Background

Fractures of the leg are believed to be a common occurrence in athletics, but the actual incidence of the injury is unclear. Tibia fractures can be separated into low-energy and high-energy injuries. Mechanisms of low-energy injuries include simple falls and sport-related causes, whereas high-energy injuries are primarily caused by automobile accidents and falls from heights. Fractures are also classified by the extent of bony or soft tissue damage. The Gustilo-Anderson grading scale is a widely-accepted system used to classify open tibia fractures. Soft tissue damage is less than 1 cm in diameter for a Grade I fracture, 1–10 cm in diameter for a Grade II fracture, and larger than 10 cm for a Grade III fracture, which involves the periosteum and wound contamination.

Several different methods of treating tibia fractures are currently used, and there is not a consensus among orthopedic surgeons for a preferred method. When soft tissue damage exists, attention must be focused on prevention of infection through wound debridement and antibiotics. Common techniques used to stabilize the fracture site include external fixation and various internal fixation methods that may utilize a plate or intramedullary nails. Regardless of fixation method, risks include infection, compartment syndrome, deep vein thrombosis (DVT), neurovascular complications, malunion, and nonunion. The incidence of nonunion is 15% or greater for open fractures, which is diagnosed when radiographic bone healing is absent for three consecutive months. When a fracture is classified as a non-union, alternative treatment methods are likely to be recommended. Bone growth stimulators (BGSs) are increasingly being used to promote bone healing. Categories of BGSs include (a) direct-current, (b) inductive coupling (pulsed electromagnetic fields), (c) noninvasive capacitive coupling, and (d) low-intensity pulsed ultrasound. Of these, the most commonly used are low-intensity ultrasound and pulsed electromagnetic fields (PEMFs). Low-intensity ultrasound can be used safely and effectively through all stages of fracture healing. PEMFs are administered through two external coils placed around the fracture site. A low-energy

CASE REVIEW

Repetitive Nonunion Fracture of the Tibia and Fibula in a Soccer Player

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Key Points

- Relatively little literature exists on non-union leg fracture associated with soccer.
- The combination of surgery, bone graft augmentation, and bone growth stimulation produced a successful long term result.
- Treatment of injuries should be based on research evidence.
magnetic field generates an electrical current through the injured limb, which enhances bony density within the fracture gap, cross-over of bony trabeculae, and cortical continuity through the medullary canal.11,12

Surgical options to promote healing of a nonunion include realignment, replacement of fixation hardware, and the use of bone grafts. Autogenous cancellous bone, often obtained from the iliac crest, is considered the gold standard, due to its revascularization and bone growth properties.13 Autograft healing rates are high, but donor site morbidity can occur.7,13-15 Allogeneic bone morphogenetic proteins (BMPs), which are directly involved in fracture healing and bone graft incorporation, have been used as an alternative with equally successful results.8,14-16 Human Osteogenic Protein-1 (OP-1) is a type of BMP that has been cloned and reproduced with recombinant technology. The cloned OP-1 is implanted at the fracture site with a bone autograft or a type-I collagen carrier derived from bone. When a large bone defect is present or a structural graft is required, OP-1 is used in conjunction with autograft or allograft bone to improve the quantity and quality of localized new-bone formation.15,16

Case Report

Prior to his enrollment at an American university, a 20-year-old English male soccer player injured his right leg while dribbling a soccer ball and being tackled from behind when playing in his home country. When the athlete planted his foot to change direction, an opponent slid into the lateral aspect of his right leg, imposing a valgus force. Upon reaching the athlete, the sports medicine staff observed an obvious deformity caused by a compound tibia fracture. The emergency medical personal applied a vacuum splint to immobilize the injury in the deformed position. His neurovascular status was not compromised, and he was transported to the local hospital by an ambulance.

At the hospital, the attending physician performed a radical debridement of a 2.5-cm wound associated with open fractures of the distal third of his tibia and fibula, and he removed all devitalized tissue. The fracture site was easily palpable, and approximately 5 mm of translation could be produced at the fracture site by application of a valgus force. A 6-L pulsed lavage was used to cleanse the wound, followed by application of 500 mg of antibiotic powder. The wound was left open, and the leg was splinted.

The attending physician reexamined the leg that evening, which revealed a clean wound. The bone was covered with a sufficient amount of soft tissue, except for a very small area where a visible portion of bone could be observed at the distal portion of the wound. The wound was recleaned with normal saline, further debrided and closed with 3-0 Nylon interrupted sutures. A sterile paraffin gauze and hypoallergenic bandage were used to cover the wound prior to application of an above-knee cast. Radiographs demonstrated satisfactory alignment of the tibia and fibula in both anterior-posterior (AP) and lateral views. The initial diagnosis was a Gustilo-Anderson Grade II fracture of the right tibia and fibula. The attending physician elected to manage the condition conservatively with a full leg cast, and the athlete was discharged from the hospital after four days.

The patient returned for further evaluation seven days after discharge. Follow-up radiographs demonstrated good alignment of the fracture site (Figure 1). Although deep vein thrombosis (DVT) did not appear to exist, a complaint of general leg soreness necessitated prophylactic administration of the anticoagulant medication Enoxaprin. The patient was instructed to self-inject a 20-mg subcutaneous dose of the medication each day for the next four weeks.

Figure 1 Radiographic examination indicating proper alignment of the tibia and fibula (one week after initial injury).