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OPEN REDUCTION OF CENTRAL COMPRESSION FRACTURES OF THE TIBIAL PLATEAU

Preliminary Report of a New Method and Device Arrangement

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A new method of reduction and fixation of a uniformly depressed fracture of the tibial condyle is described. A curved steel probe, introduced through a cortical window in the uninjured condyle, is used to reduce the fracture fragments as well as to compact the fracture region (TV-monitored x-ray projectioning is desired). The instruments needed for the operative procedure are as follows: a probe for reduction and compaction, a tube and a plunger for deposition of bone transplants, and a forked plate. Five cases in which the curved probe reduction method has been used are reported.

Key words: ceramic material; fixation; fractures; tibial condylar fractures

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A fracture of one of the condyles of the tibia is not an uncommon injury, more often occurring laterally than medially, and mostly in the elderly osteoporotic patient (Rasmussen 1973). The uniformly depressed central condylar fracture with an intact cortical rim (Hohl Type I B) represents 26 per cent of the entire tibial condylar fracture group (Hohl 1967). Several of these fractures will benefit from the method of treatment outlined below.

In a forced valgus position of the knee, the lateral femoral condyle is wedged down upon the corresponding tibial condyle. In this way, the femoral condyle depresses and compresses the central parts of the tibial plateau thus fracturing the surface in a mosaic-like manner but often sparing the outer border of the condyle and the meniscus (Kennedy et al. 1968). (Figure 1.)

As stressed by several authors (Hohl 1967, Maquet et al. 1967, Rasmussen 1973), the fracture deformity produced by a central fracture of one of the tibial condyles, can only be tolerated for a short time, and it can only, to a limited extent, be compensated biomechanically by fibrous callus.

PATIENTS

Five patients have been operated on according to the method outlined below. In four patients the lateral condyle was fractured, in the fifth the medial condyle. In all cases the central compressions amounted to or exceeded one cm and the knee was unstable in the extended position. Three patients were women, two men. All patients were more than 55 years old. In

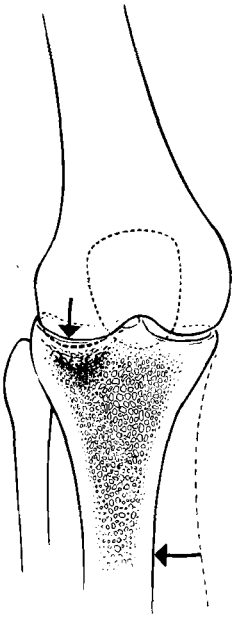

Figure 1. Forced valgus position of the knee, causing a central depression of the lateral tibial plateau.

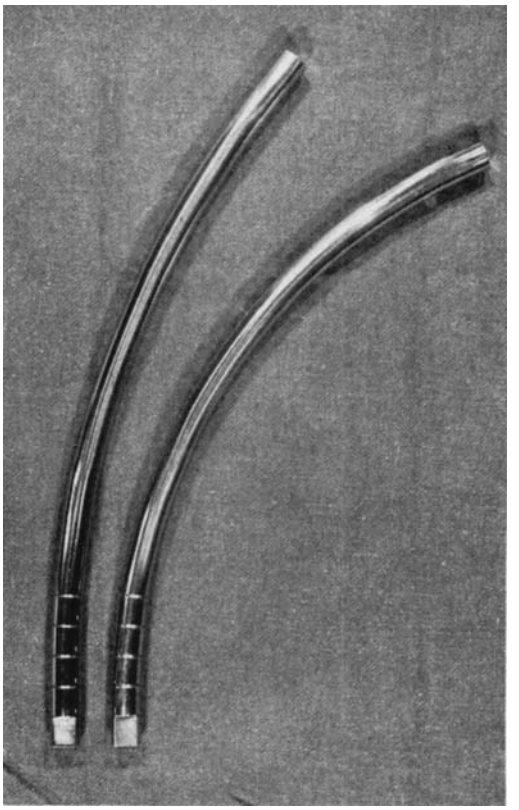

Figure 2. Two probes, with different curvatures.

one patient the fracture region was stabilized by two loops of wire, from the lateral to the medial side of the tibial condyle. Autologous bone transplantation was performed in two patients.

METHODS

The aim of the method described below is to re-establish in a simple way the all-important support of the femoral condyle and consequently the stability of the knee joint. This will prevent an otherwise unavoidable joint insufficiency due to increased load, with the forces converging on limited parts of the tibial condyle, resulting in gradually increasing strains on the ligaments.

The method requires a curved steel probe which has a diameter of 1.0–1.5 cm, a length of 20 cm, and a radius of the curve of approximately 25 cm. The "reduction end" of the probe is slightly concave. The instrument, with various curvatures, is illustrated in Figure 2.

The probe is introduced into the bone via a fenestration in the subcondylar cortex of the unfractured side of the tibial head, so that the probe will not affect the supporting cortical parts of the fractured condyle. The concave "reduction end" of the probe is placed in position beneath the compressed parts of the condyle, under TV-monitored x-ray control. The compressed fracture region is reduced by repeated careful pushes of the probe (Figure 3). On its way, the probe transfers and compacts considerable amounts of cancellous bone from the region beneath the depression. The curvature of the probe permits some "swing" and this makes some minor adjustments of the reduction possible and also compacts and forms transverse bone bridges immediately beneath the fracture parts. This stabilizes the reduced fracture parts. The reduction may, if necessary, be further stabilized by several methods of internal fixation, e.g., by a wire technique, described by Gottfries et al. (1971), or by a plate device especially designed for this purpose (Figure 4). Only a short skin incision is needed for the reduction procedure. The surgery should be performed with the fractured leg slightly extended. The pre-operative set-up is illustrated in Figure 5. A full-length circular knee-cast should be used for 4 to 6 weeks post-operatively in order to keep the fractured knee joint compartment protected.

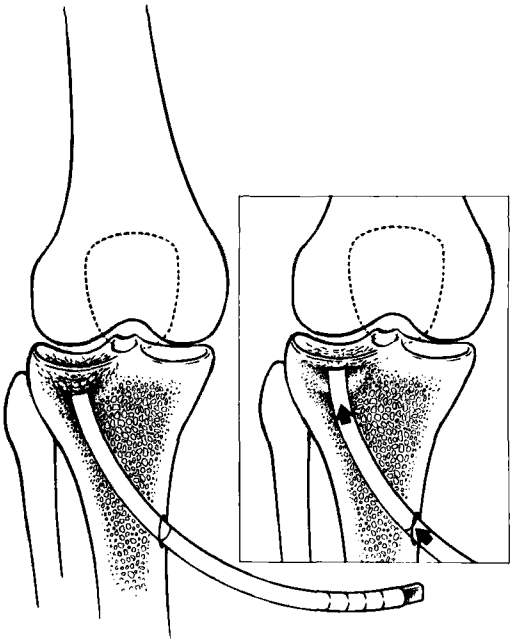

Figure 3. Principle of the fracture reduction and compaction procedure with a curved probe.

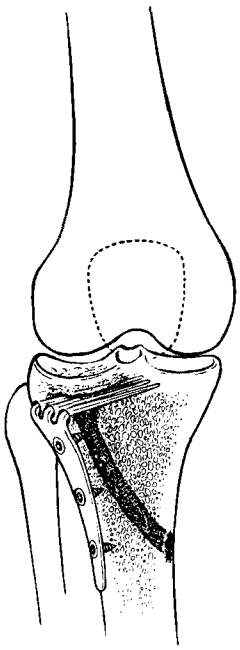

Figure 4. Outline of the support plate, applied to a reduced condylar fracture region, with bone grafts and/or ceramic material filling the bone defects.

RESULTS

All patients were followed up for at least six months, three for more than a year. A satisfactory joint function with an active flexion capacity of up to 90 degrees and with full or almost full extension capacity was noted in all cases.

A post-operative depression of 5 to 10 mm of the reduced area occurred in one case. This re-dislocation occurred within the first two months after surgery. Due to subjectively incapacitating valgus instability of the knee, this patient uses a walking stick and a short knee brace.

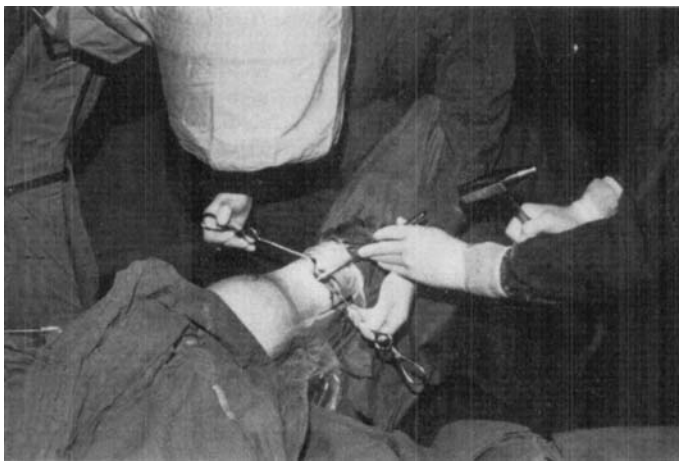

Figure 5. The per-operative set-up, with the C-bow x-ray apparatus in position for an A-P central beam projection of the knee joint space. This necessitates a free-hanging extremity, which should be slightly extended. Note that the probe is put into the slide of metaphysis contralateral to the fractured condyle.

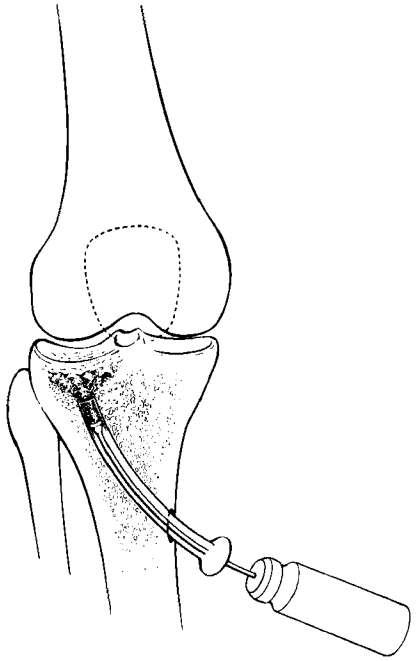

Figure 6. Principle of the use of the bone graft and/or ceramic "loaded" tube-and-plunger instrument set-up.

All patients had sagittal stability. Two patients (one mentioned above) had some valgus instability. All patients were able to use stairs. No-one was troubled by night pains. One patient had permanent joint swelling. There have been no infections or serious general complications, such as venous thrombosis or pulmonary embolism.

DISCUSSION

The method described is probably only suitable for the treatment of uniformly depressed central condylar fractures. The alternative to the selected method would have implied a wider approach to the fracture area. This would have decreased the support of the fracture region even if bone grafts had been used. This standard method usually includes visual control of the reduction through an arthrotomy. Meniscectomy would probably have been performed in order to facilitate the reduction of the fracture fragments, even if the meniscus was not ruptured primarily. It is suggested that by using the above method, arthrotomy, bone grafting, and meniscectomy could be avoided.

Instead of bone grafts to compensate for the bone defects, porous ceramic material could be used as suggested by Benum et al. (1976) and Cameron et al. (1976). The ceramic material (e.g. tricalcium phosphate) could be introduced into the bone defect region by the use of a cylinder-and-piston type of instrument arrangement, as shown in Figure 6.

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