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## STRATEGIES FOR ANKLE ARTHRITIS

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### INTRODUCTION

The problems of osteoarthritis (OA) in the US are significant and growing. There are an estimated 21 million Americans with OA, 700,000 Americans have OA of the ankle, and over 12 million people currently have ankle OA worldwide. OA is the leading cause of work disability in the US and musculoskeletal conditions including OA, cost the economy \$150 billion a year including direct and indirect costs. It is estimated that the total social cost of this condition has been as high as 1% of the gross national product of the US.

Primary or idiopathic OA is the most common joint disease and is a significant source of pain for most people. Secondary causes of joints being degenerated are: dysplasia, inflammatory conditions, infection, or vascular or neurological conditions such as post polio. Primary OA is said to occur most often in the spine, hip, and knee; however it occurs less often in the wrist, hand, elbow, and ankle. The reason is not well understood but it is said that anatomical, biomechanical, and biological factors play a key role. The most common reason for ankle joint arthrodesis remains post-traumatic arthritis following malleolar fractures or pilon fractures. This presumably occurs due to inappropriate or improper treatment of these injuries or no treatment at all. One of the reasons that surgeries fail is not getting a proper anatomic reduction during surgery. Another major reason is shortening of the fibula and/or lateral shifting of the talus.

Saltzman and colleagues evaluated the cause of arthritis of all new patients presenting to the University of Iowa Orthopedic Department between 1999-2004 with arthritis of the ankle, and compared them to those with arthritis of the hip or knee during one year. Of the 639 arthritic ankles, 445 (70%) were post-traumatic, 76 (12%) were rheumatoid disease, and 46 (7%) were idiopathic (primary OA). The post-traumatic ankle arthritis patients were most commonly associated with past rotational ankle fractures.

The majority of ankle OA is related to trauma. Trauma such as a significant ankle sprain with resultant osteochondral defects will guarantee arthritis in the future. Definitely, the mid to long-term sequela of ankle fracture is OA somewhere in the future. Articles have shown that population that has been followed up 15 to 20 years after ankle fracture have gone to have significant ankle OA.

### TREATMENT OPTIONS

Current treatments of OA include medical and surgical options. From a medical perspective, ankle injections may play a role in delaying surgical intervention. Cartilage does not do well with cortisone on a continual basis. Although initial cortisone injection may serve a fair amount of relief for patients, this is mostly temporary. Other injections that have made a difference are the use of viscosupplementation.

Hyaluronan (HA) is a high molecular weight polysaccharide and a major natural component of the synovial fluid and the extracellular matrix of the cartilage. It is a glycosaminoglycan consisting of repeating units of glucuronic acid and N-acetylglucosamine, bound together by a glycoside bond beta. HA is synthesized by chondrocytes in the cartilage and by fibroblasts of the synovial lining known as synoviocytes.

Pleimann et al published a review article: Viscosupplementation is reasonable to use in patients with mild to moderate primary OA of the ankle who had failed or are intolerant of pharmacologic and orthotic management and who wish to delay definitive surgery (arthrodesis), and concluded that the efficacy of Viscosupplementation in post-traumatic degenerative joint disease may be diminished.

Viscosupplementation has been shown to provide a therapeutic effect as well as possibly having disease-modifying benefits. They are currently 6 hyaluronic acid derivatives on the market, including Synvisc, Hyalgan, Supartz, Orthovisc, Euflexxa, and Durolane. Euflexxa and Durolane are currently manufactured or bioengineered where the others are derived from rooster combs. There have been theories regarding the molecular weight of the hyaluronate. It has been theorized that the lower molecular hyaluronate is more able to bind to the HA receptors within the diseased joint and initiate some self-production of HA within the diseased joint. This is a disease-modifying benefit that lasts much longer than just normal buffering seen with saline or other types of injectable liquids. In a study published in the Journal of Bone and Joint Surgery, Hyalgan and placebo were aesthetically significant in lowering the ankle OA pain scale in patients evaluated in a double-blind study. This has been shown in joints besides the ankle and for other indications as well. Reports have shown the efficacy

and safety of subtalar joint injection as well as first metatarsophalangeal joint injection. It is also used in sports medicine for ankle sprains, and has demonstrated quicker return to activity after injection.

From a surgical perspective, there are potential other treatment options. These include surgical arthroscopy with and without subchondral drilling and marrow stimulation. Because of alignment issues, we can perform joint arthroplasties with bone resection as well as tibial osteotomies. Arthrodiastasis has been shown to be helpful and also provides stimulation to the diseased joint. Ankle arthrodesis has always been the gold standard and is still with patients that do not fit criteria for the new ankle implants.

Current developments in allograft technology may aid in the repair of articular damage: avoid any metallic implant wear, failure, and revisions. Lee et al in 2008 did a retrospective study to report the early clinical outcomes of ankle arthroplasty with allograft and with the application of a monolateral external fixation in the treatment of ankle arthritis. Eighteen patients with end stage ankle arthritis underwent surgical intervention. Allograft implantation with external fixation for the arthritic tibiotalar joint provided encouraging preliminary results and patient satisfaction mirroring current outcomes from shoulder and animal studies.

Autologous chondrocyte implantation and mosaicplasty have been described for osteochondral lesions of the talus but donor site morbidity has been a concern. Furthermore, these techniques seem to be indicated only for relatively small, focal lesions and not for diffuse articular disease. One advantage of allografting is the ability to resurface lesions with extensive articular disease with anatomically appropriate, mature hyaline cartilage. Goals in the treatment of end stage tibiotalar arthrodesis with osteochondral allografting are relief of pain, preservation of function, and protection of adjacent joints from degenerative arthrosis.

Ankle arthroscopy can be performed with and without distraction. This is used to clean the loose bodies as well as hypotrophic synovial tissue and provide better internal environment within the joint. Care should be taken to avoid any extra-articular debridement including neurovascular structures and tendon structures. The most common portals are anteromedial and anterolateral. The anterior central portal has been reported; however, there is increased chance of neurovascular issues. Distal tibial exostectomies can also be helpful and can be performed with small osteotomes through one of the medial or lateral portals. Joint debridement can also be possible in the central and posterior aspect of the ankle joint with ankle distraction and plantarflexion of the ankle. Thermal ablation can also be used to stabilize soft tissue laxity within the joint complex. It

is used for lateral ligament instability, primarily for the ATF, because the calcaneal fibular ligament is extra-articular.

## ANKLE ARTHRODIASTASIS

Arthrodiastasis of the ankle joints has been described by several authors since the 1980s. Evolution of this procedure has involved monolateral and ring fixators. The current recommendations are to allow distraction of the ankle joint for up to 3 months before the frame is removed. A hinged device that can anatomically reproduce the ankle joint axis between the malleoli has been more physiologic and effective for the patients undergoing this procedure. A footplate can also be placed on to the fixator to allow for weight bearing during this process as well. Recent studies have shown that disease-modifying changes within hydrostatic pressure can stimulate proteoglycan synthesis and also some improved osteoarthritic cartilage degeneration. In summary, this is a joint sparing procedure. It may delay or prevent the need for future ankle arthrodesis and also can prevent shear forces on the articular cartilage. This has been shown to physiologically provide a 50% increase in the production of proteoglycans.

## ANKLE ARTHRODESIS

Arthrodesis is still today considered the gold standard for end-stage arthrodesis of the tibiotalar joint, but functional limitations remain. In addition, complications rates have been reported to be as high as 60%. One major concern of arthrodesis about the ankle is secondary, progressive arthritis at the naviculocuneiform, calcaneocuboid, and tarsometatarsal joints.

Ankle arthrodesis has been the gold standard for end-stage arthrosis of the ankle for many years. The most important tenant of surgical treatment is to provide optimum position for the ankle after arthrodesis. It is important to evaluate the proximal leg and limb deformities to better compensate and understand the best position for ankle arthrodesis. The most important plane for placement is the sagittal plane, which should be absolutely 90 degrees to the tibia. On the lateral view, the lateral process of the talus should be along the mid bisection of the tibia. Anything to the posterior or anterior will change the mechanics of ambulation and cause degeneration and wear of the proximal and distal joints. In the frontal plane, this should be in slight valgus, preferably 0-5 degrees. I believe that neutral position <5 degrees of valgus would be more appropriate than something greater. The normal base and angle of gait are also helpful to proximate compared with the contralateral limb. This is usually up to 3-5 degrees

external from the bisection of the tibia.

Currently, the recommendation is to leave the fibula intact, and this will provide more lateral stability in the future if there needs to be an ankle implant placed in the area. External fixation has also been popularized recently, possibly to allow earlier weight bearing or weight bearing during the healing process. There is much more stiffness that can be provided to the construct to allow weight bearing at an earlier point; however, the bone still takes 10-12 weeks to heal. Internal fixation with nonweight bearing for 10-12 weeks is usually the standard and then progression to protected weight bearing at that stage is usually necessary.

The standard approach is through 2 incisions; using the anteromedial and anterolateral approach is helpful because the fibula is usually maintained at this point, and the anteromedial incision is the standard. A lateral incision can be made for resection of the fibula and even replacement of the fibula, then an autogenous graft on the lateral wound has been done for many years as well. Intramedullary nail fixation can also be helpful if stability of the subtalar joint is required. This is especially common in Charcot hindfoot situations where it is important to stabilize the tibiocalcaneal and the tibiotalar joints at the same time.

## ANKLE IMPLANTATION

Ankle joint implants have been much more popular over the last several years. Autologous grafting with cadaver implantation for bipolar deformities has been described by Bugbee and Brage over the last 5-10 years. They have reported on a larger number of unipolar and bipolar replacements and have some promising results. It is not easy, however, to get a fresh allograft now with viable cartilage that is predictable. The cost is significant and some surgeons have preferred metallic implant due to the cost and reproducibility in the patient population.

Meehan et al in 2005 used fresh ankle osteochondral allograft transplantation for tibiotalar joint arthritis in 11 patients. The diagnosis was post-traumatic arthritis in 7 ankles, OA in 2, and an osteochondral defect in 2. Bipolar

replacements were used in 9 ankles and unipolar in 2. At a minimum follow up of 24 months, 6 of the 11 ankles had successful grafting procedures. Of the 5 failures, 3 underwent successful repeat allografting and 1 was revised to a total ankle arthroplasty, and 1 has had no further surgery.

Kofoed et al performed 52 cemented ankle arthroplasties for painful OA (n = 25) or rheumatoid arthritis (n = 27) using an ankle prosthesis with a near-anatomical design. Patients were assessed radiologically and clinically for up to 14 years. Survivorship analysis of the 2 groups showed no significant differences, with a 72.7% survival for the OA group and 75.5% for the RA group at 14 years. The estimated survival rate of the arthroplasty was 61% at 15 years.

Total ankle arthroplasty has undergone a new resurgence that has been exciting. There are constrained and semi-constrained designs that are slowly gaining FDA approval. Currently, the Agility DePuy implant, InBone from Wright Medical, and the Salto Talaris from Tornier are the most well known. The Ellipse from Integra may be getting more exposure soon, as well as a revisional designs from Agility. There have been case studies that showed that the ankle fusion has better timing of the gait and less limp. Seven of 16-year followup of the total ankle implant from Knecht in 2004 showed that 90% of the 132 implant patients were happy with the surgery, 20% had subtalar joint arthritis, 15% had talonavicular joint arthritis, and about 8% went on to syndesmotic nonunion. There was also concern of talar subsidence in the past but some of the near modifications have shown better outcomes and less stress to the talus and the tibia. Bonnin in 2004 showed that of 98 SALTO implants placed, the AOFAS preoperative score went up from 32 to 83 postoperatively. Range of motion of the ankle also went up from 15 to 28 degrees.

In summary, there are a growing number of surgical options for ankle arthritis. Implants are definitely becoming better engineered and have better outcomes. Regardless of the surgical approach taken, it is important to remember that medial treatment including viscosupplementation has been shown to be helpful and should be considered in all patients before surgery.