Clinical Review of the Corex™ Minimally Invasive Autogenous Bone Graft Harvester for Augmentation in Foot and Ankle Procedures: A Case Series Involving 23 Surgeries

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INTRODUCTION

Pedal arthrodesis procedures have traditionally been a "work-horse" for surgical treatment of foot and ankle problems addressing pathology that ranges from general osteoarthritis to complex deformity correction. A well-aligned and pain free joint is often the main goal of patient and surgeon when addressing these challenges, and arthrodesis lends itself well to accomplish said goal. Current and historical literature demonstrates that autogenous bone graft can be an important factor in positively augmenting successful arthrodesis. Bone grafting can and should be considered for both primary and revision arthrodesis procedures when indicated. The Corex™ bone harvester (Trinity Orthopedics, LLC, San Diego, CA) represents a perfect example of a simplistic, widely applicable, and user-friendly medical device that facilitates successful augmentation of foot and ankle surgical procedures with the use of autogenous bone graft.

Despite the expanding array of bone allograft products over time, autogenous bone graft remains the gold standard and retains superior healing capacity. This is mainly due to autograft's histocompatibility and biologic features it affords, including osteoconductive, osteoinductive, and osteogenic properties[1]. Cancellous autograft is optimal for foot and ankle arthrodesis procedures because it is extremely osteogenic due to functional osteoblasts that line the porous trabeculae, combined with its large surface area that permits rapid remodeling and incorporation[1]. Furthermore, depending upon the quantity of bone graft needed, there exist multiple sites within the lower extremity that bone graft can be easily and safely procured. Two common anatomic sites include the calcaneus and tibia (distal and proximal tibial metaphysis). Additional advantages exist for harvesting autogenous bone on the ipsilateral lower extremity during foot and ankle surgery, including: 1) the ability for a single extremity positioning/prepping/draping protocol; 2) facilitates postoperative analgesia via lower extremity regional anesthetic blocks, such as popliteal block; 3) for arthrodesis procedures in which patient is immobilized and non-weightbearing it provides protective healing of bone graft harvest site while not altering recovery time for the main procedure; 4) lower postoperative complications and morbidity when compared to autogenous bone graft harvest from the iliac crest[1].

PURPOSE

The purpose of this paper is to present a single foot and ankle surgeon's clinical experience with the Corex™ minimally invasive bone graft harvester. This includes a review of the surgical technique, and a case series retrospective review involving twenty-three procedures that encompassed myriad of foot and ankle surgical procedures augmented with autogenous bone graft procured by the author using the Corex™ device.

SURGICAL TECHNIQUE

Several powered and non-powered medical devices currently exist on the market to aid in harvesting autologous bone graft from lower extremity anatomical sites. The Corex™ minimally invasive bone harvester device is provided as a sterile packaged single-use metallic trephine with 7 mm and 9 mm diameter options. It is non-powered, with a sharp trocar tip that is initially utilized to create an access point through a small osseous cortical window at the harvest site, and the device boasts a unique cancellous bone capturing mechanism. Once an osseous window is created at the site of harvest, the trocar tip can be easily removed, and the remaining trephine tip features a non-aggressive leading edge to micro-fracture through the cancellous bone substrate while at the same time limiting risk/potential of penetrating adjacent cortices. Surgeons can make multiple passes in different angles until the desired quantity of bone graft is obtained. Corex™ is a financially responsible device when compared to the cost of other bone harvesting systems and/or bone allografts, which can approach several thousands of dollars. Furthermore, unlike allografts, use of autogenous bone graft obviates the risks of disease transmission and immunogenicity (graft rejection). In addition, it provides the previously described benefits that translate into faster bone healing with lower risk of delayed/nonunion[2,3].

Specific to foot and ankle procedures, the Corex™ can be safely and efficiently utilized in the calcaneus, distal tibia, or proximal tibia depending on the volume of autogenous bone graft needed for the primary procedure. The literature demonstrates significant potential morbidity associated

with harvest of autogenous bone graft from the iliac crest[4,5], and thus the calcaneus and tibia are preferred harvest sites. A reproducible technique for identifying the proper location of harvest within the calcaneus has been previously described by Roukis in 2006[5]. Bone graft procurement from these sites adds minimal additional operative time, minimal blood loss and has been demonstrated to carry low complication rates. On average, the calcaneus can typically provide 1-5 cc of bone graft, distal tibia 10-15 cc, and the proximal tibia can provide over 30 cc. There are 7 mm and 9 mm diameter bone harvesters available. For the calcaneus and distal tibia the 7 mm diameter option is ideal, whereas the 9 mm diameter device is advantageous when harvesting from the proximal tibial metaphyseal bone.

The harvest process is initiated by using the sharp trocar tip in a drilling fashion while holding the device perpendicular to the bone harvest site to penetrate the initial cortex. The trocar tip is carefully removed, exposing the non-aggressive trephine tip that can be further utilized to micro-fracture through the inner cancellous autogenous bone. Once passed to sufficient depth or to the opposite cortex, the actuator handle is rotated from green to red, which locks the cancellous bone within the trephine for subsequent removal. A plunger is then introduced to easily expel a core of harvested autogenous bone into a sterile cup for collection. Multiple passes can be made with the Corex™ device changing the angle or trajectory in order to harvest supplemental bone graft until sufficient volume is acquired. It is not necessary to routinely back-fill the harvest site with allogenic bone graft or substitutes, but gel foam impregnated with local anesthetic and epinephrine can be helpful to aid with postoperative analgesia and hemostasis. The periosteum is repaired over the harvest site to reduce potential bleeding, and incision closed per surgeon's preference.

CASE SERIES

From May 2018 until present day, the author has utilized the Corex™ minimally invasive bone harvester in 23 surgical procedures on 22 different patients. This included 14 females and 9 males. Mean age was 55.7 years (range 17 – 78). The distal tibia was used in 12 cases, the calcaneus in 9 cases, and in 2 cases both sites were utilized in the same setting. No major complications have been witnessed to date with any of the involved patients. Typically, the majority of patients have reported no pain (graded as zero on the visual analogue scale of 0-10) at their bone graft harvest site by the first postoperative visit at one week after surgery. For patients that did express pain, everyone's pain at the harvest site had resolved by the second postoperative visit at two weeks after surgery. No thromboembolic events have been witnessed postoperatively. No revision or subsequent surgeries have been required on any of the involved patients, and no hardware removals have transpired. No clinical or radiographic delayed unions or nonunions have been witnessed.

CONCLUSION

Use of the Corex™ minimally invasive bone harvester to enhance foot and ankle surgical procedures with autogenous bone graft is a safe, user friendly, cost-conscious device that aids in quick harvest of autogenous bone graft from multiple lower extremity sites. Autogenous bone graft offers foot and ankle surgeons (and their patients) the powerful benefits of osseous healing properties, with osteoconduction, osteoinduction, and osteogenic capabilities. Furthermore, it is histocompatible with the patient, obviating risks of rejection or disease transmission. These are potent characteristics that allogenic bone and/or bone substitutes cannot offer and translates into faster healing while concurrently limiting potential for delayed and nonunions. Augmentation with autogenous bone graft utilizing the Corex™ device should be considered to enhance your next pedal arthrodesis procedure.

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