

Is It Time To Retire The Triple Arthrodesis?

Point



Yes. Citing long-term outcomes in the literature and surgical experience, these authors say the triple arthrodesis is a 'biomechanically unsound' procedure for the most part that has been usurped by isolated and medial double arthrodesis procedures that achieve better outcomes.

By John Grady, DPM, FASPS, FACFAOM, and Mallory Schweitzer, BS

Certainly, foot and ankle surgeons in general (and the senior author in particular) use triple arthrodesis sparingly as we learned that motion is so important to all of us. With some notable exceptions, such as Charcot reconstruction, it is still very unusual to get good results with a triple arthrodesis. The senior author only uses this procedure when conservative care has failed and generally prefers joint mobilizing procedures more than joint immobilizing procedures. The senior author's surgical experience has made him skeptical over the years of the procedure commonly known as the triple arthrodesis but a review of his own cases taught him to retire the triple arthrodesis in 2003 with rare exceptions. The senior author says he should have realized earlier in his career that it never made biomechanical sense to fuse the lateral column at the same time the medial column is fixed in one position.

Originally described by Ryerson in 1923, the triple arthrodesis was commonly in use to stabilize the hindfoot in patients with polio.^{1,2} The procedure subsequently became popular for treating semi-flexible and rigid cavus feet. It has also become a workhorse procedure for the treatment of posterior tibial tendon dysfunction, primary and secondary osteoarthritis, rheumatoid arthritis, congenital deformity, and neuromuscular deformity.^{1,3-5} However, due to a better understanding of the development of these pathologies as well as the biomechanical effects and complications of various surgical treatments,

the triple arthrodesis has more recently come under scrutiny and alternatives have emerged. Alternative procedures include isolated fusions, such as talonavicular and subtalar joint arthrodesis, as well as a combination of these fusions.⁵⁻¹²

As with any arthrodesis procedure, subsequent arthritis in joints proximal and distal to the fusion site is a concern with the triple arthrodesis. Researchers have assessed mid- and long-term outcomes for triple arthrodesis, and frequently observed arthritis of surrounding joints including the ankle and naviculocuneiform joints.⁴⁻⁶ In one study, authors reported this incidence of arthritis affecting surrounding joints to be as high as 100 percent with long-term follow up.⁴

Saltzman and colleagues followed 67 triple arthrodesis procedures in 57 patients and assessed the naviculocuneiform joint, tarsometatarsal joint and ankle joint at average follow-up times of 25 and 44 years.⁴ At the last follow-up evaluation, they found no degenerative changes in the naviculocuneiform joint in 1 percent of patients, mild changes in 58 percent, moderate changes in 31 percent and severe changes in 9 percent. They noted similar results in the tarsometatarsal joint.

At the last follow-up, all ankle joints had degenerative changes with 49 percent having mild changes, 42 percent having moderate changes and 9 percent having severe changes. Although neuromuscular deformity was the most common indication for intervention in this study and it has an effect on the development of

arthritic changes because of differences in gait, joint loading and walking ability, this study provides insight to the eventual long-term degeneration of adjacent joints due to altered biomechanical function and joint stresses.⁴

In a retrospective review of 28 in situ isolated subtalar joint fusions, Jovenieaux and coworkers found that at an average follow-up time of 56 months, arthritis increased one stage in 12 tibiotalar joints, 18 talonavicular joints, and 12 calcaneocuboid joints.⁵ However, they did not find a significant relationship in the American Orthopaedic Foot and Ankle Society (AOFAS) ankle hindfoot score and grade of arthritis in adjacent joints.

Understanding The Impact Of Post-Op Hindfoot And Midfoot Alignment

When correcting abnormal joint motion and position, like one would find with pes planovalgus deformities, surgeons should keep in mind that postoperative hindfoot and midfoot alignment greatly influence outcomes. Astion and coworkers measured the range of motion of unfused joints in isolated subtalar, talonavicular and calcaneocuboid arthrodesis procedures as well as double arthrodesis of the talonavicular and calcaneocuboid joints.¹³ They found that fusing the talonavicular joint resulted in 8 percent of the subtalar joint motion available before arthrodesis and a double arthrodesis (talonavicular and calcaneocuboid joints) resulted in 9 percent of the original subtalar joint motion.¹³ When it came to the

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isolated subtalar joint fusion, the range of motion of the talonavicular joint and the calcaneocuboid joint were 26 percent and 56 percent, respectively, of the range of motion available before arthrodesis. Fusion of the talonavicular joint reduced motion of the subtalar and calcaneocuboid joints to approximately 2 degrees whereas subtalar joint arthrodesis somewhat reduced motion of the other joints in the triple joint complex.

Mann and colleagues also found preservation of motion in adjacent joints associated with isolated subtalar joint arthrodesis.¹⁰ Subtalar arthrodesis resulted in 40 percent less transverse tarsal motion, 30 percent less dorsiflexion and 9 percent less plantarflexion. This finding differed from the study by Gellman and colleagues, who noted dorsiflexion and plantarflexion decreases of 2.3 and 1.0 percent, respectively, following isolated subtalar joint fusion.¹⁴

Comparing Isolated Arthrodesis Procedures With Combined Procedures: What The Literature Reveals

Surgeons also need to consider complication rates between various arthrodesis procedures and combinations of arthrodesis procedures. DeVries and Scharer performed a retrospective radiographic review on 20 consecutive triple arthrodesis procedures and 20 consecutive talonavicular and subtalar arthrodesis procedures with calcaneocuboid preservation.¹² They found that both groups had a statistically significant reduction in deformity and a return to more normal radiographic findings after arthrodesis. The advantages of preserving the calcaneocuboid joint include decreased operative time and fewer sites of potential complication. By avoiding the removal of articular cartilage in the lateral column, one can preserve the length of the lateral column and correct forefoot abduction.

Mann and colleagues retrospectively reviewed 44 isolated subtalar joint arthrodesis procedures with an average follow-up of 59.5 months for talocalcaneal coalition,

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healed calcaneal fractures with subtalar joint arthrosis, acquired flatfoot deformities, degenerative subtalar joint arthritis and psoriatic arthritis.¹⁰ This study found that pain and function significantly improved and 93 percent of patients were very satisfied or satisfied with their treatment at follow-up.

Easley and co-workers evaluated the outcomes of 148 cases of isolated subtalar joint arthrodesis, and found a significantly increased non-union rate due to smoking, failure of a previous subtalar joint arthrodesis, and the presence of greater than 2 mm of avascular bone at the arthrodesis site.⁹ The overall union rate in the study was 84 percent but this increased to 93 percent with exclusion of the aforementioned subgroups that had decreased union rates.

Yuan and colleagues found no difference in fusion rate and fusion time with an isolated subtalar joint fusion performed from a traditional Ollier's approach, a lateral tarsal sinus approach and a posterolateral approach.¹⁵

What You Should Know About Post-Op Changes With Ankle Alignment And Peak Pressures

Researchers have previously observed that postoperative changes in ankle alignment may occur following hindfoot arthrodesis. In a retrospective review, Hyer and co-authors compared the incidence of postoperative ankle valgus in patients undergoing either triple arthrodesis or medial double arthrodesis (subtalar and talonavicular joints).¹⁶ They found that the odds of

having an increase in postoperative valgus ankle alignment for patients in the triple arthrodesis group was 3.64 times greater than that of patients in the medial double arthrodesis group. The study authors originally hypothesized that the results of this study would be the opposite of what they found due to potential deltoid ligament disruption from a medial approach. However, they concluded that their findings may be due to tightening and realignment of the medial column that took a greater amount of force off the deltoid ligament than they expected.

Authors have also investigated peak pressures in the ankle joint following triple arthrodesis. Using a dynamic foot model in cadaveric specimens, Suckel and colleagues assessed peak loading pressure in the ankle and naviculocuneiform joint following both triple arthrodesis and isolated talonavicular arthrodesis.¹⁷ They found that peak ankle pressure, especially anteriorly, was higher in the triple arthrodesis group as was the peak pressure in the naviculocuneiform joint. The study authors concluded that isolated talonavicular arthrodesis leads to lower and more evenly distributed pressure within the ankle joint.

Should You Fuse Or Spare The Calcaneocuboid Joint?

In determining whether a triple arthrodesis or an isolated arthrodesis is most appropriate, the surgeon must decide whether to fuse or spare the calcaneocuboid joint. Berlet and coworkers found that the medial double arthrodesis — which allows



surgeons to retain mobility of the calcaneocuboid joint — can help improve or stabilize subchondral changes at the calcaneocuboid joint in patients with mild to moderate preoperative arthritis.¹⁸

These findings are interesting in that one could argue calcaneocuboid joint arthritis is an indication for triple arthrodesis rather than a double arthrodesis. However, Berlet and colleagues concluded that distraction and decompression of the calcaneocuboid joint resulting from a medial column fusion may improve existing mild to moderate arthritis, and preserve some motion of the calcaneocuboid joint.¹⁸

Final Notes

Triple arthrodesis has recently fallen out of favor because the procedure is technically demanding, increases joint pressure and increases the likelihood of subsequent joint arthritis. Additionally, several alternative procedures have emerged and are effective in terms of functional and clinical outcomes. Surgeons have advocated the isolated hindfoot fusion as an appropriate alternative to triple arthrodesis and many authors have described techniques and outcomes with talonavicular, subtalar and double arthrodesis procedures.

As if the results in literature did not point to enough complications to render this procedure in need of retirement, the senior author has been convinced to stop using it in most instances based on what he has learned from some of his earlier patient satisfaction studies.

Out of 127 triple arthrodesis procedures the senior author performed from 1984 to 2001 (and reviewed in 2003), 21 patients would not choose the procedure again and an additional 13 patients were comfortable, but unable to resume preoperative desired activity. This is a 27 percent satisfaction failure rate.

Out of the 64 isolated subtalar arthrodesis the senior author performed from 1987 to 2005, three patients would not have the procedure again and an additional two patients were comfortable but unable to resume preoperative desired

activity. This is an 8 percent satisfaction failure rate.

Out of the 36 isolated talonavicular arthrodesis the senior author performed from 1984 to 2005, two patients would not have had the procedure done and one patient was comfortable but unable to resume desired preoperative activity. This is an 8 percent satisfaction failure rate.

Out of the 29 concurrent talonavicular and subtalar arthrodesis procedures the senior author performed from 1983 to 2005, one patient would not have the procedure done and one patient was comfortable but unable to resume desired preoperative activity. This is a 7 percent satisfaction failure rate.

Granted, in reviewing this small quantity of satisfaction results, there is a recognition that complications can occur with all procedures. However, it is interesting to compare the patient satisfaction results following these different arthrodeses at least two years postoperatively.

In conclusion, for surgeons who have not done so already, it is past time to consider the official retirement of this most ineffective and biomechanically unsound procedure. It may be prudent to suggest replacing it with isolated subtalar, talonavicular or subtalar/talonavicular arthrodesis procedures. ■

Dr. Grady is the Director of the Foot and Ankle Institute of Illinois and the Director of the Foot and Ankle Institute for Research in Oak Lawn, Ill. He is also the Director of the Jesse Brown Veterans Affairs Medical Center Residency Program in Chicago. Dr. Grady is a Fellow of the American Society of Podiatric Surgeons.

Ms. Schweitzer is a fourth-year podiatric medical school student at the Dr. William M. Scholl College of Podiatric Medicine at Rosalind Franklin University.

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