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Osteochondral Fracture (exogenous) of the
Femoral Condyle

by

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So-called osteochondral fracture is a special type of fracture within the knee joint accompanied by thin subchondral bone. While a considerable number of reports have appeared on the endogenous variety of this fracture (for instance, tangential osteochondral fracture accompanying patellar dislocation), only rare reports are available on the exogenous type in Japan. We have experienced two such cases probably due to a direct impact. In these cases, osteochondral fragments have well grown fixed after 2.5 and 4 years, with clinically satisfactory condition up to the present.

Case 1 : A 62 year old male fell upon being hit at the right knee by a light motorcar while riding on a motorcycle. At the time of initial examination, marked swelling of the right knee was noted with ballottement of the patella. A puncture revealed haemarthrosis. Tenderness was found on the medial and lateral condyle regions of the right femur, without dislocation of the patella. The initial x-ray picture revealed an osteochondral fracture of the lateral condyle of the right femur, with displacement of the osteochondral fragment at approximately 7 cm from the lateral articular margin to the proximal direction. On the other hand, (Fig. 1) abrasion fracture was noted at the atta-



Fig. 1 Case 1. 62 years old male, at the time of injury.

Key words : Exogenous osteochondral fracture, femoral condyle, reduction of large fragment autografting

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chment of the medial collateral ligament on the medial supracondyle of the femur.

Operative findings : Operation was carried out at about 1 week after injury. Through a lateral longitudinal incision the knee joint was approached. Upon incision of the joint capsule, about 100 ml of the haematoma content ran out. After examination of the inside of the joint, two free osteochondral fragments were removed. Upon flexion of the knee joint by about 90 degree, however, a defect was noted in the articular cartilage from the lateral margin of the femoral condyle over the weight-bearing surface to the cancellous bone. The fracture surface was already covered by thin granulation tissue. The removed osteochondral fragments measured

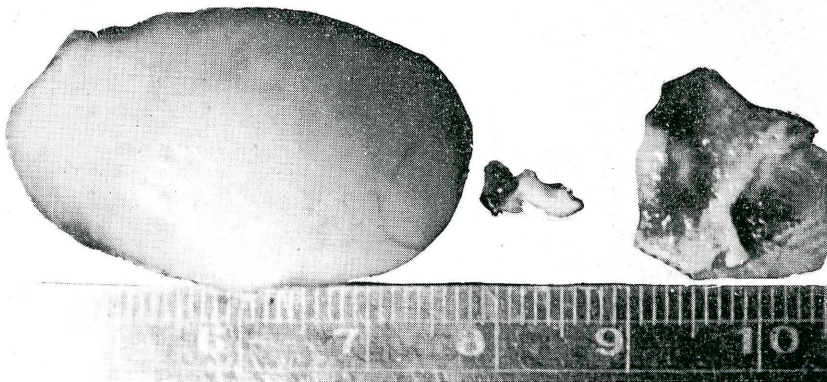


Fig. 2 The removed large osteochondral fragment measured $4.0 \times 3.0 \times 0.5$ cm.

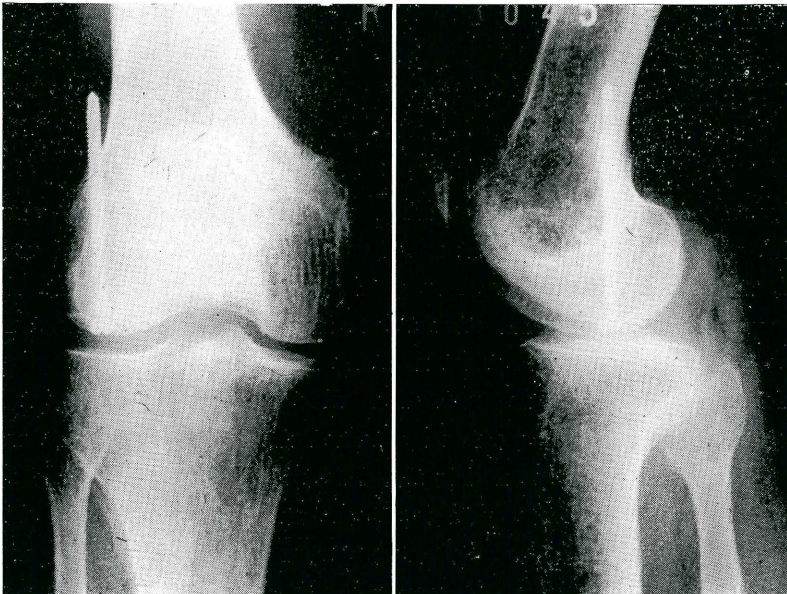


Fig. 3 After reduction of large osteochondral fragment it was fixed by a screw of 5 cm in length.

1.0×1.5×0.3 cm and 4.0×3.0×0.5 cm, respectively. The convex surface of the larger osteochondral fragment was the articular surface, and the fracture surface was covered by thin cancellous bone. After reduction of large osteochondral fragment, it was fixed by a screw of 5 cm in length. On this occasion, care was taken to avoid protrusion of the screwhead from the articular surface, confirming the smooth joint movement. The patella was free of any abnormalities. Along with the removal of the small avulsed osteochondral fragment, the avulsed portion of the medial collateral ligament was sutured.

Postoperative course : Treatment was started from the third postoperative day. After about 2 months, gait was permitted, with the use of a non weight-bearing apparatus. After about 7 months postoperatively, the nail was removed. Meanwhile,

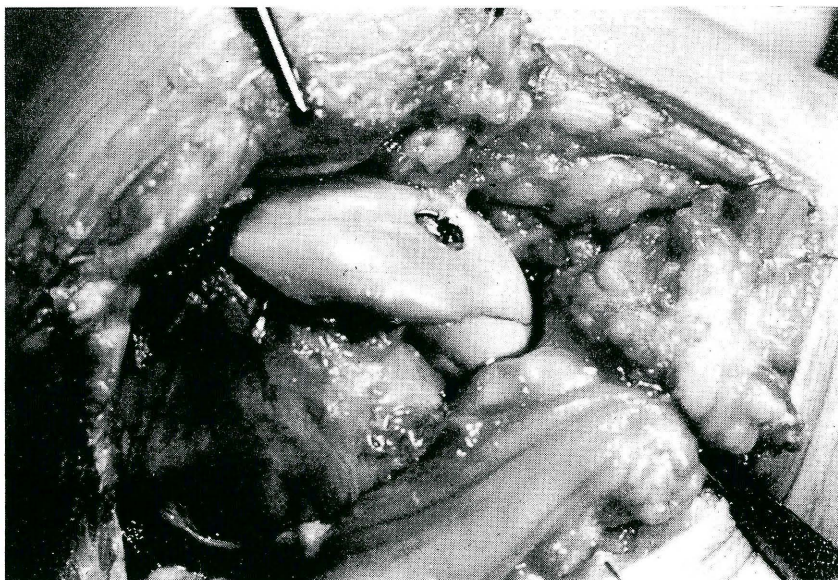


Fig. 4 Case 1.

arthrography and arthroscopy were carried out in addition to simple radiography. The R. O. M. of the right knee joint was improved to 0-120 degree before removal of the nail, without erythema, swelling, pain or loosening of the joint. At the time of nail removal, invasion of connective tissue into the fissure of fracture over the joint surface was noted with indistinct fracture lines.

The defect created by the removal of small osteochondral fragment was filled with connective tissue. In the specimen obtained from this site, there was a slight invasion of the connective tissue filling the defect by blood vessels. No chondrocyte was noted in the fissure and the cartilage tissue on the recipient bone side appeared almost normal. At present, after 2.5 years postoperatively, the range of movement of the joint is almost normal with scarcely any complaint. Fracture surface are fused roentgenologically, with mild osteoarthritic changes.

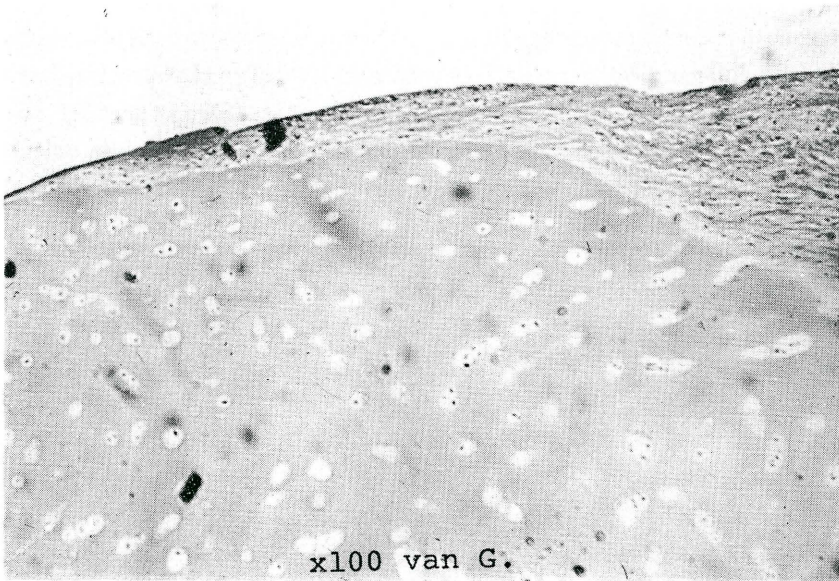


Fig. 5 The defect created by the removal of small osteochondral fragment was filled with connective tissue, but no chondrocyte was noted in the fissure.

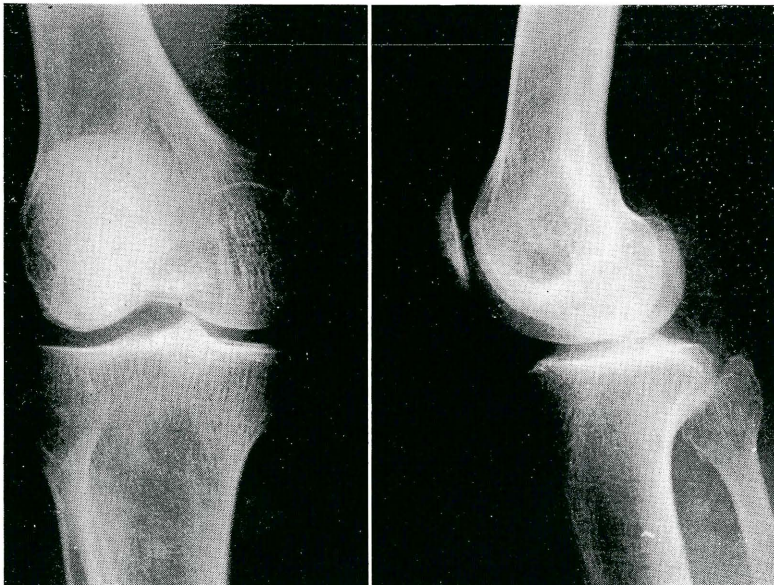


Fig. 6 Case 1. After 2.5 years after operation.

Case 2 : A 15 year old boy ran out from behind a bus and was hit by a passing car, sustaining a fracture within the right knee joint, along with contusion of the head, left shoulder and both feet and loss of consciousness for a few minutes after trauma. At the time of initial examination, marked pain and swelling of the right knee joint were found without patellar dislocation. In the X-ray picture at the time of initial examination, a wedge-shaped osteochondral fracture was found on the weight-bearing surface of the medial condyle of the right femur. On account of the minor

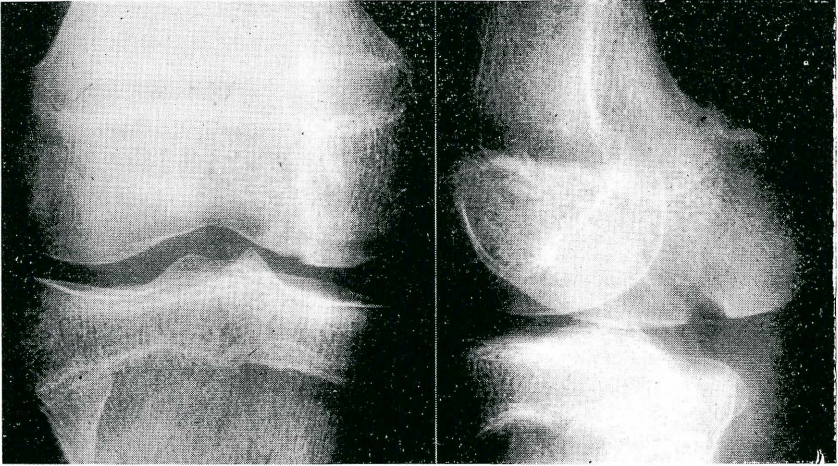


Fig. 7 Case 2. 15 years old boy. A wedge-shaped osteochondral fracture was found on the weight-bearing surface of the medial condyle of the right femur.

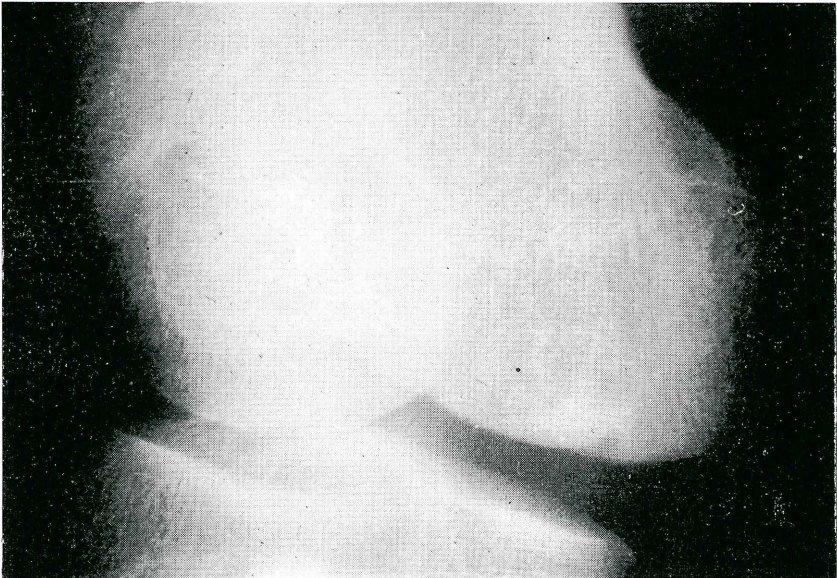


Fig. 8 Four years after trauma, knee joint is normal with mild deformity of the articular surface.

displacement of the osteochondral fragment, conservative treatment was given. After cast immobilization for about two months, training for functional restoration was carried out. Gait was started after about 3.5 months. After 1 year and 9 months, the R. O. M. of the right knee joint was 0-135 degree, without any complaint, with mild depression on the joint surface in the X-ray picture. At present, 4 year after trauma, R. O. M. of the knee joint is normal with mild deformity of the joint surface in the X-ray picture.

Discussion

Since the report of KRONER on osteochondral fracture accompanying patellar dislocation in 1905, many reports on this disease are available in Japan and other countries, with attempt at classification and discussion on the mechanism of injury. Our present cases correspond to the ones based on an exogenous mechanism by direct impact according to the classification by J. C. KENNEDY. In KENNEDY'S experiment however, fracture of this type are said to be frequent encountered in the young age group, since older subjects with distinct tide mark sustain only avulsion fracture of the more superficial cartilagenous layer and thus lack the characteristics of osteochondral fracture. Our first case is an osteochondral fracture accompanied by subch-

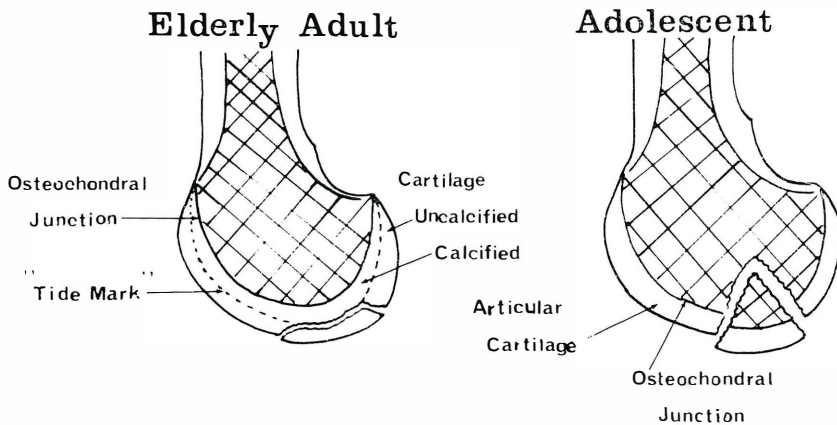


Fig. 9 J.C.Kennedy, 1966.

ondral bone in an older subject due to an exogenous mechanism of injury.

The treatment of osteochondral fractures should consist of reduction when the fragment is large, displaced and involving the articular surface.

In our experimental study on the injury of articular cartilage in rat, the mechanism of recovery varied greatly depending upon the degree of maturity of the individual. In an adult rats, scarcely any regeneration of cartilage was noted, and the superficial layer of the defect was covered by connective tissue, while only the deeper layer was filled with bone tissue in an insufficient repair. These findings

were in agreement with those of specimens obtained from the portion of cartilagenous defect at the time of removal of the nail. Various discussions have been made as to the fate of the reduced osteochondral fragment. In the experimental osteochondral fracture in adult rabbits by P. AICHROTH, osteochondral fragments fixed by a pin survived in all of the 10 cases. When the fixing power mode of fixation was insufficient, however, a decrease in survival was frequently noted. A large osteochondral fragment, consequently, should not be just left alone especially on the loading surface of the joint.

In transplantation of osteochondral fragments, (even autografts) cartilagenous degeneration or necrosis occurs over the course of time, thus leading to an unsuccessful result. In a sense, this case is of interest as a clinical example of autograft of an osteochondral fragment. Long term follow-up would be of real interest.

Summary

We have recently experienced one case of osteochondral fracture of the medial condyle of the femur in a young subject and the other case of osteochondral fracture of the lateral condyle of the femur in an aged subject. In the juvenile case, a wedge-shaped osteochondral fragment was found on the weight-bearing surface with minor displacement, and treated conservatively. In the older subject, large osteochondral fragments accompanied by a thin subchondral bone on the weight-bearing surface were found. There was major displacement. Reduction was therefore carried out and the fragments were fixed by a screw with a favorable course. Transplantation of osteochondral fragment was also discussed.

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和文抄録

大腿骨顆部の骨軟骨骨折（外因性）

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膝関節内骨折の特殊な型としてうすい軟骨下海綿骨を伴う骨軟骨骨折，いわゆる *osteochondral fracture* がある。このうち内因性のものの報告（例えば膝蓋骨脱臼に伴う *tangential osteochondral fracture*）は少ないが，外因性によるものの報告は本邦ではまれである。最近我々は *direct impact* によると思われる2症例を経験したが，1例は若年者の大腿

骨外顆関節面の楔状骨折であり，他は年長者の大腿骨外顆荷重面におけるうすい軟骨下骨を伴ったシャーレ状骨折で転位が大であったため，整服して螺子固定を施行した。骨軟片はいずれも2.5年および4年を経過した現在よく生着しており，臨床的にも満足すべき状態を維持していると思われるので報告する。なお骨軟骨移植について若干の考察を加えてみた。