The use of Kiel bone in the repair of nasal deformities

J. Siegler, Liverpool, U.K.

SUMMARY

The nose is injured frequently and an ugly saddle deformity follows. The patient complains of an obstructed airway in addition to the deformity. Temporary relief is obtained by supporting the tip, permanent relief follows reconstructing the skeleton using a graft to support the bridge after mobilizing the skeleton.
The materials used to replace the depressed bridge are considered. Plastic implants have not been satisfactory because of lack of surrounding tissue and the rejection rate has been high. Homogenous grafts of bone or cartilage have also been rejected. Autogenous bone grafts have stood the test of time but the patient has to undergo a major operation. Heterogenous bone grafts are considered and recommended, because of the facility in storage and the relative simplicity of the operation.
The steps of the operation are outlined in detail and results of 15 cases are reported. 13 were completely successful. 2 grafts were rejected. This is a small series but results of more recent experience will be published later.

The nose is injured very often because of its prominent position on the front of the face. Its skeleton is part bone and part hyaline cartilage, but the nasal bones are thin and unprotected by surrounding muscles. A direct injury to the front of nose causes the nasal bones to fracture and fragment. The bony particles are dispersed into the loose subcutaneous tissues and many are absorbed. The cartilagenous septum may be bent or fractured. The result is an ugly saddle shaped deformity. (Figures 1 and 2).

A patient with such a deformity might be content to disregard the cosmetic appearance but will complain of nasal obstruction. Temporary relief follows supporting the bridge and tip with the fingers but obstruction recurs immediately after relaxation of support.

Paper presented at the V Congress of the European Rhinologic Society, Barcelona, June, 1972.

Figure 1. Deformity before operation.

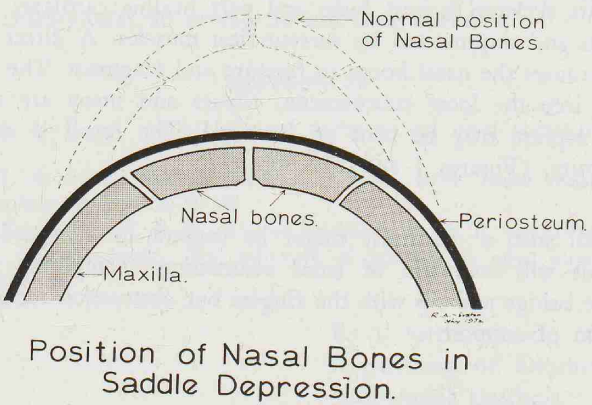
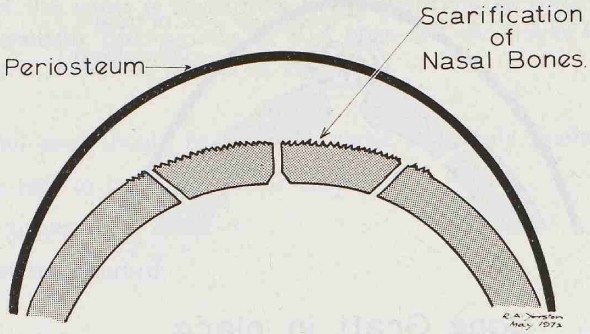
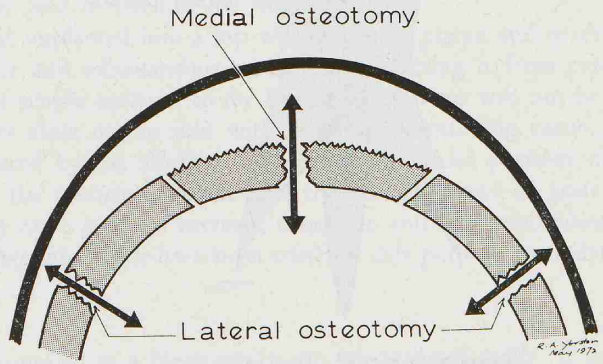


Figure 2. Position of nasal bones in saddle depression.



Preparing bed for Graft.

Figure 3. Preparing bed for graft.



Restoration of height.

Figure 4. Restoration of height.

A satisfactory nasal airway can be restored by elevating the depressed nasal bridge thus reconstructing the deformed skeleton. A rhinoplasty operation combined with insertion of bone graft will be required to achieve this. The steps of such an operation are:

1. To prepare a bed on the surface of the nasal bones to receive the graft. It is necessary to remove the periosteum and expose the cortical bone by scarification. (Figure 3).

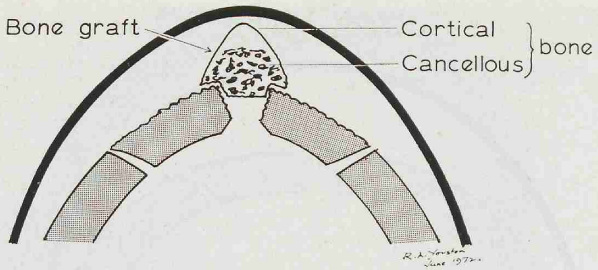


Figure 5. Bone graft in place.

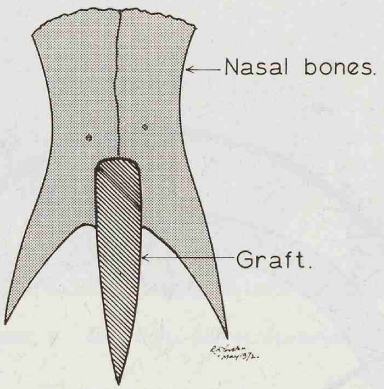


Figure 6. Bone graft in place.

2. The height of nasal bridge is elevated after mobilizing the remains of the bony skeleton by osteotomy and moulding the fragments into a satisfactory position. (Figure 4).

3. Replacing the deflected nasal septum in the mid-line to partially restore the cartilagenous bridge.

4. Inserting a graft to obliterate the residual depression and to support the bridge. A bone graft becomes attached to the nasal bones thus using the cantilever principle to support the bridge. (Figures 5 and 6).

The purpose of this paper is to consider the properties of the materials available for grafting especially heterogenous or Kiel bone and the results obtained. The following criteria should be obeyed in every case.

a. The material used should be supplied sterile and easily available.

b. It must be easy to cut into suitable shape.

c. The host's tissues must accept it.

d. It must not be absorbed.

Surgeons have tried a variety of materials when correcting a saddle deformity. Plastic materials have been used successfully by orthopaedic surgeons to replace damaged bone, e.g. hip replacement using a Teflon acetabulum. They have earned a reputation of being non-irritant to the surrounding tissues and are therefore not rejected. The uniformly smooth surface of an implant might be disturbed after shaping — microscopic irregularities appear and experimental evidence has shown reaction in surrounding tissues. Similar events have followed when chemicals have been used to sterilize the implant.
Plastic material implanted into a hip will be deeply placed and covered by a thick layer of muscle and subcutaneous tissue thus protecting it from external trauma. An implant of plastic material to the bridge of the nose will not be so protected. It will be very close to the skin with minimal surrounding tissue. The implant may be displaced by the slightest injury. Its superficial position may cause engorgement of the cutaneous vessels over the nose. Pressure of graft on the overlying skin may cause pressure necrosis, ulceration and later perforation of the skin. The plastic materials which have been tried for this purpose are Polythene, Silastic and Teflon.

Polythene is supplied as a block which can be sterilized easily. It can be cut and shaped after softening by heating. It hardens later after cooling. The implant remains as a hard mobile strut, easily displaced, liable to penetrate the skin and has now been abandoned.

Silicone rubber has been introduced by Berman (1963), recently for obliterating the defect. It would seem to have much to recommend it because it is resistant to extreme variations of heat and cold, it is easily adaptable, pliable, resistant to absorption, and will not warp. Unfortunately, our experience of using it in a small number of patients was that its insertion was followed by acute infection.

Teflon suspension in glycerine has also been tried by Wilson (1966), but it has been abandoned. It is not possible to deposit and retain a quantity of the suspension over a narrow line of the bridge, thereby reconstructing the saddle depression.

Homogenous grafts of cartilage and bone have been used in otology, e.g. homograft incus and septal cartilage for reconstruction of ossicular chain without rejection. Homografts of septal cartilage have been used for repairing the bony walls of the external auditory canal. Macewen (1912) introduced the homografts in 1880 but abandoned them after experiencing difficulties with their preservation. Recently their use has been revived by Inclan (1942) following on the great advances made in freezing and storage of food. Rapid freezing permits preservation of tissue as the water and salt do not separate. Slow freezing produces large crystals which destroy the bone. These grafts have not been used extensively for replacement of depressed nasal bridges because of several rejections in early cases.

Autogenous bone grafts have stood the test of time. They are taken from the iliac crest. Mowlem (1941) reported on 102 such bone grafts to the nasal bridge. 66 of these showed evidence of union with the underlying bone. They are not displaced by contraction of surrounding tissues and there is less tendency for them to become absorbed. There is also very little reaction of the surrounding tissues to the grafts.

There are certain disadvantages:

1. The operation may be prolonged to remove the graft from the iliac crest. It may take as long as 2 hours.

2. The patient often suffers considerable pain in the hip region after operation due to haemotoma formation and may need to remain in hospital for 14 days.

Autogenous grafts of costal cartilage are unsatisfactory because they are absorbed and many curl up causing recurrence of the deformity. Mowlem (1941).

Heterogenous bone grafts — A recent development in the Orthopaedic Clinic at the University of Kiel (1966) has been the preparation and use of a bone graft taken from a calf. The bone is scrubbed in order to remove blood vessels, fat and periosteal fibres. The residual fat is removed by fat solvents. The protein is then denatured by immersing the bone in hydrogen peroxide. The graft is then washed, cut to requisit size and sterilized by gamma radiation. Hydrogen peroxide alters the nature of protein in a bone so as to destroy is antigenic properties. Kiel bone acts merely as a scaffold into which new bone may grow. It possesses no osteogenic potency as distinct from autogenous bone which is able to produce new bone which will grow into the surrounding tissues. It can be easily cut after soaking in warm saline and shaped to restore a narrow linear nasal bridge of suitable length. The patient is spared the discomfort of an autogenous graft taken from the iliac crest as well as the prolonged stay in hospital.

STEPS OF THE OPERATION

Approach

a. Columella incision provides direct access to the nasal bridge. However, it is limited and it is not easy to elevate the periosteum sufficiently to cover the graft. Pressure may cause necrosis of the overlying skin and perforation by the graft through the incision.

b. Lateral approach through rhinoplasty incisions and transfixing the membranous septum permits:

1. Wide elevation of the skin and periosteum.
2. Lateral and medial osteotomies if necessary.
3. A groove can be made between the 2 nasal bones to allow the graft to lie flat and avoid a rump on the bridge.

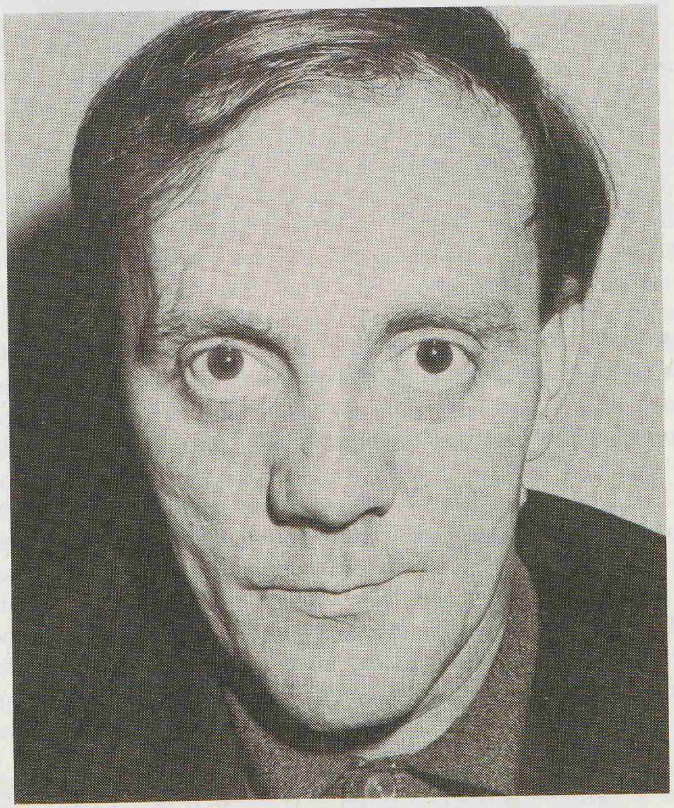


Figure 7. Patient's nose 3 months after operation showing repair.

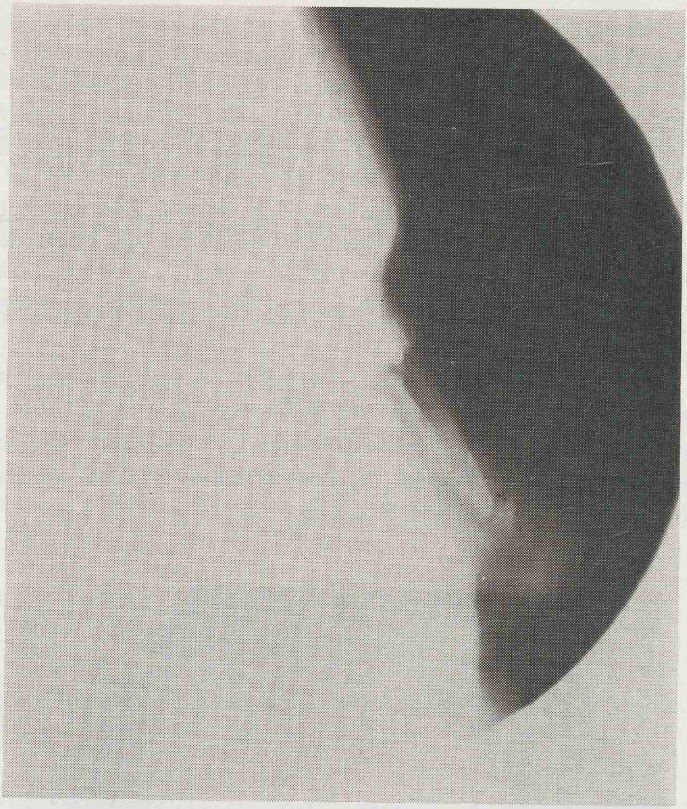


Figure 8. X-ray of nasal bones 3 months after operation showing graft.

Preparation of bed. The surface of the nasal bones is sacrificed to expose the cortical bone and the underlying cancellous bone.

Mobilization of the remnants of the nasal bones, by osteotomies to restore height to bridge.

Insertion of bone graft. The graft is soaked until the bone is sufficiently soft to cut with a scalpel or scissors. Care must be taken whilst handling the graft because the pressure of a pair of artery forceps will crush the cancellous bone. It should be held *only* by the surgeon's fingers or by a pair of non-toothed dissecting forceps. The graft will need considerable reduction of the cortical surface to restore the sharp border of the nasal bridge, fit into the space between the nasal bones and not to project beyond the tip.

Protection during healing. The incision is closed and the nasal bones are immobilized externally by a Plaster of Paris splint and internally by a pack of

tulle gras impregnated with silver disulphate. The pack is removed after 48 hours but the plaster is worn continuously for 14 days after the operation. It is then removed but is worn at night for another 4 weeks.

THE RESULTS OF THIS OPERATION

I am able to report on a series of 15 patients into whose noses a Kiel graft has been implanted. It is a small series, but I hope others will use it.
One patient rejected the graft — he returned to my clinic with the bone projecting from the tip of his nose. One patient developed an abscess superficial to the graft, it was drained and the graft remained undisturbed. The patients in whom the graft had taken were able to leave hospital next day.
They were seen in the clinic one week after operation, the patient was asked to return after an interval of 1 month and, if all was well, after an interval of six months for final examination.

RÉSUMÉ

Les accidents fréquents auxquels le nez est sujet, provoquent une déformité en forme de selle, dès agréable à voir. En plus de la déformité, le malade se plaint d'une obstruction des voies nasales. Il est momentanément soulagé si la pointe du nez est soutenue; un son soulagement permanent s'obtient à la suite d'une re constitution du squelette, en se servant des éléments du squelette, on pratique une greffe qui soutient l'arête du nez.
Il s'agit d'envisager les matériaux dont on se sert pour refaire l'arête aplatre.

Nous n'avons pas un grand succes avec des implantations en matière plastique, parcequ'il n'y a pas de tissu vivant pour les entourer; le taux de rejet a été élevé. Il y a un également rejet dans les cas de greffes homogènes d'os ou de cartilage. Les greffes d'os autogènes ont duré mais le malade doit subir une grave opération. Nous avons envisagé et nous recommendons les greffes d'os hétérogènes à cause de la facilité de préservation et de la simplicité relative de l'opération.
Nous avons exposé en detail les grandes lignes de l'opération et nons vous donnons le résultat de 15 interventions, 13 ont parfaitement réussi; il y a eu rejet dans le cas de 2 greffes. Ce n'est que'une petite série le résultat d'expériences plus récentes paraîtra ultérieurement.

REFERENCES

1. Berman, W. E., 1963: Use of silicones in rhinoplasty and chin implants. Read before the Academy of Ophthalmology and Otolaryngology, New York,
2. Foman, S. and Bell, J., 1970: Rhinoplasty, new concepts. Evaluation and application. C. C. Thomas, Springfield, 175-179.
3. Inclan, A., 1942: Use of preserved bone grafts in orthopaedic surgery. J. Bone & Joint Surg., 24, 81.

4. Macewen, W., 1912: Growth of Bone. J. Maclehouse & Son, Glasgow.
5. Mowlem, R., 1941: Bone and cartilage transplants, their use and behaviour. Brit. J. Surg., 29, 182.
6. Symposium on bone grafting materials, Armour Pharmaceuticals Ltd., 1966.
7. Wilson, T. G., 1964: Use of teflon injection to correct saddle deformity. J. Laryng., 78, 953-958.

J. Siegler, F.R.C.S.,
31 Rodney Street,
Liverpool, U.K.