Supramalleolar Osteotomies

Varun Chopra, DPM, Paul Stone, DPM*, Alan Ng, DPM

KEYWORDS

• Supramalleolar osteotomy • Ankle arthritis • Asymmetric ankle arthritis
• Varus ankle or valgus ankle • Ankle realignment

KEY POINTS

- A supramalleolar osteotomy is a joint-sparing osteotomy that can correct deformities in all planes at the distal tibia.
- Supramalleolar osteotomies have been found to provide substantial pain relief and functional improvement.
- With proper patient selection and preoperative planning, the supramalleolar osteotomy can effectively redistribute the forces placed on the ankle with the goal of limiting progression of degenerative changes.

INTRODUCTION

Distal tibial malalignment can result from posttraumatic malunion, physeal disturbances, congenital or metabolic diseases, and degenerative arthritis. The load-bearing area of the ankle is smaller than that of the knee, which leads to an increase in load per unit area. Kimizuka and colleagues[1] reported that when a force of 500 N was applied, the area of contact in the ankle was 350 mm^2 compared with 1100 mm^2 in the hip and 1120 mm^2 in the knee. For this reason, osteoarthritis (OA) readily develops once a structural abnormality is present. Approximately 15% of the world's adult population is affected by joint pain resulting from OA and approximately 1% have OA of the ankle.[2] Around 80% of the cases of arthritis of the ankle are posttraumatic and tends to effect more young people compared with those with hip and knee arthritis.[3]

Procedures treating ankle arthritis can be divided into 2 categories: joint-preserving and joint-sacrificing procedures. Joint-preserving procedures include ankle arthroscopy/arthrotomy with joint debridement,[4] distraction arthroplasty,[5] partial or total osteochondral resurfacing procedures,[6] and alignment corrective osteotomies.[7]

Disclosure Statement: None.
Highlands-Presbyterian, St. Luke's Podiatric Medicine and Surgery Residency Program, Colorado Health Foundation, 1719 East 19th Avenue, Denver, CO 80218, USA
* Corresponding author.
E-mail address: pstonehighlandspslresidency@comcast.net

Clin Podiatr Med Surg ■ (2017) ■–■
http://dx.doi.org/10.1016/j.cpm.2017.05.003 **podiatric.theclinics.com**

Joint-sacrificing procedures include ankle arthrodesis[8] and total ankle replacement.[9,10] Malalignment of the ankle leads to an altered load distribution across the joint, interfering with normal cartilage metabolism leading to early ankle joint arthritis that usually presents asymmetrically.[11] For patients where a substantial part of the joint is still salvageable, ankle fusion or joint replacement is not always the best option. For this patient population, realignment osteotomy of the distal tibia is a valuable procedure.

A supramalleolar osteotomy is a joint-sparing osteotomy that can correct deformities in all planes at the distal tibia. The goals of supramalleolar osteotomy are to realign the ankle and foot to the leg to transfer the ankle joint under the weightbearing axis and to normalize the direction of the force vector of the triceps surae. Restoring the axial alignment allows for redistribution of loads to an area where the articular cartilage is less affected to slow down further articular degeneration. Several studies have found the successes of the osteotomy in improving function and relieving pain.

HISTORY OF SUPRAMALLEOLAR OSTEOTOMY

In 1936, Speed and Boyd, orthopedic surgeons who presented their treatment algorithm for posttraumatic deformities above the ankle joint.[12] They published a clinical study that included 50 realignment surgeries in patients with posttraumatic deformities. They determined 3 crucial aims of supramalleolar realignment surgical procedures[1]: restoration of appropriate weight-bearing alignment of the leg,[2] restoration of the appropriate alignment of articulating surfaces of the tibiotalar joint, and[3] restoration of physiologic and pain-free range of motion of the tibiotalar joint.

One of the first publications to report outcomes of a supramalleolar osteotomy came from Saint Petersburg in 1966 by Dzakhov and Kurochkin, titled "Supramalleolar osteotomies in children and adolescents."[13] The authors presented their results in 59 patients who underwent supramalleolar realignment osteotomy between 1936 and 1964. Another early article on supramalleolar osteotomy was published by Barskii and Semenov from Kujbyshev, Russia in 1979. In their publication, "Methods of the supramalleolar osteotomy in ununited fractures of the malleoli," the authors described their surgical technique and preoperative planning for a medial closing-wedge supramalleolar osteotomy.[14]

Most review articles detail a historical perspective on supramalleolar osteotomy; a study by Takakura and colleagues[15] in 1995 is noted as the first to report outcomes systematically in patients who underwent supramalleolar osteotomy. They are considered the pioneers of this field and their work substantially influenced the work of many foot and ankle surgeons. Since Takakura's report, an increasing number of clinical studies of patients who have undergone supramalleolar osteotomies have been published. Overall studies consistently show good short-term and midterm results for pain relief, functional improvement, and return to sports and recreation activities.

BIOMECHANICS

There is no consensus in the literature regarding the degree of distal tibial malalignment and the potential for development of arthritis and symptoms. Tarr and colleagues[16] established that distal deformities with an angulation of 15° showed up to a 42% reduction in contact area. However, another study by Kristensen and colleagues,[17] who looked at patients with low tibia fractures with greater than 10° angular malunion, found that many of the patients were asymptomatic and none of the patients had limitations of ankle motion. Their patients also had no radiographic signs of ankle arthrosis 20 years after injury.