Simultaneous leg lengthening and knee arthrodesis using an external ring fixator—a case report

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A 9-year-old boy sustained a left distal femoral Salter Harris V injury to the lateral growth plate. This resulted in a progressive valgus deformity and limb shortening. He subsequently underwent 3 varus opening wedge osteotomies with autologous bone graft and k-wire fixation to overcome the valgus deformity. Due to persisting valgus deformity, he later had a distal femoral medial epiphysiodesis. Because of progressive leg shortening, he underwent tibial epiphysiodesis of the contralateral knee.

He then complained of knee pain, hyperextension, locking and mechanical instability o the injured left knee. At 25 years of age, an arthrodesis of the left knee was done, using a Day Frame external fixation device with Denham pins and two uniplanar bars. However, the arthrodesis failed to unite, leaving him with a short leg and painful knee.

At 27 years of age, he was referred to our limb reconstruction unit with a painful pseudarthrosis of the left knee and leg length discrepancy of 5 cm (Figure 1).

In view of his age and previous surgery, we decided that an arthrodesis was the optimal treatment as regards pain relief.

The surfaces of both the femur and tibia were resected to bleeding bone, which ultimately resulted in further bone loss of approximately 1.5 cm. Appropriate limb alignment was achieved with a 7 degree valgus distal femoral cut, with an intramedullary jig. The tibial cut was made using an extra medullary jig with a 5 degree posterior slope. Both jigs were taken from a commercially available Total Knee Replacement set.

We then constructed a four-ring external fixator device, with a combination of fine wires and cortical screws. 4 distraction devices were placed

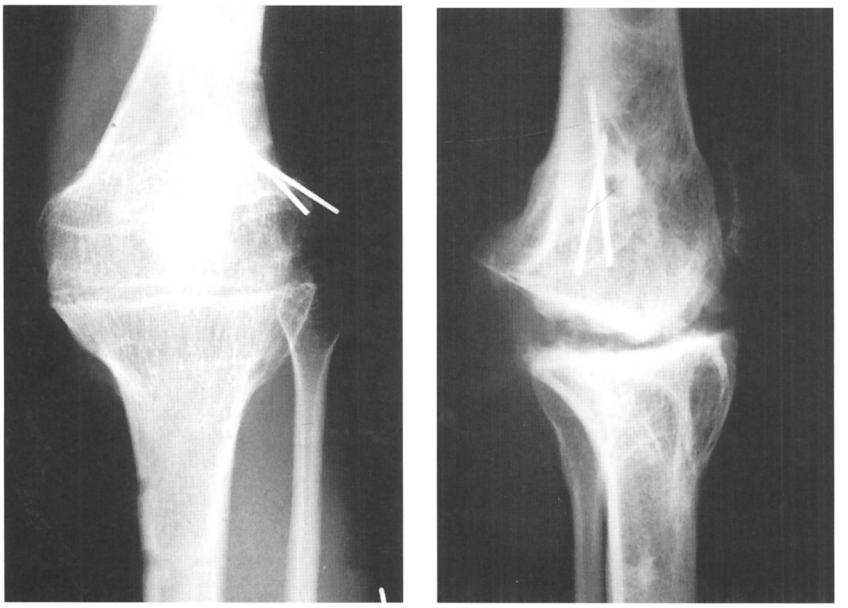

Figure 1. Preoperatively. Pseudarthrosis with residual wires.

Figure 2. Immediately after surgery.

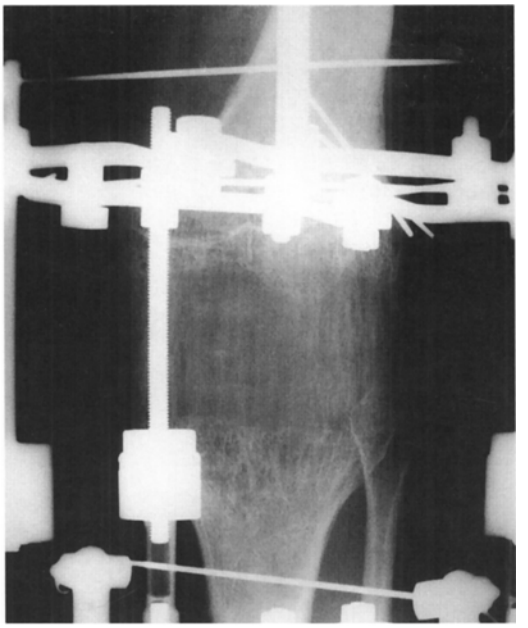

Figure 3. Consolidated callus at 5 months with 45 mm regenerate.

within the construct at the level of the arthrodesis. The construct was compressed and the patient allowed to bear weight partially immediately after surgery (Figure 2). After 2 weeks of compression, the distraction was started at 1 mm per day divided into four equal intervals.

Radiographs taken at 2 weekly intervals followed the formation of callus at the distraction site and also the alignment

During the distraction, we noted that the regenerate was hyperextending, which was corrected by differential distraction of the anterior and poste-

Figure 4. Antero-posterior and lateral radiographs showing limb alignment at 5 months.

rior distractor units.

After 3 months, 45 mm of length had been obtained and we stopped the distraction. The callus was allowed to consolidate for a further 4 weeks within the frame.

At 5 months, radiographs (Figure 3) showed consolidation of the callus with 45 mm of new bone. Long leg views showed the leg alignment was satisfactory (Figure 4). Before complete removal of the frame, the construct was partially destabilized by removal of several wires. Following fixator removal, the patient was placed in a walking long leg cast for 4 weeks.

There were no major complications. A grade 2 pin site infection resolved with oral antibiotic treatment. During part of the distraction phase, the patient developed calf and ankle pain due to soft tissue stretching that ressolved with a temporary reduction in the rate of distraction.

Discussion

Many techniques for achieving fusion of the knee have been described. Compression arthrodesis of the knee using external fixation provides stable fixation and allows early weight bearing. The Ilizarov technique has potential advantages over other external fixators thanks to the higher degree of mechanical stability achieved, the ability to beam load and compress, and its versatility, which allows changes in the axis of distraction to be made during callotasis.

De Pablos et al. (1991) have previously reported chondrodiastasis of the knee using the Wagner technique incorporating limb distraction with a unilateral frame. These authors were able to distract simultaneously at the site of arthrodesis and through the tibial growth plate.

Although the Ilizarov technique has been used to produce distraction of callus at the site of arthrodesis (Ilizarov and Barabesh 1975), this study was done under experimental conditions and it has not been translated into English.

Oostenbroek and van Roermund (2001) recently reported union in 14 of 15 patients at the first attempt, utilizing the Ilizarov technique in a simple compression arthrodesis of the knee following excision and debridement of an infected knee arthroplasty. Manzotti et al. (2001) have reported the use of the Ilizarov method to achieve salvage arthrodesis of the knee following an infected total knee arthroplasty. These authors particularly recommended arthodesis of the infected knee replacement using the Ilizarov method if there is associated extensive bone loss, substantial shortening and previous failed arthrodesis.

We have highlighted the versatility of the technique to permit both distraction at the site of arthrodesis and simultaneously correct leg length inequality by callotasis and allow adjustment of the mechanical axis during distraction. Distraction at this site has the advantage of a large area of bony contact for the formation of callus. It should be noted that this regenerate is not formed within the thickened periosteal sleeve seen at the usual lengthening sites and therefore the formation of new bone may be less predictable.

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