

## Section of Orthopaedics

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### Short Papers

#### Treatment of Freiberg's Infraction

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It is possible by timely surgical intervention to interrupt the pathological process of Freiberg's infraction and restore the conformation of the metatarsal head. For the purposes of treatment, the natural history of the disease can be conveniently divided into five stages:

*Stage I:* A fissure fracture is present in the epiphysis (Fig 1); it is difficult to find, is without visible reaction and often so narrow that little more than a knife-blade can be inserted. When access to the depths of the fracture has been obtained, the impression is that of sclerosis of the opposing cancellous surfaces. When the bone on the metaphyseal side of the epiphysis is compared with that of the epiphysis, it is seen that the epiphysis is deficient in or completely devoid of blood supply. The narrowness of the fracture line provides the explanation of the failure of radiographs to detect the fracture or the ischæmia of bone at this stage: it is not possible to detect loss of blood supply unless and until there is a relative increase in radiopaque material in the bone.

*Stage II:* Absorption of cancellous tissue has occurred on the proximal side of the lesion so that the dorsum of the main portion of articular cartilage begins to sink beneath the level of the margins hinging on the intact cartilage at the plantar aspect (Fig 2).

*Stage III:* Further absorption has occurred and the main portion of the articular surface sunk so far into the head that sizeable projections remain on either side. The small exostoses on the dorsum of the proximal side may have fractured but retain soft tissue attachments. The isthmus of articular cartilage on the plantar aspect is intact (Fig 3).

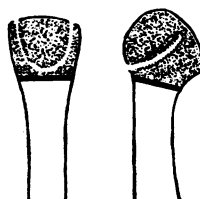


Fig 1 Stage I A fissure fracture develops in the ischæmic epiphysis

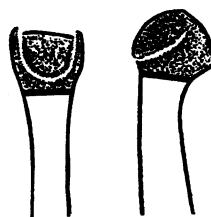


Fig 2 Stage II Absorption of bone has taken place and the central portion begins to sink into the head, altering the contour of the articular surface

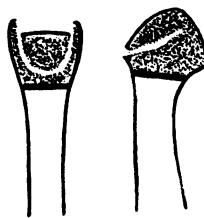
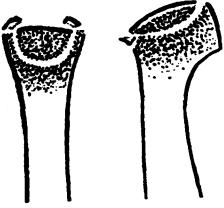
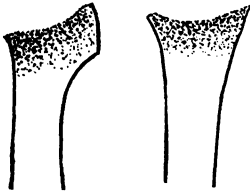


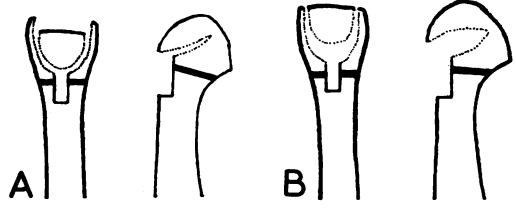
Fig 3 Stage III Further absorption has occurred and the central portion sinks into the head leaving projections on either side. The plantar articular cartilage remains intact



**Fig 4 Stage IV** The plantar isthmus of articular cartilage has given way and the loose body separated. Fractures of the lateral and dorsal projections have occurred. Restoration of the anatomy is no longer possible. The epiphysis is probably closed at this stage

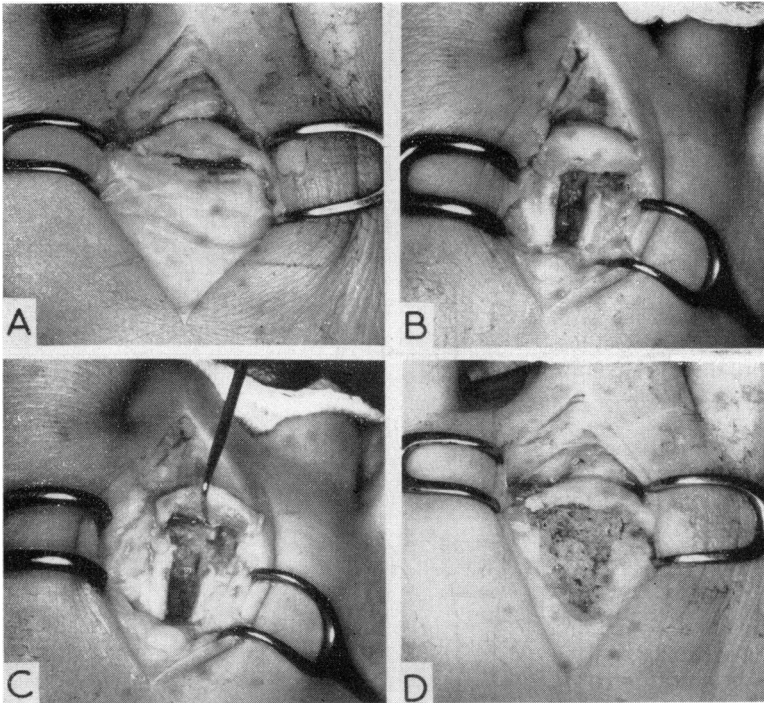


**Fig 5 Stage V** Final stage of flattening, deformity and arthrosis



**Fig 6 Technique of operation in Freiberg's infraction:** diagrammatic representation. A, access to the posterior aspect of the potential loose body and to the sclerotic bone in the neck of the metatarsal is obtained by cutting a slot 14 mm long by 5 mm wide in the dorsum of the shaft. B, when fibrous tissue has been excised and sclerotic bone and epiphyseal plate perforated, the deformity is reduced and the resulting space packed with cancellous bone chips

**Stage IV:** The main portion of the articular surface has sunk so far that the plantar hinge has finally given way and thus the possibility of restoration of the anatomy has passed. The projections on either side have fractured and have, with the soft tissue intact, become folded over the central loose body (Fig 4).



**Fig 7 Technique of operation in Freiberg's infraction.** A, head of metatarsal exposed to reveal the fracture. B, slot to gain access to epiphysis, epiphyseal plate and metaphysis has been cut. C, central portion of the head levered distally to reduce the deformity. D, resulting space packed with cancellous chips

*Stage V:* The final state is that of an arthrosis and is characterized by marked flattening and deformity of the metatarsal head. Only the plantar aspect, where the final isthmus of cartilage fractured, retains the original contour (Fig 5). The loose body is much reduced in size or may have disappeared, apparently ground between the incongruous joint surfaces. The shaft of the metatarsal is thickened and dense.

*Treatment:* That restoration of the normal conformation of the metatarsal head is possible at Stages I, II and III is due to the fact that the articular cartilage, having no blood supply, remains intact and is unaffected by the ischaemic process in the underlying bone. Once fracture of the hinge of the articular cartilage on the plantar surface has occurred (Fig 4) perfection or anything approaching it is unattainable.

The aim of operation is the establishment of a new blood supply to the epiphysis across the epiphyseal plate. In addition, replacement of the bone tissue which has been absorbed may be required to preserve and maintain reduction so that the original contour of the head is restored.

*Operation:* An incision 5 cm long is made over the dorsum of the metatarsal head extending a short distance on to the proximal phalanx. The tendon is identified and retracted to the lateral side. The capsule, synovial membrane and periosteum are divided in the mid-line and dissected off the head and neck to a degree sufficient only to expose the fissure and determine the extent of the lesion. Access to the fracture site, epiphysis and metaphysis is obtained by cutting a slot 14 mm long by 5 mm in the dorsum of the shaft (Figs 6A, B, and 7A, B). The next step is determined by the stage of the lesion. At Stages I and II there is no serious problem of deformity due to absorption of bone. It is a matter of re-establishing a blood supply by breaking down the barrier of sclerosis on both sides of the so-called fracture: this is done by excising fibrous tissue and roughening, with the point of a fine gouge, the distal aspect of the fracture; the sclerotic zone on the proximal aspect is treated in a similar manner. Finally and most important, the epiphyseal plate is destroyed by multiple perforations of the gouge.

At Stage III, the latest stage at which reparative measures are likely to be effective, deformity of the head is present but the potential loose body is still attached by an intact hinge of articular cartilage. The degree of collapse is determined and the fragment then gently levered distally on the hinge until the deformity is corrected (Figs 6B, 7C). The fracture site and epiphyseal plate are drilled

or otherwise perforated as in Stages I and II. The space which exists when reduction is complete is packed with small autogenous cancellous chips, the quantity determined by the alignment of the cartilaginous element to the medial and lateral margins of the articular surface (Fig 7D).

*After-treatment:* At the termination of operation a compression bandage is applied in the outer layers of which a plaster slab keeps the foot at rest. In ten to fourteen days, when the stitches are removed, the bandage is replaced by a skin-tight walking cast which incorporates the second and third toes but leaves the big and remaining toes exposed. The cast is retained for a total of twelve weeks, when radiographs to determine progress are secured. If healing is judged to be satisfactory, a gradual return to weight-bearing is permitted using a lacing shoe with a leather insole and sponge rubber metatarsal dome.

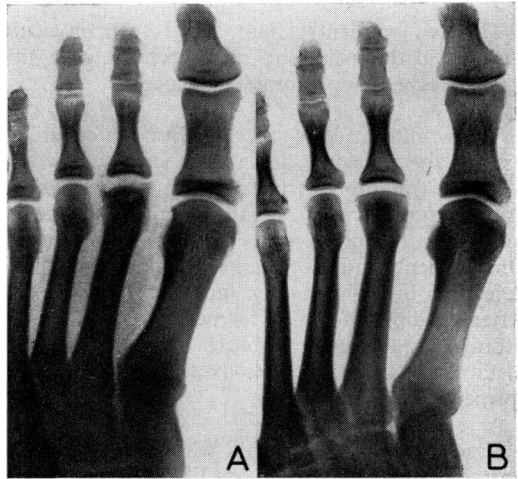


Fig 8 Result of operative treatment in Freiberg's infraction. A, before, Stage III; note the deformity of the head and the bony projections on either side of the potential loose body. B, after; Contour and trabeculation of the head has been restored

*Results:* If the treatment outlined is carried out with meticulous attention to detail a return to normal or something approaching it is possible in the large majority of cases. At Stage I, before pathological changes have advanced to a degree detectable radiologically, perfection can be anticipated. At Stage III the result depends on the degree of reduction achieved and maintained until healing is complete (Figs 8A, B).

#### REFERENCES

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(1960) *Osteochondritis Dissecans*. Edinburgh