Acta orthop. scand. 47, 125–128, 1976

THE CALCANEAL OSTEOTOMY OF DWYER: AN INDICATION FOR KIEL BONE

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Kiel bone has been used with uniformly good results as a bone graft in 15 cases of Dwyer's calcaneal osteotomy. It is suggested that Kiel bone is indicated for this operation in preference to autogenous bone.

Key words: talipes equinovarus; calcaneal osteotomy; heterogenous bone graft

Accepted 30.vi.75

Kiel bone is the most widely used preparation of heterogenous bone graft and there have been many, often conflicting, reports of its usefulness since it was introduced. It is now evident, from animal experiments and clinical experience, that autogenous bone is generally preferable to heterogenous "Kiel bone" (Baadsgaard 1970, Wilppula & Bakalim 1972). Despite much evidence we believe that Kiel bone is still useful as a grafting material on certain limited occasions, as in children from whom it may be difficult to obtain adequate autogenous bone grafts. We suggest that calcaneal wedge osteotomy, performed in talipes equinovarus (Dwyer 1963), is a definite indication for the use of Kiel bone.

Dwyer advised that varus deformity of the heel should be corrected by an open wedge osteotomy of the calcaneum and used autogenous bone from the proximal tibia to hold open the medially based wedge. A drawback of this procedure is the ensuing weakness at the donor site and we have experience of two children who subsequently sustained fractures of the proximal tibia. To avoid this complication we have used Kiel bone and report here on 15 such procedures performed between 1965 and 1972.

MATERIAL

The children listed in Table 1 all had congenital talipes equinovarus without any underlying neurological defect. In two cases calcaneal osteotomy using Kiel bone was performed on both feet, making a total of 15 such procedures in 13 children. The initial treatment in these children had usually been by serial plasters and in some of them by subsequent surgical procedures as shown in Table 1.

In all cases calcaneal osteotomy was performed on the basis of the criterion suggested by Dwyer, namely a small inverted heel, persisting after the age of three years. Operation was performed in a bloodless field, approaching and dividing the calcaneum by a medial incision as described by Dwyer. The osteotomy was held open with the heel in a corrected position, using a wedge of cancellous Kiel bone which is readily cut to a suitable size and shape. In ten of our cases there was also equinus deformity and this was simultaneously corrected by elongation of the tendo calcaneus, performed through

Table 1. Age at operation, previous operations and results of calcaneal osteotomy.

Case no.	Age at operation	Previous operation	Skin healing	Follow-up	Partial incorporation radiologically	Comments
1	5 years	None	2 weeks	7 years	2 months	Good result.
2	9 years	None	8 weeks	6 years	5 months	Good result but required subsequent lengthening of tendo achilles.
3	5 years	Rotation osteotomy of tibia	10 weeks	4 years	3 months	Recurrent equinus deformity.
4	5 years	Lengthening tendo calcaneus Rotation osteotomy of tibia	4 weeks	4 years	3 months	Poor result. Required sub-talar arthrodesis.
5 Right	4 years	Lengthening tendo calcaneus	4 weeks	4 years	3 months	Slight forefoot adduction.
Left	4 years	Lengthening tendo calcaneus	6 weeks	4 years	2 months	Slight forefoot adduction.
6	3 years	None	2 weeks	1 year	24 months	Good result.
7	8 years	Transfer tibialis anterior	2 weeks	3 years	3 months	Good result.
8	12 years	Lengthening tendo calcaneus	12 weeks	3 years	6 months	Good result.
9	5 years	Lengthening tendo calcaneus Transfer tibialis anterior	2 weeks	3 years	6 months	Slight forefoot adduction.
10 Right	4 years	Lengthening tendo calcaneus	2 weeks	3 years	6 months	Slight forefoot adduction.
Left	6 years	Lengthening tendo calcaneus	6 weeks	1 year	6 months	Forefoot adduction and supination.
11	10 years	Lengthening tendo calcaneus	6 weeks	2 years	3 months	Slight adduction and supination of forefoot.
12	7 years	Lengthening tendo calcaneus Transfer tibialis anterior	4 weeks	1 year	2 months	Good result.
13	13 years	None	7 weeks	1 year	12 months	Slight forefoot adduction.

Figure 1. The bone graft 3 months after operation.

a separate lateral incision. Post-operatively the leg was immobilised in a short leg plaster. The child was protected from full weightbearing until there was radiological evidence of incorporation of the graft or new bone formation at the osteotomy.

RESULTS

The results are also shown in Table 1. Skin healing was frequently delayed and occurred after a mean period of 5.4 weeks (range 2–12 weeks). This compares favourably with skin healing in Dwyer's series and results from difficulty in closure of the often scarred skin. The varus deformity has remained well corrected in all cases, except for one subsequently treated by subtalar fusion. This procedure does not completely correct forefoot deformity and many cases have slight forefoot adduction.

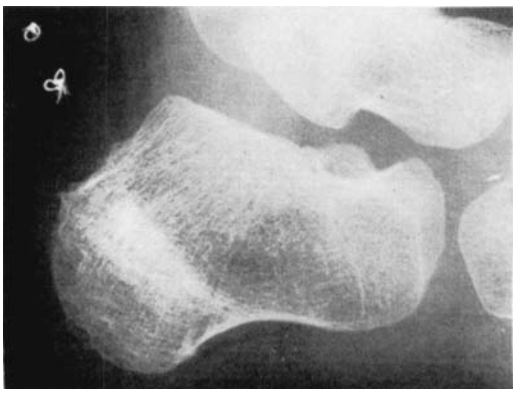

Figure 2. About 1 year after operation the bone graft is partly incorporated into the surrounding bone.

Figure 3. After 3 years, total incorporation of the graft has occurred.

Partial incorporation of the graft, as shown radiologically, occurred after a mean period of 5.8 months (range 2–24 months). Although no child was immobilised for more than 6 months, most of our cases were kept about 12–14 weeks in plaster. That is a longer period than those of Dwyer, who advises mobilisation after 10 weeks. In none of our cases was there radiological evidence of sepsis or rejection of the graft. A typical sequence of radiographs is shown in Figures 1 to 3. Complete incorporation of the graft, as shown in Figure 3, is a slow process but usually is seen after 2 to 3 years follow-up.

DISCUSSION

The results of using Kiel bone for osteotomy of the calcaneum compare well with those reported by Dwyer himself for autogenous bone. In this series the mean immobilisation period in plaster was 12–14 weeks but probably such a long period of post-operative immobilisation is not

necessary. In seven out of fifteen cases 2–3 months immobilisation was used without any signs that this time would be too short for safe incorporation of the graft. The chief advantage of Kiel bone is to obviate the risk of removing bone from the proximal tibia.

Kiel bone is most successful when both the host bone and the graft are cancellous (Hallen 1966). Such conditions occur in calcaneal osteotomy and the radiological appearance suggests that the Kiel bone is acting as something more than just a simple mechanical 'spacer'. It is known from animal experiments (Plenk et al. 1972) that Kiel bone impregnated with autogenous marrow cells is an effective grafting material. It is possible that Kiel bone inserted between the vascular cancellous bone surfaces of the calcaneum becomes rapidly infiltrated by marrow cells and gives rise to a similar preparation. Whatever its mode of action, Kiel bone is a successful grafting material in this circumstance and its use prevents the risk of an important complication of this procedure.

REFERENCES

Baadsgaard, K. (1970) Kiel bone in the treatment of pseudoarthrosis. *Acta orthop. scand.* **40**, 696.

Dwyer, F. C. (1963) The treatment of relapsed club foot by the insertion of a wedge into the calcaneum. *J. Bone Jt Surg.* **45**-B, 67.

Hallen, L. G. (1966) Heterologous transplantation with Kiel bone. An experimental and clinical study. *Acta orthop. scand.* **57**, 1.

Plenk, H. Jr., Hollmann, K. & Wilfest, K.-H. (1972) Experimental bridging of osseous defects in rats by the implantation of Kiel bone containing fresh autologous marrow. *J. Bone Jt Surg.* **54**-B, 735.

Wilippula, E. & Bakalim, G. (1972) Kiel bone in the surgical treatment of tibial condylar fractures. Acta orthop. scand. **43**, 62.

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