FROM THE SURGICAL UNIVERSITY CLINIC GOETTINGEN (GERMANY)
(DIRECTOR: PROF. H. HELLNER, M.D.)

THE CONSERVATIVE TREATMENT OF THE PSEUDARTHROSIS OF THE OS NAVICULARE OF THE HAND

With 5 Illustrations

By

WALTER DÜBEN, M.D. and HEINZ GELBKE, M.D.

Normally, the correctly treated and fresh fracture of the scaphoid heals thoroughly. Failures are not more frequent than in other cases of fracture. To-day, failures cannot be explained any more by bad vascularisation of the scaphoid or by the already refuted osteolytic potency of the synovia (*Gelbke*). The example of the fracture of the femoral neck demonstrates plausibly that the insufficient immobilisation is alone responsible for the absence of the osseous healing. The same applies without reservations to the scaphoid fracture of the hand. Certainly, the small anatomic conditions offer only few points of application for the necessary absolute immobilisation of the fragments.

In the case of old scaphoid fractures and of pseudarthrosis healing conditions are especially difficult. All former methods of treatment have a high percentage of failures. The conservative treatment is to-day only applied in certain cases. Operative treatments predominate which are supposed to promise a greater certainty of success. The American and English literature open to us shows that *Dwyer* still recommended an early extirpation of both fragments a few years ago. According to his observations, an absence of complaints and an improvement of the wrist's function are to be achieved by this procedure. Grave objections on account of general anatomic and physiological conceptions must be raised against such a coarse destruction of the complicated structure of the carpal joint. The function of the wrist after this operation was in

our cases more impeded than before, radial deviations of the hand were frequent, and arthrotic changes and complaints arose early.

The extirpation of the proximal fragment is connected with similar but less considerable disadvantages, experiences of which *Wagner* communicated in 1952. We can only decide on this operation in the case of certain forms of fracture with a small ulnar fragment, after attempt at conservative treatment has failed. All other operative procedures, such as scratching out the fracture surfaces, even in connection with spongiotransplantation, are always accompanied by a certain amount of failures. *Barnard* and *Stubbins* consider the movements caused by the radial collateral ligament an impediment for the fracture's healing. Therefore, they propose to remove the often much extended processus styloides of the radius. With the spongeous osseous tissue obtained in this way the fractural space is simultaneously stopped. Healings are even achieved in cases where the fractural space had been left untouched, i.e. when only the processus styloides had been removed and then the hand had been immobilised for some time.

Consequently, this operation as such as well as the excochleation of the fragments can only be considered as supporting measures, whereas the immobilisation of the hand is of supreme importance. Neither the hoped for abbreviation of the treatment nor any greater security of success is obtained by operative procedures.

Even if the fracture appears fixed on the X-ray photo the therapeutic method's value cannot be based on it alone. Functions and complaints are of greater practical importance. Impeded functions are more frequent in procedures connected with the opening of a joint and are not demonstrated by X-ray photographs alone.

Wagner was the last to report on conservative treatment of obsolete scaphoid fractures and pseudarthrosis. 14 healings are confronted with one failure. The average bandaging period was 11 months, in some cases the immobilisation had to be continued up to 16 months. The fingers and the thumb tip were not included in the immobilising bandage.

Normally, the scaphoid follows the movements of the proximal carpal joint series which can be looked upon as an osseous discus articularis. If the continuity of this disc is interrupted by a fracture line of the os naviculare, the sequence of movements in the radiocarpal and intercarpal joint are fundamentally changed. By radial and ulnar abduction, but also by dorsal and volar reflexing, shearing forces are transmitted on the distal navicular fragment which now functionally changes over to the distal series of the carpal bones. This, consequently,

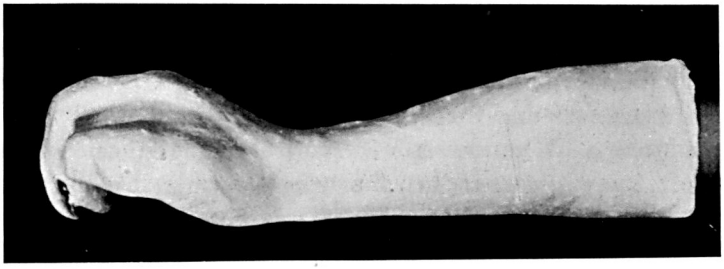
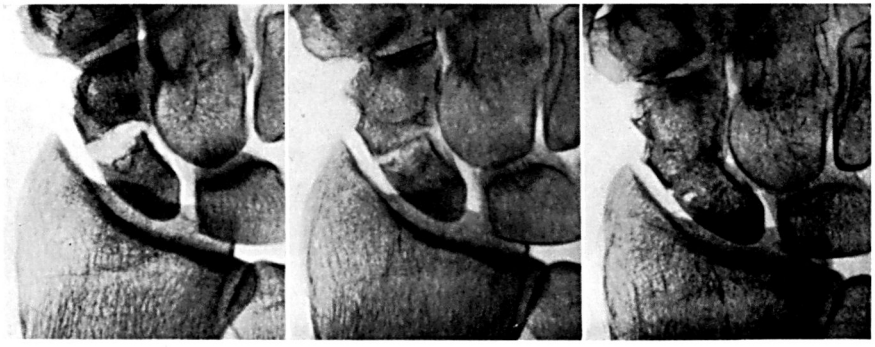


Fig. 1.
Plaster cast for absolute immobilisation.



a b c

Fig. 2 a, b and c.
a. Scaphoid Pseudarthrosis when treatment started.—*b.* After 4 months of immobilisation.—*c.* Osseously consolidated after 6 months of immobilisation.

leads to retarded ossification and formation of pseudarthrosis. Considerable finger movements will influence the fractural space in the same way.

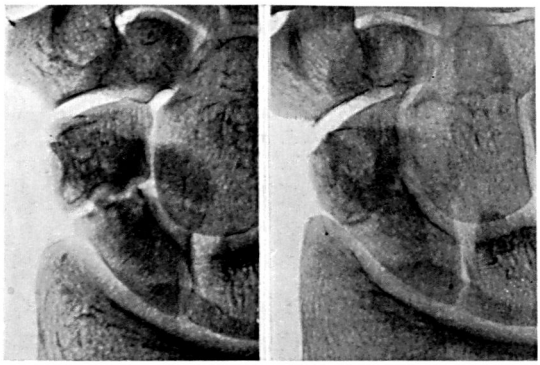
We know that a pseudarthrosis is a mistaken differentiation of the fracture's healing caused mechanically and functionally. Osseous callus is formed best under complete exclusion of mechanical forces. If the mechanical forces exceed a certain amount of time and intensity (particularly damaging are shearing and gliding forces), the regenerative tissue of the fresh fracture does not develop into a bone, but into tight connective tissue and cartilage, i.e. into pseudarthrosis.

In principle, the pseudarthrosis can therefore be healed in two ways:

1) In leading back the straying regenerative process to its starting point and letting the whole healing procedure revolve, i.e. all methods which create a new bone wound, *Kirschner*'s splintering, pseudarthrosis resection with bone graft and spongiosa transplantation.

2) In excluding for a sufficient period of time the mechanical forces hostile to ossification which led to the pseudarthrosis. The misdifferentiated connective and cartilage tissue is thereby at first dissolved by resorptive processes and then led to ossification.

As examples well known from practical application, only the inversive osteotomy by *Pauwels* in the case of pseudarthrosis of the neck



a b

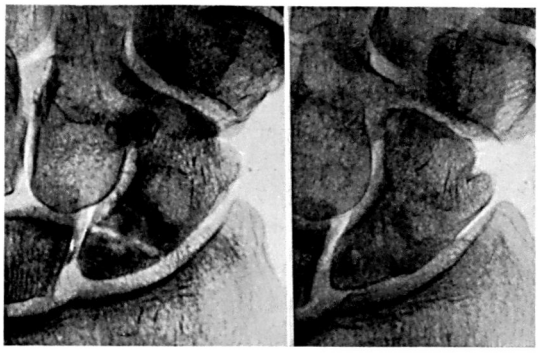
Fig. 3 a and b.
a. 4 years old Scaphoid Pseudarthrosis with sclerosed space and cysts.—*b.* Consolidated after 4 months of immobilisation. X-ray 1 year after treatment finished.

of the femur and the resection of the barring bone in the bi-osseous limb section, developed by *Brandt,* will be mentioned. The exclusion of all hand and finger movements including the rotatory movements of the forearm provides the conditions necessary for the pseudarthrosis consolidation of the scaphoid of the hand. Therapeutically, we must aim at keeping away any mechanical insults from the pseudarthrosis space for a sufficient length of time by a well arranged plaster of Paris cast.

The cast technique is therefore the determining factor and is quite simple. An unupholstered plaster of Paris cast is arranged to guarantee an absolute immobilisation of the fragments. That is only rendered possible when all finger and hand movements, including the rotatory movement of the forearm, are excluded. That is the essential point of this special bandaging technique. Only the fingerpoints and the free nailbeds are excluded from the plaster cast in order to be capable of controlling the blood circulation. A volar gypseous splint of normal strength which is applied in dorsal flexion of the wrist and in semi-

flexion of the fingers serves as a base for the bandage. Circular tours complete the closed plaster cast (Fig. 1).

The cast is changed every 6–8 weeks. An X-ray control is performed every time. The immobilisation is carried on until the fractural space is largely ossified. As a rule, this is the case after 3–4½ months. Under the protection of a dorsal gypseous splint, the first finger movements



a b

Fig. 4 a and b.

a. 4 years old Scaphoid Pseudarthrosis with small ulnar fragment.—*b.* After 17 weeks immobilisation osseously consolidated. X-ray 1 year after treatment finished.

and, 4 weeks later, the full functioning of the hand are allowed. Heavy labour with the hand concerned ought to be forbidden for another 4 weeks. Theoretically, a considerable stiffening of the fingers must be feared after such a long immobilisation. This danger does not exist, as practical experience teaches and cannot therefore be used as a counter-argument against conservative treatment. The often discussed question whether changes in the direction of the hand lead to closer contact of the fracture surfaces and so create better healing conditions may be answered to the effect that they are unimportant and superfluous according to our experiences up to date.

The various phases of the healing process of the pseudarthrosis treated in this way can be differentiated on X-ray photographs (Fig. 2 a–c). During the immobilisation a slowly increasing decalcification of the whole hand skeleton expresses within the first weeks the beginning resorption which ordinarily culminates after 8–10 weeks. Then the ossification processes commence, recognisable on X-ray photos by the vague structures and light shadows. Finally, the space of the

pseudarthrosis is bridged at first in one point. From this point develops the union of the fragments with primarily undirected bone. On an average, the pseudarthrosis gap begins to ossify after 3 months (Fig. 2 b). The calcination of the hand skeleton, which is reduced in the beginning, slowly increases later on (Fig. 2 c). The sclerotic rim

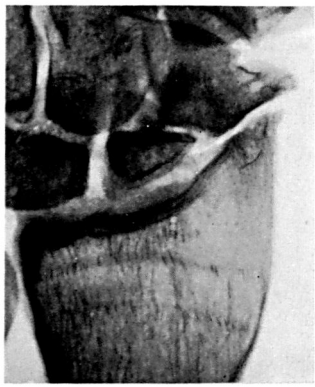


Fig. 5.
Case not suitable for conservative treatment (nor for operation).

remaining at the pseudarthrosis space dissolves only later. During function, callus develops into ordered osseous structure.

25 out of 30 pseudarthrosis and old fractures treated in this way have healed osseously. 21 of these had existed for more than a year, 8 of these for more than 4 years (Fig. 3 a–b). Even the badly healing small ulnar fragment frequently smelts with the radial fragment (4 such observations of our own) (Fig. 4 a–b). The calciferous density of a fragment cut off from vascular supply must not prevent an attempt at conservative treatment. The reparatory forces proceeding from the distal fragment are obviously sufficient for the consolidation, when immobilisation has been carried out long enough.

There are, however, some reservations to be made concerning the conservative treatment, which do not detract from its other value. Those cases should be excluded from conservative treatment which have serious secondary arthrotic metamorphoses and considerable dissimilarity of the fracture surfaces concerned, as well as pseudarthrosis with greater dislocation (Fig. 5). These are cases generally resistant to therapeutic measures, where operation does not lead to healing either and especially not to unimpeded functioning. If the

fracture surfaces covered by a several millimetres thick sclerotic margin do not split up within 6–10 weeks, this must indubitably be considered a prognostically unfavourable symptom. These remain, however, exceptional cases for which operation will still be opportune.

Owing to these considerations, the fresh scaphoid fracture should also be supplied with a similar plaster bandage in order completely to prevent a delayed healing. The osseous union of the fragments is then frequently achieved after only 3 or 4 weeks. This corresponds to the healing period of the typical radius fracture. To make quite sure, we leave this bandage, however, until the end of the 6th week. The immobilisation period can consequently be considerably abbreviated by the bandage arrangement as described.

SUMMARY

A report is made of experience with the conservative treatment of old scaphoid fractures and pseudarthroses. The bandaging technique practised for this is of decisive importance and consists of a non-upholstered plaster cast enclosing all the fingers, so that complete immobilisation of the fragments is achieved. On average this is maintained for 3–4½ months. Even with unfavourable initial conditions such as a small ulnar fragment healing is obtained. Cases with severe, deforming articular metamorphoses, considerable unevenness of the fracture surfaces and dislocation of the fragments are not suited to conservative therapy.

RESUME

Il est rendu compte d'essais faits au sujet du traitement conservateur de vieilles fractures scaphoides et de pseudarthroses. La technique du bandage pratiqué dans ces cas est d'une importance décisive et consiste en un bandage de plâtre non rembourré enfermant tous les doigts, de manière à obtenir immobilisation complète des fragments. Celle-ci doit être maintenue en moyenne pendant 3 à 4½ mois. On a obtenu la guérison, même dans des conditions initiales défavorables, telles qu'un petit fragment ulnaire. En revanche, les cas dans lesquels il y a des métamorphoses articulaires déformantes graves, une surface de la fracture extrêmement inégale ou une dislocation des fragments, ne se prêtent pas à cette thérapie conservatrice.

ZUSAMMENFASSUNG

Es wird über Erfahrungen mit der konservativen Behandlung veralteter Kahnbeinbrüche und -pseudarthrosen berichtet. Die dabei übliche Verbandtechnik ist von entscheidender Bedeutung und besteht in einem ungepolsterten Gipsverband mit Einschluss sämtlicher Finger, sodass eine absolute Immobilisation der Fragmente gewährleistet ist. Durchschnittlich betrug die Ruhigstellung 3–4½ Monate. Selbst bei ungünstigen Ausgangsbedingungen mit kleinem ulnaren Fragment wurde eine Ausheilung erzielt. Fälle mit schweren deformierenden Gelenkveränderungen, beträchtlicher Unebenheit der Bruchflächen und Dislokation der Fragmente sind für die konservative Therapie nicht geeignet.

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