A reciprocating ledge technique in closing wedge osteotomy for genu valgum in adolescents

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ABSTRACT

Purpose. To describe a technique that preserves anterior and posterior alternate ledges in a closing wedge osteotomy.

Methods. Five patients aged 14 to 19 years underwent a closing wedge osteotomy for genu valgum in 8 limbs using a reciprocating ledge technique. A unicortical wedge of bone was removed, with the anterior and posterior cortices spared. The anterior cortex at the proximal level and the posterior cortex at the distal level were cut through. With a wobbling action, the osteotomy site was rotated, and the distal fragment externally rotated. Manual force was applied to close the osteotomy site ensuring overlapping of the reciprocal ledges. The distal fragment was translated laterally to prevent club deformity. The osteotomy site was held with one or 2 staples. Stability was tested by flexion and extension of knee.

Results. All 8 limbs attained bone union within 12 weeks, and full range of motion within a mean of 13 (range, 12–15) weeks. The mean correction of the tibiofemoral angle was 13°. At a mean follow-up of 12 months, all patients were pain-free and none developed club deformity.

Conclusion. Sparing reciprocal ledges in a closing wedge osteotomy for genu valgum may increase stability in the flexion-extension axis, enable early range-of-motion exercises, and facilitate early bone union.

Key words: adolescent; knee; osteotomy

INTRODUCTION

Persistent angular deformity of the knee usually does not correct spontaneously after age 8 years.1 Genu valgum involves medial angulation of the knee and outward deviation of the longitudinal axis of both the tibia and femur. Persistent genu valgum in adolescents induces abnormal gait and functional disturbances (including difficulty in running, knee discomfort, patellar malalignment, and ligamentous instability).2,3 Corrective osteotomy for excessive genu valgum is appropriate when the patient...
presents near or after skeletal maturity (i.e. too late for hemiepiphysiodesis). Osteotomy around the distal femur may lead to instability, loss of correction, non-union, graft resorption, and require large implants. We describe a technique that can reduce wound exposure and yet achieve stability by preserving anterior and posterior alternate ledges in a closing wedge osteotomy. These ledges reduce reliance on implants, enable faster bone union and translation, and prevent club deformity.

MATERIALS AND METHODS

Between December 2007 and January 2009, 5 patients aged 14 to 19 years underwent a closing wedge osteotomy for genu valgum in 8 limbs using a reciprocating ledge technique. In all patients, the lateral deviation of the mechanical axis was beyond the mid portion of the tibial plateau, causing gait disturbance, difficulty in running, knee discomfort, and patellar malalignment. The deviation of the mechanical axis and the proposed closing wedge angle was calculated using anteroposterior, standing long radiographs (Fig. 1).

The patient was placed in a supine position and the distal femur cut via a medial approach. The vastus medialis was reflected anteriorly. The genicular vessels were ligated and the periosteum incised and reflected, exposing the bone anteriorly and posteriorly. The derotation line was marked on the distal femur 1 cm above the adductor tubercle, and the distal cut was also marked (Figs. 2 and 3). A proximal cut was marked above the distal cut based on the calculated wedge height. The distal cut was made horizontally, crossing the lateral cortex, but the anterior and posterior cortices were spared. The proximal cut was made so as to meet the distal cut at the lateral cortex, but the anterior and posterior...
cortices were spared. A unicortical wedge of bone was removed. The anterior cortex at the proximal level and the posterior cortex at the distal level were cut through. With a wobbling action, the osteotomy site was rotated, and the distal fragment externally rotated. Manual force was applied to close the osteotomy site ensuring overlapping of the reciprocal ledges. The distal fragment was translated laterally to prevent club deformity. The osteotomy site was held with one or 2 staples. Stability was tested by flexion and extension of the knee. In one patient, the posterior ledge broke partially, but did not affect stability.

Postoperatively, the patients were placed in a long leg slab for 2 weeks. After sutures were removed, the patients started active and passive range-of-motion exercises. The patients were followed up 2 weekly. Full weight bearing was allowed after radiographic union (Fig. 4).

RESULTS

All 8 limbs attained bone union within 12 weeks, and full range of motion within a mean of 13 (range, 12–15) weeks. The mean correction of the tibiofemoral angle was 13°. At a mean follow-up of 12 months, all patients were pain-free and none developed club deformity.

DISCUSSION

Valgus alignment of the lower limbs is normal in children between 2 and 8 years of age. After age 8 years, correction in alignment is minimal, and treatment for excessive valgus may be needed. In children with excessive tibiofemoral angles, radiological evaluation is indicated. Valgus may continue to increase and...
produce out-toed gait and lateral patellar subluxation. The knees rub against each other and result in an awkward gait, as such children try to narrow their base of support.\textsuperscript{4,5} Operation for moderate or severe genu valgum is required to improve appearance, gait, and function.\textsuperscript{6,7} Restoration of normal alignment may also reduce the incidence of lateral compartment osteoarthritis later in life.\textsuperscript{8} At least one year of knee growth is required to achieve correction, and care is needed to avoid over correction of the secondary genu valgum,\textsuperscript{8} when medial physical stapling is used.\textsuperscript{7} Stapling for valgus knees has produced unpredictable results.\textsuperscript{9} Corrective osteotomy for excessive genu valgum is appropriate when the patient presents near or after skeletal maturity (i.e. too late for hemiepiphysiodesis). Usually a contoured compression plate is required to achieve stability, but a blade plate is preferred.\textsuperscript{10} To overcome the large wound exposure needed for stabilising implants, and the difficulty in contouring plates for the distal medial femur, external fixation with immediate and gradual correction has been used.\textsuperscript{11,12} Nonetheless, it has problems related to having a small distal fragment and pin tract infection. Opening wedge osteotomy has problems related to starting early range-of-motion exercise, graft resorption, slower healing, and a higher incidence of non-union. Varus osteotomy is an effective treatment if the correction is good.\textsuperscript{13} Closing wedge osteotomy may avoid neurovascular complications.\textsuperscript{14}

Sparing the anterior ledge in a closing wedge osteotomy for deformity around the knee has been used.\textsuperscript{15} Sparing reciprocal ledges for genu valgum achieves (1) increased stability in the flexion-extension axis, (2) reduced reliance on large implants, (3) early range-of-motion exercises, (3) lateral translation of the distal femoral fragment, thereby preventing medial condylar prominence, and (4) early union even after adjusting the angle, as the ledges maintain good contact.

REFERENCES