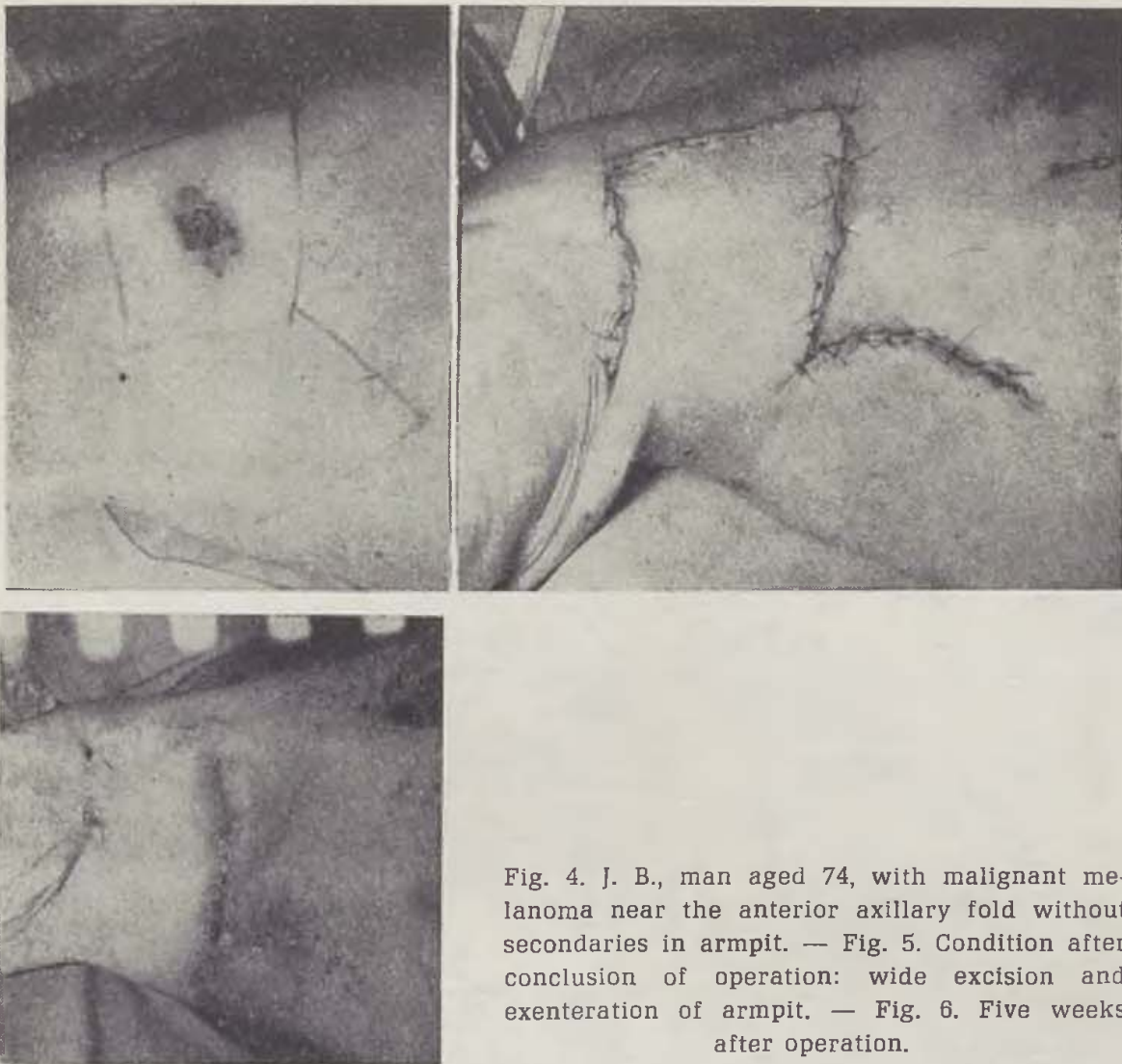
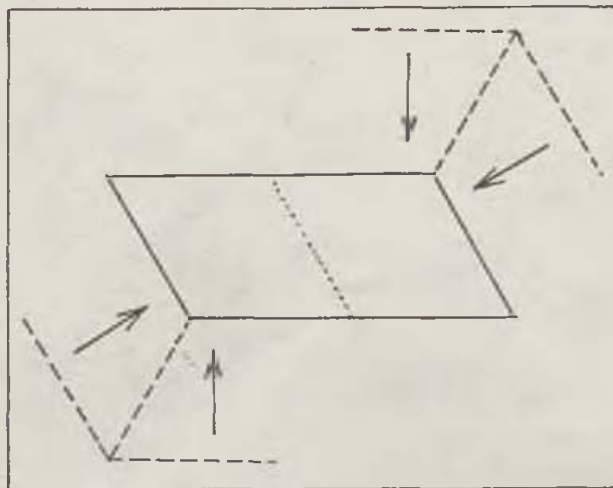


Fig. 4. J. B., man aged 74, with malignant melanoma near the anterior axillary fold without secondaries in armpit. — Fig. 5. Condition after conclusion of operation: wide excision and exenteration of armpit. — Fig. 6. Five weeks after operation.

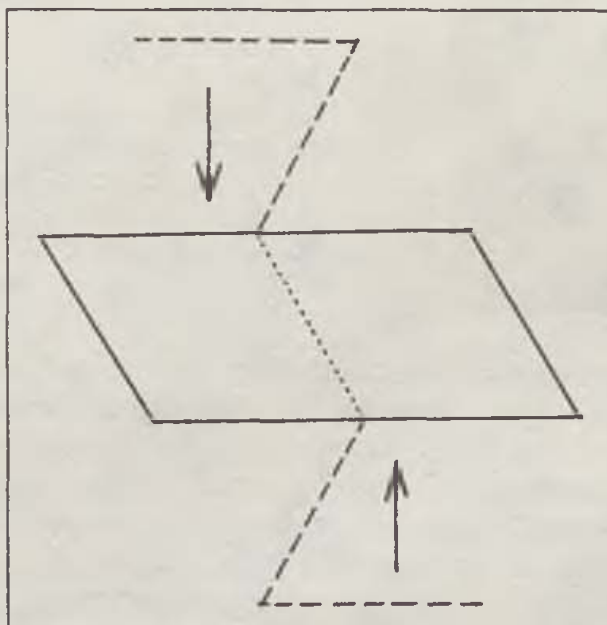
various extent, pigmentation, depigmentation. deformations. When looking for a method of covering, I was impressed by the method based on the principle of flap rotation, proposed by A. Limberg. He had calculated the method in detail and had performed it on paper models and also in practice. We have been applying this method in practice since 1970 with good results.

The basic principles is, to cover the defect of rhomb shape of angles 60, 120, 60, 120°. The defect is covered by incision, elevation and suture of a rhomb flap into the defect, whereby the defect from the latter is then sutured. It is very simple to plan the rhomb flap: one side is the side of the excised rhomb, the second side runs in continuation of the shorter diagonal of the rhomb, the third side is parallel with one side of the rhomb defect and on the fourth side the rhomb is fed and rotated. The length of all sides of the excision and flap is the same. Then the entire rhomb, enclosed by one side of the defect and by two sides formed by the excision, is elevated rotated into the defect and sutured. The defect after the rotated rhomb, is directly sutured. The drawing demonstrates all this much better. (Drawing 1.)

If somebody after studies of Limberg's drawings and pictures of paper models argues that skin is not paper, he is right but this is no proof against application of the method. Human skin is not paper of course, but it is pliable material with blood supply. The former property — the pliability — increases



Drawing 3



Drawing 4

to a certain extent our possibilities as compared with the model or calculation. The latter property — the blood supply — limits us somewhat or forces us at least to be careful. It is interesting that these properties in their degree often go against each other. The skin on the hairy part of the head for example, is not very pliable — the shift is only as exactly possible as it was measured, but the blood supply is perfect and need not be considered at all. On the



Fig. 7. F. M., man aged 46, with invasive basiloma on left cheek. — Fig. 8. Two days after operation. — Fig. 9. Three years after operation.

dorsum of the hand, the skin is of maximum pliability, but the predominantly longitudinal orientation of the blood supply limits our possibilities due to the danger of necrosis of the flap points.

#### Practical application

1. The drawing demonstrates four possibilities how to cover the rhomb defect by the described method. (Drawing 2.)

This affords us the possibility to apply the method which is the most expedient in respect of local pliability of the material, blood supply and hair cover. (Figs. 1, 2, 3. Figs. 4, 5, 6.)

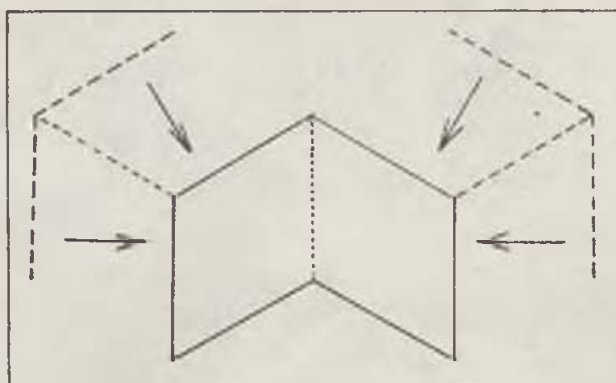
2.a) The defect of approximate rhomboid form of sides 1:2 is actually formed by placing two previously mentioned rhombs next to each other. From this also results the possibility of cover. (Drawing 4.)



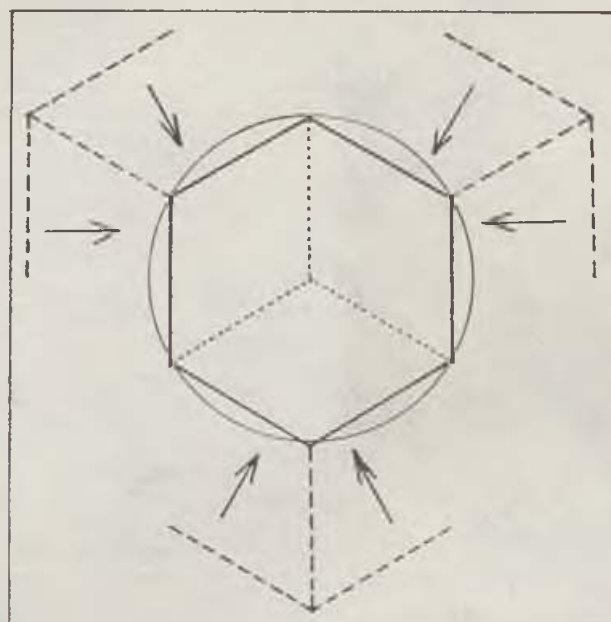


The drawings demonstrate that the possible incisions and rotations and their combinations increase. Only some combinations are applicable in practice. (Figs. 7, 8, 9.)

b) Defect in the shape of two rhombs placed next to each other in mirror pattern. (Drawing 5.)



Drawing 5



Drawing 6

We have not seen so far cover of defects of this shape, but according to our experiences this is possible to perform symmetrically as well as asymmetrically. (Figs. 10, 1, 12. Figs. 13, 14, 15.)

3. By placing three rhombs next to each other, a hexagon is formed which differs only little by its shape and the area is only negligibly smaller than the circle drawn with the same radius. As every surgeon knows, it is a very difficult problem to cover a circular defect. Just here it is that according to our experiences cover by means of Limberg's flap has proved most satisfactory. The situation is again much better demonstrated by a drawing. (Drawing 6.)





Fig. 10. M. J., woman aged 73, with three foci of recurrent cylindrocellular basilaroma in tough and adherent scar of bad quality three years after primary operation. — Fig. 11. Two days after operation. — Fig. 12. Three years after operation.

It is theoretically possible to form, elevate and rotate flaps in different directions, but we have found it best in practice, to orientate all three flaps in one direction, to rotate them by suture and to close the defect similarly as the diaphragm is closed in a camera. (Drawing 7.)

This method has proved to be excellent in excision of circular affections on soft integuments of the calva. In addition, in the hairy part, the cosmetic results too are absolutely perfect. (Figs. 16, 17, 18. Figs. 18, 20, 21.)



Fig. 13. V. V., man aged 74, with recurrent solid basilioma in adherent scar after two preceding operations. — Fig. 14. Condition after conclusion of operation. — Fig. 15. Condition two weeks (!) after operation.

#### Practical remarks from our own experiences:

1. After suture in the corners, suture of the wound edges is simple, because the sides are always of equal length. This is the main reason why we excise a hexagon instead of a circle, although this too is possible.
2. In circular defect and rotation of the three flaps, we do not suture their vertices. By suture of the corners and sides they become approximated by themselves.
3. In the region of the well supplied soft integuments of the calva we only ligate the largest vessels, the rest of bleeding is stopped by suture in one layer.
4. We do not pay any attention and do not correct dog ears. They disappear within 24—48 hours.
5. In defects in infected tissue (ulcerated tumors) we always introduce glove drains conducted through the eccentric ends of sutures for one or two days, into non-infected tissue for a period depending on the extent of elevation and upon the way bleeding had been controlled.





Fig. 16. M. C., woman aged 64, with recurrent solid basiloma on left side of forehead and smaller foci of superficial basiloma in neighborhood. — Fig. 17. Condition during operation after excision of tumours and incisions made for formation of skin flaps. — Fig. 18. Three years after operation.

6. We remove the dressing after 2 to 3 days and do not cover the wound any more, the stitches are removed after 1 to 2 weeks.

7. We apply this method on the calva safely on sites where the skull has been also stripped of the periosteum.

8. It has never caused us any complication if the operation was performed in out-patients or if major performances were carried out at early discharge from hospital.

9. None of our patients was dissatisfied with the cosmetic effect or at least never told us. The reason was perhaps that the fresh free-skin grafts which they might have possibly seen in the out-patients ward or at the hospital department, look much worse.

10. For coverage with one flap we use the term "simple" Limberg, for two flaps it is the "double" Limberg, for three flaps it is the "triple" Limberg. This terminology also referred to in the references (1) has proved satisfactory due to its brevity and simplicity.



Fig. 19. F. Z., man aged 68, with mixed type of cylindrocellular and solid basiloма. — Fig. 20. Condition after conclusion of operation. — Fig. 21. Three months after operation.

### Complications

1. We never met with bleeding which would require a new operation.

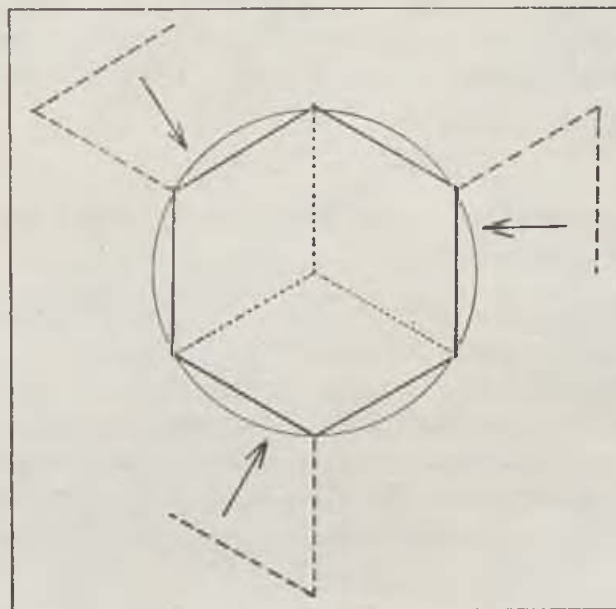
2. We saw infection in form of reddening after excision of infected tumours chiefly on sites where the skin has multiple sebaceous glands. In the majority of cases the reddening receded. Twice an abscess formed, one healed as if no putrefaction had taken place after drainage and re-introduction of drains, in the second one (a hexagon) the centre healed normally, in the corners of all three angular sutures small dehiscences formed and healed spontaneously by epithelization.

3. Necrosis of vertices and edges: rather exceptionally we saw even at large tension of the suture, small necroses of the tips of vertices, which healed by spontaneous epithelization under a small scab without dressing. On the head



this was really rare and the cosmetic results were always excellent. Once (on the dorsum of the hand) the entire flaps were livid for several days, but the condition normalized. We never encountered necrosis or dehiscence requiring a graft.

4. Recurrences: we have not observed local recurrence as yet, no conclusions may be drawn from it, however, because the number of patients has been small and only a short time has elapsed since operation of some of them.



Drawing 7

#### CONCLUSION

We operated altogether on 30 patients, 24 of these for different types of basaloma, 3 for spinocellular carcinoma, 2 for malignant melanoma and one for blue naevus. We have five years of experience with this method and consider it to be a contribution chiefly due to the brevity of treatment, the negligible percentage of complications and the good cosmetic effect.

H. S.

#### SUMMARY

After considering the possibilities of covering some local defects by a geometrical method, the essence of the flap as recommended by A. Limberg for rhomboid defects is explained. The various possibilities of coverage using one, two and three flaps of this type are referred to on hand of theoretical drawings and case photographs. The author also reports on his own experience, makes practical remarks and refers to possible complications. Finally he gives his recommendations for suitable cases.

## RÉSUMÉ

### Couverture des défauts de surface sur la base du principe de lambeau de Limberg

J. Rus

Après avoir considéré la possibilité de traiter certains défauts par le mode géométrique on a expliqué le principe de lambeau proposé par A. Limberg qui est destiné à la couverture du défaut en forme rhombique. Puis, on présente — sur les dessins par la voie théorique et pratiquement par la photodocumentation — les possibilités de couvrir les défauts d'un, deux ou trois lambeaux de ce type. Ensuite, on cite des notes pratiques provenant de propre expérience et les complications possibles de cette méthode avec la recommandation de celle-ci dans les cas favorables.

## ZUSAMMENFASSUNG

### Deckung von Flächendefekten nach dem Prinzip des Limbergschen Lappens

J. Rus

Nach einer Betrachtung der möglichen geometrischen Lösung einiger örtlicher Defekte wird das Prinzip des von A. Limberg vorgeschlagenen Lappens zur Deckung des rhombischen Defekts erörtert. Ferner zeigt man theoretisch an Zeichnungen und praktisch an der Photodokumentation die Möglichkeiten der Deckung mit einem, zwei und drei Lappen dieses Typs. Abschliessend werden aus eigenen Erfahrungen praktische Bemerkungen vorgelegt und Komplikation der Methode sowie auch Fälle beschrieben, in welchen die Methode zu empfehlen ist.

## RESUMEN

### Cobertura de defectos de superficie basado en el principio del lóbulo de Limberg

J. Rus

Después de haber considerado las posibilidades de tratar algunos defectos locales de manera geométrica fue explicado el principio propuesto por A. Limberg para cubrir un defecto en forma romboidal. Después fueron presentadas las posibilidades de cubrirlos con uno, dos y tres lóbulos de este tipo teóricamente en diseños y prácticamente en la fotodocumentación. Después fueron presentadas observaciones de experiencia propia y complicaciones posibles del método con recomendación del mismo en casos convenientes.

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## STANDARD NON-CONTACT BURN (Vascular Changes)

J. ŠMAHEL

In 1972 Prouza, Moserová et Janeček described a new model of standard non-contact burn in rat and the method of measuring subcutaneous temperature. In a further paper (Moserová et Prouza, 1973) the authors carried out a detailed study of the dynamics of subcutaneous temperatures during thermal injury. The present paper deals with the vascular changes in this non-contact burn. The main object of the study was to compare the vascular processes taking place in the burned skin with those found when studying the revascularization of a skin wound in rat (Šmahel et Charvát, 1968; Šmahel et al., 1973).

### MATERIAL AND METHOD

A total of 81 male rats [Wistar, Menzo] of 200 to 250 g. in weight was used for the experiments. The experimental conditions and inflicting of burns by plasmatron was the same as in previous studies (Prouza et al., 1972). On exposure lasting 1 sec., the skin of the animal's back was burned over an area of 20 cm<sup>2</sup>. Examination of the burn and its vicinity was carried out at intervals of 1 to 50 days after exposure. In the animals to be investigated, the vascular system was filled with a mixture of gelatine and Indian ink by the technique described in previous papers (Šmahel et al., 1973). The burned area, including the undamaged skin surrounding it, was excised down to the dorsal fascia, fixed in Carnoy fluid and clarified in glycerin. The total specimens were examined under the stereomicroscope. After appraisal of the changes in vessels, parts were excised from these specimens and frozen and histological sections were cut. The frozen sections, 30 to 90  $\mu$  thick, were stained with haematoxylin-eosin (HE). The histological sections, 8  $\mu$  thick, were stained with HE and haematoxylin-eosin-saffron (HES).

### RESULTS

In the total specimens excised on the first day after exposure, the vessels in the undamaged skin surrounding the burn are filled with the injected mass and show a pattern typical of the arrangement of vessels in the skin of rat



(Fig. 1a). A few millimeters from the margin of burned skin filling of the vessels suddenly ceases. The following zone, 5 to 10 mm wide, shows vessels of a bright red colour (Fig. 1b). In the thickest vascular trunks, arteries by their course, an admixture of the injected mass can occasionally be seen. A similar zone, even if much narrower, is also found in the depth of the burned skin. Towards the centre of the burn only occasional thick vessels or no vessels at all can be found (Fig. 1c). In the histological slides of undamaged skin (zone 1a), prepared at the same time intervals, the vessels are filled with Indian ink in all layers. In the „red“ zone (1b), the injected mass is first missing in superficial vessels, then also in deep vessels and in the lumina sludged blood can be seen. On the border between the dermis and the skin muscle and under it, there is a difference between arteries and veins (Fig. 2). The arteries are contracted and contain a small number of agglutinated erythrocytes or are empty. The veins are enormously dilated and completely occluded with sludged blood. At the same levels the veins are more affected than the arteries. In the coagulation zone (1c), the minute vessels show agglutinated walls and resemble structures without a lumen. The larger vessels are filled with coagulated blood.

The second or third day after exposure the injected mass penetrates to the edge of the burn and the zone characterized by red content of vessels has grown narrower. Now it is conspicuous by its diffuse pink discoloration. In this zone the veins and arteries are markedly dilated. The lumina of most vessels are filled with a pinkish substance in which shadows of erythrocytes can be seen, sometimes however only a fibrin network with clusters of leucocytes (Fig. 3). In some vessels the endothelial and muscle cells have become detached and fill the lumen together with the fibrin (Fig. 4). Occasionally in this zone the injected mass has penetrated into arteries and to a small extent even into the veins (Fig. 5). In the zone of coagulation necrosis, the vessels present clusters of necrotic cells which have lost their typical arrangement. In the suprafascial connective tissue under the undamaged skin regeneration of vessels has started. The capillaries are dilated and show an undulated course. Loops and blind sprouts develop, which by linking with one another form an arcaded vascular network.

In the following days of the first week after exposure, the zone with red content of vessels has again grown narrower. The injected mass has, in places, penetrated into vessels under the coagulation necrosis. The vessels of the „red zone“ show different changes. In some of them disintegration of the wall has continued, in others mural thrombi and partial recanalization of the lumina can be seen (Fig. 6). Some of the vessels of this zone already contain free erythrocytes. The arcaded network which has developed in the subfascial connective tissue of the perivulneral zone has grown wider. Around the burn, the capillaries have grown a large number of sprouts and these begin transformation into vascular trees (Fig. 7).

In the second week after exposure the changes in vessels correspond to the evident morphological demarcation between surviving and necrotic tissues.

In the tissues surrounding the necrosis the vessels are patent and contain free erythrocytes or have well been filled with the injected mass. The zone with the typical red content of vessels has disappeared. In the region of necrosis the vessels disintegrated to an advanced stage. Processes of regeneration in vessels have acquired predominance over those of regression. Regeneration of vessels shows differences depending on the depth of necrosis. In the peripheral region of the burn where only skin was damaged, regeneration starts from the vascular bed of the skin muscle. On its surface vascular trees have developed quite regularly. When the entire skin including the skin muscle was lost, typical of the burn centre, the vascular trees invade the necrotic part from the subfascial connective tissue under the skin muscle. It is typical of this regeneration that it proceeds from the periphery towards the centre.

With the beginning of the third week after exposure the processes of regeneration completely dominate in the changes observed in vessels. The vascular trees which have developed on the surface of the skin muscle link up with the invading vascular trees originating from the subfascial connective tissue. At the base of the defect a dense capillary network has developed. In the following days the capillaries penetrate towards the skin surface and, at the same time, devascularization takes place in the deeper layers of granulation tissue.

In the fourth or fifth week after exposure the capillary network has reached the level of the surrounding skin. Observation was terminated by the 50th day after exposure. The defect was but a fraction of the original size by that date. The number of vessels in the tissue filling the defect depended on epithelization. When epithelization was complete the reduction of the number of vessels was conspicuous, yet they were more numerous at the residual granulating areas.

#### DISCUSSION

The results achieved may be divided into three groups or localized into three zones of the burned skin.

1. Zone into the vessels of which the injected mass has never penetrated, which histologically corresponds to the zone of coagulation necrosis. The coagulation necrosis had the shape of a bowl. At the centre of the burn it reached down to the skin muscle and even determined the curvature of the other layers. The vessels of this zone proved irreversibly occluded.

2. The intermediary ring-like zone in which the vessels were at first occluded by sludged blood yet later the injected mass penetrated into them to a varying extent. This zone was typical of the damage to skin by thermal source and is usually termed as the zone of stasis. The morphological changes described in the vascular bed, which in some vessels led to recanalization and in others to their disintegration, were in accordance with the observations of other authors (Order et al., 1965, Berlin, 1966). The fate of the zone of stasis determined the final degree of skin loss; the pathophysiology of this zone was studied by a number of authors (Sevitt, 1949; Robb, 1967; Birch et al., 1968; Order et al., 1965 and many others). In the total specimens of



the first day after exposure, this zone clearly showed as a red ring of several millimetres thickness enveloping the zone of coagulation necrosis. In the further course, this zone grew narrower and in the second week had become almost imperceptible. At this stage it was only possible to distinguish the zone in which the vessels had completely filled with the injected mass from the zone with vessels which were definitely occluded. In the histological slides a distinct demarcation rim marked the border between these two zones, separating the necrotic from the surviving tissues. The sharp border between the perivulneral skin in which the vessels were well filled with Indian ink and the burned area with vessels filled with coagulated blood has also been described by Hughes et Dann (1941) who, however, never mentioned the red zone. In his histochemical investigation (1965), Converse et al. observed a "red band" in burned skin which they interpreted as the line of demarcation between reparable and irreparable damage to tissues.

3. The border between the zone of skin where vessels initially had been filled with the injected mass, copied in its course the bowl shape of the coagulation necrosis, i. e. it ran from the epidermis on the periphery of the burn down to below the skin muscle in the centre of the defect. From this zone the regeneration of vessels and the reparative process took their origin. Regeneration of vessels, in principle, proceeded in the same way as described in the healing of a skin defect due to excision (Hughes et Dann, 1941; Šmahel et Charvát, 1963). Comparison of the time data ascertained in the present study and also in papers of other authors (Hughes et Dann, 1941; Order et al., 1965) shows that regeneration of vessel is retarded by one or two weeks in thermal damage of skin. Another peculiarity of vascular processes in the burn wound was a combination of two types of healing, caused by the difference in the histological composition of the healing area: In the peripheral parts of burned skin regeneration proceeded as in a suprapannicular defect, i. e. the vascular trees developed on the surface of the skin muscle (Šmahel et al., 1973). In the central parts, where the skin muscle had undergone necrosis, regeneration proceeded in a way typical of a subpannicular defect. The vascular trees developed in the suprafascial connective tissue at the periphery of the defect and grew towards its centre (Hughes et Dann, 1941; Šmahel et Charvát, 1963). The combination of the two modes of revascularization in burned skin was also demonstrated by Birch et al. (1968).

B. K.

#### SUMMARY

The vascular changes in a non-contact burn of the skin of rat were described as they developed during seven weeks after exposure. These changes were divided into three groups in respect to the typical zones in burned skin (zone of coagulation necrosis, of stasis and of undamaged peripheral tissue). Regeneration of vessels proceeded, in principle, in the same way as that in a skin defect after excision, but was retarded. The different histological composition of the healing area which was given by the shape of the necrotic part, was the cause of differences in the regeneration of blood vessels.



## RÉSUMÉ

### Brûlures standards n'étant pas de contact. Constatations vasculaires

J. Šmahel

On a décrit des constatations vasculaires en cas d'une brûlure n'étant pas de contact de la peau d'une rate pendant 7 semaines après l'exposition. On les a partagées en trois groupes selon le rapport avec les zones caractéristiques de la peau brûlée (zone de la nécrose coagulatrice, de la stase et du tissu périphérique non endommagé). Les actions de régénération se passaient en général d'une même manière que dans les cas du défaut cutané dus à l'excision, mais ils paraissaient en retard. C'était une structure histologique différente de la surface guérissant, causée par la nécrose de forme de cuvette, qui était à l'origine des différences existant au cours des actions régénératrices de vaisseaux.

## ZUSAMMENFASSUNG

### Kontaktlose Standardverbrennung. Gefässbefunde

J. Šmahel

Es wurden die Gefässbefunde bei kontaktloser Verbrennung der Haut von Ratten im Verlauf von sieben Wochen nach der Exposition beschrieben. Die Gefässbefunde wurden in drei Gruppen nach den charakteristischen Zonen der verbrannten Haut eingeteilt (Zone der Koagulationsnekrose, Stase und des unbeschädigten peripheren Gewebes). Die Gefässregenerationsprozesse verliefen im wesentlichen in gleicher Weise, wie bei einem durch Excision entstandenen Hautdefekt, nur zeitlich verspätet. Die unterschiedliche histologische Struktur der heilenden Fläche, gegeben durch die tellerförmige Form der Nekrose, war die Ursache der Unterschiede im Ablauf der Gefässregenerationsprozesse.

## RESUMEN

### Quemadura standard causada por contacto. Hallazgos vasculares

J. Šmahel

Fueron descritos hallazgos vasculares en una quemadura de la piel de rata no causada por contacto durante 7 semanas después de la exposición. Los hallazgos vasculares fueron divididos en tres grupos en relación con las zonas características de la piel quemada (la zona de necrosis de coagulación, estasis y tejidos periféricos no heridos). Las acciones vasculares regenerativas transcurrían en general de la misma manera como en un defecto cutáneo debido a una escisión, pero aparecían con atraso. Era la distinta composición histológica del área en curación dada por la diferencia en el transcurso de las acciones vasculares regenerativas.

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## TO THE TECHNIQUE OF EXCISION OF SURPLUS SKIN IN EYELIDS OF AGING FACE

I. A. FRISHBERG

At present the complex treatment of an aging face can rarely avoid operating in the region of the eyelids, where due to the constant movements of facial muscles and the mobility of the thin skin, very early and frequently folds and wrinkles develop. The surgical treatment of this cosmetic shortcoming usually consists in excision of the surplus of soft tissues in the eyelids, carried out by one or the other method and approach. Here a better cosmetic result is achieved by removal of fatty herniae in the eyelids and transposition of the temporal canthus out- and upwards (Gonzalez-Ulloa et Stevens, 1961; Frishberg, 1969; Lewis, 1969).

The technique of this operation which is basically uncomplicated can be mastered by a surgeon-cosmetologist with even little experience, but it still has its finesses and details, the neglect of which may bring about typical complications in the region of the eyelids, such as ectropion of the lower lid and temporal epicanthus.

The author set himself the task to report on his experience with the removal of skin surplus in aging eyelids on the basis of a surgical technique which he employed on more than 500 patients over almost ten years. It has shown that the success of the operation to a great extent depends on correct planning of the operation, thoroughness of the execution of technical steps, a sparing attitude to the tissues, and employment of a complex of technical and remedial measures during the postoperative period.

### PLANNING OF OPERATION

Since the object of the operation is to remove the skin surplus, its correct and complete determination becomes the main indication for the operation. The eyelids, as is known, represent structures with a free and mobile edge which is constantly moving. This leads to the skin cover being moved about and constantly more or less taut or shrunken. This is the reason why the



indisputable rule of determining the skin surplus of eyelids consists of measuring it in a position when the skin is taut to the maximum. For the upper lid the position is that during calm closure of eyelids, for the lower lid when looking upwards. The absence of skin folds in the respective eyelids is a contraindication for operation.

Efficacy of the treatment greatly depends on the texture and condition of the skin of eyelids. Thin skin which leaves the contours of the orbital region visible after transposition is preferable for operation. Less plastic and thick skin without these properties can smooth out the surface relief after operation and may give the face the appearance of a mask.

Rather conspicuous postoperative scars develop on thick and glossy skin of eyelids, particularly in the presence of deep furrows which at some stage can only be removed by mechanical or chemical dermabrasion.

#### PARTICULARS OF SURGICAL TECHNIQUE

In the upper eyelid the surplus of skin is determined with the patient in a sitting position, because the weight most fully acts upon the skin folds in this position. The lower border of the fold is marked with paint in the depth of the furrow and then the upper border by using a forceps with which the fold is apprehended. It should be said that on the nasal side one should not come too near the canthus and the slope of the nose, which due to subsequent scarring may lead to the development of a conspicuous fold resembling an epicanthus.

Based on his experience the author arrived at the conclusion that one need not be afraid to plan and carry out the incision on the upper eyelid beyond the limit of the orbital region. The very distribution of the skin surplus in that region (i.e. being more conspicuous in the lateral parts of eyelids) makes it necessary to widen the limits of the skin excision towards the temporal canthus.

The author carried out excision not only of skin of the upper eyelids, but also of parts of the circular muscle, the submuscular tissue and the orbital fat

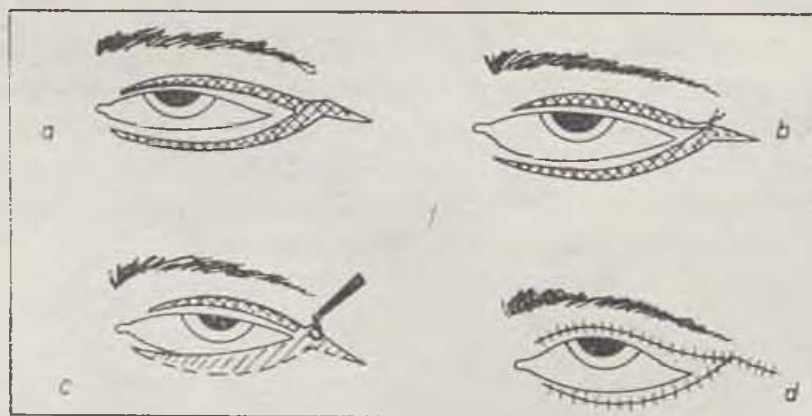


Diagram of different stages of operation in region of eyelids: a — skin incisions; b — triangle of skin at temporal canthus transposed up- and outwards; c — skin of lower eyelid spread out and limits of skin surplus to be excised marked; d — general view after complete suture of wounds.

as far as it herniated into the operation wound, in most cases where the tissues were markedly overhanging. Thus, as was shown by later observation, it was possible to achieve a better appearance of the eyelids.

Excision of skin lateral of the folds of the upper eyelid is rather dangerous, because in the region of the lower lid the eyelash margin may be pulled downwards or some displacement of the eyebrow downwards may occur.

In the region of the lower eyelids, 2 or 3 mm away of the eyelash margin, an incision is made through skin parallel to that margin. The continuation of the incision depends on the direction of skin tension, as a result of which it always becomes necessary to excise surplus tissue at the temporal canthus in the shape of a triangle. Thus the incision represents a line in the shape of a triangle. Thus the incision represents a line in the eyelid, which sharply turns downwards at an angle of  $135^{\circ}$  near the temporal canthus. It should be said that at the point where the skin incision bends, unfavourable conditions are created for the healing of the wound. Neglecting the fact that the lower eyelid shrinks more and is heavier than the upper lid, leads to the latter being easily displaced downwards, i.e. epicanthus develops. However, it is practically impossible to harmonize and account for these forces of tension. Making the skin incision in a lower position is undesirable because of the postoperative scar occupying a less favourable site from a cosmetic point of view.

The recommendation of Gonzales-Ulloa (1961) to form triangles at the temporal canthus by suturing them in an upward and lateral direction, which this author made with initial enthusiasm, later proved disappointing, because in a large number of cases it led to the development of hypertrophic scars (Rees et Wood-Smith, 1973) and the line of the skin incision did not permit to give the skin of the lower eyelid the correct tension.

Accepting the formation of triangles at the temporal canthus from the Gonzales-Ulloa method, the author supplemented the technique by a number of measures permitting to forego the shortcomings referred to above. This was in the first place mobilization of the thus formed triangle and its free transposition (without tension!) up- and outwards. This made it possible to better utilize the plastic properties of the skin and create more favourable conditions for healing. It should be added that the author has not observed hypertrophic or keloid scars in his patients.

The other measure differing from the method of Gonzalez-Ulloa was an additional skin incision running from the top of the skin triangle either in a more or less horizontal or somewhat slanting direction [which is determined by the amount of the skin surplus in the lower eyelid when taut (see picture)].

Excision of skin surplus of the lower eyelid represents the chief stage of the operation; prevention of ectropion depends on the thoroughness with which this part of the operation is carried out. With regard to this, the author takes great pain in 1) wide mobilization of skin of the lower eyelid down to the lower orbital fold, which frees the skin from the movements of muscles and gives full play to its plastic properties; 2. good lay-out of the skin of the lower eyelid after its mobilization up- and outwards (without tension!); 3. ex-

cision of surplus skin only after fixation by suture of the skin triangle, because its transposition upwards increases the gap between wound edges. If the tissue defect cannot be filled with the surplus skin of the lower eyelid, the skin triangle should be sutured in a lower position.

It should be added that the limit of skin excision in the lower eyelid is given by the line of the skin incision, but excision itself is carried out while the eye is looking upwards, which ensures the uppermost position of the lower eyelid.

Finally, a special part in the achievement of a good result is played by the suture technique and a number of prophylactic measures. According to the author's opinion, an outer uninterrupted suture with fine synthetic monofil material (kapron, nylon, supramid, etc.) is biologically inert, less traumatizing the wound edges and easier removed than knotted silk sutures. He recommends to take the stitches out after three days, because later the suture canal is invaded by epithelium, which leads to development of epithelized canals and cysts.

After several months, the surgeon must carefully examine the condition of the scars. If they show any sign of thickening, corticosteroid ointment or creme, injection of nonspecific biological preparations (hyaloid, aloe) or lidase, massage, soft X-ray (or Bucky ray) irradiation, etc. are indicated.

The experience over several years with operations in the region of the eyelids has shown that strict observation of the rules of surgical technique and the understanding of the mechanism of all manipulations carried out bring about highly satisfactory results and make wide-scale application of these operations in facio-maxillary surgery, ophthalmology and cosmetic surgery possible.

B. K.

#### SUMMARY

When excising the skin surplus in the eyelids of an aging face, i.e. when carrying out a cosmetic blepharoplasty, the result of the treatment depends on correct determination of this surplus and a rational surgical technique based on the knowledge of the mechanism of the manipulations carried out. The recommended formation of a triangular skin flap at the temporal canthus, its mobilization and transposition to a higher position as well as an additional angular incision for the correct lay-out of the skin make it possible to utilize to the full the plastic properties of skin and prevent development of an eyelid ectropion, epicanthus and ugly postoperative scars.

#### RÉSUMÉ

#### **Sur la technique de l'excision de la peau excédente dans la région des paupières d'une face vieillissant**

I. A. Frichberg

En faisant une excision de la peau excédente dans la région des paupières d'une face vieillissant, c'est-à-dire en cas d'une blepharoplastie cosmétique, les résultats du traitement dépendent de la détermination parfaite de cet excès et de la technique opératoire rationnelle. On recommande l'incision du lambeau cutané triangulaire chez



les angles externes des yeux, sa mobilisation et le déplacement dans une position plus haute et même une excision angulaire supplémentaire dont le but est de réprendre la peau d'une manière correcte. Ca permet d'utiliser, pour le mieux, les qualités plastiques de la peau en prevenant l'ectropie des paupières, l'épicanthus et les cicatrices post-opératoires vilaines.

#### ZUSAMMENFASSUNG

##### **Zur Technik der Exzision der überflüssigen Haut in der Gegend der Augenlider beim alternden Gesicht**

I. A. Frischberg

Bei der Exzision der überflüssigen Haut in der Gegend der Augenlider bei alterndem Gesicht, d.h. bei kosmetischer Blepharoplastik, sind die Behandlungsergebnisse von der richtigen Bestimmung dieses Überschusses und von der rationellen Operationstechnik abhängig. Die empfohlene Exzision des dreieckförmigen Hautlappens bei den äusseren Augenwinkeln mit seiner Mobilisierung und Verlagerung nach oben, aber auch die ergänzende Winkelexzision zur richtigen Verteilung der Haut gestatten, die plastische Eigenschaft der Haut am besten auszunutzen und dem Ektropium der Augenlider, dem Epikanthus und unansehnlichen postoperativen Narben vorzubeugen.

#### RESUMEN

##### **Sobre la técnica de escisir el exceso de la piel en la región de los párpados en una cara haciéndose vieja**

I. A. Frishberg

En una escisión del exceso de la piel en la región de los párpados en una cara haciéndose vieja, es decir en una blefaroplastia cosmética, los resultados del tratamiento dependen de la determinación correcta del exceso y de una técnica racional de operar. Las escisiones recomendadas de un lóbulo cutáneo triangular en los ángulos exteriores de los ojos con la movilización del mismo y transferencia hacia una posición más elevada, pero también una escisión angular complementaria para disponer la piel correctamente permiten aprovechar a lo mejor las cualidades plásticas de la piel y evitar el ectropión de los párpados, el epicanto y las feas arrugas postoperativas.

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## OPEN TREATMENT OF AVULSION OF SCALP USING A CRUTCHFIELD SKULL CALIPER

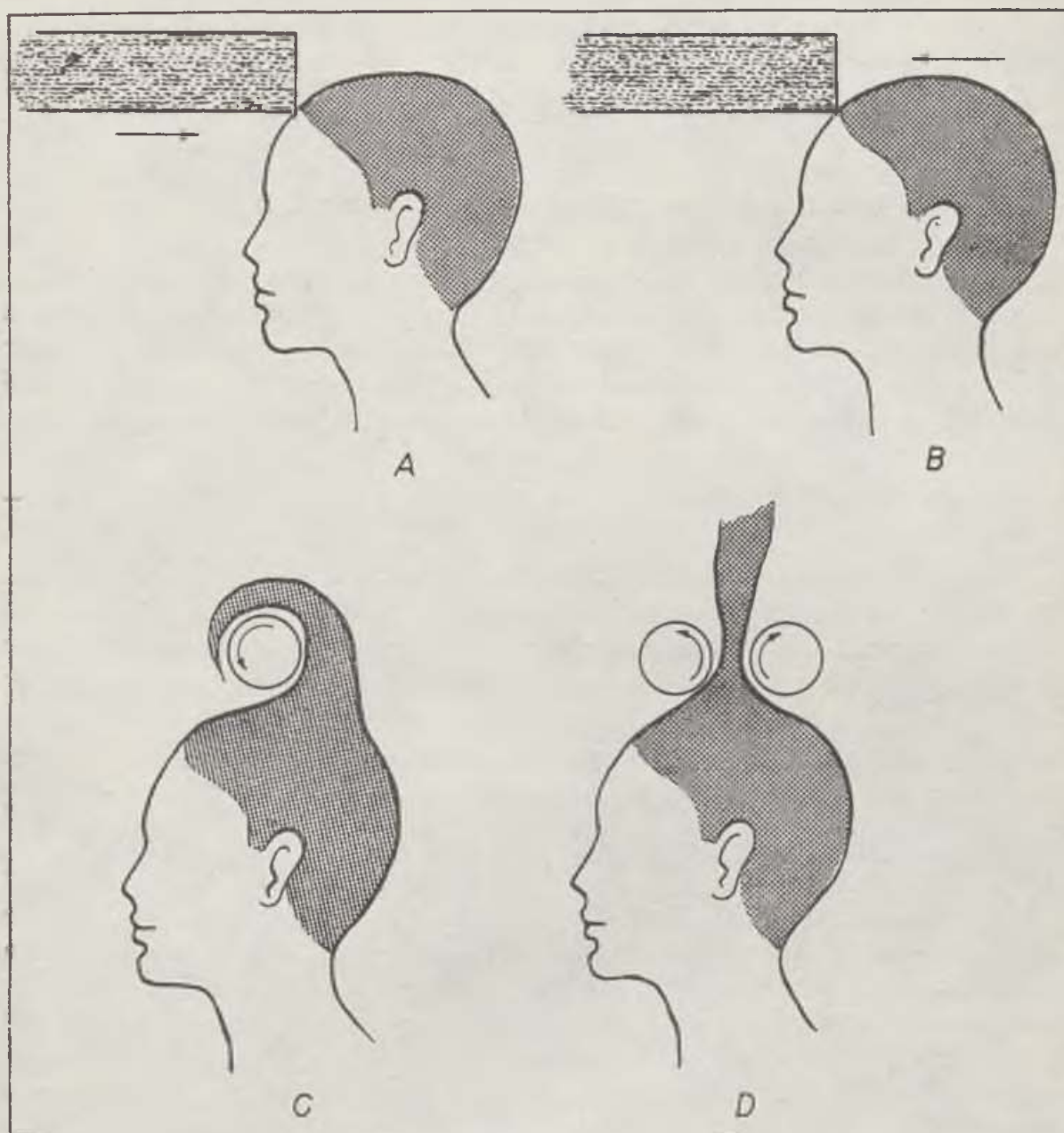
J. RUS

Avulsion of the scalp is a relatively rare injury. Its occurrence is connected with the development of industry, where powerful machines or their parts, shafts or shaft drives revolve in one direction as it is chiefly the case with machine tools. Rather exceptionally some other mechanism is involved — such as in one of our female patients — who was pulled in between rotary rollers. The frequency of this type of injury is definitely related to unprotected long hair and decreases in proportion to strictly complying with explicit safeguards.

### ANATOMY

In avulsion of the scalp the soft integuments of the skull are torn from their base. Some anatomic remarks are required for understanding the mechanism of the injury, the layer of separation and the treatment. The soft integuments of the skull are arranged in a characteristic way. The skin of the head covered with hair is — even after the loss of hair — rather thick and stiff, noncompliant and fragile, with numerous sebaceous glands. The subcutaneous fatty layer with hair bulbs and vessels is densely interspersed by vertically orientated bundles of collagenous fibres which form a very firm connection of the skin with the underlying layer, the galea aponeurotica. This structure is actually the aponeurotic centre of the circular epicranus muscle. This again can be divided into the musculus frontalis with the middle and temporal parts and the musculus occipitalis. Thus the functional mobile unit is jointly formed by the specialized skin with hair follicles, the immobile subcutaneous tissue and the galea with its circular muscle. The layer which affords the motion of this unit over the calva covered by the thin periosteum is the pericranium a readily shifting layer of sparse, fatless connective tissue. The blood supply of the mobile functional unit comes from numerous superficial tortuous vessels, chiefly from the region of the superficial temporal artery and the occipital artery. This system has a few weak links in the layer of the pericranium to the diploic and meningeal vessels, which are the chief vessels supplying the periosteum.

Avulsion of the scalp may be either complete or partial with regard to the size of the area or it may be a complete or partial separation i.e. with the soft integument completely separated from the base or still connected with it by pedicles of various width.



Drawing A, B, C, D

There may be two kinds of mechanisms of avulsion determining superficial or deeper location of the separation:

1. Mechanism of direct impact, which is possible even with short hair or a bald head. (Drawing A, B.)





Impact of the head in almost tangential direction upon an object e.g. a beam etc., or of an object upon the head e.g. an object transported by crane etc., causes perforation of the fragile mobile unit [see above] between the object and the calva and avulsion in direction of the motion, in the loose connective tissue layer of the pericranium. These avulsions are mostly partial as to area and separation and located according to the place of impact with different, mostly very broad pedicles. The treatment is rather easy thanks to the rich blood supply by superficial vessels and is carried out by simply suturing the avulsed flap into its place and inserting rubber glove drains after having cleaned the base of the wound.

## 2. Mechanism by coiling or pulling in hair. (Drawing C. D.)

In this mechanism the mobile functional unit is torn at the site of least resistance and this is some place of the muscular part of the epicranium muscle either in front or at the back. The scalp is mostly completely avulsed from the base, most frequently in its entirety, often including the forehead. Only rarely is the avulsion partial to the hair-style (as with one of our female patients) and it is very rare indeed that the hair is merely torn out when a smaller tress of hair was caught.

## TREATMENT

First the bleeding must be stopped and treatment of shock introduced. Shock is by no means unusual with this kind of injury. Further injuries have to be ascertained and treated appropriately, as well as the avulsed area. It is no less important to secure the avulsed scalp and to deposit it in an ice-box for further use.

Only after all this has been done is it possible to go ahead with the plastic procedure, which as the actual subject of this communication.

## PRELIMINARY CONSIDERATIONS

The surgeon is being faced with a defect of the soft integument of the skull in which the vital, often contaminated periosteum may be abraded from the calva at some places. (Fig. 1.) The area to be repaired is approximately a segment of a globular surface. Consideration is given to coverage by open or closed methods of autografting and utilization of grafts from the scalp of various thickness if it is at disposal, or from some other part of the body if possible.

After good results with dermoepidermal autografts by the open method were generally achieved, we decided to apply this method. The near-impossibility to fasten the dressing on the spherical surface of the head securely, was an additional reason for deciding in favour of this method. There remains the problem of possibly tearing-off or dislocating the graft due to movements of the head on the headrest, mainly during sleep. We solved this problem by suspending the head with a Crutchfield skull caliper over a pulley with weights attached.

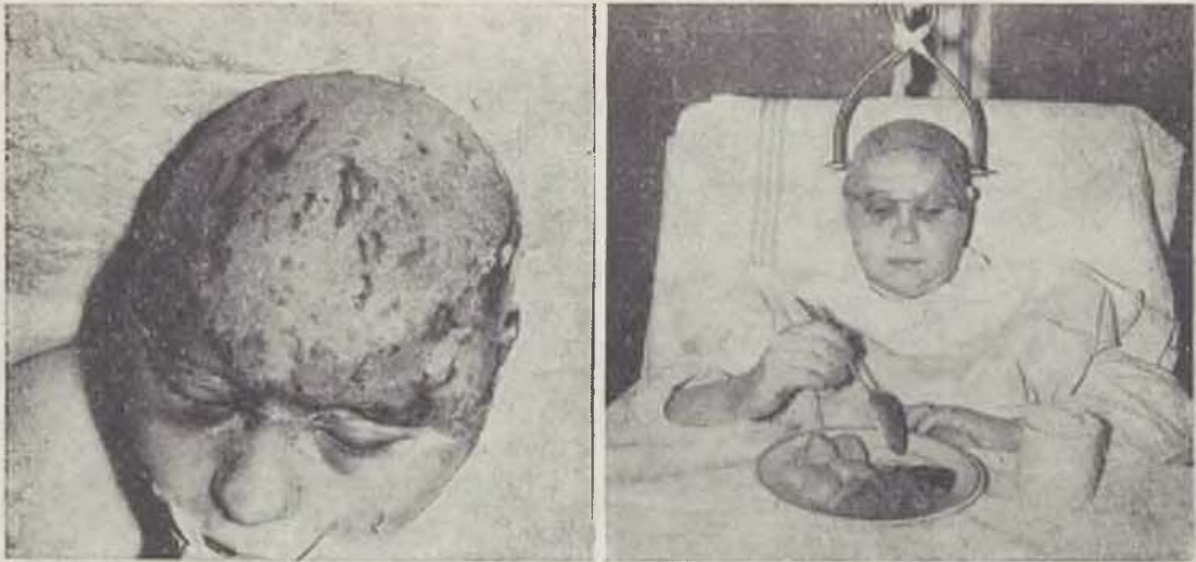


Fig. 1. Avulsion of scalp (patient J. K.). — Fig. 2. Suspension on Crutchfield skull caliper (patient J. K.)

#### METHOD

First we treat the patient after the accident as described above, secure the blood required for the operation and if the scalp was not lost, it is preserved in the ice-box. On the following day during the session the scalp is first inspected. If possible, we use the hairless part — forehead and eyelids — as a full thickness autograft. Only after processing the scalp, we remove by means of a Humby knife, the longest possible dermoepidermal grafts under general anaesthesia, from the thigh. Then we make a burr hole through the outer table of the skull at the farthestmost flanges of the skull and into the trephine openings we insert the prongs of the Crutchfield skull caliper. The patients is then moved from the operating table upon a wheel bedstead.

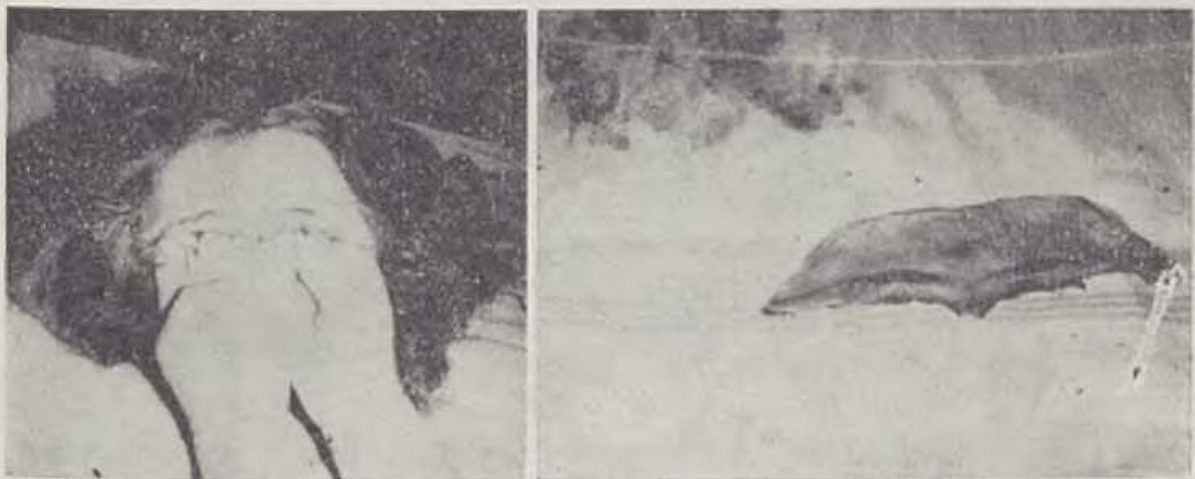


Fig. 3. Scalp (patient V. D.). — Fig. 4. Hairless part of scalp (patient V. D.)

Thereafter we use the grafts of the forehead and the eyelids and suture them exactly into the raw defect from which they were torn off. Then — still under general anaesthesia — the patient is raised into a sitting position and firmly suspended in this position by the Crutchfield skull caliper. To the upper margin of the flap covering the forehead, we suture the two best and longest grafts by their short ends. They are joined together by sparse stitches and then we suture them under light tension to the edges of the intact skin in the occipital region. The remaining lateral defects are also covered by suturing grafts into place under slight tension. This ensures a well fitting adhesion of the grafts on the spherical base of the head. While placing and suturing the grafts, we

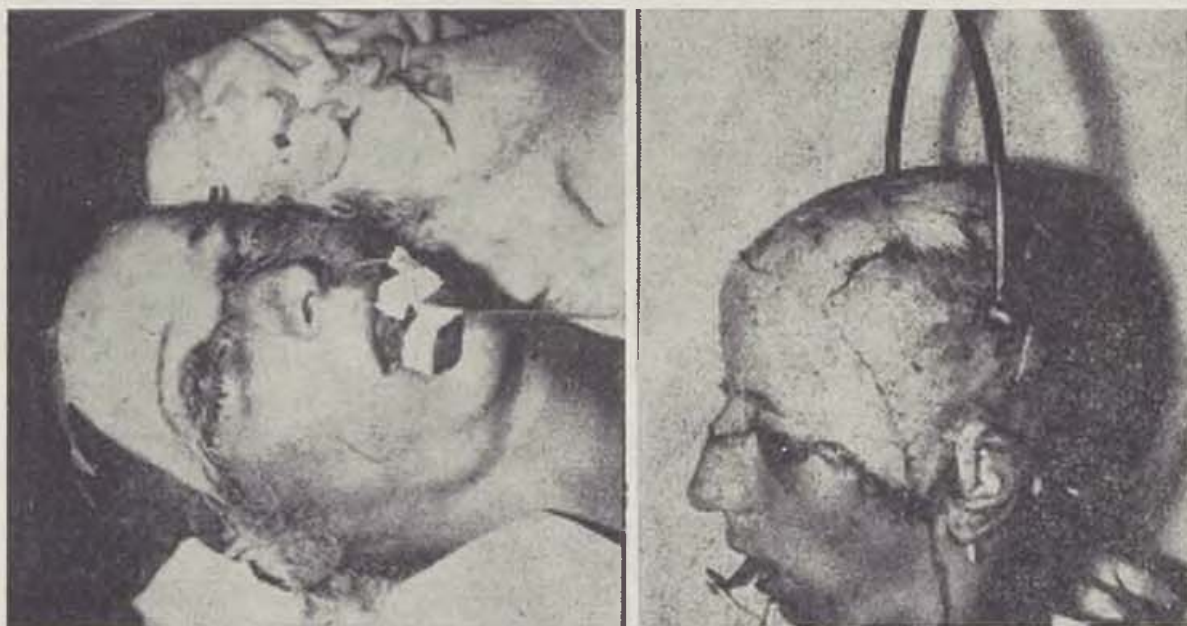


Fig. 5. Hairless part of scalp sutured in place (patient V. D.). — Fig. 6. Condition after suturing all grafts in place (patient V. D.)

endeavour to cover possible defects of the periosteum with a graft of good quality in one piece, but we perforate it above the defect in order to afford drainage to secretions. By squeezing out all air bubbles and approximating the margins of the grafts, the operation is terminated. At the emergence of the patient from anaesthesia the fixed suspension is substituted by the dynamic suspension over weighted pulleys with a load of 3—5 kg. Further treatment does not differ from any open grafting procedure. The removal of wound secretion is performed by roller squeezing, liquid and dried secretions are swabbed from the surrounding skin. Eschars and stitches are later removed together with eventual necrotic parts of the grafts. The first signs of a satisfactory take are noted on the forehead after about 48 hours, by the appearance of pink spots. The livid marbling is gradually spreading until the entire graft shows this sign of viability after about 92 hours. The patients tolerate sus-



pension on the Crutchfield skull caliper very well, it is absolutely painless (Fig. 2). When the device is removed after 14—18 days they are expressing anxiety about possible pains or discomfort and that they would prefer to remain suspended on the pulleys. The burr holes for the prongs heal after their removal within 7—10 days, showing formation of a crust immediately after suspension has been discontinued. Residual defects or defects coinciding with missing periosteum (at the sites of the burr holes) are easily managed at autografting without suspension, even if the open method was applied.



Fig 7. Marbling of forehead as sign of incipient blood supply 48 hrs. after application (patient V. D.). — Fig. 8. Healing nine weeks after accident (patient V. D.)

#### CASE REPORTS

1. V.D., female, aged 21 years. She worked in a machining workshop with uncovered hair and was caught by a turning shaft between two machines. She was thrice turned around the shaft before the scalp was torn off. She was not unconscious but had amnesia for the accident. She was brought to hospital by ambulance in good condition, the scalp was brought along wrapped in a sterile towel. Objective finding: the entire hairy part and the forehead with eyebrows, the root of the nose and the upper eyelids except the skin over the tarsal plates, were scalped. The base was soiled by dirt from the workshop floor and by shavings. There were also small lacerations behind the torn-off auricles. In the parietal region on the right, there was a defect of the periosteum about 7×4 cm in size. BP 110/70, P 92/min. Internal examination: normal findings. Neurological examination: cerebral concussion without focal signs. An i.v. infusion was given on admission, matched blood was ordered and

analgetics and antitetanic serum were administered. Larger bleeding vessels were locally ligated and a moist, compressive bandage applied. The scalp was stored in a refrigerator. After 4 hours, the requested compatible units of citrated blood having been secured, the base of the defect was cleaned of dirt and shavings, the lacerations of the auricles and in the periauricular region were sutured, dermoepidermal grafts were taken by Humby knife from one thigh. The defect on the head was covered with moist compressive dressings. On the next day (26 hours after the accident) we began to cut off and trim

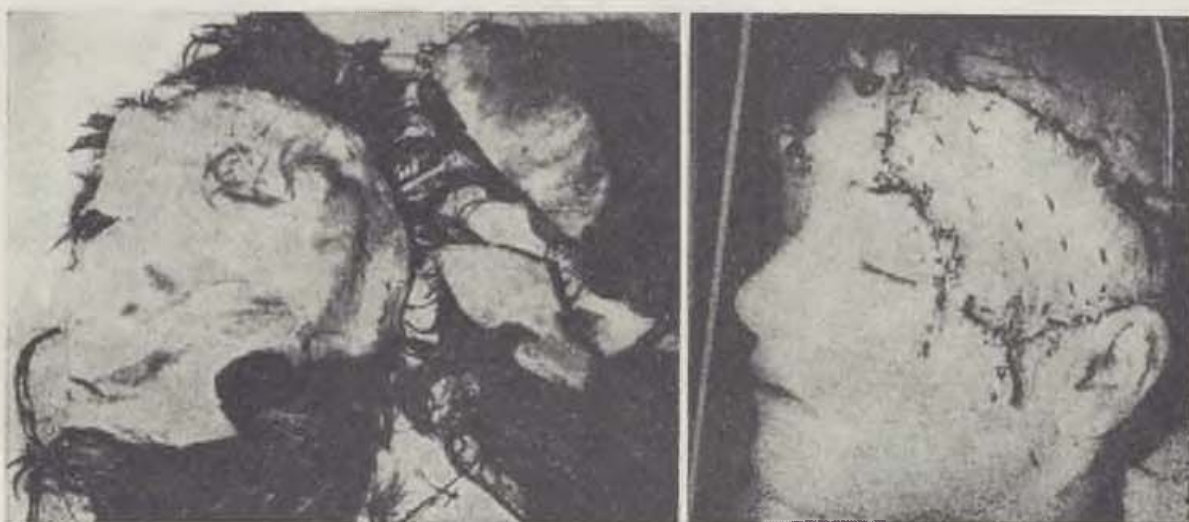


Fig. 9. Bruised and torn scalp (patient A. K.). — Fig. 10. Dermoepidermal grafts sutured in place (patient A. K.)

the hairless part of the scalp (Fig. 3, 4). Then, under general anaesthesia, this full thickness graft was sutured into place (Fig. 5). The Crutchfield skull caliper was inserted into the burr holes and the patient transferred upon a wheel bed on which she was supported in the sitting position by the Crutchfield skull caliper, fixed pull. Dermoepidermal grafts taken in the primary treatment (Fig. 6) were then sutured into the remaining defect in the manner described in the previous part. The head was left without a dressing. After the emergence of the patient the fixed suspension was exchanged by weighted pulleys with 3 kg. The patient tolerated the suspension without the slightest complaints. Treatment was carried out as described above. The graft of the forehead and eyelids started marbling gradually within 48 hours after application (Fig. 7). The full thickness graft showed a complete take, the dermoepidermal grafts took to a large extent, no take, however, occurred over the periosteal defect but it was decreased by the overlapping edges of adjacent grafts.

The caliper was removed after 14 days. After three weeks the dried outer table was drilled and chipped off and the dermoepidermal grafts were placed over small residual defects. After another four weeks the healthy granulations at the site of the periosteal defect could be covered by grafts



and a fortnight later the patient was discharged home from the hospital with a healed wound (Fig. 8).

During the treatment she had received 1,300 ml whole blood but no antibiotics were administered. Treatment till complete healing took 9 weeks.

2. A.K., female, aged 17 years. She worked in a weaving shop with insufficiently covered hair, combed into two tresses. Only one side was caught and completely torn off, the other side suffered only separation from nearly the entire half of the head except a broad pedicle. She was not unconscious



Fig. 11. Condition seven weeks after accident (patient A. K.)

but did not remember the accident and after a few hours she was transported to our department in good condition. After admission, dressings were not changed, only matched blood was ordered. Under general anaesthesia on the next day dermoepidermal grafts were first taken with a humby knife from the thigh and the dressing removed from the head. Objective finding: the soft parts of the left half of the hair bearing part transcending somewhat the mid-line and the greater part of the left half of the forehead were missing. The base was clean on the whole, the defect of the periosteum in the parietal region was about 3×3 cm in size. The scalp brought along in the towel of the patient and stored in the ice-box was useless being badly torn and bruised (Fig. 9). The Crutchfield skull caliper was applied while the patient was in a sitting position on the bed. After the patient woke up the cord was conducted over a pulley with a weight of 4 kg attached to it. The defects were covered by suturing dermoepidermal grafts into place (Fig. 10). A good take was observed with the exception of the site of the periosteal defect but the size of the defect was considerably decreased. Crutchfield's device was removed after 18 days. After 3 weeks a hole was drilled into the outer table at the defect of the periosteum and after a week growing granulations were covered by new grafts. At the same time a defect in the occipital region caused by excision of necrotic parts from the scalp of the opposite side which was not



torn off and only put back into position, was covered by grafts too (Fig. 11). She had received altogether 900 ml of whole blood but no antibiotics.

3. J.K., female aged 35 years. She worked with uncovered hair at a pressing machine for sheet glass. The cold rotating cylinder caught her by the hair and drew the avulsed scalp in between them. She was not unconscious, could remember the accident, but vomitted. After treatment at the surgical department at her home town, she was transported to our department in good condition. Matched blood was requested at once and the scalp — proper sterile



Fig. 12. Condition after grafts sutured in place (patient J. K.). — Fig. 13. Healed after four weeks (patient J. K.)

wrapping disregarded — which was sent with the patient, was stored in an ice box without being inspected. Next day the forehead up to the hairline of the scalp was processed, cleansed and trimmed. Dermoepidermal grafts were taken from one thigh. Objective findings (Fig. 1): defect over the calva and forehead including eyebrows with clean base. The forehead sutured as a full thickness graft into position and Crutchfield skull caliper applied. While the patient was firmly suspended, the remaining defects were covered with grafts from the thigh (Fig. 12). A take to the full extent resulted, forehead graft included. The caliper was removed after two weeks and two weeks later the patient was discharged from hospital cured (Fig. 13). She received 500 ml blood during her stay at our department.

#### CONCLUSION

We consider the above described method of treatment of avulsion of the scalp to be expedient because it represents a painless and comfortable treatment for the patient, rapid achievement of satisfactory results at greatly simplified and easier care.

H. S.

## SUMMARY

A method of treatment of avulsion of scalp in suspension on a Crutchfield skull caliper using autologous skin grafts in an open way is described. The reason which has led the author to use this method and its advantages are considered in detail. The supplement contains the case histories of three patients treated in this way with good results. The skin integument of the skull had completely healed after nine, seven and four weeks respectively.

## RÉSUMÉ

### **Traitement de la tête scalpée par une suspension sur l'agrafe ouverte de Crutchfield**

J. Rus

On présente un nouveau mode du traitement de la tête scalpée à l'aide d'une suspension sur l'agrafe ouverte de Crutchfield simultanément avec une autographe.

On a bien considéré les raisons qui ont mené l'auteur à choisir ce mode-ci, ses avantages y compris. La casuistique du traitement de trois femmes malades ainsi soignées est ajoutée. Elle comporte la durée de guérison de la couverture cutanée au cours de neuf, sept et quatre semaines.

## ZUSAMMENFASSUNG

### **Behandlung der Kopfskalpierung durch Aufhängen auf die Crutchfieldsche Klemme auf offene Weise**

J. Rus

Es wird eine neue Methode zur Behandlung der Kopfskalpierung beschreiben, die auf dem Aufhängen auf die Crutchfieldsche Klemme und der Autotransplantation auf offene Weise beruht. Es werden ausführlich die Gründe und Vorteile erwägt, die den Autor zu diesem Verfahren geführt haben. Abschliessend beschreibt der Autor die Krankengeschichte von drei auf diese Weise behandelten Patientinnen, bei denen vollständige Heilung der Hautdecke nach 9, 7 und 4 Wochen erfolgte.

## RESUMEN

### **Tratamiento de una cabeza escarpada por suspensión en la agrafe abierta de Crutchfield**

J. Rus

Fue presentado un modo nuevo de tratar una cabeza escarpada con ayuda de suspensión de la misma en la agrafe de Crutchfield con trasplante autotópico. Fue bien considerada la razón que había llevado al autor a este modo de tratamiento y sus ventajas. Está adjuntada la casuística del tratamiento de tres mujeres enfermas, y la curación de la cobertura cutánea dentro de 9, 7 y 4 semanas.

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## AN ALTERNATE TECHNIQUE FOR RECONSTRUCTION OF TENDOCALCANEUS

N. I. ELSAHY

The tendocalcaneus is the thickest and strongest tendon in the body. It is the tendon of insertion of both the gastrocnemius and soleus muscles which are the chief plantar flexors of the foot. Loss of this tendon forces the patient to walk on the heel without push off. It also causes great weakness of the power of plantar flexion at the ankle, although some power remains through the action of the tibialis posterior, the peronei, and the toe flexors. (Adams, 1966) If the last two are lost in addition to the tendocalcaneus, the power of plantar flexion almost disappears. The purpose of this paper is to present a patient having had such a problem and the technique used to correct it.

### CASE REPORT

A 50 year old caucasian male was admitted to the Grace General Hospital on October 5, 1972 following an accidental gunshot wound of the back of his right lower leg and ankle.

Debridement was carried out on the same day and a skingraft was applied on October 11, 1972.

I was asked to see the patient October 21, 1972. The wound was infected and had a rather foul smell to it. The skingraft was sloughed and the tendocalcaneus was necrotic (Fig. 1).

A swab for C & S was taken and revealed the presence of *Clostridium Welchii*, *Enterobacter*, and *E. Coli*. All were sensitive to Ampicillin which was given, and on October 25, 1972 he was taken to the operating room.

**First Operation:** (Debridement, split-skingraft coverage and delayed cross-leg flap).

Under general anesthesia, the wound was irrigated, cleansed and the necrotic tissue was debrided. It was clear that the patient had lost the following structures:

The skin, the superficial and deep fascia of the back of the lower leg, the sural nerve, the whole tendocalcaneus, part of the peroneus longus tendon, peroneus brevis muscle, flexor digitorum longus muscle, plantaris tendon and the posterior tibial artery and nerve.



Fragments of bone were detached from the superior and middle portion of the posterior surface of the calcaneus. Complete hemostasis was obtained, the area was covered with a split-thickness skin graft (taken from the right thigh) and a pressure dressing and plaster splin were applied. A flap was raised from the left leg and sutured in place for later use as a cross-leg flap.

**Second Operation: (Cross-leg flap).**

Three weeks later, cross-leg flap was performed. Immobilization was maintained with proximally placed plaster casts, supplemented with distal Steinmann pins.

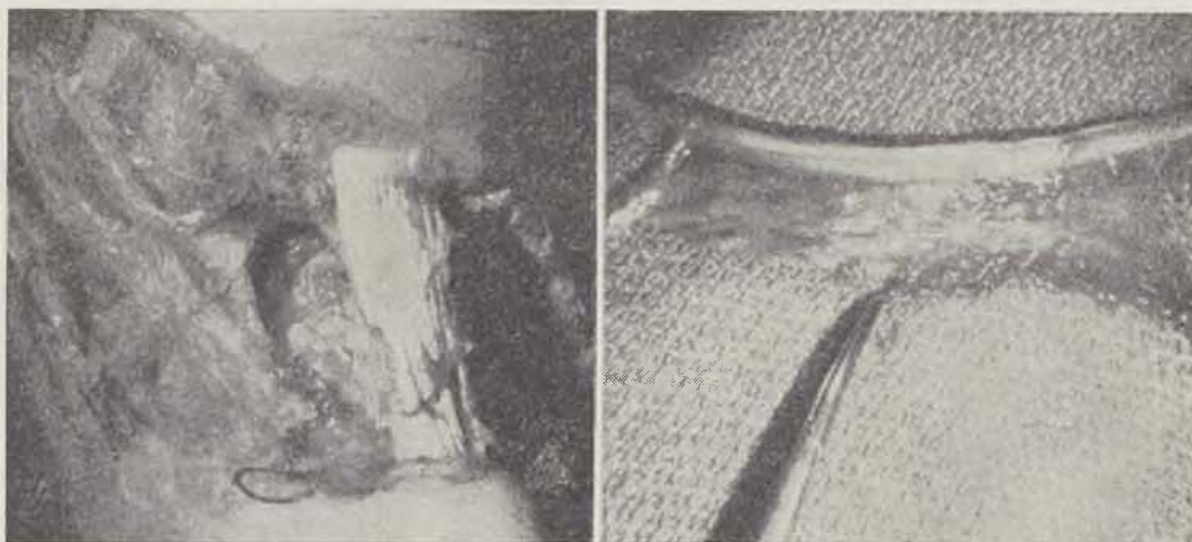


Fig. 1: The condition of the leg when first seen. Note the necrotic tendocalcaneus. —

Fig. 2: The plantaris tendon and its mesotenon

**Third Operation: (Pedicle division and inset).**

Three weeks later, the pedicle was divided and closed. Healing occurred uneventfully. However, the patient was unable to plantar flex his foot and he was walking on the heel without push off. He was kept on intensive physiotherapy to maintain the strength of the calf muscles.

**Fourth Operation: (Reconstruction of tendocalcaneus).**

Four months later, the patient was operated on for reconstruction of the tendocalcaneus. The plantaris tendon was removed from the left leg through a small transverse incision slightly above and posterior to the medial malleolus. The two palmaris tendons were removed with the paratenon and mesotenon attached to them (Fig. 2). Two incisions were made; one above and one below the cross-leg flap (Fig. 3).

The lower incision exposed the remaining part of the calcaneus through which two channels were created to meet in the depth of the bone. The plantaris tendon graft was passed through these channels. To make a loop through the bone, the two sides of the tendon were sutured to each other at one point as they emerged from the drill holes.

To reinforce the plantaris tendon, each of its sides were interwoven with a palmaris tendon through which small longitudinal splits were created and alternated with similar splits in the plantaris tendon. The junctions were secured with a number of interrupted sutures (Fig. 3).

A tunnel was created deep under the skin flap through which the proximal ends of the tendon graft were passed upward.

While the knee was flexed and the foot was in equinus, anastomosis of the proximal ends of the tendon graft to the stump of the tendocalcaneus was

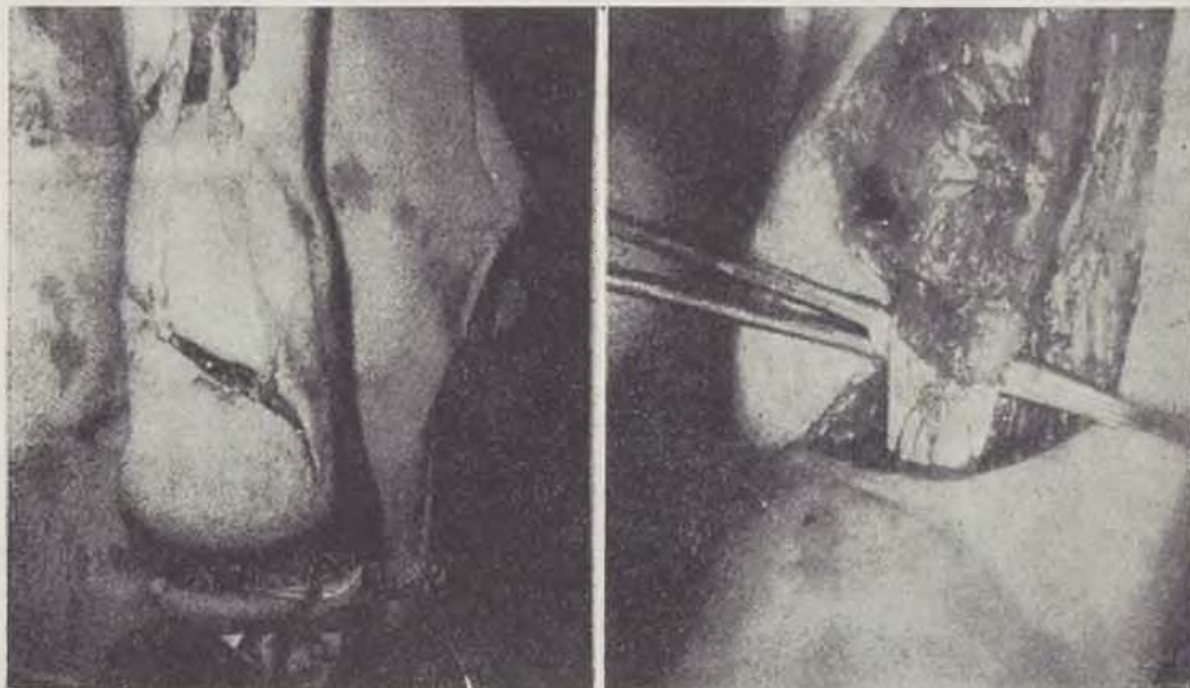


Fig. 3: The incisions above and below the flap for exposure of the stump of tendocalcaneus and the calcaneus bone. Note the interwoven tendons which will be passed under the flap. — Fig. 4: Anastomosis of the tendon graft to the two flaps created from the stump of the tendocalcaneus and the gastrocnemius aponeurosis

performed. From the stump of the tendon and gastrocnemius aponeurosis, two flaps were fashioned and left attached at a point proximal to the end of the stump. Each flap was twisted 180° on itself. In the raw surface of each flap, the end of the tendon graft was anastomosed (Fig. 4) and the position of the leg was maintained with a long leg plaster cast.

#### Post-operative Course:

The long leg cast was replaced with a short leg walking cast after four weeks. The patient then gradually resumed walking. Four weeks later, this cast was removed and walking with weight-bearing was started.

Examination of the patient one year post-operative revealed the following:

Anaesthesia of the sole as well as a strip of skin of about half an inch wide along the lateral aspect of the dorsal surface of the right foot (due to injury



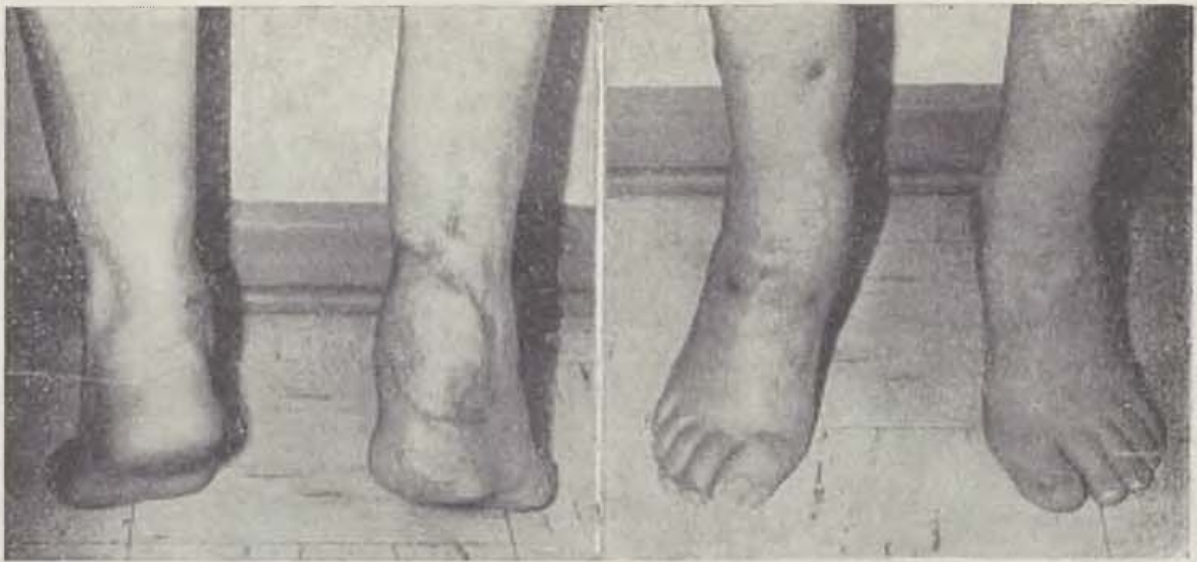


Fig. 5, 6: Three months post-operative — the patient standing on his toes.

of the posterior tibial nerve}. There was some improvement in the sensation in the medial aspect of the sole in the past few months (probably due to overlapping of sensation). These areas of anaesthesia were dry and demarcated by fine desquamation.

The right foot was slightly cold in comparison with the left foot (due to injury of the posterior tibial artery and nerve). However, no cyanosis, redness, swelling, ulceration, nor hyperaesthesia was detected.

No limp was noticed and the patient indicated that he was now using his leg the same as he had before the accident.

The patient was able to stand on his toes (Fig. 5 & 6), to accomplish almost normal range of ankle movement (35 degrees of plantar flexion and 25 degrees of dorsiflexion) (Fig. 7 & 8). He was only partially able to lift the



Fig. 7, 8: Good range of dorsiflexion and plantar flexion

heel from the floor while standing upon the affected leg. It was decided to calibrate the motor power of the gastrocnemius muscle at 4 using Zachary's method [Zachary, 1954]. Loss of the peronei and the toe flexor was the cause of the partial limitation of lifting the heel while standing upon the affected leg.

In 1972, I described the use of interwoven tendon graft in correction of traumatic footdrop [Elsahy, 1972]. The same principle was applied for reconstruction of the tendocalcaneus in the case described. However, joining the plantaris tendon with the two palmaris tendons provided a stronger tendon graft that replaced the strongest tendon in the body (the tendocalcaneus). If the plantaris tendon on the right leg was available, it could be used with or without the palmaris tendons for reinforcement.

In order to decrease the chance of necrosis, the tendons were not connected as one graft, but as two. This decreased the cross-sectional diameter and accordingly increased the chance of better blood supply.

Interwoven fascia lata or the extensor digitorum communis tendon of the second, third, and fourth toes could provide an alternative method for reconstruction of the tendocalcaneus.

Steinmann pin immobilization in the presence of infection is a real hazard which can lead to osteomyelitis. However, it was used in the case presented because the infection was controlled and the wound was successfully covered with split skin graft in the first operation. In addition, these pins proved to be of value in immobilization of the legs in the cross-leg flap operation.

Acknowledgment: The author thanks Dr. L. Gazley for his assistance.

#### SUMMARY

An alternate technique for reconstruction of tendocalcaneus is described. By using the interwoven tendon grafts it was possible to replace the whole tendocalcaneus and to regain its functional use.

#### RÉSUMÉ

##### **Technique alternative de la reconstruction du tendon d'Achille**

N. I. Elsayh

On décrit une technique modifiée de la reconstruction du tendon d'Achille. A l'aide des greffes entrelacées de tendon, il était possible de remplacer tendo calcaneus entier et de renouveler sa fonction.

#### ZUSAMMENFASSUNG

##### **Alternative Wiederherstellungstechnik der Achillessehne**

N. I. Elsayh

Der Autor beschreibt eine modifizierte Technik der Wiederherstellung der Achillessehne. Mittels durchflochtener Sehnentransplantate konnte der ganze tendo calcaneus ersetzt und seine Funktion wiederhergestellt werden.

## RESUMEN

### **Técnica alternativa de la reconstrucción del tendón de Aquiles**

N. I. Elsahy

Está descrita la técnica alternativa de la reconstrucción del tendón de Aquiles. Fue posible reemplazar el tendón calcáneo entero y restablecer la función del mismo mediante trasplantes de tendón entrecruzados.

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## BACTERIOLOGICAL STUDY OF THE BURN WOUND AND THE ENVIRONMENT

D. BARISONI, D. BERTOLINI, A. BARTOLANI, S. FURLAN

### INTRODUCTION

One of the most worrying problems, as yet unsolved, is the colonization of the burn wound, which may well be the first step towards a diffuse spread of microorganisms into the body.

The studies of Lowbury [1], Sevitt, Thomsen [2], Mir y Mir, Alexander [3], Vilain and co-workers [4] and many others have pointed out most definitely that infection is the biggest problem in the management of the burned patient.

This study describes the bacteriological condition of the burn wounds of the patients and the premises of the Center in the light of previous reports published on the subject [5, 6, 7, 8].

### MATERIALS AND METHODS

The Burns Unit of Verona was opened in September 1971; immediately afterwards a study on the microbial growth in the environment, the burn wounds and the oral cavities was started according to the following schedule: the premises and the patients' oropharynges were checked once a week, the burned areas twice a week, nurses' and doctors' oral cavities once every second week.

The Burns Unit has the following plan (Fig. 1):

— six single or double bedded rooms, for a total number of 8—9 patients; each room is supplied with a toilet room, and a window air conditioner, which does not provide for a great or large air exchange. Humidity and temperature are kept under control in each room.

The service area consists of a nurses' station, a small bath-room and a toilet room.

Nurses and doctors only are admitted onto the premises, visitors are not allowed inside, and communications between the patients and the outside world are carried out by telephone.

As Fig. 1 shows, the Unit lacks a filter area.

In order to counteract bacterial contamination, the following precautions are taken:

— change of shoes at the entrance, use of masks and caps, use of sterile gowns in each room, sterile techniques in the nursing and dressing of the patients.

The cleaning schedule, in order to neutralize the environmental contamination, is carried out by double washing of the floors once a day with Liso-phorm, fogging the rooms twice a week with a jodophor compound [Joteen], and by a through washing and fogging of the room from which the patient is discharged or removed to another sterile room.

For the bacteriological checking of the environment, we exposed 11 Petri's plates for 12 hours (8 p.m. to 8 a.m.), the culture medium being Agar-brain-heart infusion.

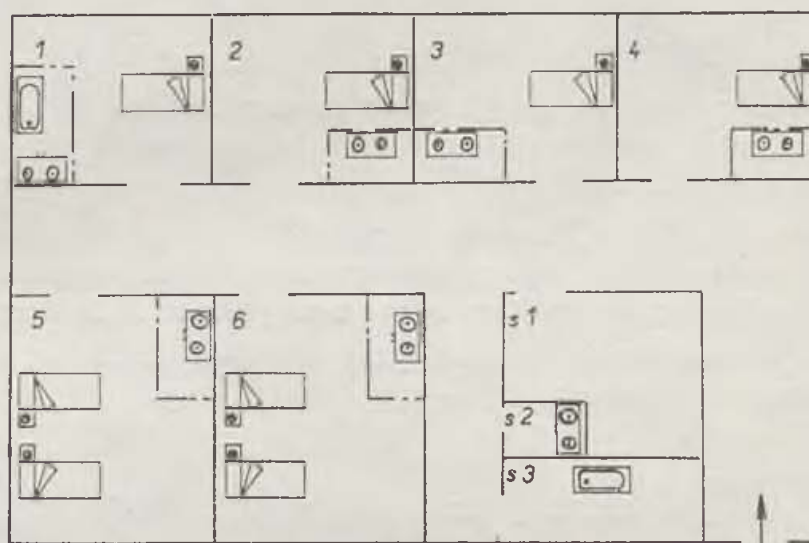


Fig. 1. — Plan of Verona Burns Center. — 1 to 6 single or double bedded rooms, S<sub>1</sub> — Nursing Station, S<sub>2</sub> — W.C., S<sub>3</sub> — Bath room.

Oropharynges and wounds were tested using sterile and slightly wet cotton swabs, the culture media being Agar-brain-heart infusion, plus 3% mutton blood or crystal violet: 100.000, McKonkey plates, salted Agar and Mannite.

Exposure treatment is the method of choice even during the grafting phase.

Early excision and homo- and/or autografting are carried out whenever possible in order to decrease the risk of infection.

No systemic antibiotic therapy is used prophylactically, while Fucidin and Gentilyn ointments are used topically, prophylactically or therapeutically.

## RESULTS

### A. Environmental study

Tab. 1 reports the non pathogenic bacteria isolated in 770 plates. *Staphylococcus albus* is by far the most frequent microorganism in this group.

Tab. 2 shows the pathological growth and in this group *Staphylococcus* pathogenes is present in more than 25% of the plates.

Apart from *Alcaligenes*, the other bacteria are present only in a scanty incidence.

### B. Bacteriology of the oropharynx

251 swabs were taken from the oral cavities of 80 patients.

Results are shown in Tab. 3; *Klebsiella* is the microorganism more frequently cultured.

Tab. 1

Environmental non-pathogenic bacteria isolated during 70 consecutive weeks exposing 11 plates per week

Microorganism	Total number of positive plates	% of positive plates
Non-pathogenic staphylococcus	494	64,1
Enterococcus	8	1,0
Environmental bacilli	117	15,2
Alpha streptococcus	81	10,5
Micrococcus	2	0,2
Iphomyceti and myceti	23	2,9
Rhinopharyngeal Neisseria	2	0,2
Serratia	2	0,2
Achromobacter, Acinetobacter	13	1,6
No growth	17	2,2

Tab. 2

Environmental pathological bacteria isolated during 70 consecutive weeks exposing 11 plates per week

Microorganism	Total number of positive plates	% of positive plates
<i>Staphylococcus</i> pathogenes	212	27,5
<i>Escherichia coli</i>	13	1,6
<i>Pseudomonas a.</i>	9	1,2
<i>Alcaligenes</i>	44	5,7
<i>Klebsiella</i>	26	3,4
<i>Proteus</i>	5	0,6

### C. Burn wound bacteriology

To this purpose 80 patients, with burns between 16 and 80% of body area (average % of b.a.b. 30,5%), were examined; 648 swabs were taken from the burn wounds, with an average of 8,1 swabs/patient. Tab. 4 summarizes the results of the bacteriological findings.

*Staphylococcus* pathogenes is present in 27,3% of the swabs and *Pseudomonas* in 20,3%. No growth was found in 44,7% of the swabs.



Of the 80 patients examined 58 were not colonized on admission to the Center, while, of the remaining 22, 10 had *Staphylococcus pathogenes*, 5 *Klebsiella*, 4 *Pseudomonas*, 2 *Proteus* and 1 *Escherichia coli*.

The onset of colonization in the 58 non colonized patients is showed in Fig. 2, where it appears that colonization of the burn wound is a rather early event, having its maximal incidence between the second and the fourth day.

Of these patients, 6 only showed no signs of colonization until they were discharged.

Tab. 3  
Bacteria isolated from 251 oropharyngeal swabs taken from 80 burned patients (average % of b.a.b. = 30,5)

Microorganism	Number of cultures
Non pathological bacteria	302
<i>Staphylococcus pathogenes</i>	21
<i>Klebsiella</i>	34
<i>Escherichia coli</i>	4
<i>Proteus</i>	4
<i>Pseudomonas a.</i>	3
No growth	71

Tab. 4  
Bacteria isolated from 648 burn wound swabs taken from 80 burned patients (average % of b.a.b. = 30,5)

Microorganism	Number of positive swabs	% of positive swabs
<i>Staphylococcus pathogenes</i>	177	27,3
<i>Pseudomonas a.</i>	132	20,3
<i>Klebsiella</i>	39	6,0
<i>Proteus</i>	22	3,4
<i>Escherichia coli</i>	12	1,8
No growth	209	44,7

Tab. 5 outlines the number of patients who incurred colonization during the course of the disease.

Examining the range of occurrence of each single pathological bacterium during the first 34 days of the post burn period, we find that *Staphylococcus pathogenes* describes a double domed curve, with a maximal incidence between the twelfth-fifteenth day, and a decrease between the eighteenth-nineteenth day (Fig. 3).

*Pseudomonas* (Fig. 3) steadily increases throughout hospitalization, reaching the highest levels in the later phases.

In Fig. 4 the incidences of *Proteus mirabilis*, *Escherichia coli* and *Klebsiella* are reported during the first 31 days.

From these data, *Proteus* appears to increase in the later days, *Escherichia* has a scanty initial incidence and disappears completely by the 20<sup>th</sup>—23<sup>rd</sup> day while *Klebsiella* shows a constant and consistent incidence.

### CONCLUSIONS

The present conditions of our Burn Center do not allow a complete separation from the other wards of the Plastic Surgery Department.

The incidence of *Staphylococcus* pathogenes is slightly more than a quarter of the exposed plates, points to the evidence that continuous cleaning and fogging is not „per se“ sufficient to eliminate or even decrease the rate of the enviromental contamination.

Tab. 5  
Analysis of the colonization in 80 patients during the staying to the Burn Center

Microorganism	Number of patients
<i>Staphylococcus</i> pathogenes	45 (56%)
<i>Pseudomonas</i> a.	(46%)
<i>Escherichia coli</i>	7 (8,7%)
<i>Klebsiella</i>	6 (7,5%)
<i>Proteus</i>	8 (10%)
No growth	6 (7,5%)

MacMillan and co-workers [7] have indeed showed that the rigid isolation of the Center and the filtration of the air exchanged are valid measures to decrease the number of bacterial counts; the same authors have demonstrated a parallel decrease of bacterial contamination of the burn wounds.

As regards the environmental contamination, we observed an increase proportional to the number of patients admitted to the Center; this is probably due to the fact that in a busy period the staff move more frequently from room to room, thus helping bacteria to settle in.

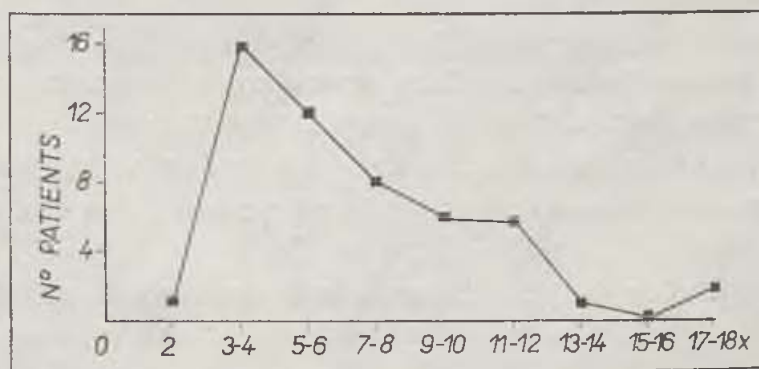


Fig. 2 — Onset of local contamination in 52 patients non colonized on admission to the Center.



It is to be pointed out that *Staphylococcus* pathogenes has the same incidence in the swabs and the enviroment; of the 80 patients 45 (56%) were colonized by this microorganism; this datum, although referred to a small group of patients, is very similar to the data reported by Hambraeus (8).

In our experience, the staphylococcus contamination shows a rapid onset and is present throughout the hospitalization.

Loss of skin grafts and in seven cases pustulation in newly healed skin, as reported by Thomsen (5), has ocurred in our patients, too.

Thirty seven (46%) of the patients were colonized in ore or more occasions by *Pseudomonas aeruginosa*.

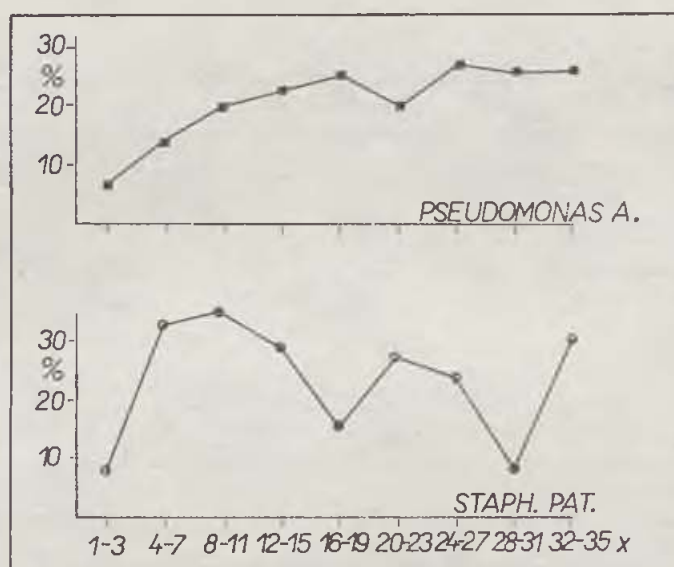


Fig. 3 — Incidence of contamination by *Staphylococcus* pathogenes (bottom) and *Pseudomonas aeruginosa* (above) in 80 patients (average b.a.b. 30,5 %). In abscissa the number of positive swabs. In ordinate the days post burn.

Colonization by this microorganism is quite low, but not rare, in the first week, according to Birke and al. and Thomsen (5). The maximal frequency is reached after the third week.

The method of treatment used (early excision and grafting) did not allow us to carry out our analysis of the burn wound swabs longer than 34 days since only a few patients were still under treatment by that time.

The study of the swabs taken from the patients after the 34<sup>th</sup> day confirms that *Pseudomonas* contamination is the most frequent one during the second month of the disease.

Earlier colonization by *Pseudomonas* was observed in patients with more extensive burns. These data are in accord with those reported by Brentano et al.

Associated colonization by *Pseudomonas* and *Staphylococcus* pathogenes was often observed.



The contamination rate of the environment by *Pseudomonas* is in accord with the data reported by Kohn who refers 1,8% of positive isolation from the air.

*Proteus*, *Escherichia* and *Klebsiella* were isolated much less frequently.

*Proteus* and *Klebsiella* appear to have a higher frequency after the 15<sup>th</sup> day; *Escherichia coli* disappears completely by the third week and, in our experience, is cultured only in the early phases.

The complete absence of colonization by beta-haemolytic *Streptococcus* is very surprising and does not agree with the data reported by several authors [5, 7].

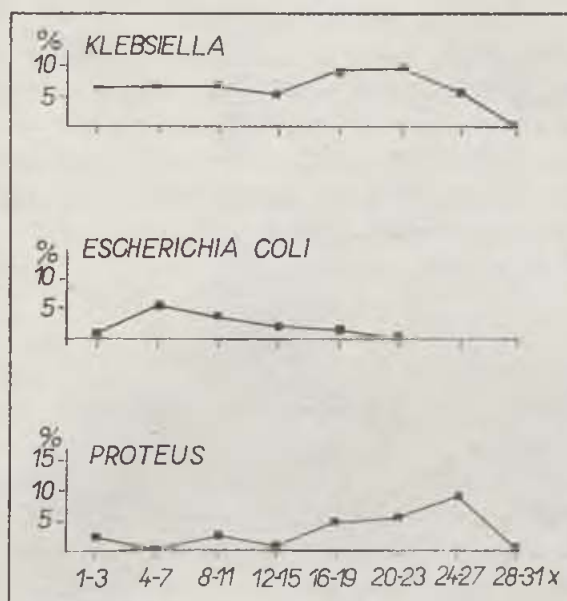


Fig. 4 — Incidence of contamination by *Proteus* (bottom) *Escherichia coli* (middle) and *Klebsiella* (above) in 80 burned patients (average b.a.b. 30,5 %). In abscissa the number of positive swabs. In ordinate the days post burn.

Only two patients, not included in this study, with 14 and 12% of body area burns were colonized by this bacterium.

Even in oropharyngeal swabs beta-haemolytic *Streptococci* were absent.

As pointed out by Thomsen [5], in the comparison of different materials, attention should be paid not only to the extent and the depth of the burn wound, but also to its localization, age of the patient, and, we should like to add, to those factors as the climate of the region, and the type and the frequency of the antibiotic treatment of the population.

#### SUMMARY

The authors report the incidence of bacteriological colonization on burn wounds, oral cavities and environment in the Burns Unit of Verona.

The method of choice is exposure. Under the present conditions, *Staphylococcus* colonization is the most frequent both in the environment and the burn

wounds. *Pseudomonas aeruginosa* has a high incidence on the burn wounds, especially in the later phases. No colonization by beta-haemolytic *Streptococcus* is reported in this group of patients. Mixed gram positive and gram negative colonization were present in several occasions.

#### R É S U M É

##### **Etude bactériologique des brûlures et leurs environs**

D. Barisoni, D. Bertolini, A. Bortolani, S. Furlan

On fait le rapport sur l'incidence de la colonisation microbienne des brûlures, des cavités bucales et même du milieu du Centre médical des brûlures à Verona. Comme la méthode de prise on a utilisé l'exposition des plaques et les essuyages faits par les tampons d'ouate. Actuellement, c'est la colonisation de staphylocoque qui se recontre le plus souvent et cela dans le milieu externe aussi bien que dans les brûlures. *Pseudomonas aeruginosa* présente une incidence élevée dans les plaies surtout dans les phases ultérieures de la guérison. Dans ce groupe des malades le streptocoque beta-hémolytique n'a pas été trouvé. Dans plusieurs cas on a constaté une colonisation mixte gram-positive et même gram-négative.

#### Z U S A M M E N F A S S U N G

##### **Bakteriologische Studie der Verbrennungen und ihrer Umgebung**

D. Barisoni, D. Bertolini, A. Bortolani, S. Furlan

Man berichtet über die Inzidenz der mikrobiellen Kolonisierung der Verbrennungen, der Mundhöhlen und der Umwelt in der Zentralheilstelle für Verbrennungen in Verona. Die Methode der Materialentnahme war die Auslegung von Platten und Ausstriche mit Wattetampons. Unter den bestehenden Bedingungen wurde am häufigsten Staphylokokkenkolonisierung festgestellt, und das sowohl in der Umwelt als auch in den Verbrennungen. *Pseudomonas aeruginosa* hat eine hohe Inzidenz in den Wunden, hauptsächlich in den Spätphasen der Heilung. Bei dieser Gruppe von Kranken wurde der beta-hämolytische Streptokok nicht gefunden. In einigen Fällen wurde gemischte grampositive und gramnegative Kolonisierung beobachtet.

#### R E S U M E N

##### **Estudios bacteriológicos de quemaduras y de las inmediaciones de las mismas**

D. Barisoni, D. Bertolini, A. Bortolani, S. Furlan

Se relata sobre la incidencia de una colonización microbica en quemaduras en cavidades bucales y en el ambiente del Centro para quemaduras en Verona. El método de la toma era el de exponer las láminas y después enjugarlas con tapones de algodón. Bajo las presentes condiciones es la colonización de estafilococos que se encuentra lo más frecuente, es decir tanto en el ambiente exterior como en las quemaduras. *Pseudomonas aeruginosa* presenta gran incidencia en las heridas, especialmente en las etapas tardías de la curación. El estreptococo beta-hemolítico no fue encontrado en este grupo. Colonización mixta grampositiva y gramnegativa fue observada en algunos casos.

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**The II<sup>nd</sup> Congress of the International Association for Maxillo-Facial Surgery will be held at Basel (Switzerland) on the days of September 1st—3rd 1976.**

On the programme are tumors of the maxillo-facial region, especially squamous cell carcinoma of the oral cavity and lips, malignant melanoma of the mouth and face and bone tumors of the facial skeleton.

Applications of the participants should be sent by June 15th 1976 to the Chairman of the Congress Prof. Dr. Dr. B. Spiessl, Postfach 182, CH-4013 Basel (Switzerland).



A. V. Vishnevskiy's Surgical Institute,  
Director Prof. A. A. Vishnevskiy, academician of Academy of Medical Sciences  
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## KELOID SCARS AFTER BURNS

L. G. SELEZNEVA

Keloid scars, as is known, are special types of skin scars which develop as a result of perversion of the healing processes of a wound. These scars are characterized by a peculiar clinical picture, by a special course and the likelihood of recurrence after excision.

They can develop after various processes taking place on the skin cover, sometimes at the site of an injection, puncture of an lobe for fixing ear rings, tattooing and various skin diseases.

Keloid scars are found most frequently after burns (Mikhelson, 1947; Sibileva, 1964), much less after inflammatory processes in the skin (Berliner, 1893; Welandar, 1893), injury, including surgical operation (Pautrier, 1933).

Keloid scars, particularly those developing on exposed parts of the body, frequently lead to severe disfigurement, decrease or even complete loss of fitness for work.

The author observed 371 patients with keloid scars after burns. According to him, keloid scars develop most frequently as a result of the healing of 3rd-degree burns (in 227 out of 371 patients keloids had developed at sites of 3rd-degree burns). Similar observations were reported by Kravchenko (1966), Dimitrev (1965), Margolin (1967), Pekarskii et Chiznik (1968) and others.

Keloid scars after 3rd-degree burns develop at sites where the transplanted skin grafts had undergone lysis and the scar had healed by islet epithelization of their remnants or during intervals between autotransplantations which also led to healing by marginal or islet epithelization.

In most cases keloid scars develop two or three weeks after the burn wound had healed. Among the early clinical signs of development of a keloid scar is a bluish purple discoloration of the affected part and severe local itching and pain which increase on movement. Itching and pain in scars provoke asomnia which weakens the patient. The growth of untreated keloids developed after burns continues during one to three years after the burn wound had healed (Selezneva, 1963; Kravchenko, 1968).

It should be stated that with the rather multiform clinical types of scars developing after burns, no stereotype employment of any one method of

treatment can be recommended, particularly starting the treatment with surgery. The treatment must be complex and strictly individual. Surgery should be employed after a sufficiently long trial with conservative therapy which not infrequently can by itself bring about absorption of the scar and cure. Thus only 116 (32 %) out of the 371 patients were operated on. The rest it was possible to cure with the employment of a complex of conservative measures. In the literature, available to the author, she had not found any similar report so that she had no chance to carry out a comparative analysis. Nevertheless knowledge of the results of treatment of patients with burns treated at other units permit to maintain that the elaborated complex of measures in the treatment of keloid scars is most encouraging.

Modern methods of treatment of keloid scars which develop after burns are rather multiple, yet their effects are not unequivocal and greatly depend on the time treatment was started; the earlier the start the better the result.

The complex of conservative measures elaborated consists of the following: With the first signs of the development of a pathological scar (itching, pain in the healing wound), i. e. prior to complete healing of all wound surfaces, the author applies ultrasound in two stages; 1st application of small doses (up to 0.2 to 0.7 Vt per  $\text{cm}^2$ ) on the regional sympathetic ganglia (paravertebral) and 2nd application of larger doses (1.0 to 2.0 Vt per  $\text{cm}^2$ ) direct to the scar surface. Generally the procedure lasts no longer than 15 min. In case the scar relief shows a complicated surface (hand, foot), the second stage of the procedure is frequently carried out through water where the hand or foot has been submerged, using an intensity of 0.2 to 0.4 Vt per  $\text{cm}^2$ . This method was applied in 74 patients, in 56 of whom, apart from cessation of itch and pain, markedly paling and softening of the scar was observed, which usually takes place after two or three courses of treatment.

The turns of ultrasound treatment consisted of ten to twelve daily procedures and were repeated after one or two months.

However, contact application of ultrasound cannot be carried out in some patients because of mechanical traumatization of the fine epithelial covers, particularly in small wounds.

If application of ultrasound through water is impossible, beta-therapy should be employed using radioactive applicators which are immediately applied to the cicatrizing parts of the burn surface, even if the wound has not yet healed.

As is known, actinotherapy for the various surgical affections of the skin, the subcutaneous tissue and also after injuries, has hitherto rarely been employed. In recent years beta-therapy using radioactive applicators has chiefly been practiced by dermatologists and in the treatment of eye diseases. Some authors have stated that beta-therapy has an analgesic and antiinflammatory effect.

Taking these data into account, the author decided to investigate the action of beta-therapy on keloid scars resulting from burns. Beta-therapy was

employed in 36 patients. The following observations have shown that beta-therapy, after diminishing itch and pain in the growing scars, led to softening and partial absorption. A similar effect was seen in 31 patients. The advantage of this over the already known types of irradiation treatment which had been employed long before (X-ray treatment, Buchy rays) is the relatively small energy of  $\beta$ -particle radiation and its shallow penetration in the tissues (0.535 to 1.5 mm,  $R_T$  — 147 and 204). This important quality of  $\beta$ -particles makes their employment quite safe and not damaging, which permits to consider this type of treatment to be one of the most sparing methods of irradiation therapy.

It should be stated, however, that this method is contraindicated in leucopenia and also in large scars in close vicinity of endocrine glands (thyroid and gonads).

After complete healing of the wounds and complete epithelization of the surface, employment of diadynamic therapy is indicated. It has an analgesic effect, diminishes itch and stimulates neurotrophic processes in tissues. This type of electrotherapy gives good results in keloid scars of long standing. It should be taken into consideration that in ulceration and also in a thin slowly developing scar diadynamic current is contraindicated.

An important means of complex treatment of keloid scars resulting from burns is pyrogenal which was administered by a scheme elaborated by the author. This drug led to softening of keloid scars in almost all cases and in some patients to complete absorption.

Pyrogenal was only used after complete healing of the burn wound. It should be stated that a number of papers (Budnitskaya, 1961; Dzheksenbayev, 1961; Nesmeyanova et al., 1961 and 1965) were found in the literature reporting on observations of pyrogenal not only having a desensibilizing and antiinflammatory effect on cicatrization, but also a positive influence on the healing of wounds. The author, on the contrary, noticed a certain inhibition of regeneration processes. This was particularly evident in ten patients who were given pyrogenal up to complete healing of the wounds. The cause of this contradiction is not yet clear. However, in order to solve this problem, one may perhaps make use of Kogan's remark (1965) about pyrogenal impeding maturation of fibroblasts. Inhibition of fibroblast growth due to the influence of pyrogenal was observed during the growth of a piece of connective tissue in tissue culture. It is possible that this constitutes the cause of the influence of pyrogenal inhibiting the regeneration process in the above patients.

On the basis of these observations, the author started to administer pyrogenal only after complete healing of all wounds, and he never observed any side complications.

The treatment of keloid scars resulting from burns with pyrogenal by the author's method has widely been used since.



The author's experience bears witness to the fact that in the treatment of keloid scars complex procedures are necessary and that it is rational to alternate courses of ultrasound, beta-applicators, diadynamic therapy and pyrogenal injections.

An important element of the entire complex treatment of keloid scars resulting from burns is sanatorial spa treatment using hydrogen sulphide and radon baths. This treatment has proven effective as an element of conservative measures, particularly in the very beginning of the formation of pathological scars. Balneotherapy has arrested further development of the keloid in many cases and diminished and sometimes even stopped the agonizing itch from which the patient had suffered. Balneotherapy is also effective in the postoperative period as a means for preventing recurrence of a keloid scar. It should also be understood that remedial exercises occupy an important place among the complex of remedial-prophylactic measures.

The author believes that surgical treatment should be resorted to if conservative treatment has proven ineffective and only after definite formation of the keloid scar, i. e. not earlier than 12 to 14 months after the healing of the burn wounds has been completed. Premature surgical intervention may give rise to recurrence.

The operation consists in complete excision of the keloid scar and following coverage of the skin defect with a splitskin graft, but on the weight-bearing surfaces of limbs with a pedicle flap.

During the postoperative period, another course of conservative treatment should be carried out for prophylactic purposes.

B. K.

#### SUMMARY

The paper deals with the experience in the treatment of 371 patients with keloid scars resulting from burns, who had been admitted for treatment in the All-Union Burns Unit of the Vishnevskiy Surgical Institute of the Academy of Medical Sciences of the USSR. The author's scheme of complex treatment is recommended, including conservative and surgical methods. The conservative treatment includes injection of pyrogenal, ultrasound, diadynamic therapy, beta-applicators, sanatorial spa treatment at places where they provide hydrogen sulphide and radon baths.

#### RÉSUMÉ

##### **Cicatrices chéloïdes après les brûlures**

L. G. Selezneva

Le travail présente les expériences du traitement de 371 malades avec les cicatrices chéloïdes après les brûlures qui ont été reçus dans le Centre général de l'Institut de chirurgie A. V. Vichnevski de l'Académie des sciences médicales de URSS. L'auteur propose le procédé établi par lui même du traitement complexe qui

est une combinaison des méthodes conservatives et chirurgicales. Le traitement conservatif comprend les piqûres de pyrogène, l'ultra-son, le traitement diadynamique, les beta-applicateurs, la cure thermique et celle de sanatorium dans les endroits où il y a des bains d'hydrogène sulfuré et de radon.

#### ZUSAMMENFASSUNG

##### Keloide Narben nach Verbrennungen

L. G. Selezneva

Die Arbeit beschreibt die Erfahrungen mit der Behandlung von 371 Kranken mit keloiden Narben nach Verbrennungen, die zu diesem Zweck in das Allunion-Zentrum für Verbrennungen des chirurgischen Institutes A. V. Wischnewski der Akademie der medizinischen Wissenschaften der UdSSR angenommen wurden. Der Autor empfiehlt das von ihm entwickelte Verfahren der komplexen Behandlung, d. h. eine Kombination der konservativen und chirurgischen Methoden. Die konservative Behandlung beinhaltet Pyrogenal-Injektionen, Ultraschall, diadynamische Therapie, Beta-Applikatoren, Kur- und Bäderbehandlung an Orten, wo Schwefelwasserstoff- und Radonbäder verabreicht werden.

#### RESUMEN

##### Cicatrices queloides después de quemaduras

L. G. Selezneva

En esta obra han sido publicadas las experiencias con el tratamiento de 371 enfermos con cicatrices queloides después de quemaduras, los cuales fueron ingresados con este motivo al Centro general de quemaduras del Instituto quirúrgico de A. V. Vishnevskii de la Academia de las ciencias médicas de la URSS. El autor propone emplear el procedimiento de un tratamiento complejo desarrollado por él mismo, es decir una combinación de métodos conservativos y quirúrgicos. El tratamiento conservativo incluye iniecciones de pirógeno, ultrasonido, tratamiento diadinámico, beta-aplicaderos, tratamiento en sanatorios y balnarios en lugares con baños de ácido sulfhídrico y de radon.

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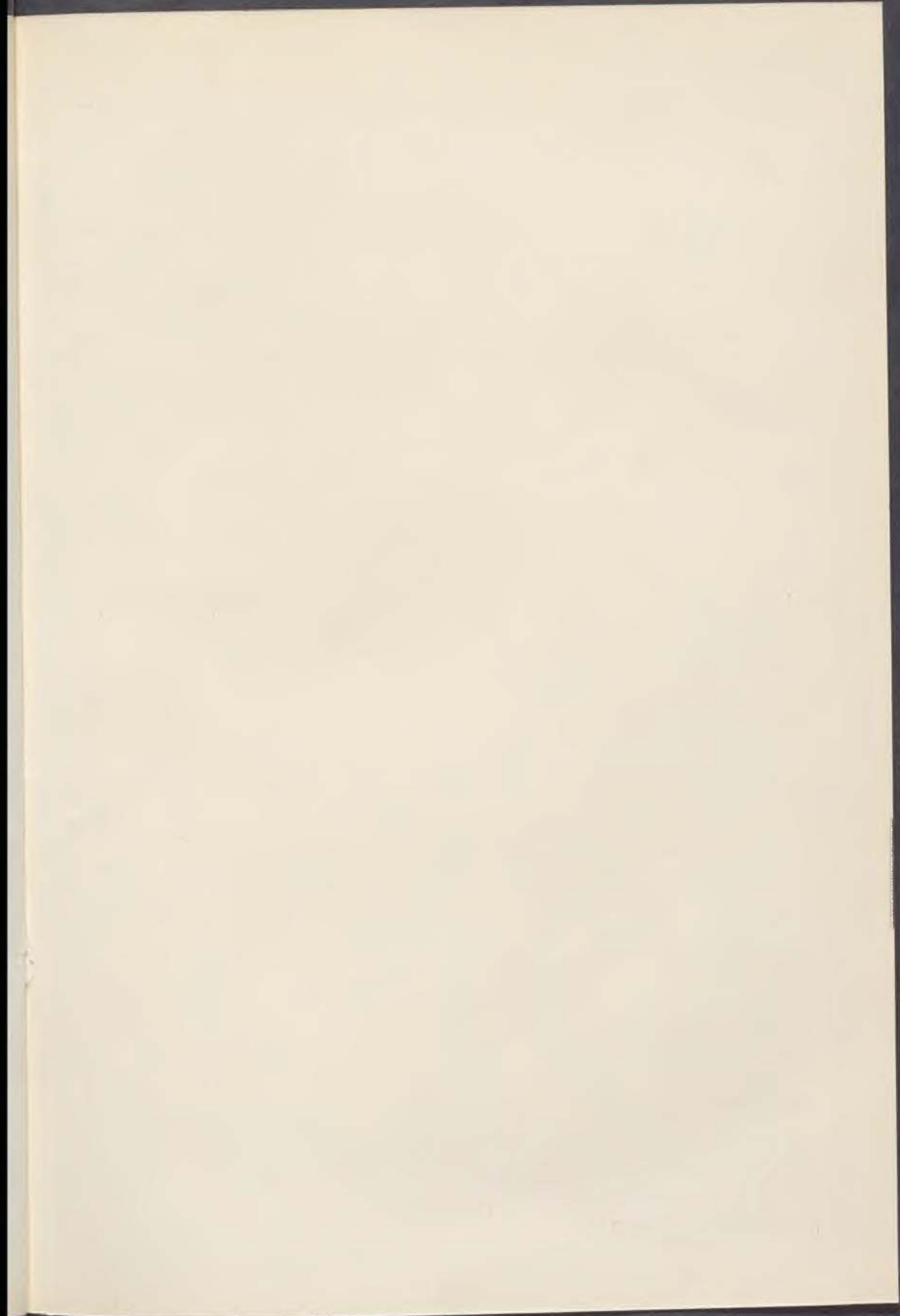
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