Exploring The Potential Of A New Modality For Harvesting Bone Autograft

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In an intriguing case study involving the referral of a 73-year-old male who had one failed revision surgery for a post-op non-union after a Lapidus procedure, this author discusses the use of a new bone harvesting modality to help achieve osseous fusion.

Physicians widely view autologous bone graft as the “gold standard” for surgeries requiring bone grafts. Bone harvested from the patient’s own body is osteoconductive, osteoinductive and osteogenic, making it the ideal substance for promoting bone healing and regeneration.[1,2] Autologous bone also eliminates the possibility of host graft infection and adverse immunologic reactions. Since autologous cancellous bone is concentrated with growth factors, osteoblasts and mesenchymal osteogenic precursor cells, it maximizes the osteo-characteristics listed above and therefore increases the likelihood of a successful graft.[3]

Although autograft remains the gold standard, some patients and providers are concerned by associated pain and morbidity at the donor site. These drawbacks, combined with an increasing availability and acceptability of cadaver bone, have led to surgeons not capitalizing on the benefits of autograft as often as they did in the past.[4,5]

These alternatives include both allografts as well as various synthetic bone grafts. Commercial interests have encouraged the use of these products and independent research thus far has not validated claims by industry representatives.[2,6]

Indeed, multiple reports have described synthetic options as equivalent at best and even inferior in some cases. For example, in a prospective study of patients who had cervical spinal fusions, Suchomel and colleagues found that autografts had a significantly faster union time than allografts as 95 percent of patients with autografts achieved full fusion by six months.[7] By contrast, similar fusion rates did not occur until 12 months in the allograft group. Researchers have observed similar results for lumbar fusions.[8,9] Additionally, synthetic and allograft options cost more than autografts.[10]

A More Efficient Approach To Harvesting Autograft

The Avitus® Bone Harvester (Avitus Orthopaedics), an emerging device on the market, can enable foot and ankle surgeons to avoid the drawbacks of autograft harvesting. Depending on the state scope of practice, podiatrists can use this device to harvest autograft from the calcaneus, distal tibia or proximal tibia within a few minutes.

This device simplifies the harvesting procedure to a single surgeon process with no need for an additional surgeon to harvest the bone. The size of the incision is 1 to 2 cm long and the surgeon can operate through a small access window. The device’s access to the cancellous bone and marrow is the same access one would have through a larger and more painful osteotomy. This results in fewer stress risers and less stress fracture risk at the harvest site. The other benefit is the surgeon is guaranteed live cells rather than dead bone alternatives.

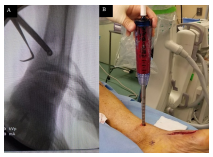
Furthermore, the procedure results in a less painful harvest site due to minimal cortical and periosteal disruption. Additionally, the device facilitates the use of an additional CPT code or relative value units for the harvesting procedure, which only takes a few minutes of surgical time. The suction-powered device prevents the loss of bone chunks inside the harvest site and ensures collection of valuable liquid marrow from inside the bone while one collects the cancellous bone.

A Closer Look At The Patient Presentation

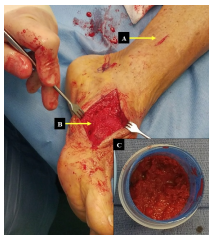
The patient is a 73-year-old man who got a referral to my practice with a Lapidus non-union. The patient already had a failed revision. The non-union was mobile with broken hardware present. The plan was to remove the hardware, excise the non-union to live bleeding bone, harvest a distal tibial bone graft and apply a contoured plantar locking plate. I chose the distal tibia as opposed to the proximal tibia due to the patient having had bilateral knee replacements.

The plan went accordingly. I made a 1.5 cm incision at the distal medial tibia 5 cm above the joint line. Subsequently, I performed blunt dissection to the periosteum with care in order to retract the great saphenous vein that courses over that area. I used the Avitus® Pilot Hole Creator to puncture the cortex to create a 1 cm hole. Next, I introduced the Avitus Bone Harvester into the medullary canal and actuated it similarly to a curette enhanced with suction.

While scraping, I continually aspirated the intramedullary bone and marrow and collected them into the handle without having to pass the instrument in and out of the harvest site (see left photo). I could easily gauge how much graft the harvest was collecting inside the handle.

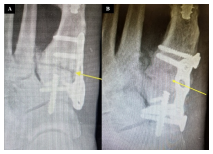


I used fluoroscopy to evaluate the harvest site. I harvested 15 cc of cancellous graft and 15 cc of bone marrow. My preference was not to backfill the site but it is not contraindicated if that is the surgeon's preference. I only needed one to two sutures to close the skin post-harvest and retrieved the total volume of harvested bone through a one-stitch incision in four minutes of surgical time. Additionally, the graft was able to add a few millimeters of length to the metatarsal, therefore preventing a misalignment in the metatarsal parabola (see right photo).



The patient reported minor tenderness at the incision site, which resolved at one week post-op. The patient's pain profile was negligible in comparison to when I have used a traditional osteotome and curette method for harvesting. I didn't have to use any biologic alternatives and saved the cost on the surgery for the patient and hospital.

The patient remained non-weightbearing and radiographs showed osseous fusion at eight weeks post-op (see left photo). Common protocols recommend six weeks of non-weightbearing after harvest and I would emphasize this non-weightbearing period regardless due to the primary fusion.[11]



The photo at right shows the harvest site immediately post-op and at eight weeks post-op. Clear bone remodeling has occurred in the cancellous region, which is consistent with findings from Vanryckeghem and colleagues.[12]

In Conclusion

Tools like the Avitus Bone Harvester allow us to capitalize on the regenerative benefits of bone autograft without having to spend lots of time harvesting it and dealing with the drawbacks of traditional methods of harvesting. The volume of graft obtainable with this device can exceed previously reported yields through a 1x1 cm and 1x2 cm osteotomy.[13-15] In addition, this replaces expensive alternatives that are biologically inferior to the gold-standard autograft.[16] The surgeon can get reimbursement for the time harvesting the graft, which is not the case with allograft. Utilizing this harvester is a safe method that all podiatrists can now use for procuring bone graft when necessary.

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References

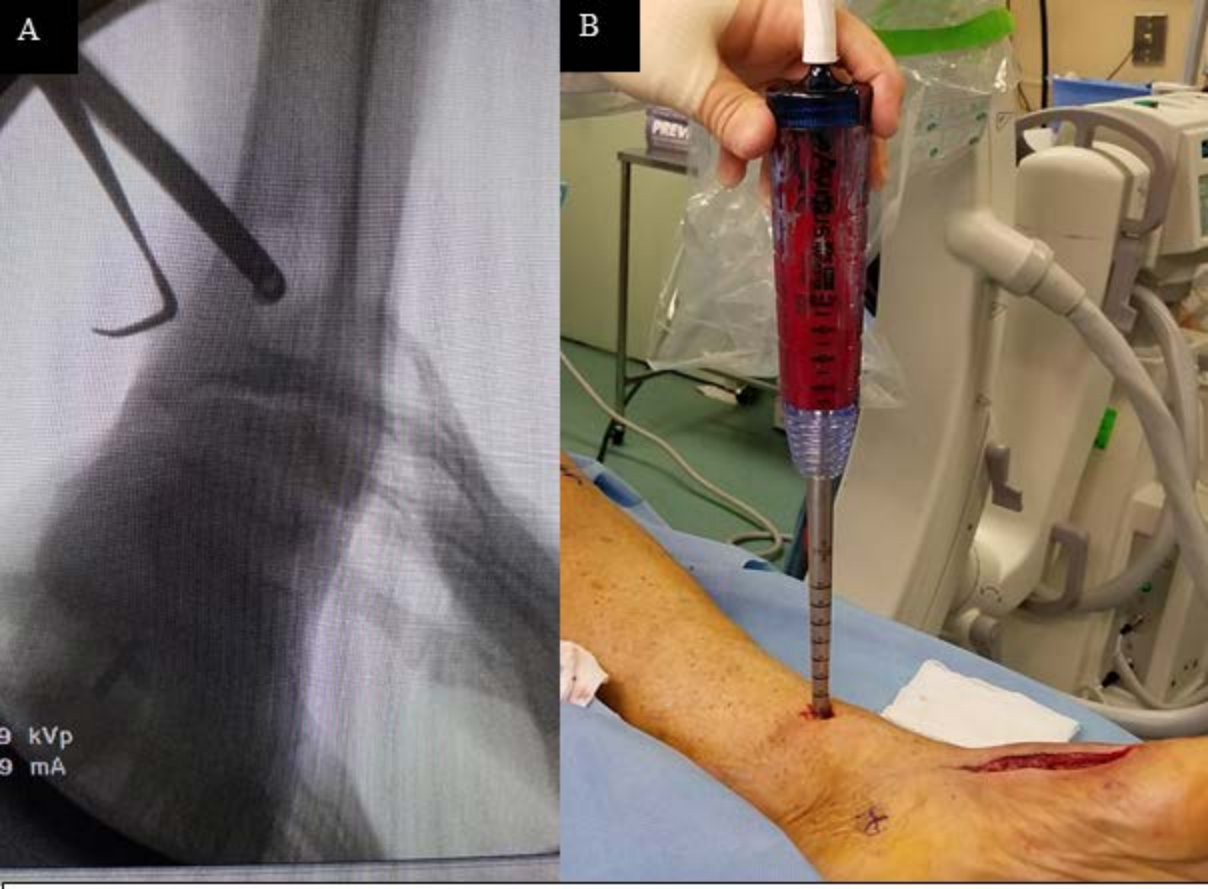

EXHIBIT I - A) Avitus® Bone Harvester collecting cancellous bone and marrow from inside metaphyseal region of distal tibia under fluoroscopy. Note the small cortical window, but large cancellous access. B) Cancellous bone and marrow collected into the handle of the device, outside the percutaenous incision over the distal tibia.

EXHIBIT II – A) Percutaneous harvest incision B) 15 CC's of Avitus® Autograft packed into non-union site C) 15 CC's of cancellous bone separated out from 15 CC's of marrow as collected with the Avitus® Bone Harvester, in the collection cup.

EXHIBIT III – A) Non-union pre-op B) 8 weeks post-op, fusion fully formed

EXHIBIT IV – A) Harvest site under fluoroscopy intraoperatively B) 8 weeks post-op fluoroscopy shot showing bone remodeling occurred at the harvest site.

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