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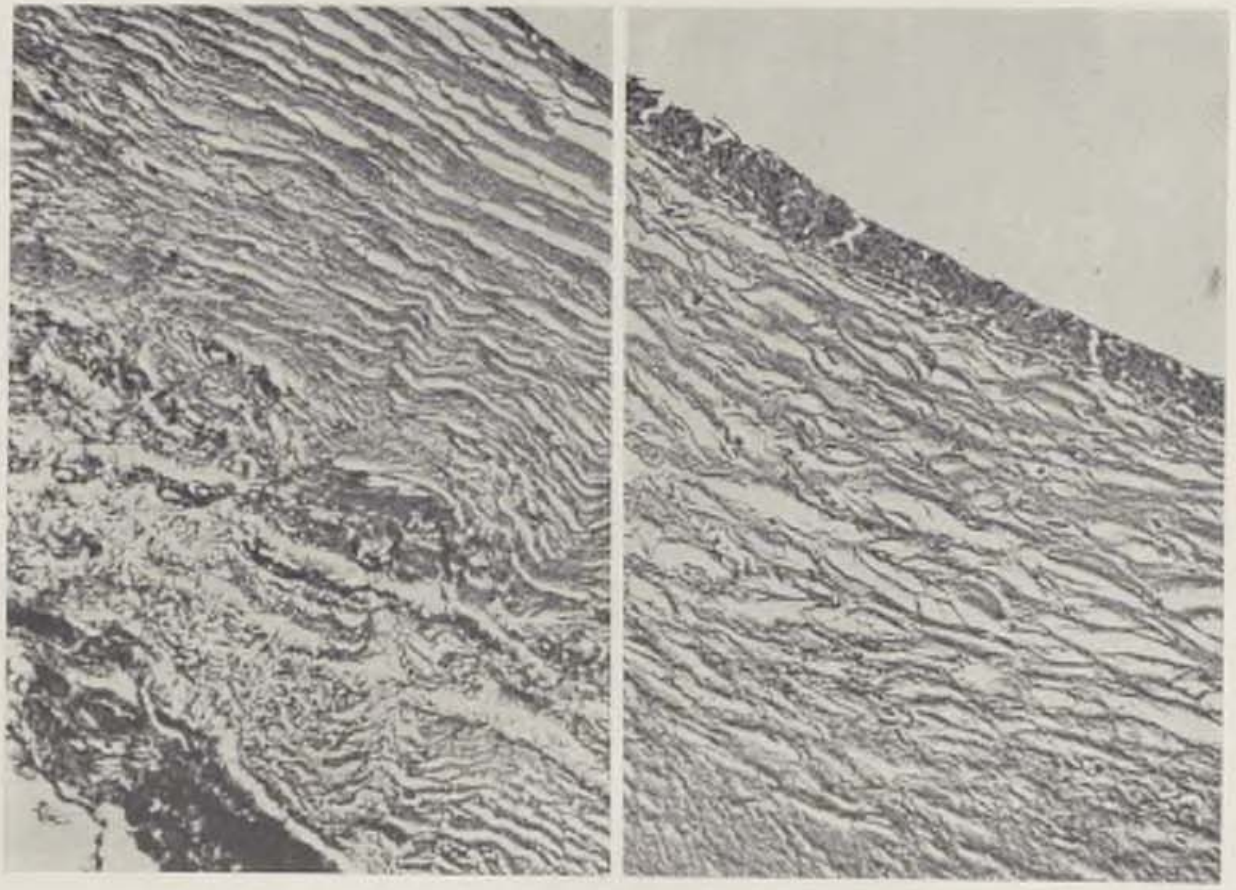

Fig. 1. Histological preparation from pseudocapsule 8 months after implant extirpation. — Fig. 2. Preparation from pseudocapsule in the same patient. Local response to heterogenous material seen as granulation. Lymphocytic infiltration is evidence of chronic inflammation.

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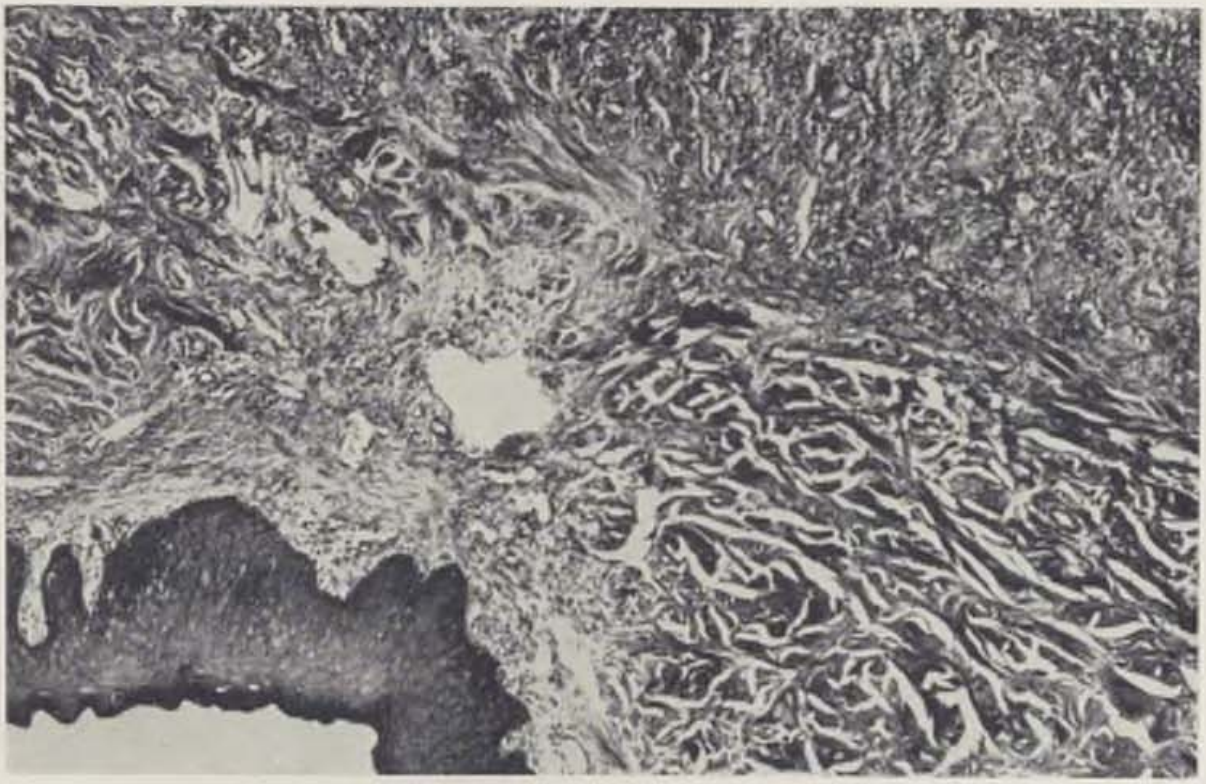

Fig. 5. Mucosa of oral cavity (at bottom) and layer of lyodura above it. (80×, Mallory stain).

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Z. V. Bazilevskaya

RECONSTRUCTION OF A METATARSEAL BONE BY AN ALLOGRAFT IN THE CASE OF OSTEOBLASTOCLASTOMA

(Long-term results.)

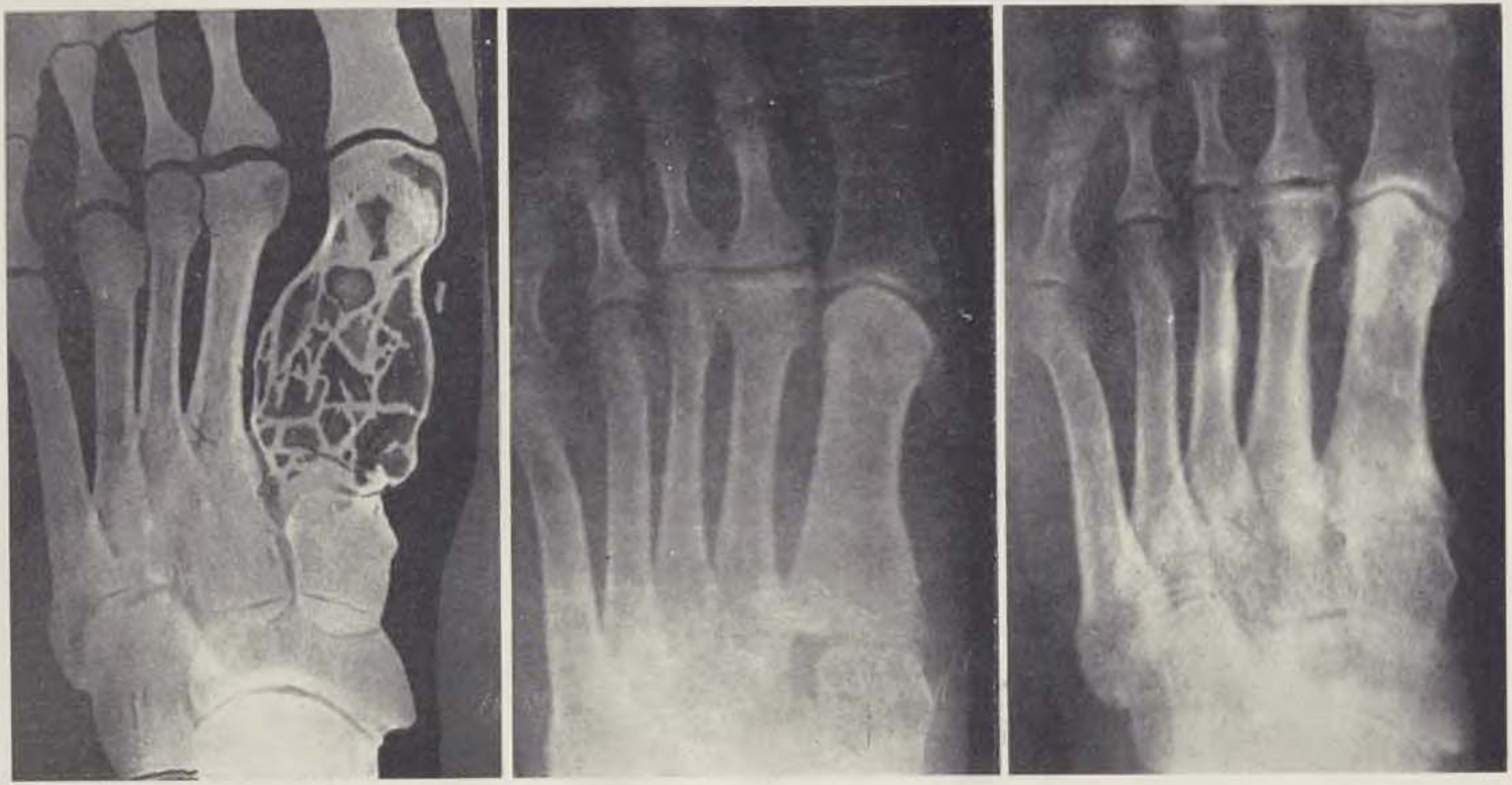

Fig. 1. Patient V. The roentgenogramm taken before exstirpation of the first metatarsus. — Fig. 2. The same patient. Five years after the surgical reconstruction of the first metatarseal bone using an allograft in the case of osteoblastoclastoma. — Fig. 3. The same patient. Thirteen years after the operation.

ACTA CHIRURGIAE PLASTICAE, 21, 1, 1979

Priorov's Central Scientific Institute of Traumatology and Orthopaedics, Moscow (USSR)
Director Professor M. V. Volkov

CLINICAL USE OF AN ALLOGENIC SKIN PRESERVED IN FORMALIN-GLYCEROL SOLUTION AND SUBSEQUENTLY STORED IN POLYETHYLENE PACKAGES

A. V. KAPLAN, N. E. MAKHSON, S. S. FEYGELMAN, O. N. MARKOVA,
I. S. KHUDAYDATOV, Z. I. URAZGILDEEV,
YU. M. SVERDLOV, U. A. GYULMAGOMEDOV

The positive role of transplantation of an allogenic preserved skin is generally well-known. Until recently, a skin preserved by freezing (—70° to —35° C) was used most frequently. However, such a skin was rapidly resolved or rejected after transplantation and secondary transplantations were necessary. The recipient's organism was undesirably sensibilized by graft antigens. In addition to it, resolution and rejection of skin was accompanied by greater suppurative discharge, thus making the patient's condition worse. In this way, the utilization of skin for covering the skin defects was limited by patients, who suffered from open fractures, infected wounds, chronic osteomyelitis, burns etc.

In our Institute, a new method of the skin preservation in formalin-glycerol solution was designed. It can be applied in complex treatment of infected wounds of open fractures and of trophic ulcers by orthopaedic and traumatologic patients. The method's principle consists in the fact that the skin acquires a capability to inhibit growth of pathogenic microorganisms (Staphylococcus, Streptococcus, Pseudomonas aeruginosa and their combinations), if it is preserved in formalin-glycerol solution. It is especially important in treatment of suppurative wounds. In addition to it, formalin, which is a constituent part of the solution, binds water-soluble proteins in the transplanted skin and inactivates proteolytic enzymes, thus diminishing processes of a tissue incompatibility. It enables to transplant repeatedly the skin, if necessary, without a risk of sensibilization of the recipient's organism by graft antigens. Finally, it should be noted that the skin preserved in formalin-glycerol solution is rejected somewhat later, in comparison with the ski preserved by other methods.

The suggested method is extremely simple. Split skin flaps (0.2—0.3 mm thick) collected from corpses are put into flasks containing formalin-glycerol solution (2.5 ml formaldehyde, 850 ml physiologic solution of sodium chloride, 150 ml glycerol), without any need of aseptical conditions. The skin acquires

not only sterility, but also antimicrobial activity after 4 weeks of preservation in the formalin-glycerol solution.

However, using such a method of preservation for 3—4 months, the skin loses its activity and badly attaches to a wound surface. It causes some difficulties during its transplantation. In order to preserve the skin for longer periods of time in the condition suitable for transplantation, the skin having been preserved for 4 weeks in formalin-glycerol solution is transferred into a steril

Fig. 1. The skin preserved in formalin-glycerol solution and stored in a soldered polyethylene package

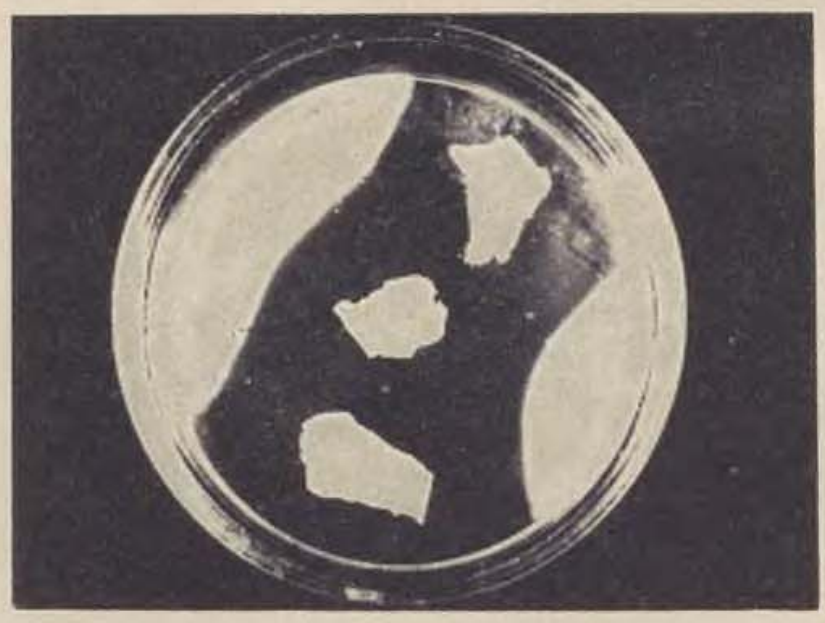

Fig. 2. A zone of growth inhibition of associated microorganisms (Pseudomonas aeruginosa and Staphylococcus) around the skin preserved in formalin-glycerol solution and stored for 3 years in a polyethylene package

polyethylene package, which is hermetically soldered (Fig. 1). The skin preserved for 4 weeks in formalin-glycerol solution is transferred into a steril and its transplantation is possible without any difficulties. The antimicrobial activity of the skin was stable for all the time of the observations (Fig. 2).

A total of 185 patients with transplantation of skin preserved by the described method, was followed. Before transplantation, the skin was immersed into a steril physiologic solution for 10—15 minutes. The graft was applied in such a way that its margins overlapped the limits of the wound surface and exceeded to healthy parts of the skin. Usually, the graft got firmly attached to the wound along its all surface. Sometimes it attached loosely to the bottom of the wound; in this case, this part of the graft was removed during subsequent redressings, and a new skin flap was placed on this area. The skin preserved in formalin-glycerol solution promoted a quicker cleaning of the wound from necrotic tissues, acquirement of a healthy state of granulations and more active epithelization.

In majority of patients, the skin graft was retained on the wound for 10—15 days. During this time, the discharge of the wound decreased and after tearing the graft away the wound showed to be covered by bright granulations. Sometimes the allogenic graft retained the appearance of the living skin for 2—3 weeks of even for 1—1 ½ months. Later on, it gradually got dry and packed. However, the process of epithelization below the thickened graft continued.

The grafts are especially valuable by patients with open fractures of shin bones and with exposed great parts of bones lacking periosteum. Using usual methods of treatment, the uncovered parts of bones most frequently get infected and sequestre later on. Good results were achieved by covering the exposed parts of bones by the skin preserved in the formalin-glycerol solution.

Some observations will be described as an example.

The patient Kh., 34 years old, was admitted on October 5, 1976, to the Department of wound infections. His diagnosis was an open fracture of left shin bones with dislocation. The injury happened during a car accident. On the frontal surface of the left shin was seen a wound of 2×5 cm size. The tibia was exposed in the region of the fracture. The operation was performed on October 11, 1976. The aparatus of Volkov and Oganesyan was applied in a closed way on the left shin, thus achieving reposition and fixation of the fragments. The necrotic tissues around the wound were cut off and the wound surface reached the size 4×6 cm. An uncovered bone was present in the bottom of the wound. The allogenic skin graft preserved in formalin-glycerol solution was placed on the wound (Fig. 3). Four days later, it was substituted by another analogous graft. The applied skin graft firmly adhered to the wound margins and the bone surface. For as long as 2 months, the allogenic skin remained in a good condition. Later on, the margins of the graft got thickened and gradually the graft turned to a firm crust. The Volkov's and Oganesyan's apparatus was taken away after 7 months. The fractured bones were united. The wound was fully healed (Fig. 4).

The patient B., 49 years old, suffered on September 4, 1976, during a car accident, an open fracture of right shin bones with dislocation and many fragments, large injury of soft tissues and open fracture of femur, besides a brain concussion. He was treated in Lyuberec district hospital. When admitted to our Institute, large infected wounds on a right patient's shin were observed. On the frontomedial surface of the middle third of the right shin was a wound of 10×18 cm size and tibia was exposed in the area of 5×4 cm. On the medial surface of the upper third of the right shin was a wound of 5×8 cm size. Bedsores were present on both calcanear regions. An operation was performed on October 14, 1976, in the Central Institute of Traumatology and Orthopaedics. The apparatus of Volkov and Oganesyan was applied in a closed way on the right shin, in order to secure a reposition and fixation of the fragments. A reposition of left femur was made in an open way, followed by an osteosynthesis using a tetrahedral metallic pin.

During the postoperational period, a suppuration was observed around the needles. But the apparatus was not taken away, as an immobilized position could be disturbed. The active measures against infection were undertaken, i. e. a catheterization of right femoral artery was made and an intraarterial infusion of antibiotics and antiseptics was applied. Allogenic skin grafts preserved in formalin-glycerol solution were placed upon the wounds. The wounds localized

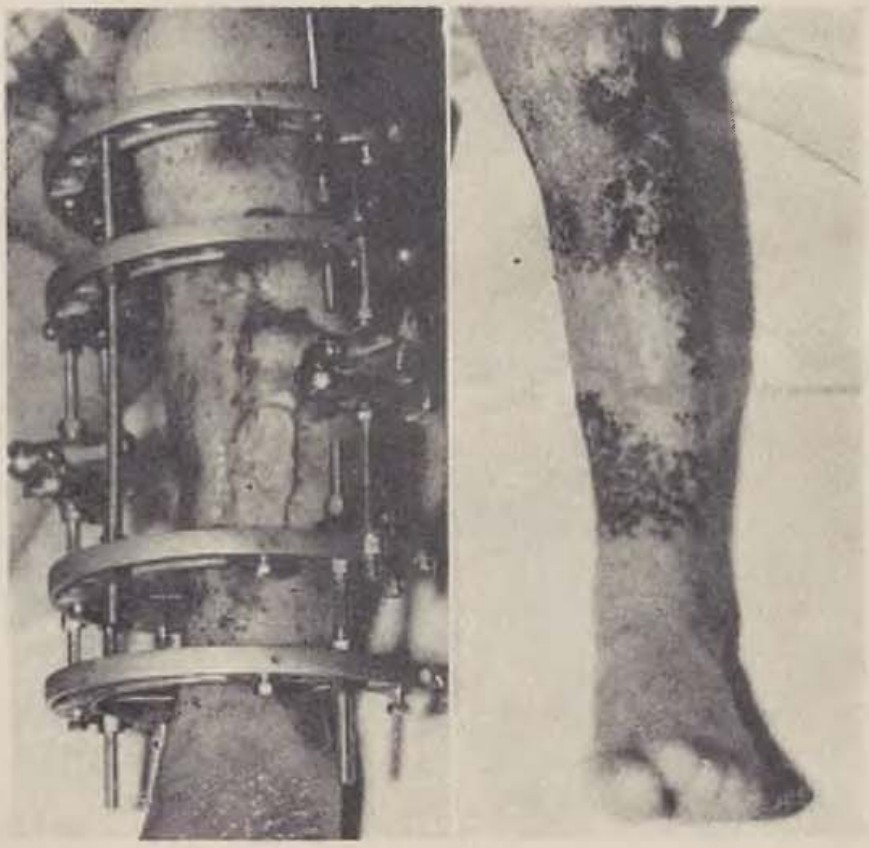

Fig. 3. The skin transplantation upon an exposed bone by a patient with a fracture of left shin bones. — Fig. 4. Wound epithelization occurring after transplantation of the skin preserved in formalin-glycerol solution by a patient with an open fracture of a shin.

in the upper third of the right shin and in the region of Achilles tendons recovered during 1 ½ months, while they were covered by an allogenic graft. The grafts were not exchanged until the wounds healed. A significant part of the large wound localized on the frontal shin surface got rapidly cleaned off from the necrotic tissues and epithelized, while having been covered by an allogenic graft. The graft covering the exposed part of the bone was exchanged once a week, as long as the wound discharge gathered below it. The exposed part of the bone was gradually covered by granulations, beginning by margins of the wound and the wound was epithelized, although a fistula persisted. When consolidation of the fracture was achieved, a sequestrectomy was performed as treatment of osteomyelitis. It was followed by a full recovery.

Thus, utilization of the allogenic skin preserved in the formalin-glycerol solution and stored for long time periods in polyethylene packages was proved to be very efficient in the complex therapy of suppurative and infected wounds and open fractures. M. T.

SUMMARY

The utilization of the skin preserved in formalin-glycerol solution was shown to be efficient in complex treatment of patients with infected wounds by open fractures of bones. The skin preserved in the formalin-glycerol solution and stored in polyethylene packages for long time periods (till 3 years) is suitable for transplantation; its elasticity is maintained and it proved to possess an antimicrobial activity against various pathogenic microorganisms. The transplantation of such a skin promoted a decrease of a suppurative discharge, improved a condition of granulations and activated an epithelization. The skin preserved in such a way prevents development of osteomyelitis in many cases of open fractures, when it is transplanted upon the exposed bone.

RÉSUMÉ

Utilisation clinique de la peau d'allogène conservée dans la solution de formaline-glycéryle et puis gardée dans des petits paquets de polyéthylène

Kaplan, A. V., Makhson, N. E., Feyguelman, S. S., Markova, O. N., Khoudaydatov, I. S., Ourazguildyev, Z. Z., Sverdlov, Yu. M., Gyulgamedov, U. A.

On a montré l'effectivité de l'utilisation de la peau conservée dans la solution de formaline-glycérile pendant le traitement complexe des malades ayant des plaies infectées dans les fractures osseuses ouvertes. La peau laquelle a été conservée dans la solution de formaline-glycéryle et placée dans des petits paquets de polyéthylène à long terme (jusqu'à 3 ans) est convenable pour la transplantation. Elle maintient son élasticité et possède un effet bactéricide contre beaucoup de microorganismes pathogènes. La transplantation d'une telle peau aide à diminuer la secrétion purulente, elle améliore les conditions des granulations et active l'épithélisation. La peau conservée de cette manière empêche le développement de l'ostéomyélite dans beaucoup de cas des fractures ouvertes, si celle-ci a été transplantée à l'os nu.

ZUSAMMENFASSUNG

Klinische Anwendung der allogenen, in Formalin-Glyzerollösung konservierten und nachher im Polyäthylenbeuteln aufbewahrten Haut

Kaplan A. V., Machson N. E., Fejgelman S. S., Markowa O. N., Chudajdatow I. S., Urazgildjejew Z. I., Swerdlov Ju. M., Gjuldamedow U. A.

Die Autoren zeigten die Effektivität der Anwendung der in Formalin-Glyzerollösung konservierten Haut in der komplexen Behandlung von Kranken mit infizierten Wunden bei offenen Knochenfrakturen. Die Haut, die in Formalin-Glyzerollösung konserviert und in Polyäthylenbeuteln eine lange Zeit (bis drei Jahre) aufbewahrt wurde, erweist sich zur Transplantation geeignet zu sein. Sie bewahrt ihre Elastizität und hat bakterizide Wirkung auf eine Reihe von pathogenen Mikroorganismen. Die Transplantation solcher Haut hilft zur Senkung der eitrigen Sekretion, verbessert den Zustand der Granulationen und aktiviert die Epithelisation. Die nach diesem Verfahren konservierte Haut verhindert die Entwicklung der Osteomyelitis in einer Reihe von Fällen offener Frakturen, wenn sie auf nackten Knochen transplantiert wurde.

RESUMEN

Empleo clínico de la piel alógena conservada en la solución de formalina-glicerol y luego mantenida en bolsas de polietileno

Kaplan, A. V., Majson, N. E., Feigelman, S. S., Markova, O. N., Urazguildieyev, Z. I., Sverdlov, Yu. M., Guyulgamedov, U. A.

Fue demostrada eficacia del empleo de la piel conservada en la solución de formalina-glicerol en tratamiento complejo de los pacientes con heridas infectadas en fracturas abiertas de los huesos. La piel, que fue conservada en la solución de formalina-glicerol y mantenida en bolsas de polietileno durante un tiempo largo (hasta 3 aňos), es conveniente para la transplantación. Mantiene su elasticidad y tiene efecto bactericido de matar bacterias para una serie de microorganismos patógenos. La transplantación de tal piel ayuda reducir secreciones supurativas, mejora la condición de las granulaciones y aviva la epitelización. La piel conservada de modo mencionado impide el desenvolvimiento de la osteomielitis en una cantidad de casos de fracturas abiertas, si había sido transplantada a un hueso desnudo.

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Kalininsk Medical Institute, Kalininsk (USSR)
Department of Paediatric Stomatology
Director Professor R. D. Novoselov

MECHANISM OF DEFORMITIES OF THE MIDDLE PART OF THE FACE OCCURRING BY INBORN CLEFTS UNILATERAL

R. D. NOVOSELOV

The hypotheses concerned with reasons, which determine development of deformities in the middle part of the face by inborn unilateral clefts, are quite contradictory. By majority of authors (Kozin 1971, Limberg 1968, Sementchenko and Vakulenko 1968, Burian 1963, Fára 1972, Farrior 1962 and others), an inborn underdevelopment of maxilla on the side of the cleft is considered to be their essential cause.

The differences in the opinions are mainly due to the facts that only insufficient data related to morphological changes of the complex consisting of lip, nose and palate and describing a character of topographic-anatomical relationships by inborn facial clefts developing during the prenatal ontogenesis are available, and that any information on normal periods of establishment, differentiation and developmental dynamics of cartilaginous and muscular structures of the middle part of the face is missing.

MATERIAL AND METHODS

The morphological features of structures present in the middle part of the face were studied on 149 human embryos and fetuses in the age from 4½ weeks to 10 months that were histologically examined, on 34 macroscopical preparations of 17 fetuses that were 3 to 10 months old, on 20 macroscopical preparations of 6 dead newborns and children of young age that developed normally and on 32 macroscopical preparations of 7 dead children of the same age that suffered from inborn facial clefts. Anthropometric features of the face were examined in by 143 human fetuses in the age from 3 to 10 months and by 528 children in the age from 6 months to 15 years. A number of 235 patients in the age from 6 months to 15 years suffering from inborn clefts of the upper lip and palate was clinically followed.

RESULTS AND DISCUSSION

The normal morphological development of the middle part of the face during the prenatal ontogenesis is connected with developmental dynamics of the external nose, its cartilaginous structures and mainly with growth of the nasal cartilaginous septum.

As shown by our studies on embryogenesis of the nasal cartilages by human embryos and fetuses 4½ weeks to 10 months old (90 slides), the cartilage of the primary nasal septum is established on the 6th week of the intrauterine development. It originates from mesenchyme. The septal cartilage differentiates earlier than other nasal cartilages and during early stages of the intrauterine development (6—8 weeks) it is situated in a mid-line of the face from base of the cartilaginous skull to the primary palate. Later on, it extends from a cartilaginous perpendicular cribriform plate of the ethmoid bone to the intermaxillar bone. Lateral wings of the nasal capsule are connected with it. They support nasal cavities and lay upon developing palatal processes forming the secondary palate.

The cartilage of the nasal septum plays an active and leading role in the entity of the developing cartilaginous system present in the middle part of the face. It grows forwards and downwards. It is documented by our data regarding concentration of a skeletogenous tissue and growth cones in the marginal parts of the septal cartilage and by anthropometrical data obtained by our method in human fetuses 3—10 months old (143 fetuses, including 80 males and 63 females) showing prevalence of the longitudinal enlargement in the middle part of the face especially due to lifting it forwards and downwards and to morphological growth of the facial height. The length of the nose increases 3.9 times and its width 3.2 times. The morphological height of the face increases 4.1 times and its width 3.7 times.

During the first period of the postnatal ontogenesis (till 6—7 years), the framework of the nasal septum is mainly formed by the cartilaginous skeleton: from above — a non-ossified perpendicular plate of the ethmoid bone, from the front and from below — cartilages of the nasal septum with the posterior process extended backwards and upwards, from below and from behind — a non-ossified upper margin of vomer (Fig. 1). The septal cartilage is situated between cranial base (region of the ethmoid bone) and intermaxilla (incisival part of maxilla). The cartilage of the nasal septum grows forwards and downwards. It is confirmed by our anthropometrical studies on growth variability of the face, performed on 208 children in the age from 6 months to 7 years (103 boys and 105 girls). The external nose grows most intensively, especially in the early infantile age. The ingrowth of logitudinal and sagittal dimensions of the face and of its parts is greater than the ingrowth of the transversal dimensions. Thus, the mean length of the nose increases by 47%, the nasal height (corresponds to the length of the cartilaginous nasal septum) is greater by 46%, but the width of the nose enlarges by 27% in the upper part and by 21% near the bottom.

During this period, the morphological height of the nose increases by 27.9% in boys and by 27% in girls, a zygomatic width of the face enlarges by 13,3% in boys and by 11.6% in girls.

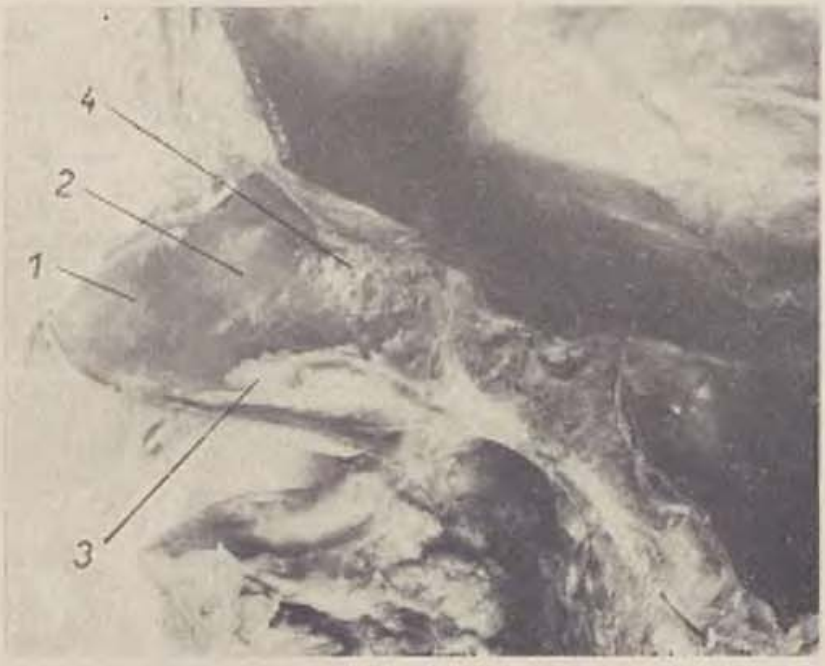

Fig. 1. Septum of the nose (normal): 1 — cartilage of the nasal septum, 2 — perpendicular plate of the ethmoid bone, 3 — vomer, 4 — cribriform plate (a newborn).

The forward and downward growth of the nasal septum actively influences development of the facial skeleton. The mechanism of this process is proposed. The septal cartilage lifts the maxilla forwards and downwards by a pressure exerted on the intermaxillar bone. The tractive force is transmitted to palatal bones, through them to plates of pterygoid processes of the sphenoid bone and finally to structures of the skull base. Such a directed influence exerted by the septal cartilage growing forwards and downwards promotes development of the segments localized between maxilla and facial bones that are bound together by a system of sutures. According to data from literature, the growth of facial bones is brought about by an apposition to external surface in the sites of sutures, or by an enchondral growth in the case of cartilage (Vares 1967, Scott 1954, 1959 and others). The sutures situated between the maxilla and the surrounding bones (frontal, ethmoid, sphenoid, nasal, zygomatic and palatal ones) belong to the septal system of sutures. In the limits of it, the growth proceeds in the perpendicular and antero-posterior directions. By lifting maxilla forwards and downwards, the septal cartilage stimulates the growth of maxilla and of bones constituting the facial skeleton inside the sutures belonging to the septal system. The zygomatic bone, which is connected with maxilla by a system of sutures, is drawn forwards and downwards as well. It actively influences the great wing of the sphenoid bone during lateral growth of the skeleton to width and the maxilla during growth of the skeleton

in the sense of its height. As the result, maxilla is moved forwards and downwards in respect to the skull base.

The forward and downward influence of the nasal septal cartilage, which is exerted on the incisival part of maxilla, is counterbalanced by forces acting in the system of synchondroses of the skull base (synchondrosis spheno-petrosa, synchondrosis petro-occipitalis) and in sutures between temporal and zygomatic bones in the backward and upward direction. It results in displacement of the zygomatic bone backwards and upwards. Together with it, the maxilla is drawn off as well.

During the second period of postnatal ontogenesis (7 to 14 years), the growth of the external nose, of the middle part of the face and of facial skeleton inside the sutures is sharply showed down. It is documented by data of Scott (1953, 1954, 1959) and by our anthropometrical studies on growth variability of the face by 320 children 7 to 15 years old (160 boys and 160 girls).

In the case of the inborn unilateral cleft lip and palate, a mesenchymal origin of the maxilla becomes deficient on the side of the cleft during early stages of embryogenesis (Farrior 1962, Stark 1954, Atherton 1967 and others). It causes a primary underdevelopment of the maxilla. The balance of forces determining a harmonious development of facial skeleton is disturbed by total unilateral clefts of the upper lip and by manifested cleft palate on later stages of embryogenesis and in the first period of postnatal ontogenesis. The septal cartilage is connected with maxilla on the healthy side and its influence is transmitted either along a lateral vector to the region of the zygomatico-maxillar suture, where it stimulates growth of bones constituting the facial skeleton inside the sutures, either to the region of the intermaxillar bone, where intermaxilla, maxilla and zygomatic bone, which are interconnected, are displaced forwards and downwards. Simultaneously, the frontal part of the alveolar process of maxilla and intermaxillar bone are pushed forwards and spread to the normal side. However, the directed tractive force (forwards and downwards) of the nasal septal cartilage is counterbalanced by forces acting backwards and upwards in the system of the skull base synchondroses (synchondrosis spheno-petrosa and synchondrosis petro-occipitalis) and in the sutures between the temporal and zygomatic bones. On the side of the cleft, the maxilla is isolated from the influence of the nasal septum. In addition to it, the forces acting in the system of skull base synchondroses (synchondrosis spheno-petrosa et petro-occipitalis) and in sutures between temporal and zygomatic bones prevail. The maxillar growth in the system of adjacent sutures is not stimulated and it secondarily deepens its underdevelopment. The maxilla together with the zygomatic bone moves backwards and somewhat upwards (Fig. 2). The size of maxilla is smaller on the side of the cleft in all dimensions, in comparison with the normal side and with the anthropometrical mean normal value of growth (4 mm). It is underdeveloped along the lateral margin of the pyriform aperture and in the region of its body. The alveolar process falls backwards and inside. The pyriform aperture is widened and deformed. The zygomatic bone is flattened, smaller in all dimensions, underdeveloped. Orbita is widened and drawn outwards, backwards and downwards

Fig. 2. Relations of the nasal septum and maxilla on the normal side (a) and on the side of a cleft (b) in the case of the right total cleft lip and manifested cleft palate (a child 18 months old). — Fig. 3. Underdevelopment of nasal bones, maxilla and zygomatic bone on the cleft side (a) and deformed nasal septum in the case of the right total cleft lip and manifested cleft palate (a child 10 months old).

(Fig. 3). Deformities of bones forming facial skeleton extend to the external base of the cerebral skull. It is deformed, all its anatomical structures are moved 5—7 mm backwards in comparison with the normal side. The dimensions of fornix and skull base bones are greater (Fig. 4). Thus, it was shown by us that all bones constituting the facial skeleton and bones of the skull base are deeply changed in respect to their form and spatial arrangement on the side of the cleft. The underdevelopment of the facial skeleton on the side of the cleft and the disturbed growth balance of the nasal septal cartilage and facial bones lead to deformation of the osseous nasal skeleton and make the cartilage skeleton deformity still worse.

The deformities of the nasal cartilages occurring by inborn unilateral clefts of the upper lip and palate are typical. The form and arrangement of the nasal cartilages are altered, but sings of underdevelopment are absent. An important topographic-anatomical feature of the nasal cartilage architecture was observed on the side of the cleft. The external pedicle of the wing cartilage is shorter, wider and turned downwards. Its upper margin and lower margin of the lateral cartilage demarcate a fissure-like space, whose width increases in direction to border of the pyriform aperture (Fig. 5).

Embryogenesis of muscles related to nasal apertures and mouth fissure were studied by 59 normal human embryos and fetuses in the age ranging from 6 weeks to 10 months. It was found that the facial mimic muscles are fully differentiated on the 12th week of the embryonal development. The earliest differentiation was seen by the orbicularis oris muscle, which is constructed in a complex way. The upper muscle bundles cross each other in their middle parts and are fixed to inner pedicles of the wing cartilages (Fig. 6). This feature, which was revealed by us, is present by the end of the intrauterine period and during the postnatal period. The upper bundles of the orbicularis

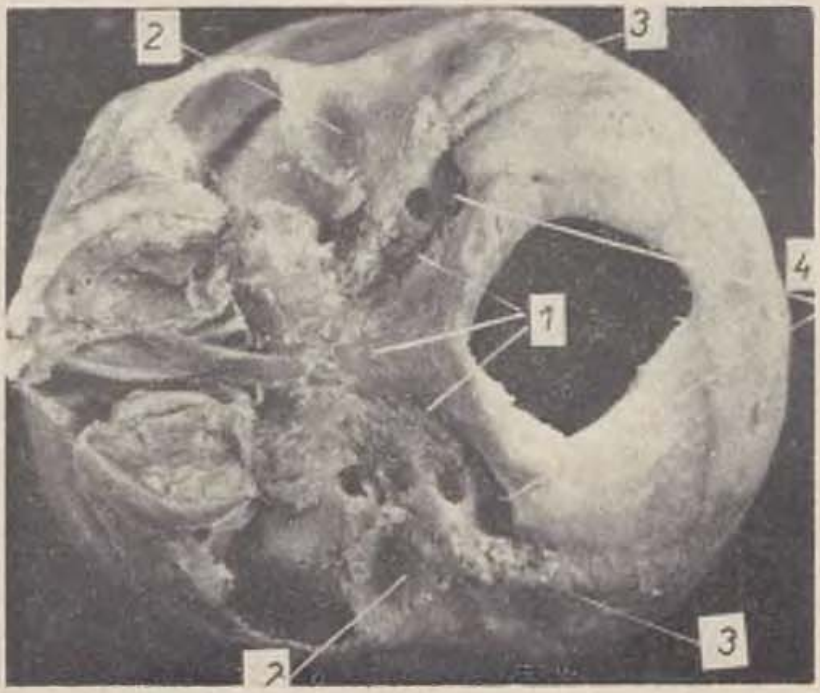

Fig. 4. Asymmetry, enlargement and lifting backwards of structures forming skull base by an 18-month-old child suffering from the right total cleft lip and manifested cleft palate: 1 — interosseous sutures, 2 — joint cavities, 3 — mammiform processes, 4 — jugular openings.

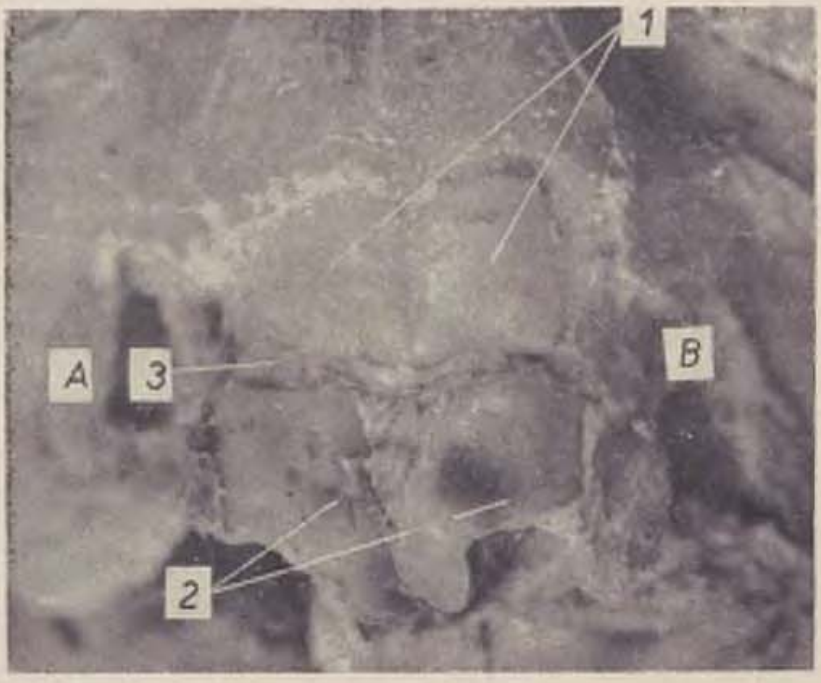

Fig. 5. Lateral cartilage (1), external pedicle of the wing cartilage (2), and a fissure-like space between them (3) on the side of the right total cleft lip (a) and manifested cleft palate (a child 10 months old).

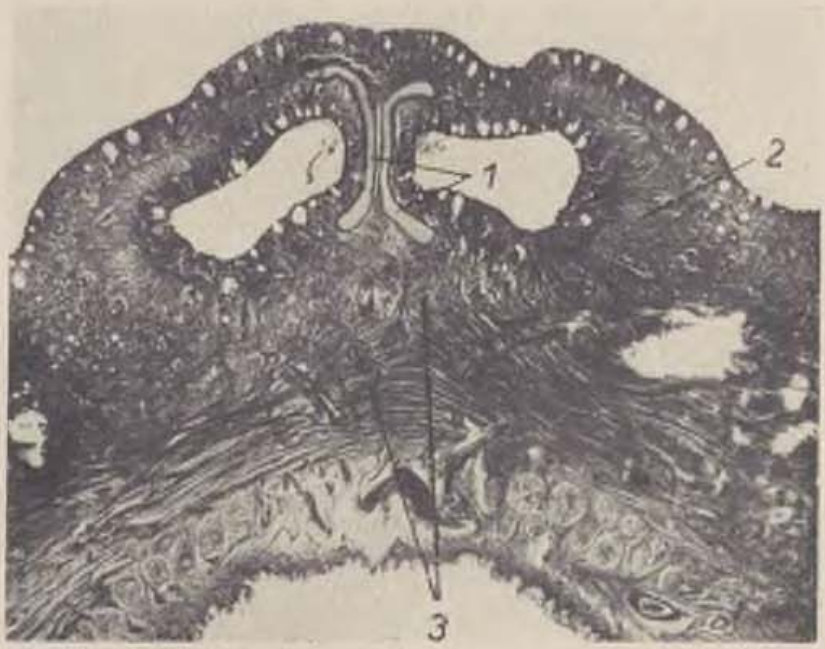

Fig. 6. A frontal section of a facial mask lead on the level of the upper lip by a fetus 8½ months old (normal): 1 — inner pedicles of the wing cartilages, 2 — wing-like part of the nasal muscle, 3 — orbicularis oris muscle (a crossing of the upper bundles). Stained according to Mallory. A histotopogramm.

oris muscle are rather well expressed anatomical structures, begin from the lip commissure, cross each other and fix to inner pedicles of the wing cartilages. When contracting bilaterally, the upper bundles function as a depressor of the nasal septum (Fig. 7).

By unilateral clefts of the upper lip combined with splitting of the orbicularis oris muscle, the upper bundle coming from the normal side is fixed to the inner pedicle of the wing cartilage on the cleft side, and the upper bundle coming from the cleft side is fixed to the base of the deformed nasal wing (Fig. 8). Each bundle conducts the unbalanced influences of the facial mimic muscles arranged radially and interspersed in the stump of the lip.

The dysfunction of upper bundles of the orbicularis oris muscle was firstly revealed by us. It causes a displacement of the inner pedicle of the wing cartilage on the cleft side and of the nasal septum base towards the normal side, flattening of the external pedicle of the wing cartilage and dislocation of the nasal wing base backwards and downwards (Fig. 9).

The dysfunction of the muscles connected with nasal openings, which occurs by inborn unilateral clefts of the upper lip, is determined by an asymmetrical arrangement of their insertion points on maxilla and by special features of their topography and function. On the side of the cleft, the muscle lifting upper lip and nasal wing is interspersed in skin along rather long distance and causes eversion of the nasal wing margin and its dorsal flexure.

The transversal part of the nasal muscle is narrower on the cleft side than on the normal side. It lies on the nasal clivus in the fissure-like space between the lower margin of the lateral wing cartilage and upper margin of the external pedicle of the wing cartilage. It forms a fold in the latero-superior quarter of the nasal vestibule (which is hard to remove during the operation). It increases dorsal flexure and flattening of the nasal clivus. On the cleft side, a wing-like part of the muscle is shorter and narrower by its beginning and wider by its insertion to the wing cartilage, in comparison with the normal side. A contraction of the radially oriented fibres belonging to the wing-like

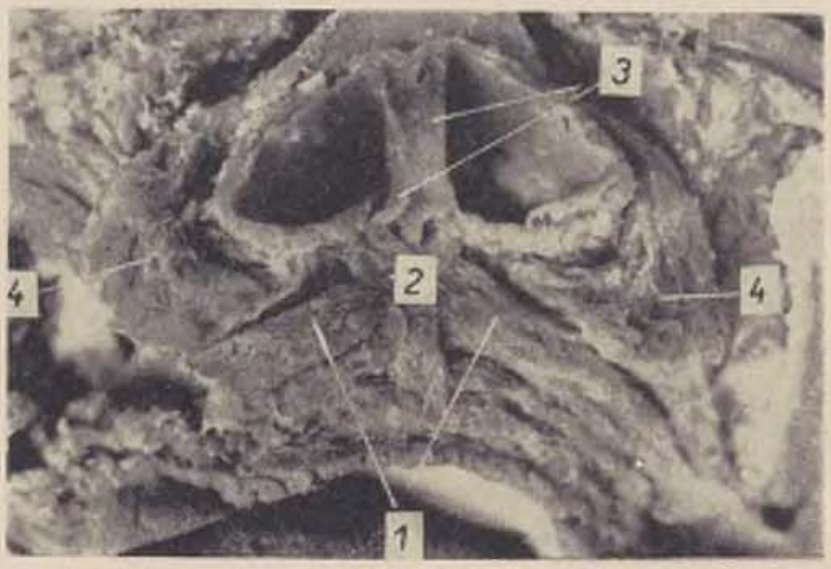

Fig. 7. Orbicularis oris muscle of the upper lip (normal): 1 — upper bundles, 2 — crossing of the upper bundles, 3 — inner pedicles of the wing cartilages, 4 — wing-like part of the nasal muscle (mask of newborn). — Fig. 8. Relations of the upper bundles of the orbicularis oris muscle (1), the inner pedicles of the wing cartilage (2) and the base of the nasal wing on the side of the right total cleft lip and manifested cleft palate (mask of a newborn).

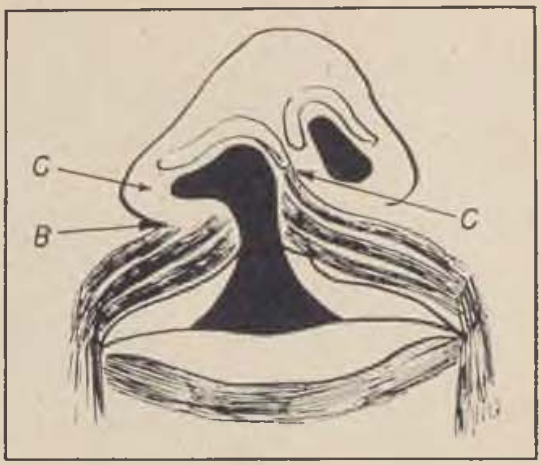

Fig. 9. Relationships of the upper bundless of the orbicularis oris muscle: a — in respect to the inner pedicle of the wing cartilage on the cleft side, b, c — in respect to the winglike part of the nasal muscle in the case of the right total cleft lip and manifested cleft palate (a diagramm).

part of the nasal muscle situated in the posterior-superior region of the nasal vestibule brings about widening of the nasal opening, flattening of the nasal wing cartilage and a shift of the nasal base outwards and downwards (Fig. 10).

According to our data, the nasal deformities, which are combined with the inborn unilateral cleft lip. occur in 100% of the cases, are localized mainly in the cartilaginous part and depend on type of the cleft. All variations of shape and localization of the nasal cartilages can be classified into four types: a flattening of copula of the nasal tip (9.3 %), a flattening of the nasal wing (33.1 %), a deformity affecting all the cartilaginous framework of the nose (12.6 %), a deformity of the cartilaginous and osseous framework of the nose (45 %).

The alterations of the cartilaginous skeleton of the nose are directly related to the degree of dysfunction affecting the muscles of he nasal openings and mouth fissure. They are more expressed by total clefts of the upper lip. Their basic features remain the same both by isolated clefts and by clefts combined with cleft alveolar process and palate, although character of the osseous alterations is different (Fig. 11). It is proved by these data that the dysfunction of the mimic muscles is the most important factor. Underdevelopment of the maxilla and widening of the pyriform aperture are factors just augmenting the deformity of the nasal cartilages. The alterations of the osseous nasal skeleton depend directly on deformities of bones constituting the facial skeleton and on dysfunction of muscles belonging to the circle formed by lips, cheeks and pharynx.

CONCLUSIONS

1. The deformities localized in the middle part of the face, which occur by inborn unilateral cleft lip and palate, are connected with deep morphological changes of histologically and antogenetically different tissues belonging to a complex formed by the lip, nose and palate.

2. The deformities of the cartilaginous nasal skeleton accompany all kinds of the unilateral cleft lip anomalies. They are directly related to degree of

Fig. 10. Muscles situated around hasal openings and mouth fissure by left total cleft lip and manifested cleft palate (a newborn): 1 —transversal, 2 — wing-like part of the nasal muscle, 3 — muscle lifting the mouth angle, 4 — orbicularis oris muscle (superficial layer), 5 — cheek muscle.

Fig. 11. Patient G., 6 months old. Diagnosis: Inborn isolated total cleft lip on the right side combined with deformity of the nasal cartilaginous framework.

dysfunction affecting muscles of nasal openings and mouth fissure (upper bundles of the deep layer of orbicularis oris muscle) and they are expressed to the greatest extent by total clefts.

3. The facial skeletal deformities develop by all types of the cleft lip anomalies, however, they are most expressed by the unilateral cleft lip combined with the manifested cleft palate. They are determined by the inborn underdevelopment of the maxilla on the side of the cleft, or by underdevelopment of the facial bones resulting from a disturbance in the symmetrical influence of the nasal septal cartilage on the developing facial part of skull and by dysfunction of muscles belonging to the circle formed by lips, cheeks and pharynx.

M. T.

SUMMARY

There is described the mechanism, by which the nasal septal cartilage influences the prenatal and the first part of the postnatal ontogenesis of the facial part of skull in normal conditions and by inborn clefts. In the case of the inborn unilateral cleft lip combined with manifested cleft palate, the balanced growth of the nasal septal cartilage and facial bones is disturbed. On the side of the cleft, which is deprived of influences originating from the nasal septal cartilage, an underdevelopment of all facial bones occurs. A deformity of bones constituting the facial part of skull, which extends to fornix and basis of the cerebral part of the skull, develops in correspondence with the degree of the described changes. The alterations of the osseous nasal framework are directly related to deformities of the facial bones and also to dysfunction of muscles belonging to a circle formed by lips, cheeks and pharyns. The dysfunction of the muscles localized around the nasal openings and mouth fissure is considered to possess a basic significance among other factors causing deformation of the cartilaginous nasal framework. The dysfunction of the upper bundles of the orbicularis oris muscle plays a leading role in development of the deformity affecting the nasal wings. According to our data, the nasal deformities, which are connected with inborn cleft lip anomalies, occur by all patients; they are localized preferentially in the cartilaginous part of the nose and are related to the type of the cleft.

RÉSUMÉ

Mécanisme des déformations de la partie médiale de la face en cas des fissures unilatérales congénitales

Novoselov R.

On explique le mécanisme de l'influence du cartilage de la cloison nasale dans la période prénatale et dans la première phase de l'ontogenèse postnatale sur le développement normal de la partie faciale du crâne et dans les fissures congénitales. Dans les fissures congénitales unilatérales de la lèvre supérieure en combinaison avec les fissures de la voûte du palais l'équilibre de la croissance du cartilage de la cloison nasale et des os de la face est troublé. C'est le degré de ces modifications duquel dépend la déformation des os de la partie faciale du crâne qui peut s'étendre jusqu'à la voûte et la base de la partie cérébrale du crâne. Les modifications qui se produisent ainsi dans le scelette osseux du nez dépendent immédiatement de la déformation des os de la face et même du dysfonctionnement des muscles de la bouche, de la face et du pharynx. C'est le dysfonctionnement des muscles des narines et de l'orifice buccal

qui a une importance essentielle parmi les causes des déformations du scelette cartilagineux du nez. Le dysfonctionnement des faisceaux supérieurs de m. orbicularis oris joue le rôle le plus important dans la déformation des cartilages des ailes nasales. Selon nos constatations, les déformations du nez qui accompagnent les fissures congénitales de la lèvre supérieure se présentent chez tous les malades étant localisées pour la plupart dans la partie cartilagineuse du nez et dépendent du type de la fissure.

ZUSAMMENFASSUNG

Mechanismus der Deformationen des mittleren Gesichtsabschnittes bei angeborenen einseitigen Spalten

Novoselov R.

Der Autor erläutert den Mechanismus der Wirkung des Knorpels des Nasenseptums in der pranatalen Zeit und in der ersten Phase der postnatalen Ontogenese auf den sich entwickelnden Gesichtsteil des Schädels in der Norm und bei angeborenen Spalten. Bei angeborenen einseitigen, mit Gaumenspalten kombinierten Oberlippenspalten ist das Gleichgewicht zwischen dem Wachstum des Nasenseptumknorpels und der Gesichtsknochen gestört. In Abhängigkeit vom Grad dieser Veränderungen entwickelt sich eine Knochendeformation des Gesichtsteils des Schädels, die sich bis auf die Wölbung und Basis des Hirnteils des Schädels erstrecken kann. Die Veränderungen, die dabei in dem Knochenskelett der Nase entstehen, sind von der Deformation des Gesichtsknochen und auch von der Dysfunktion der Mund-, Gesichts- und Speiseröhrenmuskeln direkt abhängig. Unter der Ursachen der Deformation des Knorpelskeletts der Nase ist von grundlegender Bedeutung die Dysfunktion der Muskeln der Nasenöffnung und der Mundspalte. Eine leitende Rolle bei der Deformation der Knorpel der Nasenflügel spielt die Dysfunktion der oberen Bündel des m. orbicularis oris. Die Nasendeformationen, die die angeborenen Oberlippenspalten begleiten, sind nach unseren Befunden bei allen Patienten ausgedrückt, sie sind überwiegend in dem Knorpelteil der Nase lokalisiert und von dem Typ der Spalte abhängig.

RESUMEN

Mecanismo de las deformaciones de la parte media de la cara en fisuras congénitas unilaterales.

Nowoselow R.

Se explica el mecanismo de la acción del cartílago del tabique nasal en el estadio prenatal y en la primera fase de la ontogenesis postnatal a la parte bucal del cranio en desenvolvimiento en la norma y en fisuras congénitas. En las fisuras unilaterales congénitas del labio superior combinadas con fisuras del paladar está estorbado el equilibrio del crecimiento del cartílago nasal del tabique y de los huesos bucales. En dependencia en el grado de estos cambios se desarrolla la deformación de los huesos de la parte bucal del cranio que puede ensancharse hasta la bóveda y basis de la parte cerebral del cranio. Los cambios, que se producen con eso en el esquéleto óseo de la nariz, dependen directamente de la deformación de los músculos de la boca, cara y faringe. La disfunción de los músculos de los orificios nasales y de la rima bucal son de importancia fundamental entre las causas de la deformaciones del esquéleto cargilaginoso de la nariz.

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THE STRUCTURAL CHANGES IN THE ARTICULAR PROCESS BY CHILDREN SUFFERING FROM THE SECONDARY OSTEOARTHROSIS DEFORMANS OF THE TEMPORO-MANDIBULAR JOINT

N. N. KASPAROVA, Z. D. KOMNOVA

The results of examination of the temporo-mandibular joints by 41 children in the age ranging from 1 year and 8 months to 13 years, who suffered from a secondary osteoarthrosis deformans affecting temporo-mandibular joint are described in this study. [1])

The diagnosis of the secondary osteoarthrosis deformans was based by all the patients on the main roentgenological features of the disease: a continual deformed articular fissure, deformities of articular parts of the articular process and of the temporal bone due to osseous outgrowths, alterations of the subchondral marginal layer of the bone in the sense of its widening, deformities and structural consolidations of the osseous tissue in the adjacent parts.

By 32 children, the perpendicular movements of the jaw were possible to the extent that the mouth could be opened by 0.3—3.0 cm. By 9 children, a total immobility of the jaw was observed. The disease was caused by an injury of the joint by 23 children (by 12 children, the injury occurred during their birth), by 9 children — a haematogenic osteomyelitis of a newborn happened to localize in the articular process, by 6 children — osteomyelitis of the temporal bone developed as a consequence of the suppurative otitis media and mastoiditis, by 3 children — an etiology of the disease was not determined.

By all patients, the anatomical changes of the joint and of its ligamentous apparatus were examined during the operation by inspection of the joint in layers. Condition of the articulating surfaces, a form and a size of the articular process were examined after its resection. The examination revealed a typically

1. This paper represents a continuation of the article by N. N. Kasparova and V. I. Yevdokimova: Secondary osteoarthrosis deformans of the temporomandibular joint by children, which was received for publication in Acta Chirurgicae plasticae.

deformed shape of the process due to its shortening and thickening by all the children. The process was surrounded by firm cicatrized and ossified ligaments that, in the first sight, seemed to represent multiple osseous outgrowths. The articular surface of the articular process was flattened. An excavation was present in its centre, which coincided with the position of the articular tubercle, as the transversal dimensions of the articular cavity. By children with preserved perpendicular movements of the mandible, the articular process could be well separated after dissection of the altered ligaments. The form of the articular head was so changed, that its contours could not be identified. The articular surface of the process was covered by a layer of a fibrous tissue. When this layer was removed, an uneven denuded bone surface appeared. The typical appearance of the articular process deformity, which occurs by the secondary osteoarthrosis deformans, is shown on the Fig. 1. A ramus of the mandible, which is seen on the photograph, was resected by a child 11 years old, who suffered from osteomyelitis. (The protograph showing the resected ramus of the mandible was kindly supplied by the Clinic of the Omsk Medical Institute. The child was operated on by prof. A. M. Nikandrov using his own method and utilizing an osseochondral autologous graft.)

Considering the changes of the bone that occur during the osteoarthrosis deformans inside the joint as a long-term continuously progressing process, it was attempted to classify stages of the disease. The classification was based on the roentgenological appearance by patients with varied length of the disease beginning during the first year of life and on histological structure of the osseous tissue examined in 11 articular processes resected during the operations. A number of four roentgenological stages was defined by us, which are diagrammatically represented on the Fig. 2.

Fig. 1. A deformity of the articular process in the case of the secondary osteoarthrosis deformans. The ramus of the mandible was resected in a child 11 years old.

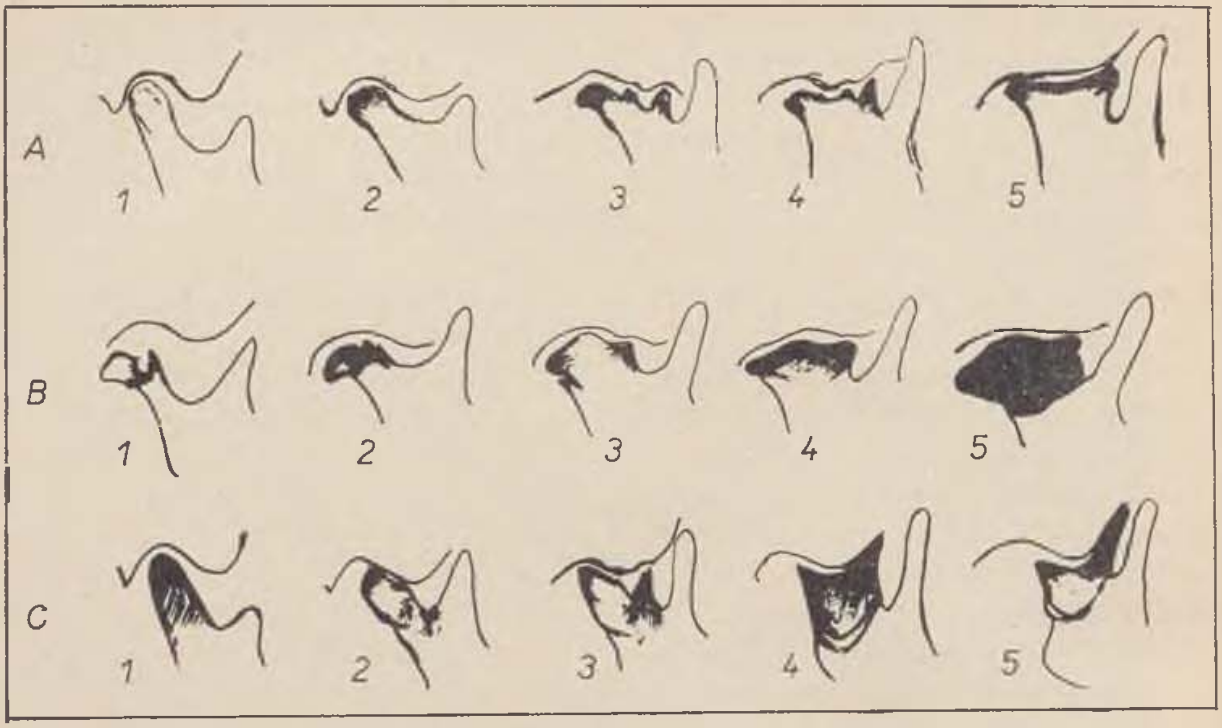

Fig. 2. The diagramm showing development of the deformities affecting the articular process during the secondary osteoarthrosis deformans. A — after the birth injury, B — after the break of the articular process, C — after the haematogenic osteomyelitis. 1 — the first stage, 2 — the second stage, 3 and 4 — the third stage, 5 — the fourth stage of the disease.

The first stage is the stage of osteoarthritis and is in fact the beginning of the disease. It lasts for several months. During this stage, an inflammation and destruction of the osseous structures take place in the articular parts of the bones, i. e. a suppurative resolution of the osseous structures and a bone necrosis occur. The inflammation causes destruction of a part of the articular cartilage. This stage has been insufficiently studied by surgeons and roentgenologists, as it remains unrecognized by majority of the children.

The second stage is the stage of an articular head destruction and of an initial reparation (Fig. 3). The articular fissure is represented by an irregularly narrowed light strip on the roentgenogramms of all the patients. The regular structure of the articular process is lost and the head is flattened. The surface of the process flattens out and, in the case of the haematogenic osteomyelitis, it is deformed and follows the contours of the articular tubercle. The initial reparation of the bone is manifested by separate thin outgrowths originating from the margin of the mandibular notch; it is especially well expressed by the previously injured joints. The limits of the articular cavity are clearly seen and the relief characteristic for the temporal bone is preserved.

The pathomorphological examination of the processes resected on the IInd roentgenological stage revealed that the articular surface of the process was covered by remnants of the articular cartilage or by a fibrillar cartilage containing large ossified islets, which were identified as foci of an osteoid tissue

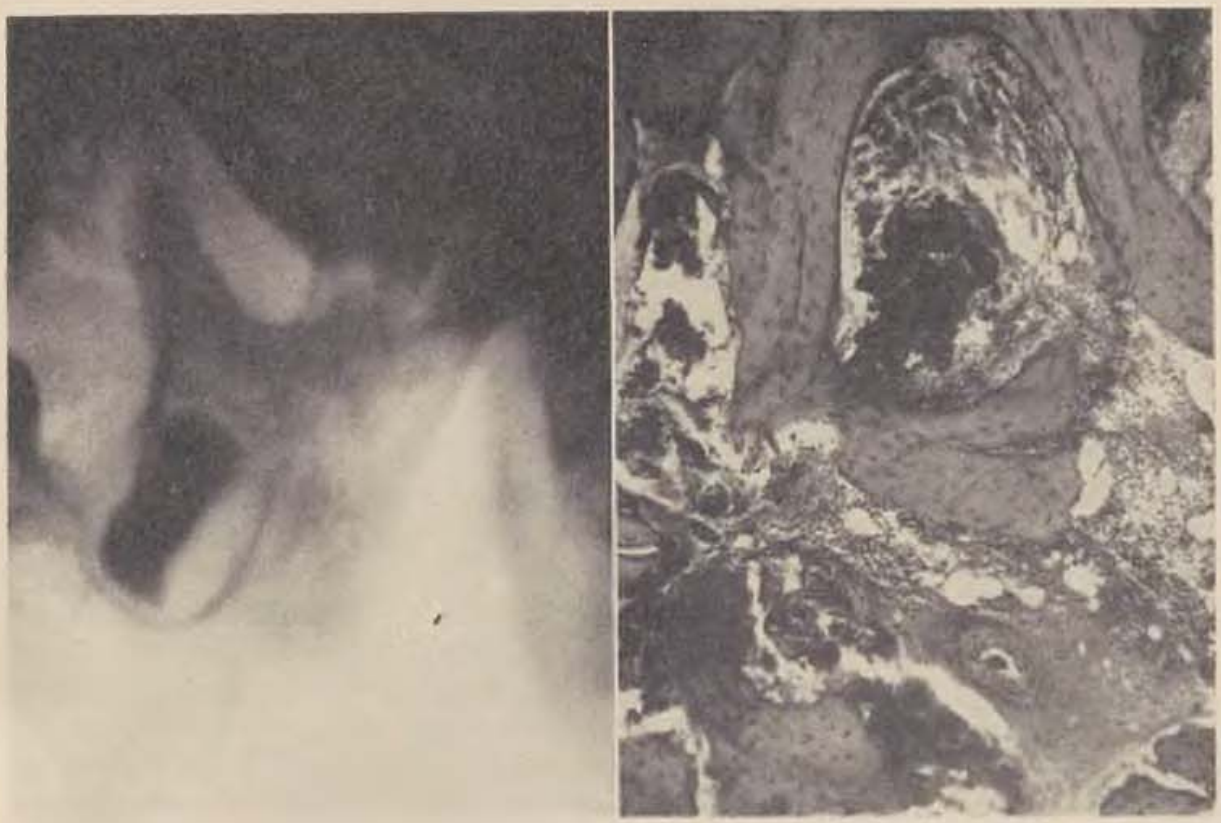

Fig. 3. Roentgenologic features of the secondary osteoarthrosis deformans (the IInd—IIIrd stage). A tomogramm of the joint in a child 3 years old suffering from the disease that was caused by the haematogenic osteomyelitis in a newborn. The mouth can be opened by 1 cm. — Fig. 4. The morphological features found during the IInd roentgenological stage of the secondary osteoarthrosis deformans. The articular process was resected in a child 3 years old. Stained by haematoxylin-eosin. Magnif. 70×.

that was sometimes calcified. In depth of the articular process, an appearance characteristic for a chronical arthrito-arthrosis was observed (Fig. 4). During 2—3 years since the beginning of the disease, many lines of the appositional growth of the bone have developed. The medullar spaces are substantially widened and filled with a cellular and fibrillar tissue that is abundantly vascularized by enlarged blood vessels of the capillary type. In some cases, the foci of the necrotic bone, breakdown of the bone lamellae to fragments and medullar necroses are present. In the adjacent parts of the bone, an inflammatory infiltration of neutrophilic and eosinophilic leukocytes is seen.

According to our observations, the IInd roentgenologic stage lasts for 2—3 years. During this period of the disease, the supporting function of the bone fails due to inflammation, partial resolution and necrosis and the bone structures are destructed under the influence of the functional load. Following the IInd stage, the disease may come to the end by pseudoarthrosis in some patients suffering from osteoarthrosis caused by a haematogenic osteomyelitis. In such cases, the perpendicular movements of the mandible are permanently preserved and the patients are able to open their mouth by 2—3 cm.

The third stage is the stage of expressed reparation. The irregular and in some places extremely narrowed articular fissure (Fig. 5) was found between the articular surfaces on roentgenogramms of all the patients. The articular process was substantially thickened and deformed. On this stage, the transversal dimensions of the process become greater than the dimensions of the articular cavity. Therefore, the articular surfaces of the temporal bone and of the process contact not only in the region of the articular cavity, but also in the region of the articular tubercle. The structure of the articular process is consolidated due to expressed sclerosis of the bone. The temporal bone is deformed on this stage: a depth of the articular cavity diminishes and the tubercle is flattened.

From the pathomorphological point of view, the articular cartilage is preserved only on small parts of the articular surfaces during the IIIrd stage (Fig. 6). The fibrillar cartilage is revealed in places, where the articular cartilage is missing. The inflammatory processes are not morphologically expressed in the osseous tissue of the articular process. Numerous lines sticking together are seen in the processes resected 5—7 years since the beginning of the disease. They resulted from rebuilding of the bone structures that were formed during intermissions in deposition of the osseous matter. The medullar spaces are enlarged and in some places filled by yellow bone marrow with sites of haematogenesis. In the peripheral parts, it is filled by a cellular and fibrillar tissue. Along the margins of the bone structures, some sites of enchondral ossification were observed (Fig 7).

Fig. 5. The roentgenological findings during the IIIrd stage of the disease. The roentgenogramm of a child 13 years old, who suffered from the osteomyelitis of the temporal bone caused by the chronical suppurative otitis media and mastoiditis. Duration of the disease was about 13 years, the mouth can be opened by 0.5 cm.

According to our observations, this period may last for 5—7 years. Increasing dimensions of the articular process cause a gradual diminishing of the articular function, while a light articular fissure remains to be roentgenologically visible.

The fourth stage is the stage when a congruency of the articular surfaces is totally lost. It represents the last stage of the disease and is characterized by total immobility of the jaw.

The articular fissure can be traced on the roentgenogramms (Fig. 8) along all the extent of the articular surfaces belonging to the process and temporal bone. Inside the articular process, which has been deformed by the disease, a compact zone of the consolidated bone is revealed. The articular process is short and wide. The limits of the articular head cannot be determined. The margins of the articular cavity and of the articular tubercle are flattened, representing almost a straight line formed by a strip of a compact bone. Therefore, the winding of the articular fissure, which is characteristic for relief of the temporal bone, is lost and the form of the fissure becomes similar to a straight line (see Fig. 7).

From the pathomorphological point of view, the articular cartilage is present on some parts of the examined preparations, collected on the IVth stage of the disease. In some places, it is replaced by a fibrillar cartilage. In other

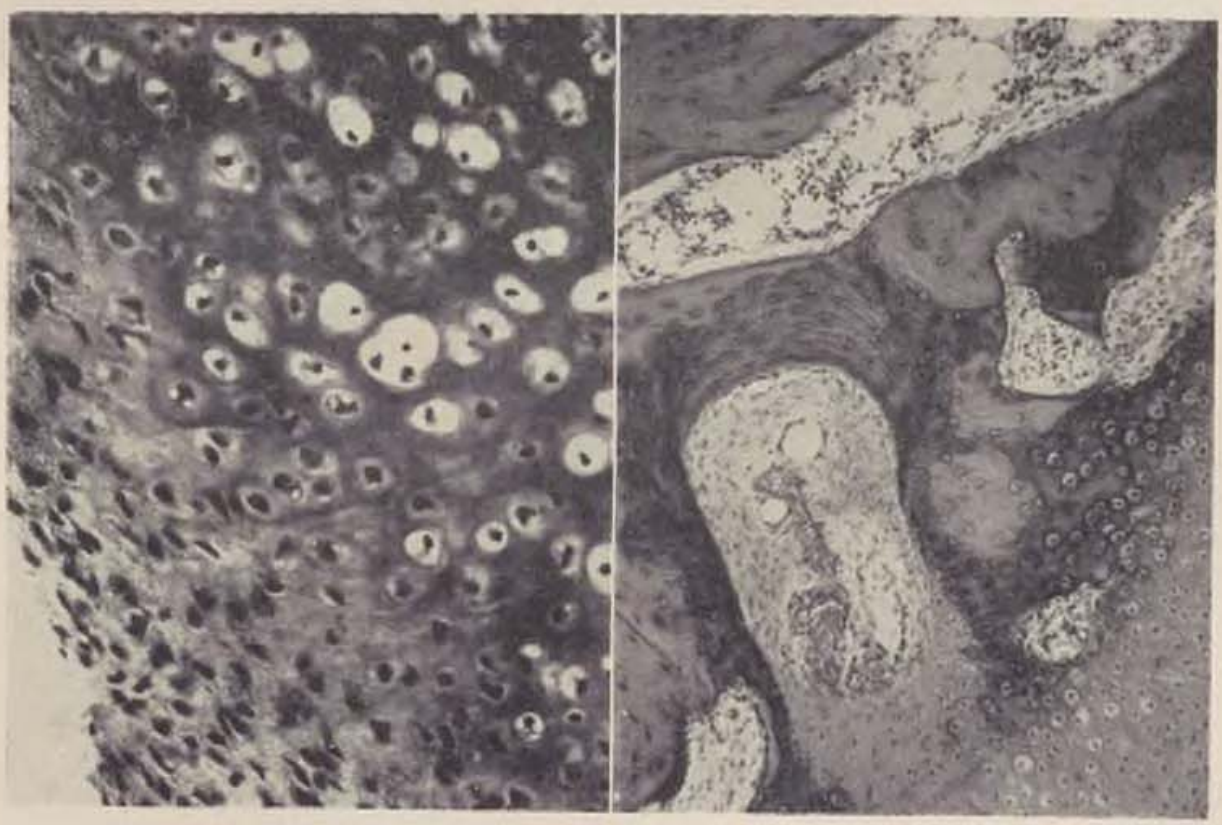

Fig. 6. A part of the articular cartilage. The articular process was resected by a child 7 years old, 4 years after the joint injury. Stained by haematoxylin-eosin. Magnif. 200×. — Fig. 7. The samples showing enchondral ossification by a child 7 years old. Stained by haematoxylin-eosin. Magnif. 100×.

places, the articular cartilage is situated between the mature bone and the newly formed layer of the rough-fibrillar bone. In the resected processes, the bone lamellae showing numerous lines sticking together were seen. The surface of the bone lamellae was uneven, deep lacunae and fantastically erroded bone fragments were present. The latter were surrounded by the outgrown rough-fibrillar bone and were interchanged by fields of the osteoid tissue (Fig. 9). The medullar spaces were filled by a yellow bone marrow lacking the inflammatory signs. In some places, the foci of haematogenesis were seen. The IVth stage of the disease was observed by children, 7—10 years since beginning of the disease.

The microscopical features, which were observed in the bone tissue of the resected articular processes indicated that a long-term chronical inflammatory process was progressing and provoked a bone proliferation. The changes of the bone revealed by the histological examination corresponded to the roentgenological findings on different stages of the disease.

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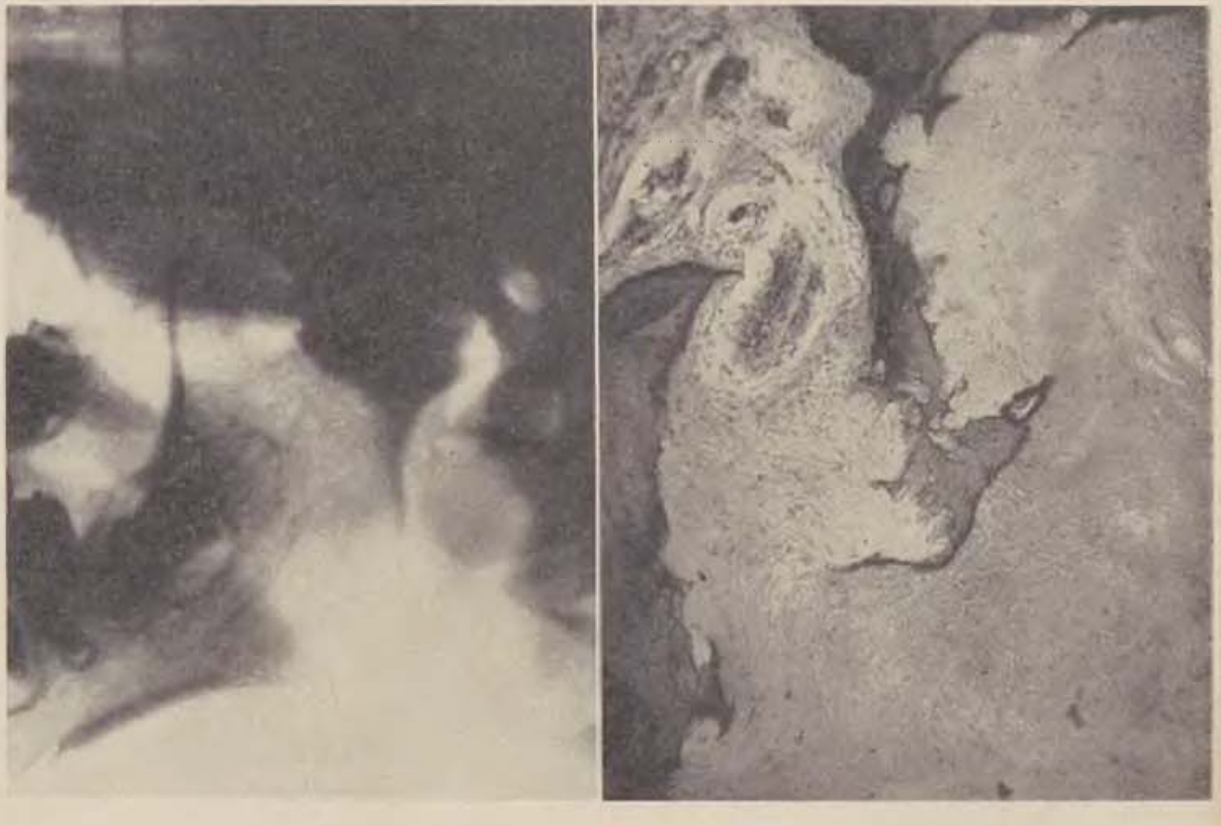

Fig. 8. Roentgenological features found during the IVth stage of the secondary osteoarthrosis deformans. A part of a orthopantogramm by a child 7 years old that suffered from the joint disease caused by an injury. Only reeling mandibular movements were possible. — Fig. 9. Pathomorphological features found during the IVth stage of the disease. The articular process of a child 12 years old suffering from the disease caused by the haematogenic osteomyelitis by a newborn. A wide zone consisting of a newly formed rough-fibrillar bone can be seen. Deep lacunae caused by resolution of the bone tissue are apparent. Stained by haematoxylin-eosin. Magnif. 70×.

SUMMARY

The macroscopical and microscopical structure of the mandibular articular process (11 processes) was studied during a disease affecting the joint, which was caused by injury or haematogenic osteomyelitis. The clinical and roentgenological features were examined and analyzed in 52 children. A number of four stages of the secondary osteoarthrosis deformans in children was distinguished and characterized by the authors.

RÉSUMÉ

Défauts structuraux dans l'apohyse articulaire chez les enfants ayant une ostéoarthose déformante secondaire de l'articulation temporo-mandibulaire

Kasparova, N. N., Komnova, Z. D.

On a étudié le macro- et microstructure de l'apophyse articulaire (11 apophyses) du maxillaire inférieur dans l'affection de l'articulation provoquée par un traumatisme et l'ostéomyélite hématogène. Chez 5 enfants on a étudié et analysé l'image clinique et radioscopique. Les auteurs distinguent et caractérisent quatre stades radioscopiques de l'ostéoarthrose déformante secondaire chez les enfants.

ZUSAMMENFASSUNG

Strukturveränderungen im Gelenkfortsatz bei Kindern mit sekundärer deformierenden Osteoarthose des Temporo-mandibulargelenks

Kasparowa, N. N., Komnowa, Z. D.

Die Autoren untersuchten die Makro-und Mikrostruktur des Gelenkfortsatzes (11 Fortsätze) des Unterkiefers bei Gelenkserkrankungen nach Trauma und hämatogener Osteomyelitis. Bei fünf Kindern untersuchte und analysierte man das klinische und röntgenologische Bild. Die Autoren unterscheiden und charakterisieren vier röntgenologische Stadien der sekundären deformierenden Osteoarthrose bei Kindern.

RESUMEN

Defectos estructurales en el saliente articlar en niños con osteoartrosis deformas segundaria del artículo temporomandibular

Kasparova N. N., Komnova Z. D.

Fue estudiada la macro- y microestructura del saliente articular (11 salientes) de la mandíbula en la enfermedad del artículo provocada por un trauma y osteomielitis hematógena. El cuadro clínico y radiográfico fue estudiado y analizado en 5 niños. Los autores distinguen y caracterizan cuatro estadios radiográficos de la osteoartrosis deformans segundaria en niños.

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REPAIR OF DORSAL MYELOMENINGOCELE
(Review of techniques)

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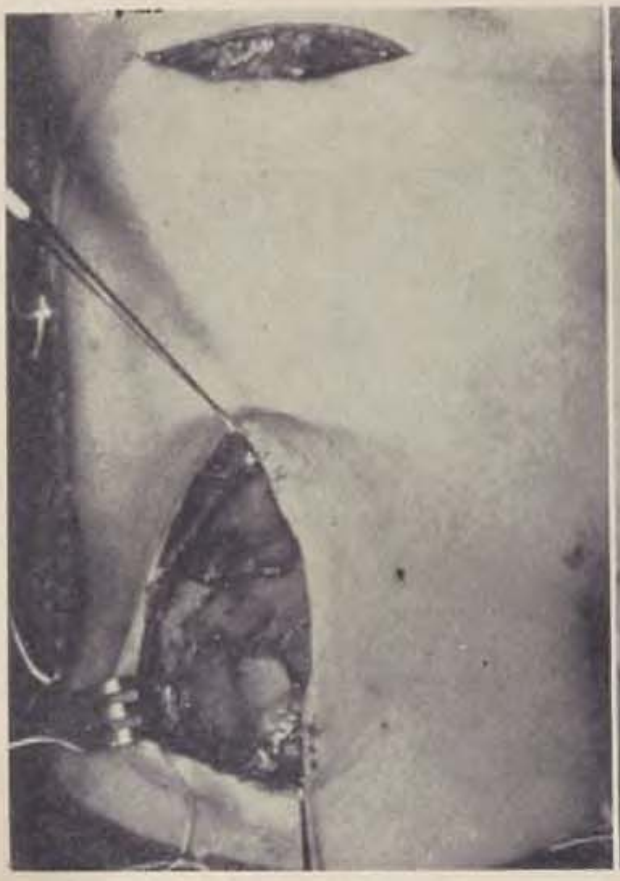
There are three basic areas wherein a fundamental difference of opinion presently exists with regard to the treatment of myelomeningocele.

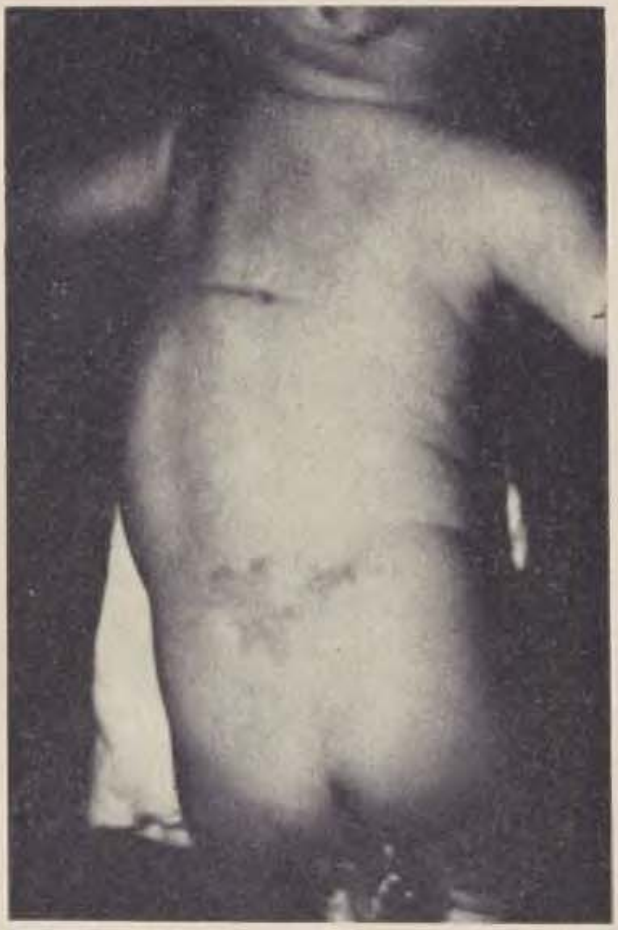
The first controversy involves the initial decision of operative intervention versus conservative treatment: is the patient a candidate for surgery or not. The second is a question of the timing of such surgery: some view these defects as an acute neonatal emergency and advocate immediate closure, while others advocate delay, operating as an elective procedure during the first days of life. Still others argue for a waiting period of a month or more before a definite decision is made. Finally, when surgery is chosen, a difference of opinion exists as to the type of skin closure to be done.

When surgical closure is elected, it often is performed within hours after birth. One advantage of early closure of the spinal defect is that it reduces the incidence of meningitis. Further, it may be that early repair preserves muscle-power and prevents drying up of the neural plate. It also removes the unsightly lesion, thereby improving the infants appearance, and making him easier to care for and more acceptable to the parents. When closure is delayed the onset of complete paralysis of previously active lower limbs within hours after birth sometimes is observed; surgical intervention within the first few days of life is indicated in the case of most low lesions with an intact sac.

Those who argue against immediate closure (10) re-evaluate the infant at one month of age. Those with low lesions who survive without associated problems such as meningitis, fulminating hydrocephalus and other gross abnormalities, may be considered surgical candidates at that time. Still others withhold surgery until late infancy when it becomes apparent the child will survive despite prediction to the contrary.

The essential features of the closing procedure in these infants are standard. The entire meningocele sac or membrane must be excised, leaving healthy skin on the one side and only the neural plate on the other. All skin should be preserved even if it is pigmented. The dura usually is identifiable as a separate layer which mobilizes easily and should, whenever possible, be closed with interrupted silk sutures to cover the remains of the spinal cord and neural plate.





Case 1. Fig. 1, 2, 3 — Plication of fascia with turn over flaps.

It is important to make a repair at the fascia level by plication of the fascia covering the lumbo-dorsal musculature, or turn-over fascia flaps. (Case 1. Figures 1, 2, 3.) In the thoracic and sacral areas it is sometimes impossible

Case 2. Fig. 4 — Large thoraco-lumbar lesion

Fig. 5 — Linear repair with extensive undermining

to raise a satisfactory fascia flap unless this layer is brought over the defect as part of a composite myocutaneous or muscle-bone flap (9). In one of our cases a secondary suture of the fascia became necessary because of CSF leak.

In most instances, however, defects in the skin are repaired by wide undermining of the soft tissues either towards the flank and umbilicus or cranially and caudally along the spine (Case 2. Figures 4, 5).

It is not the purpose of this paper to examine the ethical and moral implications of this type of surgery. The plastic surgeon is fortunate in that he usually does not have the responsibility of selecting suitable candidates for operation.

Case 3. Fig. 6 — Lumbo-sacral lesion

He cannot remain neutral, however, if he is asked to participate in the treatment of some of these infants. While our experiences demonstrate the feasibility of the simplified approach to closure of these defects, successful reconstruction may result in a mixed blessing, salvaging life but contributing to the prolongation of a miserable existence.

The illustrations of this presentation deal primarily with alternate techniques for repair of large of low lumbosacral myelomeningocele.

CONCLUSION

In the majority of cases, the plastic surgeon is not called upon to assist in the management of these infants since most can successfully be repaired by wide undermining and linear closure. I has been our experiences during the past 15 years that the neurosurgeon alone can perform the closure, and this is borne out by large samples from specialized centers. For instance, Bannister (3) of Leeds, England has, in a period of four years, operated successfully on 120 such infants using only the linear repair following wide undermining of the skin flaps. Postoperative nursing in a prone position is helpful in that it relieves tension on the suture line (Figure 8).

This simplest of procedures generally is the safest and most effective. We have used on occasion transposition flaps from the flank outlined at a ratio of 1:1 but never more than 1¼:1 of length and width. (Case 3 Figures 5, 6, 7)

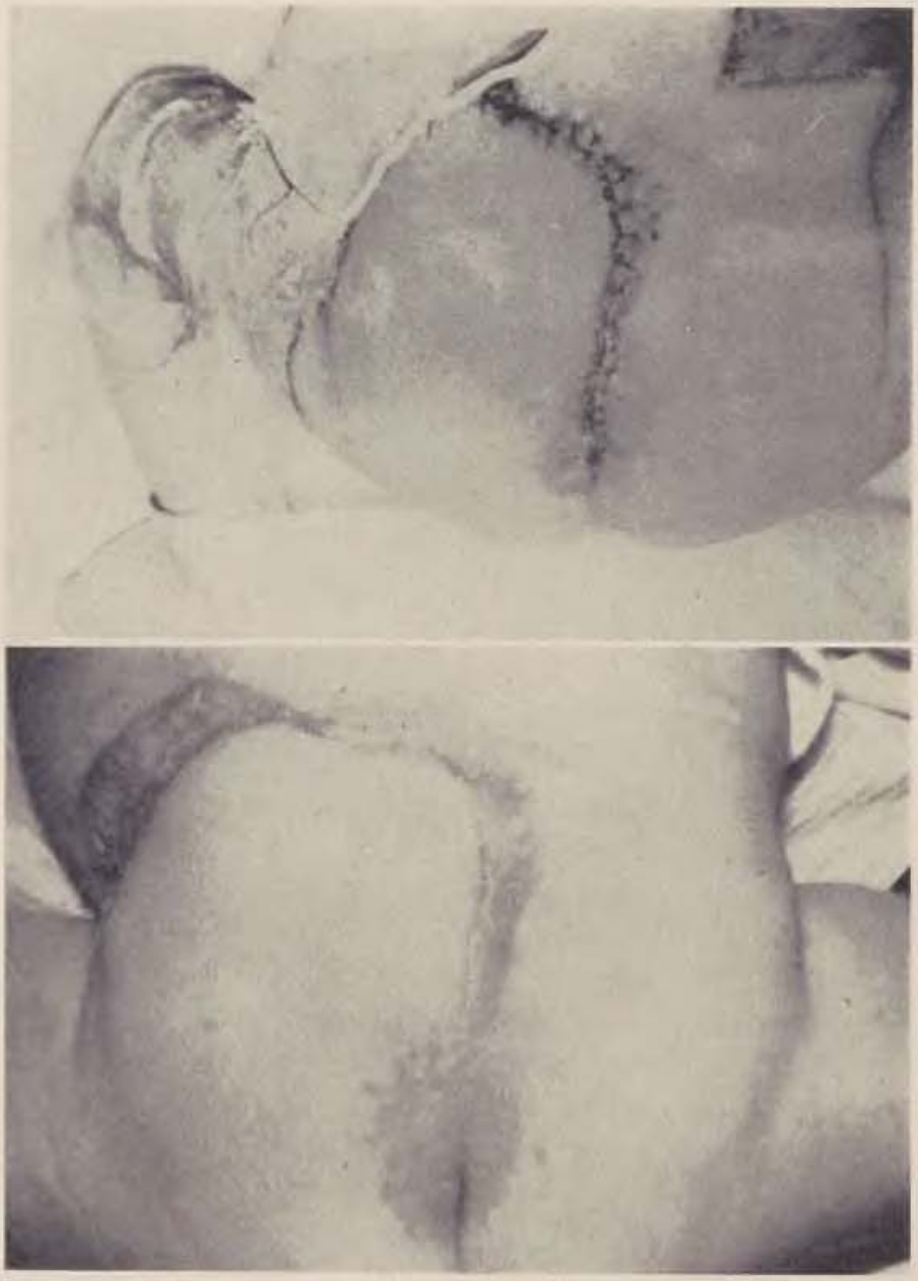
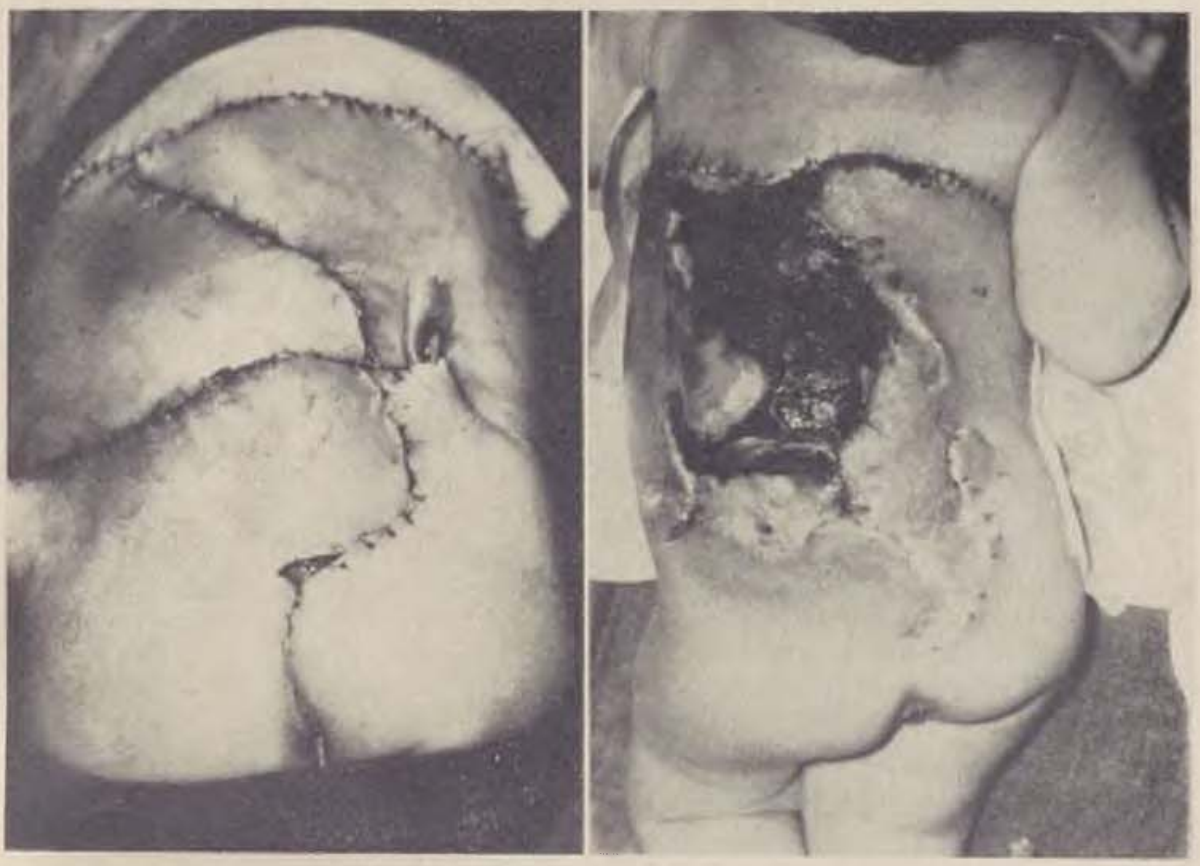


Fig. 7 — Repair with a transposition flap from the flank. — Fig. 8 — Results of primary repair with skin graft on the donor site

Large rotational flaps on the back are to be avoided as they carry a high rate of complications. (Case 4. Figures 9, 10) The S shape double flap has largely been given up because the suture line lies directly over the dorsal repair. Mustarde's procedure has been used rarely and only for low lumbo-sacral lesions.



Case 4. Fig. 9 — Lumbar lesion repaired with large rotation flaps. — Fig. 10 — Extensive slough of the flaps due to inadequate blood supply.

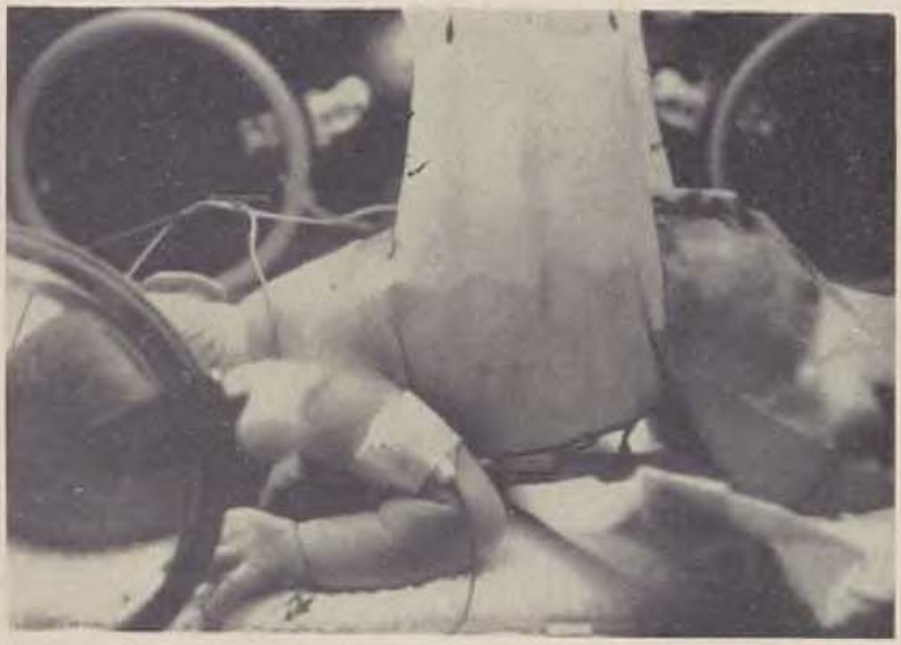


Fig. 11 — Sling used by Dr. Wiemer in the postoperative period

ACKNOWLEDGEMENTS

The author would like to thank Drs. M. Spira, R. Wiemer, F. Gerow of Baylor University College of Medicine, Houston, Texas, for use of some of the clinical photographs. Also to Mrs. C. Graham of the Rockford School of Medicine for her help in preparation of this manuscript.

SUMMARY

This article is based on the experience of two plastic surgeons for a period of 15 years and review of the literature up to 1975.

It deals with considerations as to the timing of surgery, and type of repair with particular reference to skin closure.

It has been our experience that in most cases the neurosurgeon alone can perform the closure using a linear repair following wide undermining of the skin flaps.

On occasion transposition flaps from the flank designed at a ratio of 1:1 but never more than 1¼:1 of length and width have been used. Large rotational flaps on the back are to be avoided as they carry a high rate of complications. The S-shaped double flap has largely been given up, because the suture line lays directly over the dorsal repair.

Mustarde's procedure has been used rarely and only for low lumbar-sacral lesions.

An illustration is included for nursing of the infants in the prone position with the help of a sling as used by Wiemer and Gerow of Houston.

RÉSUMÉ

Correction de la myéloménigocèle dorsale

Pap, G. S., Grulee, C. G.

Le travail consiste en expériences de deux chirurgiens plastiques faites pendant 15 ans et en vue générale de la littérature jusqu'à 1975. On réfléchit au temps de l'intervention chirurgicale et au type de la reconstruction surtout quant à la fermeture de la couverture cutanée. L'expérience montre que dans la plupart des cas, le neurochirurgien peut réaliser la fermeture du défaut par une suture linéaire après avoir tout d'abord miné le lambeau cutané. S'il était nécessaire, on a effectué une transposition latérale du lambeau cutané, déssiné en proportion de 1:1, mais la plus grande possible 1,5:1 en longueur et en largeur. Mieux, il faut éviter les lambeaux rotatifs au dos: ceux-ci sont souvent accompagnés par des complications. Maintenant, on renonce à S-lambeau double parce que la suture traverse immédiatement le défaut dorsal. Le procédé de Mustard n'était utilisé chez nous que rarement et qu'en cas d'une lésion lombaire et sacrale qui est située bas. La photographie ajourée montre la position du nourrisson dans la période postopératoire ayant le visage tourné en bas en utilisant des sangles selon Wiemer et Gerow, Houston.

ZUSAMMENFASSUNG

Korrektur der dorsalen Myelomeningozele (Übersicht der technische Verfahren)

Pap G. S., Grulee C. G.

Die Arbeit beruht auf Erfahrungen von zwei plastischen Chirurgen aus einem fünfzehn Jahre deckenden Zeitraum und auf einer Literaturübersicht bis zum Jahre 1975. Man betrachtet die Bestimmung der Zeit des chirurgischen Eingriffs und den Typ der Wiederherstellung besonders mit Hinsicht auf die Schliessung der Hautdecke. Die Erfahrung zeigt, dass der Neurochirurg in meisten Fällen die Schliessung des Defekts durch lineare Sutur nach vorhergehender umfangreicher Unterminierung des Hautlappens selbst durchführen kann. In Notfallen benutzt man die Transposition des seitlichen Hautlappens, der in einem Verhältnis von 1:1, jedoch nicht mehr als 1,5:1 auf Länge und Breite aufgezeichnet wird. Umfangreiche Rotationslappen am Rücken sind besser zu meiden: sie werden oft von Komplikationen begleitet. Von dem doppelten S-Lappen wird jetzt Abstand genommen, da die Naht direkt über den Dorsaldefekt verlauft. Das Mustardsche Verfahren ist bei uns nur selten und lediglich bei niedrig liegenden Lumbosakrallasionen gebraucht worden. Eine Photographie liegt bei, die die Lage eines Säuglings in der postoperativen Zeit mit Gesicht nach unten unter Anwendung von Gurten nach Wiemer und Gerow (Houston) zeigt.

RESUMEN

Corrección de la mielomeningocele dorsal (Sumario de las técnicas)

Pap, G. S., Grulee C. G.

La obra se basa en las experiencias de dos cirujanos plásticos durante el período de 15 años y en la sinópsis de la literatura hasta el año 1975. Se considera la determinación del tiempo oportuno para la intervención quirúrgica y se premeditan los métodos de la reconstrucción con respecto especialmente al cierre de la cubierta cutánea. La experiencia muestra que en la mayoría de los casos el neuroquirurgo por sí mismo puede hacer el cierre del defecto con sutura linear después de previamente haver minado el lóbulo cutáneo de modo extenso. En casos necesarios se usa la transposición del lóbulo cutáneo colateral, dibujado en proporción de 1:1, pero a lo más de 1,5:1 de largo y de ancho. Es mejor evitar el empleo de lóbulos rotativos extensos en el dorso; muy a menudo son acompañados de complicaciones. En el presente se abandona el doble S-lóbulo, porque la sutura pasa directamente por el defecto dorsal. En nuestro país el procedimiento de Mustard fue empleado sólo rara vez y eso solamente en caso de una lesión lumbo-sacral en un lugar bajo. Está añadida una fotografía que muestra la posición de un lactante en el período postoperativo, cara abajo en correas según Viemer y Gerow, Houston.

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Case 1. Fig. 1, 2, 3 — Plication of fascia with turn-over flaps.

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ELONGATION OF METACARPAL AND PHALANGEAL BONES USING A DISTRACTION METHOD BY CHILDREN AND JUVENILES WITH INBORN DEVELOPMENTAL ANOMALIES OF THE HAND

G. S. GODUNOVA

Various reconstructive operations were designed with the aim to recover a function of a hand with defects of the fingers: a phalangization of metacarpal bones, a plasty of skin and bones a pollicization, a transposition, a transfer of toes to a hand etc. These methods, which are mainly used in treatment of posttraumatical deformities of the hand in adults, can be utilized under certain circumstances also in patients with inborn underdevelopment of the fingers. However, such methods have not been widely used in treatment of inborn hand anomalies by children, because the technique of the operations is rather complicated: it requires a great experience from the surgeon, a skin and bone autoplasty should be applied, normal fingers or toes should be transferred and complications or failures occur frequently by the operations.

A partial underdevelopment (ectrodactyly) or a total absence of fingers (adactyly) was observed by a significant number of patients suffering from inborn anomalies of the hand. These deformities lead to functional disturbances of the hand, a degree of which depends on severity of the finger deformities. They frequently cause a serious invalidity, as even an elementary self-service may be impossible. The ectrodactyly and adactyly are usually complex developmental anomalies. According to data from literature, their treatment in the infantile age is basically limited to removal of the concommitant deformities (syndactyly, clinodactyly, strangulation of fingers etc.). A surgical rehabilitation aimed to recovery and equalizing of the length of the fingers by children with such inborn anomalies has not yet been sufficiently worked out.

A distraction method, which is used for reconstruction of the lost fingers (Matev 1969, 1970; Buck-Gramcko 1970; Vodyanov 1970, 1976; Ulitskii and Malygin 1971, 1973; Degtyareva et al. 1975; Nelzina and Lekomtsev 1976 and others), has been utilized during last several years in adult patients with posttraumatical hand deformities. Vodyanov (1976) described unic observations on inborn developmental anomalies of the hand. These authors able to elongate the

metacarpal and phalangeal bones by 1—5 cm using distraction appliances of various design, the application of which was preceded by a preliminary osteotomy.

CLINICAL MATERIAL

We used the distraction method for reconstruction of the absent fingers and for elongation of the underdeveloped fingers by 21 patients in the age from 6 to 15 years suffering from an inborn adactyly and ectrodactyly of the hand. A miniature distraction apparatus (Rationalization proposal No. 54/74) was used for elongation of phalangeal and metacarpal bones. It represents a modification of the Ilizarov's compressive and distraction apparatus. Depending on the type of the deformity and technique of distraction, two or three pairs of thin traction wires are lead through the bones, crossed and firmly attached to archs of the apparatus. In this way, a dosage of the tractive force applied to contacting fragments or to the region of the growth zone is made possible. The distraction proceeds by means of turning the screw-nuts on bars that bind together the archs of the apparatus (Fig. 1).

In 21 patients (7 boys and 14 girls), the reconstruction of 27 fingers was performed; in 16 of them, the metacarpal bones were distracted and in 11 of them, the proximal phalanges were elongated. The first finger was reconstructed in 4 cases, the second one in 16 cases, the third one in 4 cases, the fourth one in 2 cases and the fifth one in one case. The total absence or severe underdevelopment of these fingers (while the corresponding metacarpal bones were present) combined with expressed functional disturbances of the hand served as indications for application of the distraction method.

By all the patients, the affected hand represented a complex developmental anomaly. By 12 patients, a partial ectrodactyly was combined with a syndactyly, inborn strangulations, a clinodactyly and flexure contractures of the fingers. In addition to it, the distracted finger was very small (0.5—2.0 cm long) and consisted of only one more or less underdeveloped proximal phalangeal bone. By other 9 patients, the most severe hand anomalies occurred; by 3 patients, a total adactyly was present and the hand was incapable of a grip, by 6 children, a severe underdevelopment of some fingers was combined with absence of the others. A number ranging from 3 to 5 fingers of the treated hands was affected by all the patients; by 10 patients, the developmental anomaly occurred on both hands. The distraction apparatus was immediately applied only in 8 patients from the total number of 21 patients. In the remaining 13 patients, multiple plastic operations had to be preliminarily performed as a treatment of the concommitant deformities.

Two types of the distraction methods were utilized for reconstruction of the underdeveloped fingers in dependence on the age of the patients and on the form of the deformity: 1) elongation of the metacarpal bone preceded by its preliminary osteotomy (6 patients) and 2) elongation of the finger by distraction of the growth zone of the proximal phalangeal or metacarpal bone (15 patients). The age of the patients that were operated on and methods of the operations are shown in the Table 1.

Table 1.
The types of operations and the age of patients that were operated on.

Type of the operation	No. of patients	Age of patients in years			
		6—7	8—10	11—13	14—15
Distraction of the metacarpal bone preceded by an osteotomy	6	1	—	—	5
Distraction of the growth zones by the proximal phalangeal or metacarpal bones	15	5	5	5	—
Total	21	6	5	5	5

By older patients (14—15 years), the elongation of the metacarpal bone was performed following its preliminary osteotomy (5 operations) in the case of a total adactyly or if just small rudiment of the proximal phalangeal bone was present and a growth zone of the metacarpal bone was absent (revealed by X-ray examination). A similar operation was also performed by a 7-year-old child exhibiting only soft-tissue rudiments of the fingers and having extremely hypoplastic epiphyses of the metacarpal bones.

By children in the age from 6 to 13 years, suffering from ectrodactyly or adactyly, the fingers were elongated by distraction of the growth zones of the underdeveloped proximal phalangeal bones (11 operations) or by distractional epiphyseolysis of the metacarpal bones (10 operations), if the growth zones were roentgenologically distinctly expressed. The types of distraction and localization of the operations are shown in the Table 2.

Table 2.
The types of the distractions and localization of the operations.

Type of the distraction	No. of operations	Proximal phalanges of the fingers					Metacarpal bones				
		I	II	III	IV	V	I	II	III	IV	V
Method of distractional epiphyseolysis	21	1	6	3	1	—	2	5	1	1	1
Following preliminary osteotomy	6	—	—	—	—	—	1	5	—	—	—
Total	27	1	6	3	1	—	3	10	1	1	1

For elongation of the finger by distraction of the growth zone of the proximal phalangeal bone, three pairs of the traction wires were used. They were lead in a crossed way through the rudiment of the proximal phalangeal bone, through its growth zone and through diaphysis of the corresponding metacarpal bone (Fig. 2b). In the case of the distractional epiphyseolysis of the metacarpal bone, two pairs of the tractive wires were lead in a crossed way through the growth zone and diaphysis of the metacarpal bone. If a small rudiment of the proximal phalangeal bone was present and movements in the metacarpophalangeal articulation were possible, then the phalangeal rudiment was fixed by an additional traction wire lead through it in a sagittal direction, in order to prevent a compression of the rudiment.

An electric drilling machine may be used for drawing of the traction wires through the phalangeal and metacarpal bones, but an introduction by hands is preferred in respect to the growth zones. In this case, the traction wire is firstly inserted through the skin to a position near the bone in the region of the phalangeal or metacarpal metaphyses and then it is slowly moved towards the growth zone; the moment of finding it is distinctly recognized by a soft consistence of the tissue, if compared with the bone. Thereafter, the traction wire is kept between the thumb and the index finger and very cautiously is turned around, thus penetrating the growth zone, surrounding soft tissues and the skin cover on the other side. If performed by experienced hands, this manipulation does not cause any difficulties, however, using the electric drilling machine, it is much more complicated to find precisely the growth zone of the underdeveloped phalangeal or matacarpal bone in the child's hand with a thin traction wire and the first attempt often fails.

The distraction is started on the 2nd day after application of the apparatus and the elongation proceeds by 0.5—1.0 mm a day with periodic intermissions lasting 1—3 days. For all the time of the distraction, the patients, including young children, were well composed and lived in their usual way. The epiphyseolysis was confirmed by X-ray examination on the 6th—7th day of the distraction treatment and usually it was achieved painlessly.

By 3 children, 6—8 years old, with ectrosyndactyly, the proximal phalangeal bones of two adjacent fingers, which were grown together, were elongated in the same time. By a 12-year-old patient with rudimentary fingers, the three metacarpal bones were elongated at once (Fig. 3). Such a tactics in treatment of the multiple finger defects substantially shortened a period of surgical rehabilitation and the time spent by patients in the hospital. Additionally, in the case of the syndactyly, it enabled to form interdigital and intermetacarpal spaces of the necessary depth just after lengthening of the phalangeal or metacarpal bones has been completed. Usually, a secondary deepening of the interdigital spaces is required after preliminary removal of adhesions and subsequent distraction of the fingers. It should be further admitted that the simultaneous elongation of several adhering fingers or metacarpal bones by previously unoperated patients creates more favourable conditions for the distraction, as the scars are not present.

The elongation of the metacarpal bone, which was preceded by a preliminary esteotomy, was performed, if the proximal phalangeal bone was severely underdeveloped and the movements in the metacarpophalangeal articulation were preserved. The three pairs of the traction wires were introduced: through a head, through a base of the metacarpal bone and through a rudimentary phalangeal bone. In the case of the total adactyly (Fig. 4), two pairs of the traction wires were lead through the distal and proximal ends of the metacarpal bone. Thereafter, an incision 2—3 cm long was made on a dorsal surface of the hand in the place corresponding to the chosen metacarpal bone and an oblique subperiostal osteotomy was performed on diaphysis of the metacarpal bone. The bone fragments were sutured by 2—3 silk threads in order to prevent their displacement. When the suture of the wound was completed, the apparatus was applied. The distraction of the metacarpal bone was started on the 10th—12th day after osteotomy and affected the soft osseous callus in the same manner, as it was already described.

All types of the distractions were continued for about 2—2 ½ months. When the elongation was completed, the apparatus remained in the fixed position so long as a sufficiently consolidated osseous regenerate developed, as revealed by an X-ray examination (about 1 ½—2 months). When the apparatus was taken off, the hand was immobilized for a month using a circular plaster bandage and thereafter by a removable plastic splint. During the distraction and after it no neurological disturbances were observed by the patients and all kinds of the skin sensitivity were preserved on the elongated parts of the hand.

RESULTS

A classification of Ulitskii and Malygin (1971) was used for evaluation of the roentgenogramms showing formation of the osseous regenerate during the elongation of the phalangeal and metacarpal bones, which was achieved by distraction. The classification reflects in a sufficient detail the dynamics of the reparative regeneration and corresponds to our data: 1) the stage of the distractional epiphyseolysis or diastase between the fragments, when osteotomy of the metacarpal bone was done (the 6th—7th day from the beginning of the distraction); 2) the stage of point-like calcifications in the enlarging diastase of the growth zone or between the fragments (2—4 weeks); 3) the stage of band-like structure of the regenerate (5—10 weeks); 4) the stage of induration of the regenerate (11—14 weeks); 5) the stage of recovery of form and structure of the bone (during 5—7 months).

During reconstruction of 27 fingers by the distraction method, an elongation of the phalangeal or metacarpal bones ranging from 1.5 to 4.5 cm was achieved. The extent of the necessary elongation was individually estimated. The developmental anomaly affected several fingers in all cases of the operated hands. Therefore, the shortest fingers were lengthened up to level of the neighboring ones (Fig. 2e), or the second metacarpal bone was elongated by means of the distraction to the extent that it somewhat exceeded the length of the thumb, thus improving the grip capability (Fig. 4d).

The results of the operations were examined in the time periods ranging from 3 months to 5 years. Following the distractional epiphyseolysis of the phalangeal and metacarpal bones by children 6 to 10 years old, the growth zones were roentgenologically examined, while by patients 12 to 13 years old, the growth zones appeared to be closed. No complications were observed after application of the dictractional epiphyseolysis. Only in one case, the distraction had to be interrupted too early, on the stage when the elongation of the underdeveloped phalangeal bone equal to 1.5 cm was achieved, as the bone perforated the skin cover. The wound localized on the phalangeal tip was then covered by a crossed skin flap on a pedicle that was collected on the neighboring finger. By two patients in the age of 14 and 15 years, a thinned out conical regenerate developed following the oblique osteotomy of the metacarpal bone and subsequent distraction, similarly as described by Ulitskii and Malygin (1971). The rebuilding of the regenerate lasted for many months and the elongated bones became partially shortened after taking off the apparatus.

DISCUSSION

The elongation of the metacarpal bones achieved by distraction was performed by patients suffering from the most severe inborn developmental anomalies of the hand, if it seemed to be impossible to perform pollicization or transposition of fingers, by which the most favourable results would be attained. In comparison with other reconstructive operations (a phalangization of metacarpal bones, a method of skin and bone reconstruction, a transfer of toes to the hand), the distraction method is technically simpler and less traumatizing. It is important for surgical rehabilitation of children with multiple finger defects. In addition to it, using the distraction method, the fingers are reconstructed by means of regenerates of the own bones of the hand. The prolonged operative treatment consisting of many stages and utilizing skin and bone autoplasty can be avoided, similarly as the postoperational scars on donor sites of the body. Simultaneously with elongation of the bones, also surrounding soft tissues, blood vessels, nerves, tendons are gradually lengthened. Therefore, a sensitivity of the skin covering the elongated parts of the hand and active movements in the joints that acquired a new localization are preserved. For example, when the small rudimentary proximal phalangeal bone is present and the metacarpal bone is elongated by means of the distractional epiphyseolysis, the metacarpo-phalangeal articulation is moved distally and functions as an interphalangeal joint (Fig. 3c, e).

The problem, how interphalangeal and metacarpo-phalangeal joints could be formed, is studied recently by many scientists. In our opinion, as soon as this problem will be solved, the distraction method will be more widely used in the reconstructive surgery of the hand.

CONCLUSIONS

It was shown that it is possible to achieve quite sufficient and adequate elongation of the phalangeal or metacarpal bones using the distraction method

by patients with inborn developmental anomalies of the hand. Several fingers can be reconstructed in the same time and all kinds of the skin sensitivity are preserved. The method of distractional epiphyseolysis in relatively simple to perform. The fingers are bloodlessly elongated and an even osseous regenerate is formed. During the time, the regenerate acquires a form and structure of the elongated bone.

M. T.

SUMMARY

The reconstruction of 27 fingers was performed in 21 patients in the age ranging from 6 to 15 years suffering from the inborn developmental anomalies of the hand, using the distraction method by application of the miniature distraction apparatus. The number of 16 fingers was elongated by lengthening the metacarpal bones and 11 fingers were elongated due to distraction of the phalangeal bones. By 3 children, two fingers were elongated simultaneously.

The distraction of the metacarpal bone was performed following the preliminary osteotomy in patients 14 to 15 years old with total absence of the fingers (6 operations). By children in the age from 6 to 13 years, by whom the growth zones were roentgenologically clearly expressed, the elongation of the phalangeal or metacarpal bones was achieved by the method of the distractional epiphyseolysis (21 operations). The distraction proceeded by 0.5—1.0 mm a day and was continued for 2—2 ½ months. The elongation equal to 1.5—4.5 cm was achieved in all cases and the skin sensitivity was preserved on the reconstructed fingers.

RÉSUMÉ

Prolongement des os du carpe et des phalanges par la méthode de distraction chez les enfants et chez les adolescents avec des vices de conformation évolutionnaires congénitaux de la main

Godounova, G. S.

Chez 21 patients en âge de 6 à 15 ans avec des vices de conformation évolutionnaires congénitaux de la main, une reconstruction de 27 doigts (16 par le prolongement des os du carpe et 11 par la distension des phalanges) a été faite par la méthode de distension à l'aide d'un minuscle appareil de distension. Chez 3 enfants, on a prolongé en même temps 2 doigts et chez 1 enfant 3 os du carpe.

Chez les malades en âge de 14—15 ans qui étaient dépourvus de doigts, on a réalisé une distension du métacarpe après avoir fait l'ostéotomie de celui-ci (6 opérations). Chez les enfants en âge de 6 à 13 ans, quand les zones de croissance étaient expressivement illustrées par la radiographie, le prolongement des phalanges ou des os du métacarpe a été effectué par la méthode de l'épiphyséolyse de distension (21 opérations). La distension continuait toujours de 0,5 à 1 mm dans 24 heures pendant 2—2 ½ mois. Dans tous les cas on a obtenu le prolongement de 1,5—4,5 cm en conservant la sensibilité de la peau des doigts reconstruits.

ZUSAMMENFASSUNG

Verlängerung der Metakarpalknochen und der Phalangen mit Hilfe der Distraktionsmethode bei Kindern und Jugendlichen mit angeborenen Entwicklungsfehlern der Hand

Godunowa G. S.

Bei 21 Patienten im Alter von 6 bis 15 Jahren mit angeborenen Entwicklungsfehlern der Hand wurde die Wiederherstellung von 27 Fingern (16 durch die Verlängerung der Metakarpalknochen und 11 Distraktionen der Phalangen) durch die Distraktionsmethode mit Hilfe eines Miniaturdistraktionsapparates durchgeführt. Bei drei Kindern wurden gleichzeitig zwei Finger und bei einem Kind drei Metakarpalknochen verlängert.

Bei Patienten im Alter von 14—15 Jahren, denen Finger fehlten, wurde die Distraktion des Metakarpalknochens nach vorhergehender Osteotomie desselben (6 Operationen) durchgeführt. Bei Kindern im Alter von 6—13 Jahren, wo die Wachstumszonen röntgenologisch deutlich ausgedrückt waren, wurde die Verlängerung der Phalangen oder Metakarpalknochen durch die Methode der Distraktionsepiphyseolyse (21 Operationen) erreicht. Die Distraktion fuhr fort jeweils um 0,5 bis 1 mm in 24 Stunden binnen 2—2 ½ Monate. In allen Fällen erreichte man eine Verlängerung um 1,5—4,5 cm bei erhaltener Hautempfindlichkeit der wiederhergestellten Finger.

RESUMEN

Alargamiento de los metacarpianos y de las falanges por distensión en los niños y los púberes con defectos congénitos de desarrollo de la mano

Godunova, G. S.

En 21 pacientes en la edad de 6 a 15 años con defectos congénitos de desarrollo de la mano fue hecha une reconstrucción de 27 dedos (16 por el alargamiento de los metacarpianos y 11 por la distensión de las falanges) por distensión mediante un aparato minúsculo de distensión. En 3 niños alargados 2 dedos y en 1 niño 3 metacarpianos a la vez.

En pacientes en la edad de 14 a 15 años, a los cuales les faltaron los dedos, fue hecha una distensión del metacarpiano de una osteotomia previa de la misma (6 operaciones). En los niños en la edad de 6 a 13 años, cuando las zonas de crecimiento fueron expresadas por radiografía expresivamente, el alargamiento de las falanges o de los metacarpianos fue conseguido por el metodo de epifiseolisis de distensión (21 operaciones). La distensión continuaba siempre 0,5 mm hasta 1 mm en 24 horas durante 2—2 ½ meses. En todos los casos fue conseguido un alargamiento de 1,5—4,5 cm al mantener la sensibilidad cutánea de los dedos reconstruidos.

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HAIR-BEARING SCALP TUBE PEDICLE IN RECONSTRUCTION OF FRONTO-TEMPORAL HAIR LINE

A. ZIELINSKI, J. GOLDSTEIN

Large traumas causing scalpation, especially scalp burns, are quite frequent in children. They result in permanent baldness on large areas, which affects both appearance and mental status of the child. In such cases reconstruction of fronto-temporal hair line seems to be the best solution.

There are various methods of surgical treatment of such baldness, but unfortunately none of them is devoid of certain deficiences and limitations. Sometimes rotated or transposed flap of the remaining part of hair-bearing scalp can be used (2), but in most cases this method is not applicable because of the extensiveness of damage. Island flaps with vascular pedicle containing the temporal artery (3) are more suitable when dealing with baldness of temporo-occipital region. Besides, they require perfect surgical technique and in case of failure cause irretrievable loss of hair on a large area. It is also possible to transplant small segments of full-thickness hair-bearing skin. They may be in the form of narrow strips, 4—5 mm wide, taken from temporo-occipital region (5, 6), or small hair-containing plugs of scalp taken with a special sharp round punch (1, 4). However those methods do not guarantee natural appearance, and thus aesthetic results are far from satisfactory.

We applied the original method of reconstruction of fronto-temporal hair line by means of a hair-bearing scalp tube pedicle from an intact skin of occipito-parietal area. In the literature available no similar solution has been found.

CASE REPORT

In December 1974 a five-year-old girl was admitted to our Department with a large posttraumatic hair defect spreading over both parietal and the left fronto-temporal regions, as a result of a burn with boiling fat at age of 11

Fig. 1, 2. A five-year-old girl with a vast baldness as a result of a burn. — Fig. 3. Tubed bipedicle hair-bearing skin flap constructed in the occipital area. — Fig. 4. The way of transfer of one of the tube pedicles. — Fig. 5. The second tube pedicle transferred and sewed in along the desired hair line. — Fig. 6. Outline of the reconstructed fronto-temporal hair line ten months after operation. — Fig. 7, 8. The patient ten months after reconstruction.

1

2

3

4

5

6

7

8

months (Fig. 1, 2). A tube pedicle was made of a horseshoe-shaped hair-bearing skin flap 160×35 mm, both pedicles containing bundles of occipital blood vessels (Fig. 3). The resultant defect was closed by suturing the wound edges. After three weeks the right pedicle of the tube was severed and inset round the upper pole of the left ear (Fig. 4). Three weeks later the other pedicle was severed, the tube was opened and sutured into a strip-shaped defect resulting from excision of the scar along the desired anterior hair line (Fig. 5). The take was complete, hair grew normally and after 5 months reached the length of 80 mm. In ten months the success was apparent: the hair line was sharp and had perfect physiological shape (Fig. 6), and on the whole flap surface the hair was regular and thick (Fig. 7, 8).

The method described seems to be safe and advantageous with regard to blood supply, exhibits no risk of additional hair loss and ensures the entire hair restoration in the area of transferred skin which is impossible to achieve using free skin grafts. The disadvantages of the method were the necessity of performing three operations and the two-months long stay of the child in hospital. We think that our method deserved to be considered and applied in properly selected cases.

SUMMARY

The authors describe the original method of reconstruction of fronto-temporal hair line by means of a hair-bearing scalp tube pedicle from an intact skin of occipito-parietal area. The method was applied with a very good aesthetic result to a five-year-old girl with a large post-traumatic hair defect.

RÉSUMÉ

Lambeau tubulaire de la peau couverte par les cheveux pendant la reconstruction de la limite fronto-temporale des cheveux

Zieliński A., Goldstein, J.

On décrit une méthode originale de reconstruction de la limite fronto-temporale des cheveux en utilisant le lambeau tubulaire de la peau pris de la partie occipito-pariétale qui est recouverte des cheveux. La méthode a été employée avec de bons résultats chez une fille de 5 ans ayant un vaste défaut posttraumatique des cheveux.

ZUSAMMENFASSUNG

Tubularlappen der Haut mit Haaren bei der Wiederherstellung der fronto-temporalen Haargrenze

Zieliński A., Goldstein J.

Man beschreibt eine originelle Methode zur Wiederherstellung der fronto-temporalen Haargrenze unter Anwendung eines Tubularlappens deh Haut aus der haargedeckten Okzipitoparietalen Gegend. Die Methode wurde bei einem fünfjährigen Mädchen mit einem umfangreichen posttraumatischen Haardefekt mit ästhetisch sehr guten Ergebnissen benutzt.

RESUMEN

Lóbuto tubular de la piel con el pelo en la reconstrucción del borde fronto-temporal del pelo.

Zieliński A., Goldstein J.

Fue descrito un método original de la reconstrucción del borde fronto-temporal dei pelo con empleo de un lóbulo tubular de la piel de la región occipito-párietal cubierta de pelo. El método fue empleado con buenos resultados en una niña de 5 años que tenía un defecto postraumático extenso de pelo.

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CHANGES IN SKIN COLLAGEN POLARIZATION-OPTICAL PROPERTIES AFTER CONTACT BURN

F. BARTOŠ

The present report is meant as a contribution to learning more about the degree of skin injury, in particular corium collagen damage caused by contact burns.

In 2nd degree, and particularly so in third degree burns there are among other types of damage also alterations in the collagen connective tissue of the dermis. Depending on how deep the damage goes, this is then followed by repair processes going on in the skin. It is desirable that the extent and depth of the skin burned should be ascertained as accurately as possible. A histopathological investigation of the tissue affected should provide an objective criterion.

In addition to connective tissue cell population, intercellular matter of mucopolysaccharide composition, and elastic fibres, the corium consists mainly of felt-like interwoven collagen fibres. Exposed to polarized light collagen is seen as markedly birefringent. This is conditioned partly by slight birefringence of the basic structural units (birefringence proper), partly, to a predominant extent, by their parallel arrangement (structure birefringence). Any disintegration or damage done to collagen fibres due to, e.g., chemical or physical noxae is conducive to changes in the power of birefringence. This fact might prove useful for determining the degree of thermal skin injury.

MATERIAL AND METHOD

Female Wistar rats of our own breed (laboratory animals breeding station of the Pharmaceutical Faculty, Charles University, Třebeš) served as the experimental animals. The rats were all given the same conditions of environment and feeding.

PROCEDURE IN BURNING

The rats had the skin on their backs completely depilated (by shaving). A contact method was employed to produce the burns using equally sized brass rollers weighing 50 g each with a contact area of 201 mm^2. The rollers were heated up for 60 minutes in a muffle furnace at 200 ^0C.

The experimental animals had the burns produced while under ether narcosis. Once heated up, the roller was applied to the shaved part of the skin and pressed against it under its own weight. Contact periods were 15, 30, and 60 seconds.

METHOD OF TEMPERATURE TAKING DURING BURNING

The temperature was taken by means of a thermistor:

a) under the skin at the site of a developing burn. A thermistor was inserted under the skin through an opening made about 3—4 cm away from the planned burn site. The loose connective tissue between the skin and fascia was cut open so that the thermistor could be inserted right under the middle of the site planned to hold the heated up roller.

b) between the skin and the metal surface. The data are given in a table.

Histological material treatment for polarization microscopy:

The animals were sacrificed 15 minutes after burning and their burned skin removed complete with the neighbouring area including the skin muscle as far as the fascia. The skin was promptly frozen in a freezer at —20 °C. Specimens of frozen burned skin were then cut in a croyostat (Tesla Cryotome and Cryocuff) to obtain section 10 μm thick. Transverse skin section were then examined under water using a Zeiss polarization microscope with the aid of a compensator — (according to Sénarmont) and rotary compensator with 80 mu retardation.

RESULTS

We have taken the temperature by thermistor partly between the source of heat and the skin, partly under the skin at the site of he burn. During the first few seconds of contact, the temperature under the source of heat rises to 100 °C and is kept within the range of 100—115 °C for 15 seconds. Within 30 s of the beginning of the contact, temperature reading was 115 °C and more and remained, on the whole, unaltered until 60 s of contact duration (102—125 °C). The temperature under the skin keeps rising continuously from body temperature at the time of contact for 30 seconds within a range of 50—65 °C; if the source of heat continues to act on the site it will reach 58—66 °C in 60 seconds. When after 60 seconds of action the source was removed, the subdermal temperature continued to rise a little more (for another 10s) and only then began to fall slowly; 30 seconds after the removal of the heat source, however, the temperature under the skin was still well within the range of 52—60 °C, and 1 minute after the burning was discontinued it was still 48—52 °C. It remained slightly elevated (36—40 °C) for another three minutes.

COLLAGEN BIREFRINGENCE IN THE PROCESS OF BURN MAKING (at different times of exposure to heat source)

If the skin is exposed to the heat source for 15 s, the collagen fibres of the corium located close under the epidermis lose their birefringence completely, i.e. their ultrastructure and/or the parallel arrangement of tropocollagenous

molecules are completely obliterated. Deeper down in the dermis less intensive collagen birefringence can be observed which, however, reintensifies as we go deeper. Collagen fibres just over the skin muscle show birefringence as intensive as those of uninjured skin. These structures then are not heat affected.

After 30 seconds of exposure to heat, the damage caused to fibres, as regards their loss of structure birefringence, is even more pronounced affecting the corium much deeper.

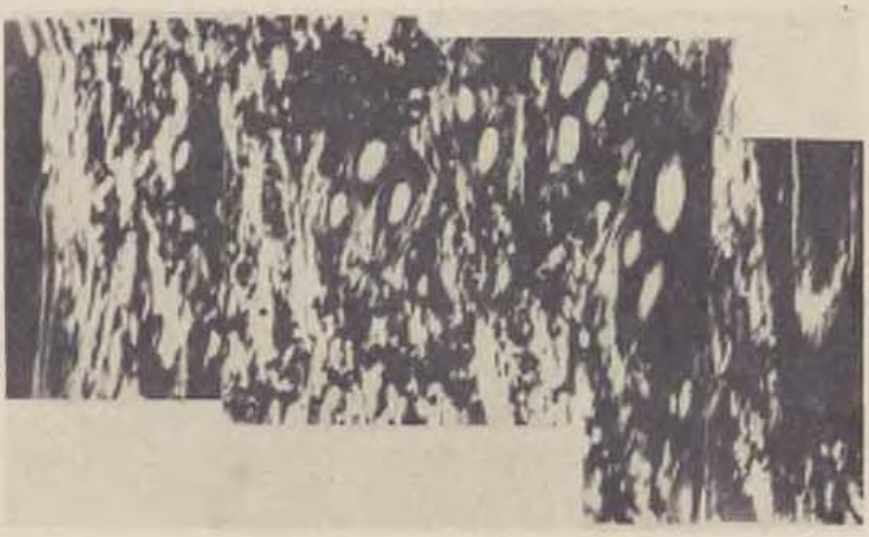

Fig. 1. Frozen transverse section through intact rat skin. Observed in polarized light. Collagen fibres of the dermis showing intensive birefringence.

Fig. 2. Tranverse section through heat-damaged rat skin. Collagen fibres of the corium are disintegrated, isotropic and without birefringence in polarized light.

After the heat source has been applied for 60 second, birefringence is lost in practically all the collagen fibres throughout the dermis down to the skin muscle (Fig. 1 and 2).

DISCUSSION

Heating up mammalian collagen fibres (or bundles of fibres) up to temperatures of 63—66 °C is followed by shrinkage of these fibrous structures and by the disappearance of birefringence which is typical of normal, plain collagen. These phenomena, i.e. contraction and loss of birefringence, can be made use of for the accurate determination of the so called temperature of collagen shrinkage (ts). At ts collagen fibres are seen "melting", i.e. being totally disintegrated, the protein denaturated. Ts is characteristic of collagens of different groups of vertebrates, but it is also affected by the age of the individual donor of the collagen under scrutiny (Viidik 1972).

Thermal denaturation as well as the action of substances responsible for what is known as chemical contraction (e.g. 2.5 M sodium chlorate — Chvapil 1960) always proceed from the periphery to the centre of a collagen bundle. This was observed with unusual clarity in, e.g., rat tendon bundles (fibres) (Bartoš 1967). In view of their relative thinness, the dermis collagen fibres are heat disintegrated as a whole with the whole fibre affected at a time.

Thermal damage to collagen can be expressed in quantitative terms with a view to the degree of temperature acting on the tissue; at temperatures higher than 66 °C mammalian collagen is already isotropic, having lost all traces of birefringence. The higher the temperature in the skin and the longer the time of exposure, the earlier and the more the dermis collagen fibres birefringence is reduced or completely lost. Structures affected by temperatures of 66 °C or more are already entirely devoid of birefringence.

Collagen fibres destroyed by heat can no longer fulfil their physiological function; the corium becomes necrotized, and has to be removed and replaced by new conective tissue.

One weighty circumstance concerns the previously discovered fact (Prouza et al. 1972, Moserová et al. 1973) that even after the source of heat has been removed the temperature in the skin and underneath will even rise a little before it starts falling gradually. We, too, believe that this considerably protracted higher temperature action causes marked damage to the skin, particularly its deeper layers.

CONCLUSION

An analysis was made of the polarization-optical properties of skin collagen fibres after contact burns in rats. Collagen fibres of the dermis are altered by heat, gradually losing their power of birefringence until they become entirely isotropic. Birefringence changes depend on the power of the heat source and on the duration of exposure (in 15 s, 30 and 60 s). Particularly critical are temperatures in the vicinity of collagen shrinkage temperature (ts) (i.e. 63—66 °C) and higher resulting in complete loss of birefringence.

Since the loss of collagen birefringence can be expressed in quantitative terms, the method appears to be suitable for the determination of thermal skin injury.

J. H.

SUMMARY

The polarization-optical properties of skin collagen fibres after contact burns in rats were studied. Collagen fibres of the dermis are altered by heat gradually losing their power of birefringence until they are completely isotropic. Birefringence changes depend on the power of the heat source and on exposure time (15, 30, and 60 s). Especially critical are temperatures in the region of collagen contraction temperature (ts), (i.e. 63—66 °C) and higher resulting in complete loss of birefringence. Since the loss of collagen birefringence can be expressed in quantitative terms, the method seems well suited for the determination of the degree of thermal skin injury.

RÉSUMÉ

Modifications des propriétés de polarisation et des propriétés optiques du collagène de la peau après la brûlure par le contact

Bartoš F.

Nous avons observé les propriétés de polarisation et les propriétés optiques des fibres de collagène du dermis après une brûlure par le contact chez les rats. Les fibres de collagène du dermis sont altérées par la chaleur. Successivement, elles perdent la biréfringence et elles deviennent totalement isotropes. Les modifications de la biréfringence dépendent du degré de la température de la source et du temps de l'action (pendant 15 s., 30 s., 60 s.). Ce sont seulement les températures s'approchant à celle de la contraction (ts) du collagène (63—66°) et les températures plus élevées qui sont critiques et qui provoquent une perte totale de la biréfringence du collagène. Vue que la perte de la biréfringence du collagène peut être exprimée quantitativement c'est cette méthode qui parait convenable à la détermination de la lésion thermique de la peau.

ZUSAMMENFASSUNG

Veränderungen der polarisierungs-optischen Eigenschaften des Hautkollagens nach Kontaktverbrennung

Bartoš F.

Wir untersuchten die polarisierungs-optischen Eigenschaften der Kollagenfasern der Dermis nach Kontaktverbrennung bei der Ratte. Die Kollagenfasern der Dermis werden durch die Wärme alteriert, sie verlieren allmählich die Doppelbrechung und werden zuletzt völlig isotrop. Die Veränderungen in der Doppelbrechung sind von der Grösse der Wärmequelle und der Wirkungsdauer (nach 15, 30 und 60 Sekunden) abhängig. Besonders kritisch sind die Temperaturen in der Nähe der Zusammenschrunpfungstemperatur (d.h. 63—66 °C) und darüber, die zu einem vollständigen Verlust der Doppelbrechung führen. Angesichts der Tatsache, dass der Verlust der Doppelbrechung des Kollagens quantitativ ausgedrückt werden kann, scheint diese Methode zur Bestimmung der thermischen Hautschädigung geeignet zu sein.

RESUMEN

Cambios de las propiedades ópticas polarizadoras del colágeno de la piel después de una quemadura por contacto

Bartoš F.

Hicimos observaciones de las propiedades ópticas polarizadoras del colágeno de las fibras de la dermis después de una quemadura por contacto en las ratas. Las fibras colágenas de la dermis son alteradas por el calor, gradualmente pierden la birrefracción hasta ser completamente isotrópicas. Los cambios en la birrefracción dependen de la temperatura de la fuente y de la duración de la acción (15 s, 30 s y 60 s). Especialmente críticas son las temperaturas alrededor de la temperatura a una contracción (ts) del colágeno (es decir 63—66°) y más altas que conducen a una pérdida completa de la birrefracción. Considerando que la pérdida de la birrefracción del colágeno se puede expresar de modo cuantitativo, este método parece ser conveniente para la determinación de una lesión térmica de la piel.

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SKIN PLASTY OF LARGE AND DEEP BURN DEFECTS IN CHILDREN

S. P. PAKHOMOV

A free skin autoplasty represents a basic procedure used in complex pathogenetic treatment of the deep burn-injuries. The area of the deep defect, which determines severity of the course of the disease, seems to be of decisive importance for choice of the method applied for reconstruction of the damaged skin. Using a dermatome skin plasty, it is possible in adults to reconstruct successfully as much as 30—40% of the whole body surface of the skin, which was injured. The situation is more complicated in children. According to Fedorovskii and Ryaboi (1968), Kazantsevaya (1977) and others, children are much less resistant to burns than adults. A relatively small area of injury (2—5% of the body surface) brings about a rather severe course of the disease by young children. Burn injuries of the 3rd degree affecting more than 10% of the body surface are considered to be critical by Smith (1970).

This fact is explained by special anatomical and physiological features of the thinner skin in children, by a smaller resistance of the child's organism and by its higher sensitivity to burn injuries. In addition to it, the child's organism is so markedly sensitive to loss of the skin cover, as a relative area of the body surface per 1 kg of its weight is higher than in adults (Moltchanov et al. 1953, Haynes 1965, Stuttgen et al. 1966).

The difficulties bound to the skin reconstruction in children often arise from a lack of skin source suitable for transplantation (Zavyalov 1972). Blokhin (1953) indicates that only 58% of the body surface of young children can be used for cutting the grafts. Glibin (1968) found that only 7—8% of the body surface can be utilized for this purpose by deep and large burn injuries. Therefore, many authors (Agratcheva 1970, Yemelyanova 1970, Ley and Ley 1971, Zavyalov 1972, Ivanov and Rozanova 1974, Bohmert 1975, Kazantseva 1977 and others) prefer a skin plasty performed by small grafts in treatment of the deep burn defects, e.g. a "postage stamp" method (Gabarro 1943, McIndoe 1943), or application of mesh grafts (Tanner et al. 1964). These methods are considered to decrease lethality of patients with large burn injuries.

Using a skin plasty by "postage stamps" in children, Agratcheva achieved not only the skin reconstruction, but also the functional disturbances were prevented in the functionally active regions like large joints, neck etc.

MATERIAL AND METHODS

The total of 475 children in the age ranging from 5 months to 14 years that suffered thermical injuries of the 3rd—4th degree affecting 1—75% of the body surface, were treated in the Burn Department of the Gorkii Institute of Traumatology and Orthopaedics; 123 patients were admitted early after the injury, 352 patient came from other medical institution 2 weeks — 7 months after the injury. The children of the first 3 years of age were 30.1%, 4 to 6 years — 26.3%, more than 7 years — 43.6%. The area of the deep burn defects was 9% by 220 children, 10—19% by 114 children, 20—29% by 73 children, 30—39% by 47 children, 40—49% by 11 children, 50—59% by 8 children and more than 60% by 2 children.

The surgical treatment using skin plasty was performed by 434 children, while amputation of a shin and hip was necessary by 3 and 2 patients, respectively. By 15 patients, who died after short period of time due to severity of the injury, only a skin alloplasty of preserved grafts covering a granulation surface had been performed. The conservative treatment was sufficient for healing of defects by 10 children with multiple, but limited deep burn defects. Just the conservative treatment was applied by 31 patients, who died during the acute period of the burn disease due to seriousness of the general condition.

The early reconstruction of the skin using free skin autoplasty has gained an exceptional significance in the system of complex therapy of the deep burns, especially by children. It is corroborated by an earlier spontaneous release of necrotic tissues in children, when compared with adults. In the same time, a rational general treatment consists in regular transfusions of blood and infusions of protein solutions leading to recovery of haematologic parameters corresponding to normal values in respect to age and of protein level in serum not lower than 6.0—7.0 g %. An enteral feeding with higher content of vitamins was also applied. The total amount of calories and proteins was two times higher than are the normal requirements of a healthy child of the same age (3—5 g of protein per 1 kg patient's body weight).

If the burn injury leads to exhaustion and to decreased function of adrenal cortex, then a hormone therapy (prednisolone) plays an important role. The dosage is individually chosen (up to 30—35 mg, gradually lowered subsequently). It is administered until the skin defect is fully healed.

In treatment of children with deep burn defects, the sparing methods of wound preparation to skin grafting were preferred. A gradual bloodless necrectomy of the burn crusts during redressings was followed by thorough wound toilet decreasing their bacterial contamination and finally bandage moistened by an antiseptic solution was applied.

The skin plasty was usually applied on the granulating wound without removal of the granulation tissue. The only exception was distortion of the healing process and presence of persisting pathologic or fibrous granulations; in these cases, the skin autoplasty was preceded by their excision. Various kinds of the skin plasty were used in dependence on the size of the affection and on the condition of the patient.

A free skin autoplasty covering all the wound surface and completed in one step, was usually performed by burn injuries affecting less than 10% of the body surface. If the injured surface was larger, the autoplasty was repeated every 5—10 days and the size of the grafts was 5—10 % of the body surface The largest skin plasty was usually done as the first one. If the wounds were localized circularly on the patient's trunk, the grafts were placed firstly on the frontal part, thus preventing a compression of the grafts by the patient's body weight. In the case of the skin transplantation on wounds localized on extremities, the unloading was achieved by suspending them.

The large skin grafts of 100—200 cm^2 sice and 0.15—0.40 mm thickness were cut by an electric dermatome and were placed on the wounds closely to each other. Thus, the best functional and cosmetic results were obtained. The skin plasty using large grafts was performed by 329 patients. By 29 patients of them, the skin autoplasty was combined with a skin alloplasty. The skin autografts were usually placed firstly on functionally active and exposed body parts (face, hands, big joints). For this purpose, larger and thicker grafts were used, that were placed in the transversal direction.

By the extremely large injuries, when the most important task was to save the child's life, the skin plasty was done in places, which were previously prepared as a recipient bed. By patients with insufficient sources of skin, i.e. by burn injuries of more than 30—40 % of body surface, the skin plasty using small grafts (mostly mesh ones) was performed, because the patient's condition was serious. Nevertheles, the intact large grafts were placed on joints and adjacent regions, on bearing surfaces and on exposed parts of the body (face, neck, hands). By weak patients and in cases, when the quality of a bed did not seem to secure good healing of the graft, a probatory skin plasty was done. When its result was good the large skin plasty was performed.

The skin plasty using small grafts was performed by 90 children. It enables to spend skin sources economically, it helps to save the patient's lives, however, it possesses also some shortcomings. These are especially expressed by the "postage stamp" method and other islet methods of the skin plasty, the functional and cosmetic results of which are less favourable. They lead to formation of a cicatrically altered skin surface, which is not resistant to any load, is inclined to ulceration, considerable retraction, development of contractures and deformities, hypertrophic and keloid scars. The development of the growing child's organism is influenced unfavourably by all these factors. According to our opinion, a subsequent cutting of skin grafts from the healed donor places is more feasible. The granulating wounds are covered by intact grafts, which are combined with skin alloplasty on other places. After rejection of the allografts, they are substituted by the skin autografts.

Using large grafts for the rationally planned skin plasties, the skin surface could be reconstructed by surgical treatment in 2—2½ months even in the case

→

Fig. 1—4. Results of treatment of patient Sh. 1—2: before treatment, 3—4: one year after treatment.

1

2

3

4

of deep burn injuries of 40% of the body surface. It diminishes indications of skin plasty by small grafts and prevents development of severe complications of the burn disease, especially of large suppurative wounds, in majority of patients.

One of our numerous observations will be described as an example.

Patient Sh., 6 years old, entered the Burn Department of the Institute one week after suffering the 3rd—4th degree burn injury of trunk, right arm and hip, i.e. of 40% of the body surface (see Fig. a, b). Due to complex treatment including sparing gradual necrectomy, the girl was prepared to the first skin plasty on the 21st day of the posttraumatic period. Full healing of the autografts and temporary healing of the allografts was observed. In respect to resolution of the allografts, four additional operations had to be done in intervals of 7 days. The skin flaps were used for covering the granulation surface. The healed donor places were secondarily used for cutting the grafts. The last skin autoplasty was done 13 days after the preceding operation. The granulations and dermal remnants of allografts causing delayed completions of the skin plasties, were cut off. The skin surface wes recovederd 2 months after admission of the patient in the Institute and less than 2 months and a half after the day of injury. The girl left the Institute without large scars and contractures, having been treated there for 107 days (see Fig. c, d).

RESULTS

The children having suffered from burn injury of more than 10 % of the body surface were reexamined one year or more after their discharge from the hospital. It showed that reconstruction of the skin surface of joints and adjacent regions not later than 4—6 weeks after injury and application of big-sized grafts leads to the best functional and cosmetic results, if compared with the skin plasty using small grafts. It is still improved by a therapeutic exercise beginning from the first days after injury, which is combined with an immobilization in a hyper-corrected position during all stages of the treatment (Table 1.).

The rational free skin autoplasty performed in a proper time which is combined with other prophylactic measures, enables not only to save lives of majority of the children having suffered from large and deep burns, but also to recover a full functional potency of the patients. Thus, 425 children (89.5 %) from the total of 475 children with deep burn injuries were healed by our treatment (Table 2).

The treatment of children with deep burns of more than 10 % of the body surface is most difficult. Nevertheless, 207 patients (81.1 %) from 255 children with deep burns of more than 10 % of the body surface were healed.

DISCUSSION

It was shown by analysis of long-term results that majority of children with skin plasty by small grafts require further reconstructive operations removing scar contractures, deformities and ulcerations, long-time persistence of

Table 1.
Long-term results of treatment of large and deep burn injuries by children.

Method of skin plasty	Full recovery of function	Cosmetic defects	Exulceration of scars	Contractures, deformities	Irreversible changes of bone & joint apparatus	Total
Transplantation of big-sized flaps	47	11	2	31	2	93
Transplantation of small-sized flaps	—	3	11	35	6	55
Total	47	14	13	66	8	148

Table 2.
The results of treatment in relation to size of the deep burns and age of the patients.

Age, years	Size of the deep burn injuries (in % of the body surface)								Total
	lower than 4	5—9	10—14	15—19	20—29	30—39	40—49	higher than 50	
1— 3	35/0	31/1	21/2	7/1	19/4	8/7	0/4	0/3	121/22
4— 6	33/0	22/1	18/0	14/0	16/1	10/5	2/0	1/2	116/9
7—14	57/0	40/0	30/1	17/0	30/3	11/6	3/2	0/4	188/19
Total	125/0	93/2	69/3	38/4	65/8	29/18	5/6	1/9	425/50

numerator — number of recovered patients, denominator — number of died patients

which would interfere with normal growth and development of the children. Therefore, the islet methods of skin plasty and small grafts should not be used by burn injuries of less than 30 % of the body surface, if the complications are absent in the course of the burn disease and any concurrent disease does not develop. M. T.

SUMMARY

An experience from treatment of 475 children in the age ranging from 5 months to 14 years, who suffered from the 3rd—4th degree thermal burn injuries of 1—75 % of the body surface, was evaluated. By 419 patients, there was performed a free skin plasty using a "postage stamp" and Moule-Jackson's methods,

mesh grafts and big-sized grafts placed on granulating wounds. The recovery was achieved by 425 children.

Immediate and long-term results (after one year or more) of treatment showed advantages of the free skin plasty by big-sized grafts, which enabled to recover the skin cover by deep burn injuries affecting as much as 40 % of the body surface. Moreover, the skin cover was functionally and cosmetically more valuable and in most cases scar alterations could be prevented.

Skin transplantation by means of small grafts leads to expressed scar formation, development of contractures, deformities, ulcerations and influences unfavourably growth and development of the growing organism. In fact, the indications of the skin plasty by small grafts are deep burn injuries of more than 30 % of the body surface.

The results of treatment can be improved by use of the more rational method of the skin plasty utilizing big-sized grafts or by its combination with alloplasty as a temporary covering of the extremely large wounds.

RÉSUMÉ

Plastie cutanée dans des brûlures vastes et profondes chez les enfants

Pakhomov, S. P.

Nous avons fait une analyse des expériences faites pendant le traitement de 475 enfants en age de 5 mois à 14 ans qui avaient des brûlures thermiques du 3e au 4e degré occupant 1—75 % de la surface du corps. Chez 419 d'eux, on a fait une plastie cutanée libre à l'aide de la méthode de «timbres postaux», de la méthode de Moule-Jackson, des greffes réticulées et des lambeaux de grandes dimensions qui ont été situés aux plaies garnuleuses. 425 enfants sont guéris.

Les résultats instantanés et de longue durée du traitement (1 an et plus) montraient les avantages de la plastie cutanée libre faite à l'aide des greffes de grandes dimensions. De cette manière on peut faire une couverture cutanée, s'il s'agit du brûlures profondes qui ne dépassent pas 40 % de la surface du corps. Ainsi, on assure une reconstruction de la couverture cutanée étant d'une plus grande valeur fonctionnelle et cosmétique et pour la plupart, il réussi à empecher la formation des cicatrices.

La transplantation cutanée faite à l'aide de petites greffes provoque une formation expressive de cicatrices, des contractures, des déformations, des ulcérations et même, elle a une influence défavorable à la croissance et l'évolution de l'organisme croissant. Ce sont les brûlures profondes couvrant plus de 30 % de la surface du corps qui font l'indication d'une plastie cutanée à l'aide des petites greffes.

L'utilisation d'une méthode plus rationnnelle de la plastie cutanée à l'aide des greffes de grandes dimensions ou sa combination avec une alloplastie qui peut être un moyen temporaire à couvrir les plaies en cas de vastes affections aide à amméliorer les résultats du traitement.

ZUSAMMENFASSUNG

Hautplastik bei umfangreichen und tiefen Verbrennungen bei Kindern

Pachomow S. P.

Wir analysierten Erfahrungen aus der Behandlung von 475 Kindern im Alter von 5 Monaten bis 14 Jahren mit thermischen Verbrennungen des 3.—4. Grades, die 1—75 % der Körperoberfläche deckten. Bei 419 Kindern unternahmen wir die freie Hautplastik

mit Hilfe der „Postmarkenmethode", der Moule-Jackson-Methode, mit Hilfe von Netztransplantaten und Lappen grosser Dimensionen, die an die granulierenden Wunden gelegt wurden. Es wurden 425 Kinder geheilt.

Augenblickliche und langzeitige (1 Jahr und darüber) Behandlungsergebnisse zeigten die Vorteile der freien Hautplastik mit Transplantaten grosser Dimensionen. Mit ihrer Hilfe kann man eine Hautdecke bei tiefen Verbrennungen bis an 40 % der Körperoberfläche bilden. Auf diese Weise ist die Wiederherstellung einer funktionnell und kosmetisch wertvolleren Hautdecke gesichert und es gelingt weitgehend die Narbenbildung zu vermeiden.

Mit Hilfe von kleinen Transplantaten durchgeführte Hauttrasplantationen führen zu markanter Narbenbildung, zur Entstehung von Kontrakturen, Deformationen und Ulzerationen und das Verfahren hat einen ungünstigen Einfluss auf das Wachstum und die Entwicklung des wachsenden Organismus. Die Indikation für die mittels kleiner Transplantate durchgeführte Hautplastik bilden tiefe Verbrennungen, die mehr als 30 % der Körperoberflache einnehmen.

Die Anwendung der rationnelleren Methode der Hautplastik mit Transplantaten grosser Dimensionen oder ihrer Kombination mit der Alloplastik als eines vorübergehenden Mittels zur Deckung von Wunden bei sehr umfangreichen Verbrennungen hilft die Behandlungsergebnisse zu verbessern.

RESUMEN

Plástica cutánea en quemaduras extensas y profundas en niños

Pajomov, S. P.

Fue hecho un análisis de las experiencias del tratamiento de 475 niños en la edad de 5 meses a 14 años con quemanduras térmicas del 3°—4° grado que cubrían 1—75 % de la superficie del cuerpo. En 419 de las mismas fue hecha plástica cutánea libre mediante et método de sellos, el método de Moule-Jackson, mediante transplantes reticulados y lóbulos de dimensiones grandes que fueron puestos en las heridas granuladas. Fueron sanados 425 niños.

Los resultados del tratamiento inmediatos y tardíos (1 año y más) mostraron las ventajas de la plástica cutánea libre mediante transplantes de dimensiones grandes. Mediante ésa puede ser hecha cubierta cutánea en quemaduras profundas hasta 40 % de la superficie del cuerpo. Asi se asegura la reconstrucción de la cubierta cutánea más valiosa en cuanto a la función y cosmética y a gran medida se coonsigue evitar cicatrices.

Transplantación cutánea mediante transplantes pequeños conduce a formación de cicatrices, de contracciones, deformaciones, ulceraciones y ejerce influencia desfavorable al crecimiento y desarrallo del organismo creciente. Indicación para una plástica cutánea son quemaduras profundas que ocupan más de 30 % de la superficie des cuerpo.

El empleo de un método más racional de la plástica cutánea mediante transplantes de dimensiones grandes o una combinación de la misma con la aloplástica como un medio provisional para cubrir heridas en afecciones extensas ayuda a mejorar los resultados del tratamiento.

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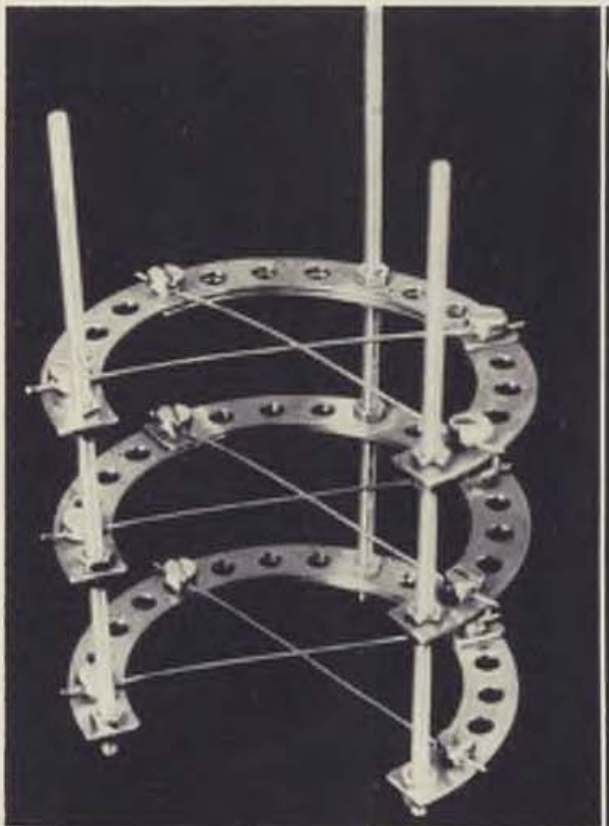
Godunova G. S.

ELONGATION OF METACARPAL AND PHALANGEAL BONES USING A DISTRACTION METHOD BY CHILDREN AND JUVENILES WITH INBORN DEVELOPMENTAL ANOMALIES OF THE HAND

1



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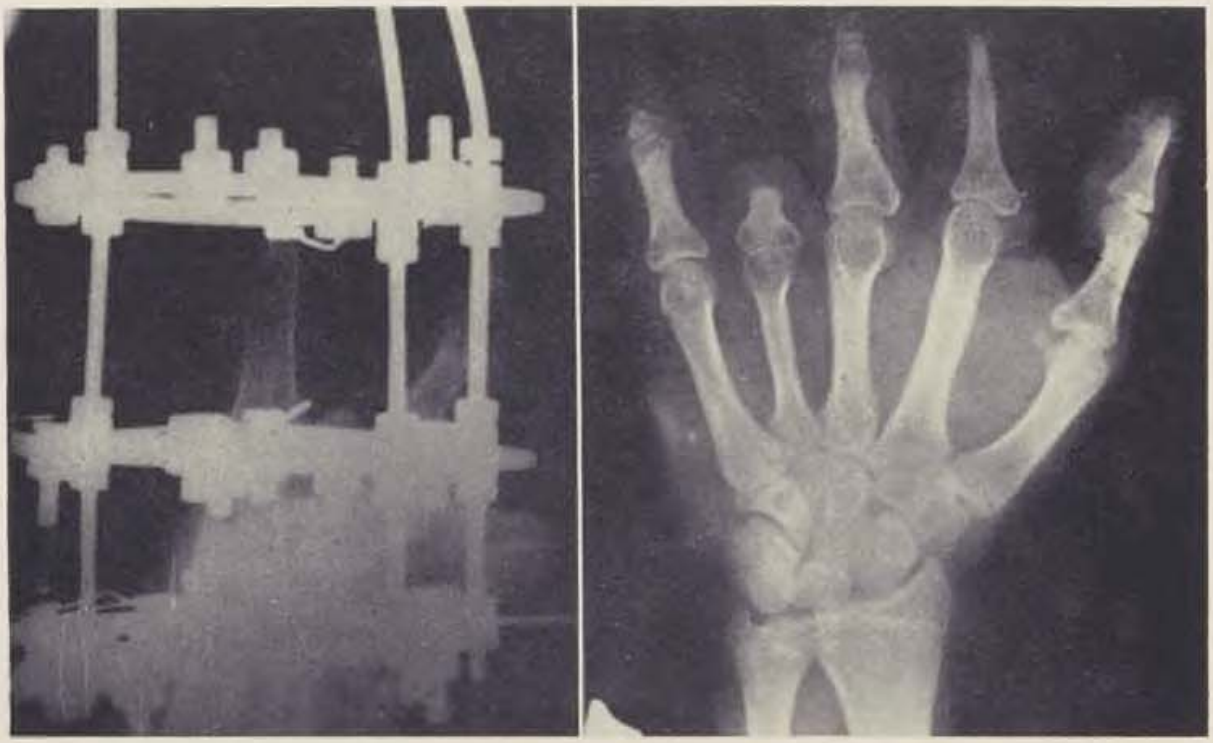
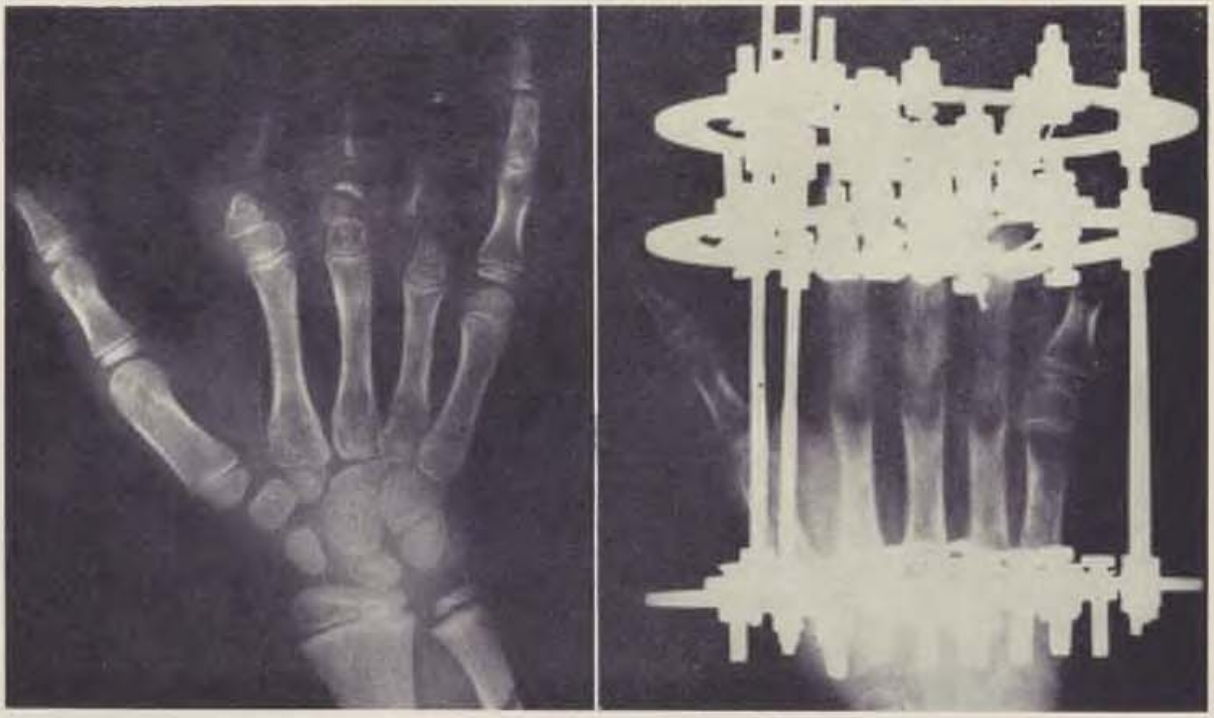


2d 2c

Fig. 1. Distraction apparatus designed for the infantile hand. — Fig. 2. Elongation of the second finger of the left hand achieved by the distranctional epiphyseolysis of the proximal phalangeal bone by a patient U., 13 years old, suffering from an inborn ectrodactyly (a roentgenogramm). a — before treatment; b — after drawing the three pairs of the traction wires in a crossed way through the rudimentary proximal phalangeal bone, its growth zone and through diaphysis of the second metacarpal bone; c — two weeks after starting the elongation of the proximal phalangeal bone: the stage of the distractional epiphyseolysis; d — six weeks after beginning of the distraction: the stage of band-like structure of the regenerate; e — three years after elongation of the second finger.



3a 3b

3c

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3e

Fig. 3. Simultaneous elongation of the second, third and fourth metacarpal bones of the right hand by means of distractional epiphyseolysis in a patient I., 12 years old, with underdevelopment of the second, third und fourth finger. a — roentgenogram of the hand before treatment; b — 5 weeks after beginning of the distraction: the stage of band-like structure of the regenerates; c — 2 months after taking off the apparatus; d — the patient's hand after elongation of the metacarpal bones and deepening of the second and the third intermetacarpal spaces, while a free skin grafting was applied; e — the second, third and fourth metacarpo-phalangeal articulations are moved distally and function as interphalangeal joints.

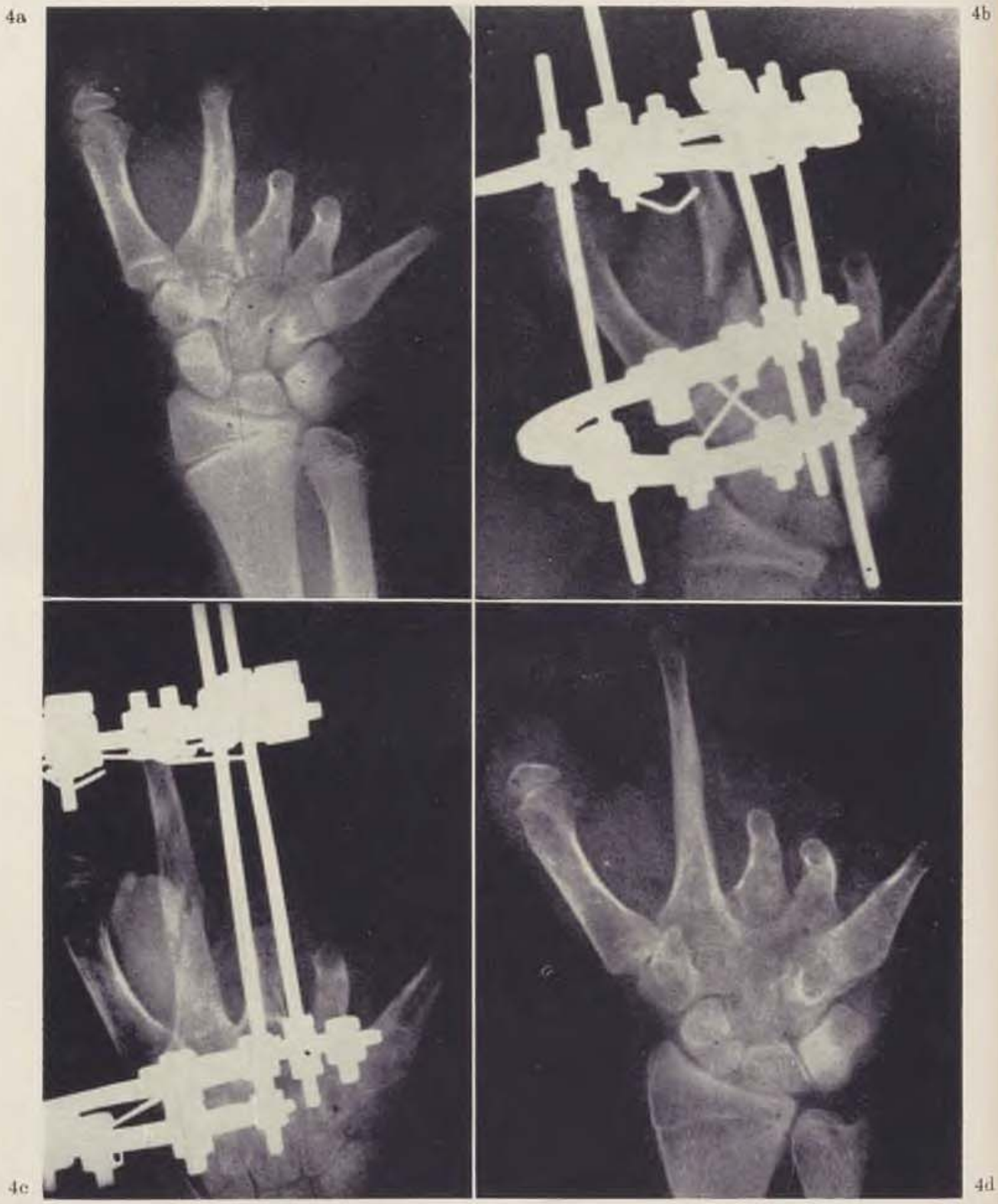

Fig. 4. Elongation of the second metacarpal bone preceded by a preliminary oblique osteotomy by a patient S., 14 years old, suffering from inborn adactyly on the right hand (a roentgenogramm). a — before treatment; b — 2 weeks after beginning of the distraction: diastase between fragments of the second metacarpal bone; c — 3 months after starting the distraction: the stage of the regenerate's induration; d — 3 years afer elongation of the second metacarpal bone.

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A SURGICAL TREATMENT OF BAT EARS

V. YOVTCHEV, M. MADJAROV

Both men and women having bat ears or cup-shaped ears often come to a specialist asking for a surgical correction of this more cosmetic than functional defect.

The method of corrective auriculoplasty of the bat ears suggested by Tanzer (1964) consists of four stages: 1. Excision of skin on the posterior surface of the auricle and on the retroauricular fold, 2. excision of cartilage in the auricular cavity, 3. reconstruction of an anthelix fold and 4. formation of a more regular shape of the anthelix fold.

Recently, the formation of the more regular shape of the anthelix fold represents the main task of operations of this sort. Suggestions of always new and new technical improvements (Stenström 1961, Mustardé 1963, Krutchinskii 1975, Skoog 1974 and others) indicate that correction of bat and cup-shaped ears only seems to simple, but till now any universal and fully satisfactory method is not available.

In our clinical practice, some modifications were also used and will be described here.

OUR METHODS OF BAT AND CUP-SHAPED EAR CORRECTION

In addition to routine methods of Converse (1955) and Pitanguy and Rebello (1962), which were used by us for correction of bat and cup-shaped ears, we designed following modifications:

1. The method of helix, anthelix and schaphoid cavity formation (Yovchev 1973). This method was used by cup-shaped ears and also by more severe deformities of bat ears, where it was applied in the strategic parts that seemed to be essential for the patient's anomaly. The method consists in the following: S — like incision of skin; mobilization of perichondrium on the posterior surface of the auricular cartilage; cutting the cartilage into small cubes in the region of the deformity (Fig. 1), while the incisions are led across all the thickness of the cartilage, but do not damage its anterior surface; suturing of the retroauricular wound in layers; application of a modelling compressive bandage prepared from pieces of gauze soaked in Rivanol.

2. The method of anthelix formation (Madjarov 1974). Depending on thickness of the cartilage in the region of anthelix, two versions of the method can be used.

The first version (Fig. 2a). It is used, if the auricular cartilage is thin. Along the posterior surface of anthelix and of the posterior pedicle of anthelix, a perichondrial strip 4—5 mm wide is excised. Further, the perichondrium is mobilized about 3—4 mm laterally from the margins of anthelix and both its pedicles. Thereafter, the anthelix is formed only by point-like parallel

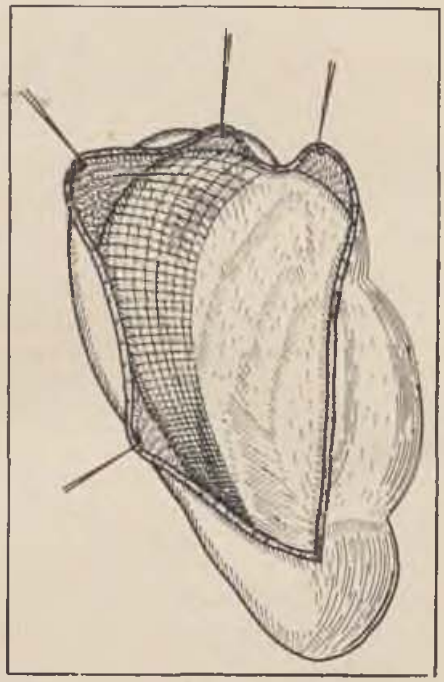

Fig. 1

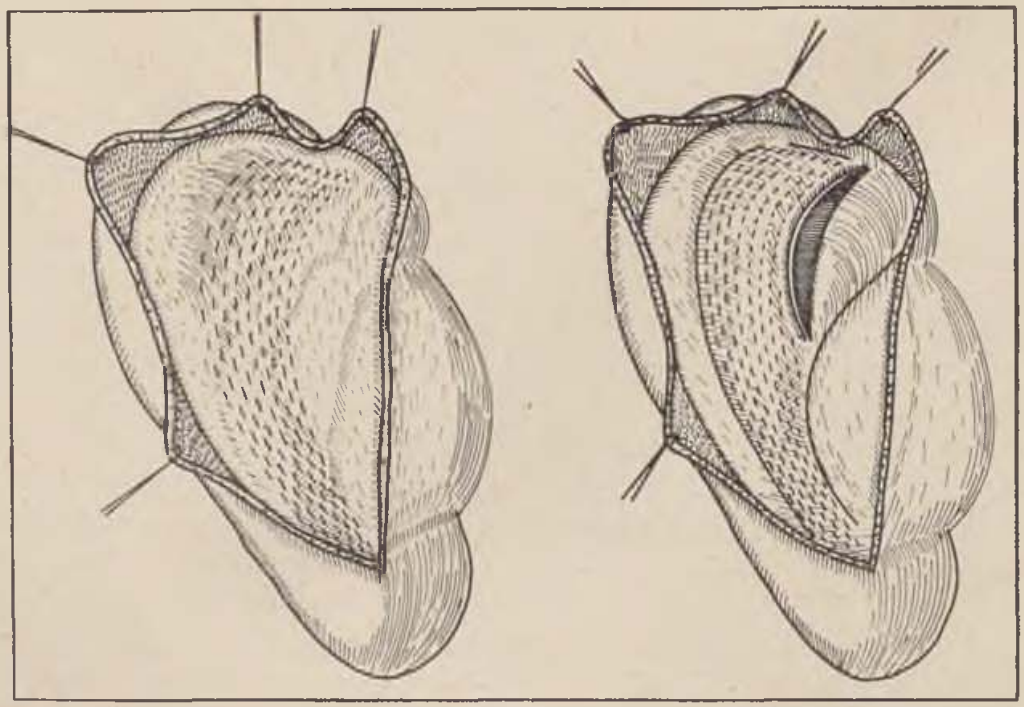

Fig. 2a

Fig. 2b

small incisions of cartilage, which do not touch the anterior perichondrium. They are distributed 2 mm apart from each other in a chess-board arrangement and are placed in the fan-shaped manner following the direction of the posterior pedicle. The retroauricular wound is sutured in layers, but cartilage is not sewn. The auricle is formed by a compressive bandage using pieces of gauze soaked in Rivanol.

The second version (Fig. 2b). It is used, if the auricular cartilage is thick. In fact, it represents a combination of the first version and of the Converse's method.

If necessary, an eliptic excision along cavity of the auricle is made as a part of both methods (Yovtchev, Madjarov).

MATERIAL

The corrective operations on auricles were performed by 36 patients treated in the Department of plastic surgery during the years 1969—1976 (Table 1). The deformity was unilateral in 6 cases: 2 on the right side and 4 on the left side. By all 36 patients, a combined deformity occured. The auricular cavity was more deep and anthelix was absent. The degree of the protrusion varied from an insignificant absence of the posterior pedicle of anthelix and slightly deeper auricular cavity to the cup-shaped deformity of the auricula. The cup-shaped auricula was treated by 5 patients, 4 men and 1 woman. The age of the youngest patient was 6 ½ years, the oldest one was 32 years old. Among 36 patients, there were 17 women and 19 men.

There were applied three methods of treatment of our patients: Converse's method — 6 patients, Pitanguy's method — 8 and our method — 22 patients.

Table 1.
Methods of the corrective auriculoplasty applied in treatment of bat-ears and cup-shaped ears.
a — men, b — women

Methods / Age	Method of Converse		Method of Pitanguy		Our methods		Total	
	a	b	a	b	a	b	a	b
5—10 years	1	—	—	1	—	—	1	1
11—15 years	—	—	—	—	5	—	5	—
16—20 years	1	—	1	2	3	6	5	8
21—30 years	1	1	2	2	5	3	8	6
31—40 years	—	2	—	—	—	—	—	2
Total	3	3	3	5	13	9	19	17

The cosmetic result was estimated mainly in respect to opinion of the patients themselves, in respect to anthelix shape and to the degree of bringing the auricle nearer to the head surface, reaching the normal limits (1.8—2.3). The long-term results were examined by 19 patients: 11 patients were corrected

Fig. 3a

Fig. 3b

Fig. 3c

Fig. 3d

by our methods and 8 patients by the other two ones. The long-term results were good in 16 cases and unsatisfactory in 3 cases. Two failures from the number of unsatisfactory cases were obtained by patients operated on by the Pitanguy's method and one failure by a patient operated on by the Converse's method. In all the three cases, there was observed an incorrect shape of the anthelix due to convexity of the sharp margins of cartilage.

CONCLUSION

Based on the results obtained by application of two methods designed in our Department of plastic surgery, it is suggested that they can be used in clinical practice with good results (Fig. 3). Although the first method is more traumatic and the second one is more palliative, the good cosmetic results can be achieved in all cases, if they are considered individually. For example, serious deformations of the cup-shaped ear may be corrected only by radical mincing and even removal of a part of the cartilage. In contrary, more simple cases are corrected by sparing methods. It fully agrees with opinion of other authors (Stenström 1973, Skoog 1974 and others). It is aimed to achieve the maximal cosmetic results producting the minimal operation injury.

M. T.

SUMMARY

The authors describe their own methods of radical and sparing auriculoplasty by bat ear deformities. The radical method consists in correction of the auricle preceded by mincing of the auricular cartilage into small cubes with sides of 2—3 mm size. Using the sparing method, point-like incisions are led in the cartilage in direction of the anthelix fold and a strip of the posterior perichondrium is excised.

The number of 22 patients was operated on according to the described methods resulting in the good aesthetic effect.

RÉSUMÉ

Traitement opératoire des pavillons de l'oreille décolés

Yovtchev, V., Madgearov, M.

Les auteurs décrivent leurs propres méthodes de l'auriculoplastie radicale et corrective soigneuse dans le cas des orielles décolées. En utilisant le procédé radical on façonne le pavillon de l'oreille après avoir broyé les cartilages de l'oreille aux osselets dont la part fait 2—3 mm. Si l'on utilise la méthode soigneuse, on perce le cartilage d'une manière de points dans la direction du pli de l'antihélix et on coupe un ruban du péricondrium postérieur.

Selon les méthodes décrites on a opéré 22 patients avec un bon résultat esthétique.

ZUSAMMENFASSUNG

Operative Behandlung der abstehenden Ohrmuscheln

Jowtschev V., Madsharow M.

Die Autoren beschreiben ihre eigenen Methoden der radikalen und schonenden korrigierenden Aurikuloplastik bei abstehenden Ohren. Bei dem radikalen Verfahren wird die Ohrmuschel nach vorhergehender Zerkleinerung des Ohrenknorpels in Stücke mit einer Seitengrösse von 2—3 mm korrigiert. Bei der schonenden Methode wird der Knorpel in der Richtung der Falte des Antihelix punktförmig durchgestochen und man schneidet einen Streifen des hinteren Perichondriums aus.

Nach den beschriebenen Methoden wurden 22 Patienten mit gutem ästhetischem Ergebnis operiert.

RESUMEN

Tratamiento operativo de las orejas resaltantes

Yovchev, V., Madzharov, M.

Los autores describen sus propios métodos de la auricolo — plástica radical y cuidadosa en las orejas resaltantes. Con el método radical el pabellón de la oreja está arreglado después de ser triturado el cartílago auricular en cubitos con el lado de 2—3 mm. Durante el método cuidadoso el cartílago se perfora por puntas en la dirección de la plica del antihélix y se corta una cinta del pericondrio posterior.

Según los métodos descritos 22 pacientes fueron operados con un buen resultado estético.

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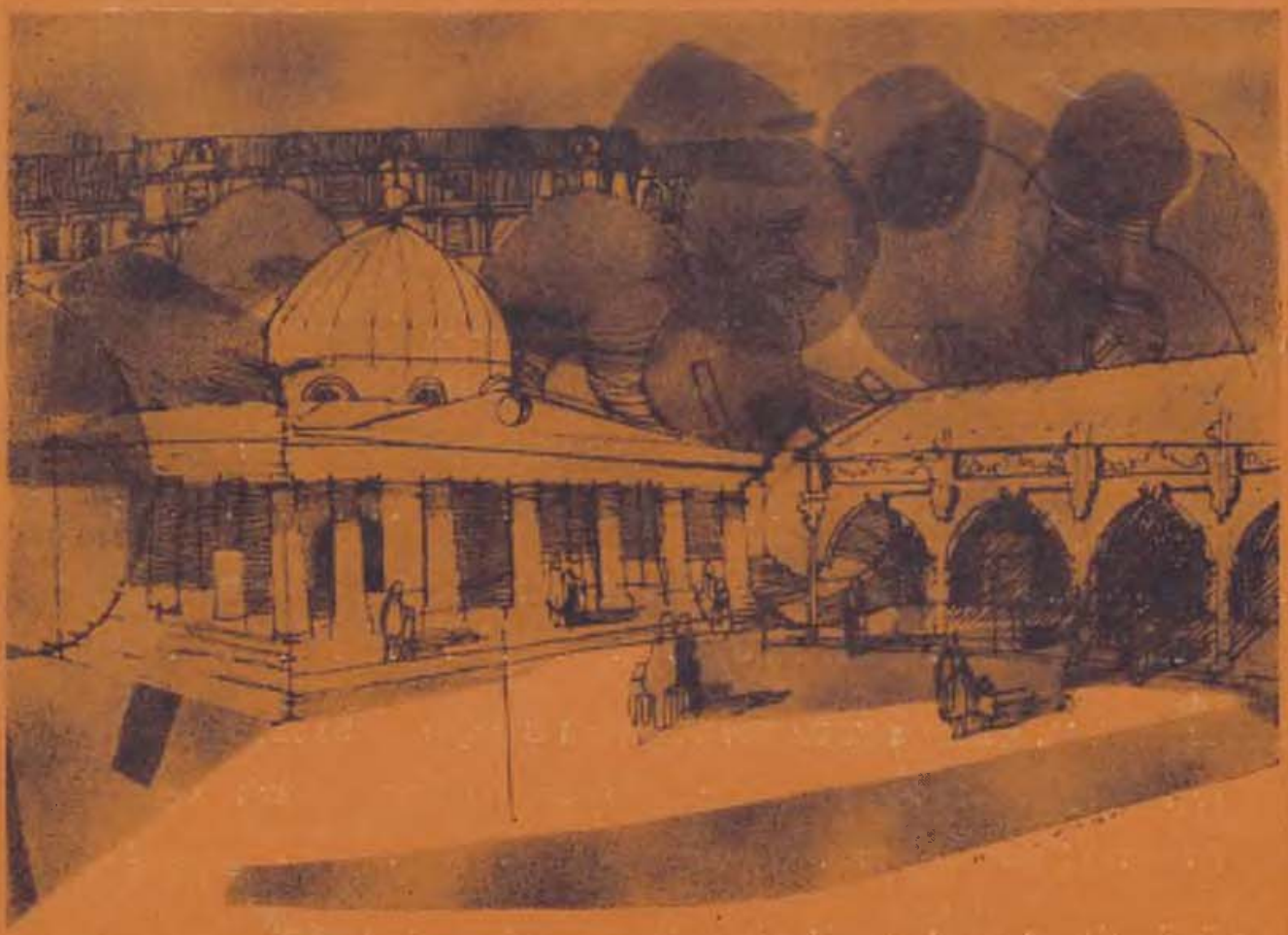

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