Case report

Endoscopic approach for docking site bone grafting in Taylor Spatial Frame during bone transport

Francesco Sala a,*, Enzo Marinoni a, Fabio Castelli a, Dario Capitani a, Giovanni Lovisetti b, Saurabh Singh c

a Department of Orthopedic Surgery and Traumatology, Niguarda Hospital, Paolo Giovio 45, 20144 Milan, Italy
b Department of Orthopedics Surgery, Menaggio Hospital, Como, Italy
c Department of Orthopedics Surgery, IMS, Banaras Hindu University, Varanasi, India

1. Introduction

Docking site non-union in external fixator devices like Taylor Spatial Frame (TSF) or Ilizarov frequently occurs in bone transport procedures in the treatment of traumatic bone loss of the tibia. Fibrocartilaginous capping of the bone ends, sealing of the medullary canal and interposition of skin and subdermal tissues are the main causes for non-union of docking site. Revision surgery for the docking site non-union is complicated by the primary reconstructive procedures like split thickness graft, free flaps, etc. And also by the in situ implants as they do not provide any surgical space to perform the grafting. Many surgeons have tried to develop less invasive such as electrical stimulation, electromagnetic field, ultrasound and bone marrow injection. As they have many limitations in their application, these methods are not suitable for docking site non-union with external fixator around limb. A mini-invasive and tissues sparing endoscopic technique used for the docking site revision with the bone grafting.

2. Case report

An endoscopic approach to the distal tibial docking site revision was performed in two polytrauma cases of non-union of docking site (Fig. 1) for complex open tibial fractures treated by Taylor Spatial Frame. Both cases were initially complicated by severe skin damage as split thickness graft was only coverage for non-union site (Fig. 2). In both the patients docking site resulted into non-union. After mean 6 months from TSF application bone grafting decision was undertaken. Through distraction with the in situ circular frame, two small skin incisions, anteromedial and anterolateral, were made to access the docking site with a common arthroscopic instrumentation (Fig. 3). Low pressure-low flow saline irrigation was obtained by mean of MFS arthroscopic pump. A 30° arthroscope and a motorized 5 mm shaver/abrader were used. Fibrous tissue was removed, bone ends abraded and the bone canal cleaned as much as possible (Fig. 4). Bone grafting of the site was obtained from the iliac crest in one case and from the omolateral medial femoral condyle in the other case with help of osteochondral transfer instrumentation (Makar Inst.).

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* Corresponding author. Tel.: +39 3334545266; fax: +39 024986078.
E-mail address: sala.francesco@gmail.com (F. Sala).
tourniquet was used on the limb. At the end, a realignment and acute compression was performed through Taylor Spatial Frame. The procedure was possible with good direct vision of the site, small surgical approach and no complications like bleeding or compartmental syndrome. After 11 weeks postoperatively patients radiographs showed good new bone formation (Fig. 5). The patients were discharged in 2 days. An endoscopic approach to docking site revision surgery in complex cases is possible with common arthroscopic instruments.

3. Discussion

Autogenous cancellous bone graft has been a treatment of choice for delayed union and non-union.\(^1\)\(^{11}\)\(^{12}\) Other authors had same experience with respect to docking site revision with iliac crest bone grafting.\(^2\)\(^{3}\) Song et al.\(^10\) used iliac crest bone grafting in 93% (25/27) cases of tibial bone transport through open approach but on normal overlying tissue. Paley and Maar\(^7\) reported that 53% (10/19) cases required bone grafting at the docking site. However, the open surgical procedure compromises the blood supplies of the docking site that was already damaged by the initial trauma and previous operations. Rozbruch et al.\(^9\) avoided bone grafting at docking site due to poor skin and concern of wound problem. In endoscopic bone grafting, refreshing the fracture site can be done effectively under direct vision without much soft tissue interference, provided that there are no dangerous anatomic structures around. The endoscopic procedure usually provides enough space for enough bone graft material to be placed. The selection of the portal can be limited due to the internal fixation device used and neurovascular bundles. Johnson\(^4\) reported that the advantages of endoscopic bone graft were minimal incision, accurate debridement, precise bone grafting, minimal vascular injury to the surrounding tissues, fewer complication, minimal hospital stay, and less expensive. Kim et al.\(^5\) stated that endoscopic bone grafting can be a less invasive alternative, obtaining rapid bone union in case of compromised healing of the complicated non-union sites.

References