FEMORAL DEROTATION FOR INCREASED HIP ANTEVERSION

A NEW SURGICAL TECHNIQUE WITH A MODIFIED ILIZAROV FRAME

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We describe a technique of femoral derotation osteotomy performed according to the Ilizarov principles of percutaneous corticotomy and fixation with a frame.

We performed 24 femoral osteotomies in 16 patients, four with cerebral palsy and 12 with idiopathic femoral anteversion. All had rapid union and there were few complications.

The advantages of the method include early ambulation, good control of rotation and axial alignment, and minimal scarring.

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Increased femoral anteversion may be idiopathic or due to cerebral palsy, Legg-Calvé-Perthes disease or congenital dysplasia of the hip. In cases of severe anteversion, spontaneous correction seldom occurs (Fabry, MacEwen and Shands 1973; Staheli, Clawson and Hubbard 1980; Staheli 1990), and there is a risk of the development of compensatory external rotation of the tibia. This usually occurs after the age of seven years, but it has been observed as early as four years.

Hip anteversion can be estimated by measuring hip rotation in the prone position with the pelvis stabilised (Kling and Hensinger 1983); increased internal rotation and decreased external rotation suggest anteversion. Several radiological methods have been described to measure anteversion, including the techniques of Magilligan (1956) and Dunlap et al (1953). CT measurements are probably the most accurate.

Correction of rotational deformity by conservative methods seems to be ineffective. Fabry et al (1973) showed that neither twister cables nor Denis Browne splints had any effect on femoral anteversion and Knittel and Staheli (1976) found that the use of shoe wedges was also ineffec-

tive. If there is considerable disability the only effective treatment is femoral derotation osteotomy, but the methods which have been previously described all have complications (Staheli et al 1980). We report a new method of femoral derotation osteotomy which is simple and safe.

PATIENTS AND METHODS

Between July 1991 and December 1992 we performed 24 femoral derotation osteotomies in 16 patients. There were three boys and 13 girls of mean age 10.6 years (5 to 16). Four of the children had cerebral palsy; in the others the rotational deformity was idiopathic.

When only the two femora were deformed, simultaneous bilateral femoral osteotomies were performed (7 patients). When there was concomitant tibial external rotation, simultaneous unilateral femoral and tibial osteotomies were done (7 patients). One patient had unilateral femoral osteotomy only, and one had bilateral femoral osteotomies and one tibial osteotomy. The standard four-ring Ilizarov circular frame was used for the tibial osteotomies.

Operative technique. Prophylactic antibiotics were given for 24 hours. The patient was supine on the operating table with the legs on a cylindrical support just above the ankles. Tourniquets were not used. Fixation was by the semi-circular modification of the Ilizarov external fixator designed by Cattaneo and Catagni (Bianchi-Maiocchi and Aronson 1991) for use on the proximal femur or humerus. Two of the smallest arches are each fixed with two 5 mm Schanz screws, the proximal arch about 20 cm above the knee and the distal arch in the supracondylar region about 5 cm above the knee.

The distal arch is placed in internal rotation relative to the proximal arch, to the same degree as it is intended to derotate the limb (Fig. 1a). This is estimated by using the limb circumference at the level of the osteotomy site as the reference. If the cross-section of the thigh is considered to be a circle, it is possible to calculate how much a point on the skin should be moved laterally to obtain the desired amount of external rotation.

The osteotomy is performed through a 1 cm long incision at the diaphyseal level using the corticotomy technique as described by Ilizarov for lengthening procedures. After completing the osteotomy the distal arch is rotated externally to bring it into line with the proximal arch and the two

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Fig. 1a

Fig. 1b

Figure 1a – Fixator with distal ring in internal rotation. Figure 1b – Alignment and stabilisation after corticotomy.

are connected by three threaded rods (Fig. 1b). If the arches are kept perfectly parallel, varus/valgus or anteroposterior deformity cannot occur. If a change in axial alignment is required conical washers can be used; these allow up to 7.5° of inclination between the rods and the arch. If combined rotational and axial correction is necessary, however, we prefer to use the standard Ilizarov frame as this allows for more complex adaptations.

After-care consists of immediate physiotherapy to mobilise the knees and hips. After unilateral derotation, walking is started on the fifth day with partial weight-bearing during the first two weeks and full weight-bearing thereafter (Fig. 2). Patients with bilateral osteotomies are in a wheelchair for the first two weeks.

The usual hospital stay was between seven and ten days. At two to three weeks the radiographs showed callus formation, and solid union of the osteotomy was demonstrable at eight to ten weeks. The fixators were then removed at a day clinic under general anaesthesia. At this stage the average range of knee flexion was only about 45° and physiotherapy was continued until a full range had been recovered.

RESULTS

The patients were reviewed one month after removal of the fixator, and thereafter every three months. Full-length anteroposterior and lateral radiographs of the femur were taken at the first review to ensure that there was no loss of alignment. Internal rotation at the hip diminished in all patients from about 70° to 90° to about 40° to 50° with a similar increase in external rotation. Hip flexion, extension and abduction remained unchanged and knee movements returned to normal within one to three months in all but one patient. This was a girl with severe spasticity who developed a knee-extension deficit of 20° due to flexion deformity at the femoral osteotomy site.

One other patient with cerebral palsy had a 10° ante-curvature at the osteotomy site but without effect on knee

Fig. 2

Full weight-bearing is allowed after the first two weeks.

function. Among the other 22 femoral osteotomies there were three with slight varus deviation (less than 5°); all the rest showed a normal alignment. In all but one of the patients the walking pattern changed from toeing-in to normal (Fig. 3). Only the above-mentioned girl with spasticity and a flexion deformity at the osteotomy site continued to have some problems with ambulation due both to the spasticity and to limited extension of the knee.

In 15 patients the fixator was removed at eight weeks; nine of them were left completely unprotected thereafter, and six used an above-knee cast for a further three weeks (three of these had undergone concomitant tibial derotation). In seven patients the fixator was removed at ten weeks; two of these (both with femoral and tibial osteotomies) wore a plaster for a further three weeks. In two

Fig. 3a

Fig. 3b

Figure 3a - The left leg shows severe malalignment preoperatively. The right leg shows the correction at six months postoperatively. Figure 3b - After derotation osteotomy on the left there is complete correction.

patients, the fixator was removed at 12 weeks; both were protected by a plaster for three weeks because of concomitant tibial osteotomies.

Superficial pin-track infection occurred in five patients. In four, this healed after oral antibiotics but the fifth patient had the fixator removed one week before the planned date. There were no deep infections and none of the pins was changed during the period of external fixation.

DISCUSSION

Only a few papers mention the operative technique and complications of rotational femoral osteotomy (Somerville 1957; Root and Siegal 1980; Staheli et al 1980; Hoffer, Prietto and Koffman 1981; Chrestian 1982; Staheli 1990; Svenningsen et al 1990) and to our knowledge there has been no report in the English literature of percutaneous osteotomy and external fixation for hip anteversion. Our method, using the Ilizarov principles, has the advantages of low morbidity, early ambulation, quick consolidation, ease of alignment and, if necessary, the freedom to alter the position postoperatively. There is minimal scarring from the four Schanz screws, and the osteotomy incision is only 1 cm long.

We must emphasise, however, that we do not advocate derotation osteotomy for most cases of increased anteversion; surgery is only indicated in severe cases with clinical problems.

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REFERENCES

- Bianchi-Maiocchi A, Aronson J, eds. *Operative principles of Ilizarov*. Milan: ASAMI, 1991.
- Chrestian P. Techniques et résultats des ostéotomies de dérrotations chez l'enfant. *Rev Chir Orthop* 1982;68:32-5.
- Dunlap K, Shands AR, Hollister LC, Gaul JS, Streit HA. A new method for determination of torsion of the femur. *J Bone Joint Surg [Am]* 1953;35-A:289-311.
- Fabry G, MacEwen GD, Shands AR Jr. Torsion of the femur: a follow-up study in normal and abnormal conditions. *J Bone Joint Surg [Am]* 1973;55-A:1726-38.
- Hoffer MM, Prietto C, Koffman M. Supracondylar derotational osteotomy of the femur for internal rotation of the thigh in the cerebral palsied child. *J Bone Joint Surg [Am]* 1981;63-A:389-93.
- Kling TF Jr, Hensinger RN. Angular and torsional deformities of the lower limbs in children. *Clin Orthop* 1983;176:136-47.
- Knittel G, Staheli LT. The effectiveness of shoe modifications for intoeing. *Orthop Clin North Am* 1976;7:1019-25.
- Magilligan DJ. Calculation of the angle of anteversion by means of horizontal lateral roentgenography. *J Bone Joint Surg [Am]* 1956;38-A:1231-46.
- Root L, Siegal T. Osteotomy of the hip in children: posterior approach. *J Bone Joint Surg [Am]* 1980;62-A:571-5.
- Staheli LT. Lower positional deformity in infants and children: a review. *J Pediatr Orthop* 1990;10:559-63.
- Staheli LT, Clawson DK, Hubbard DD. Medial femoral torsion: experience with operative treatment. *Clin Orthop* 1980;146:222-5.
- Somerville EW. Persistent foetal alignment of the hip. *J Bone Joint Surg [Am]* 1957;39-B:106-13.
- Svenningsen S, Terjesen T, Apalset K, Anda S. Osteotomy for femoral anteversion. *Acta Orthop Scand* 1990;61:360-3.