

## **Limb Lengthening by Epiphyseal Distraction in Chondrodystrophic Bone: An Experimental Study in the Canine Femur**

Distraction of the left distal femoral epiphysis was carried out in 18 chondrodystrophic dogs at 19 to 22 weeks, an age comparable to early adolescence in humans. The distraction rate was 0.5 mm/day. Epiphysiolysis occurred after 4 to 9 days, and the treatment was continued for 3 weeks. The average gain in length (measured on radiographs at cessation of treatment), compared to the contralateral control side, was  $1.4 \pm 0.3$  cm. At 2 weeks callus appeared in the gap of the lengthening zone. Osteogenic activity was most distinct at the metaphyseal side. Periosteal reaction along the diaphysis produced widening of the diaphyseal diameter. After removal of the pins, the distracted zone appeared as radiodense immature bone, which soon became mature. Closure of the distal epiphyses took place at about 8 months on the operated side and 9 months on the other.

Animals were killed 3 weeks

after cessation of distraction (group 1,  $n=5$ ), at 19 weeks (group 2,  $n=10$ ), or 71 weeks (group 3,  $n=3$ ). At postmortem, femoral lengthening in group 1 was confirmed at 1.2 cm (12.3% of metaphyseal length); in groups 2 and 3, observed after leg growth had ceased, the gain was 0.7 cm (6.1%). That is, there was a loss of residual growth potential in the distracted epiphysis. The torsional strength of the distracted femur ranged from 83% (group 1) to 98% (group 2) to 107% (group 3) of that of the contralateral control. Degenerative changes in the knee joint were observed in three animals in each group.

In conclusion, lengthening by epiphyseal distraction of the distal femur of chondrodystrophic dogs resulted in reduction of residual growth in the involved growth plate. This finding is in accordance with what we previously have observed in analogous studies of animals with normal growth. The procedure obviously had an adverse effect on the growth plate. It is unlikely that the situation would be different in humans. The observed retardation effect on the traumatized growth plate is a sequela that, in general,

restricts the use of epiphyseal distraction to the late adolescent period when residual growth is negligible. In successive bilateral lengthening of multiple bone segments by epiphyseal distraction, a procedure that requires an early onset of lengthening, retardation of residual growth may cause significant reduction of gained length. The development of degenerative joint changes is a potential risk that probably does not legitimate epiphyseal distraction as the method of choice in the femur.

Fjeld TO, Steen H. *J Orthop Res* 1989;7:184-191.

**Editor's comment**—*With the increasing demand for leg-lengthening operations, basic studies such as this one are very much needed. Its findings are clear and unequivocal. At least in dogs (and also in goats, according to an earlier report), epiphysiolysis damages the growth potential of the split-off growth plate—a not unexpected finding. This seems to restrict the technique to late adolescence, when, unfortunately, less growth potential remains.*

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