Tibial bone defects treated by internal bone transport using the Ilizarov method

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Abstract. We reviewed 27 cases of tibial bone defects treated by internal bone transport using the Ilizarov method. The causes of the bone defects were open fractures in 14 segments and infected non-unions in 13. The average length of the defects was 8.3 cm (range, 3–20 cm). There were 21 one-level tibial transports, 3 two-level tibial transports, 1 one-level tibial transport with fibular transport, and 2 fibular transports. At the docking site, 25 segments underwent bone grafting. Eleven of the 25 were Papineau-type open cancellous bone grafts. Acute shortening or docking was performed in 10 segments. Bone union was obtained in every instance. The average time of external fixation was 8 months and the average time to union was 7.1 months. Bone grafting at the docking site is recommended in order to shorten the duration of treatment and to prevent refracture and non-union.

Introduction

Segmental bone defects have been treated by various methods including cancellous bone grafting [7, 10, 11]. Papineau-type open cancellous bone grafting [12, 20, 21, 23, 24] vascularised fibular grafts [2, 25, 28] and internal bone transport with an external fixator [1, 13, 14, 15].

Autologous bone autografting is limited primarily by the quantity which can be harvested from the donor site. While vascularised osseous transfer has been successful in bridging large bone defects in the forearm [27], there are disadvantages in using this method in the lower limb [2, 6, 8, 17, 28]. These problems include length limitations of the transfer, a high incidence of refracture, pseudoarthrosis, and difference in size between the donor site and the graft mass, which could produce a potential stress concentration during weight bearing.

Soft tissue transfixation by the crossed wires used with the Ilizarov apparatus precludes the combination of soft tissue surgical procedures such as free or rotational flaps in the treatment of open fractures [16]. However, a combined procedure is possible using monolateral fixators. The modified Ilizarov system, namely an Ilizarov ring and half-pin fixation, permits certain orthopaedic approaches for associated soft tissue defects. Simultaneous transport of soft tissue and bone with the Ilizarov apparatus has distinct advantages in these circumstances.

The purpose of this study is to evaluate the results and complications of internal bone transport for large bone defects, with or without soft tissue loss, using the Ilizarov method.
Patients and methods

Thirty-one patients with tibial bone defects were treated by internal bone transport using the Ilizarov method between March 1991 and July 1995. Twenty-six patients with 27 segments were available for follow-up. There were 24 males and 2 females with ages ranging from 15 to 63 years (average 42 years). The causes of the bone defects were open fractures in 14 and infected non-unions in 13. The average length of the defects was 8.3 cm (range 3–20 cm). Fourteen segments had open fractures with bone loss ranging from 3 to 20 cm (average 8.3 cm). The open fractures were grade IIIA in 3 patients.

Fig. 1. a Shortening and fibular hypertrophy due to an infected non-union of the left tibia. b Proximal tibial corticotomy and distal tibiofibular corticotomy were performed to correct the shortening and the bone defect. c Radiograph at final follow-up

Fig. 2. a Tibial bone defect of 15 cm after debridement. b Proximal and distal tibial corticotomies were performed for internal bone transport. c Valgus deformity of the ankle which resulted from proximal migration of the distal fibula. d The distal fibula was gradually transported with the Ilizarov apparatus and fixed with a plate and screws. A normal ankle mortise was restored after distal transportation of the fibula.