METHODIST BONE & JOINT CENTER, HOUSTON, TEXAS
Explorations IN ORTHOPAEDICS
A Newsletter for Physicians

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Periacetabular Osteotomy
Kyle F. Dickson, M.D.

The differential diagnosis of hip pain in a young adult includes various overuse conditions, traumatic injuries, osteonecrosis, and developmental disorders — most notably hip dysplasia. Bony anatomical abnormalities need early intervention to prevent permanent cartilage damage of the hip. In fact, 25–50% of hip dysplasia patients develop such severe osteoarthritis by the time they are 50 years old that they require total hip arthroplasty. In select cases of hip dysplasia, a periacetabular osteotomy to reorient the joint may decrease symptoms, increase function, and may even prevent or delay arthritis.

The diagnosis of significant hip dysplasia in adults can usually be made on an anterior-to-posterior (AP) radiograph: center edge angle (CEA) < 20°; acetabular index (AI) > 10°; lateralization of the femoral head > 10 mm from the medial acetabular teardrop. Acetabular retroversion can be present in 16–33% of cases. Osteoarthritis in these hips typically starts superior

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Figure 1

AP radiograph showing left hip dysplasia.

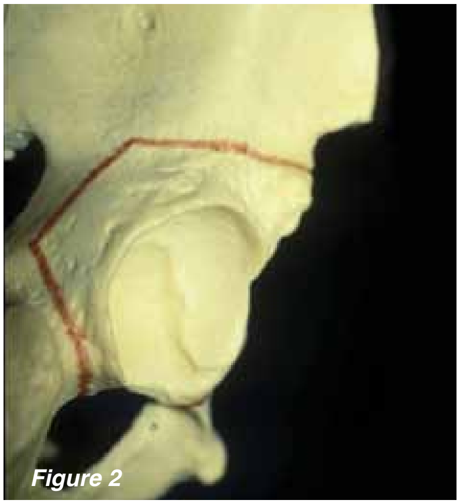

Figure 2

Model of human pelvis marked with the cuts for the Ganz periacetabular osteotomy.

Figure 3

Post-op AP radiograph showing good correction of left hip dysplasia.

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Periacetabular Osteotomy

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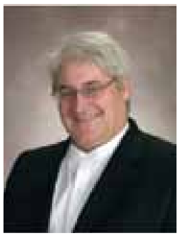
medially, which can be difficult to detect on standard AP radiographs. A functional abduction AP radiograph taken in full abduction in the coronal plane with the lower extremity internally rotated 15 degrees better represents the joint after the reorientation from a periacetabular osteotomy and may better reveal such early arthrosis. Furthermore, a false profile view can reveal lack of anterior acetabular coverage. The risk of a total hip arthroplasty for a hip dysplasia patient is 2.6 times greater than the normal population.

Case Presentation

A 19-year-old female presented with a 6 month history of increasing left hip pain of atraumatic onset. Conservative treatment by her orthopedic surgeon had failed and she was referred for joint preserving periacetabular osteotomy. AP radiograph clearly showed hip dysplasia, with CEA of 12, AI of 40, and 8 mm lateralization. Her asymptomatic contralateral hip had CEA of 33, AI of 20, and 6 mm of lateralization. She underwent a Ganz periacetabular osteotomy, which involves 4 cuts around the hip joint through an anterior iliofemoral approach. The strength of this particular osteotomy is that the posterior column remains intact so the reoriented acetabulum can be stabilized to the intact posterior column with screws. The osteotomy improved the left hip's CEA to 50 degrees, the AI to 11 degrees, and lateralization to 3 mm. Two years from the procedure, she is active and her operated hip does not cause her pain nor limit her activity.



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Spine Advanced Technology Laboratory (SATL) Explores In-Vivo Tissue Engineering of Musculoskeletal Tissues

Bradley K. Weiner, M.D.

Using unique combinations of resorbable natural materials, resorbable polymers, mesenchymal stem cells, growth factors, and nanoparticles, the Spine Advanced Technology Lab (SATL) of The Methodist Hospital Research Institute has made significant advances in musculoskeletal tissue engineering. The result has been the development of composite materials capable of generating bone and cartilage as well as other related (and unrelated) tissues — a versatile platform for in-vivo tissue engineering.[1] The vision is that someday such composite materials will be either surgically implanted or injected into areas deficient of natural tissues in humans allowing for rapid in-vivo regeneration.

Thus far, these materials have been shown to form bone and cartilage in rat models and intervertebral disc tissue in-vitro. Even studies of regeneration of solid organs, such as the liver and kidney are underway. Additionally, the materials have been used to deliver antibiotics for infection prevention and chemotherapeutic agents for cancer treatment. Fractures, osteoarthritis, osteoporosis, bony metastases, and intervertebral disc degeneration are current targets for the new technologies; but the list is expanding.

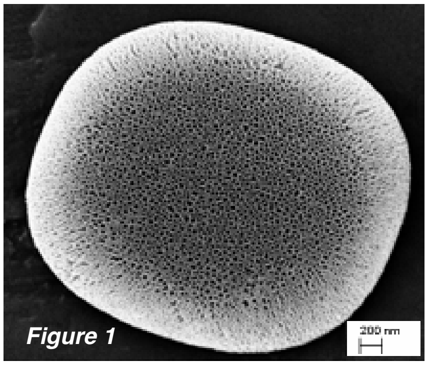

Figure 1

Figure 1 shows silicon nanoparticles that are often used in the composite materials to allow the controlled delivery of drugs. For instance, by altering the size of the pores within the particles and then coating the

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Spine Advanced Technology Lab
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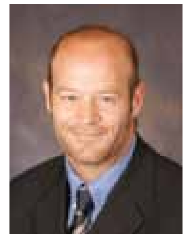
particles with various natural or synthetic resorbable substances, proteins such as bone morphogenic protein (BMP) and antibiotics such as Cefazolin can be loaded into the particles and then slowly released in the exact amounts and in the exact locations needed for up to and beyond one month — greatly exceeding the capabilities of currently available technologies. Thus, long term stimulation of bone formation and infection prevention and/or treatment can be undertaken and, given small doses and local delivery, systemic complications can be minimized.

So far, this line of investigation has garnered funding approaching $10 million, and has received attention in lay media focusing on scientific advances including *The Economist*, *Science*, and others.

Reference:

1. Murphy M, Tasciotti E, Stupp S, Weiner BK, Ferrari M: Multicomposite Bioactive Sponge for Rapid Osteogenesis. Journal of Functional Biomaterials 2: 39-66, 2011.



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Infected Nonunion Following Ankle Fracture
Kevin E. Varner, M.D.

Infected nonunions can be quite challenging, especially following intra-articular fractures. The chances of developing such a condition increase following open fractures, and are complicated at the ankle by the fracture location being subcutaneous. Systemic conditions affecting immunity, such as immunosuppressive medications, diabetes mellitus, and malnutrition, as well as local factors such as peripheral vascular disease are also risk factors.

A highly individualized approach is required for these complex cases, and often a salvage procedure is the best treatment option. A key principle for success is complete debridement of all infected and nonviable soft tissue and bone, along with removal of all infected hardware, and local and systemic antibiotic delivery for several weeks. With the infection eradicated, reconstructive surgery can be performed, usually minimizing or avoiding placing hardware in the previously infected region. This often requires a multistaged approach to first eliminate the pathogens and then encourage bony union.

Case Presentation

A 55-year-old male, with noninsulin dependent diabetes mellitus, sustained a grade 2 open trimalleolar ankle fracture treated with irrigation, debridement, and immediate fixation. Both incisions continued to drain despite oral antibiotic therapy, leading to subsequent removal of some of the hardware. However, the wound dimensions and drainage increased despite the patient not having fever, chills, or systemic symptoms. Four months following injury, he was referred for limb salvage.

He presented with thick, purulent drainage from the medial and lateral incisions. The ankle joint was visible through the medial wound with notable loss of tibial and talar articular surfaces. The ankle was grossly unstable with his pain level reported as being 8/10.

AP radiograph of right ankle at presentation.

The patient underwent removal of all hardware, as well as all nonviable bone and soft tissue, along with irrigation of the ankle joint, placement of antibiotic impregnated polymethylmethacrylate beads, and application of a spanning medial external fixator. Operative cultures grew methicillin resistant staphylococcus aureus. Two further debridements were performed with

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Infected Nonunion Following Ankle Fracture

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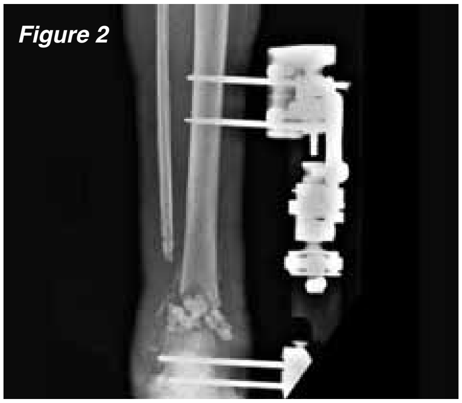

Figure 2: AP radiograph of right ankle following debridement, placement of antibiotic beads and a spanning external fixator.
Figure 3a and 3b: AP (a) and lateral (b) radiographs of right tibia showing solid ankle fusion in good alignment.

exchange of the antibiotic beads at 72 hour intervals. Subsequently, a multiplanar external fixator was applied to fuse the ankle joint and simultaneously begin distraction osteogenesis to regain lost tibial length. The medial and lateral wounds healed uneventfully over the ensuing 2 weeks. Culture specific parenteral antibiotics were administered for a total of 6 weeks.

The fixator was removed 9 months postoperatively, by which time there was a solid arthrodesis, restoration of limb length, and no evidence of infection, allowing him to return to active employment as an engineer technician.

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