**2019 Manuscript**

**Award Winners**

***Charcot Reconstruction Versus Transtibial Amputation Versus Bracing in Patients with Non-Plantigrade Charcot Foot Arthropathy: A Cost-Effectiveness Analysis***

***Total Ankle Arthroplasty Survivorship: A Meta-analysis***

***Early Post-operative Physical Therapy is Associated with Improved Recovery after Hallux Valgus Surgery***

## Honorable Mention

- ***Dual Plating Technique: Outcome Comparisons in Complex Ankle Fractures and Concurrent Complex Comorbidities***
- ***Patient Personality, Aggression and Psychological Profile in Bunion Surgery Outcomes***
- ***Radiographic Deformity is Not Well Correlated with Disability or Symptom Severity in Patients Seeking Operative Correction for Hallux Valgus Deformity***
- ***Assessing Modifiable Risk Factors in Total Ankle Arthroplasty***

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**A Scientific Approach to Evaluation and Decision Making**

- Meta-Analysis of Surgical Site Infections in Elective Foot and Ankle Surgery
- CRISPR-Cas9 Transcriptional Up-Regulation of PDGFR-beta in Primary Neonatal Fibroblasts following Lance Array Nanoinjection
- Evaluation of Polymerase Chain Reaction in the Identification and Quantification of Clinically Relevant Bacterial Species in Lower Extremity Wound Infections
- Allograft Bone as an Alternative to Autograft in Foot and Ankle Arthrodesis and Nonunion Repair
- Relationship between Charcot Neuroarthropathy and Peripheral Arterial Disease in Diabetes Mellitus Patients
- Early Weightbearing Following Foot and Ankle Surgery: A Systematic Review with Meta-Analysis
- Disparities in Inpatient Management and Outcomes of Diabetic Foot Infections

**A Scientific Approach to Surgery of the Foot**

- Management of Calcaneal Fracture Malunion with Bone Block Distraction Arthrodesis: A Systematic Review and Meta-Analysis
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***Charcot Reconstruction Versus Transtibial Amputation Versus Bracing in Patients with Non-Plantigrade Charcot Foot Arthropathy: A Cost-Effectiveness Analysis***

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**Abstract**

The optimal therapeutic approach for patients suffering with non-plantigrade Charcot foot deformity is unclear. The purpose of this study was to determine if midfoot Charcot reconstruction (CR) represents a cost-effective strategy compared to primary transtibial amputation (TTA) or bracing in adults with Charcot foot neuroarthropathy (CFN).

A formal cost-effectiveness analysis using a Markov model with microsimulation was conducted to investigate the healthcare costs (in USD) and outcomes associated with each strategy. The outcomes assessed included long-term costs, quality adjusted life years (QALYs) and incremental cost per QALY gained. Inclusion criteria included patients presenting with a non-plantigrade foot whose treatment required more than simple plantar ostectomy. The three treatment options were examined in three separate clinical scenarios: CFN without ulceration (Model 1), CFN with ulceration (Model 2), and CFN with infected ulceration (Model3).

All strategies displayed ICERs below the $50,000 threshold in Model 1, suggesting all three strategies were cost-effective when no ulceration was present. In model 2, both CR and bracing were cost-effective, but CR displayed volatility, suggesting that moderate changes in surgery costs (e.g., use of expensive hardware) and/or higher than anticipated complication rates make CR an unfavorable strategy. Neither CR nor TTA displayed value in model 3 due to high mortality rates in the cohort.

Our results suggest that from the perspective of the healthcare system, bracing is a cost-effective strategy in both ulcerated and non-ulcerated patients. CR, on the other hand, is most cost-effective in the non-ulcerated patient, and becomes a less favorable therapeutic option as the patient progresses onto ulceration and infection.

Level of Evidence: II – Economic and Decision Analysis

***Total Ankle Arthroplasty Survivorship: A Meta-analysis***

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Jeremy J. Cook, DPM, MPH, FACFAS
Emily A. Cook, DPM, MPH, FACFAS
Jordan Crafton, DPM
Matthew Knabel, DPM
Eric Swenson, DPM
Samantha Miner, DPM
Philip Basile, DPM, FACFAS

**Abstract**

The gold standard for management of end-stage ankle arthritis was previously ankle arthrodesis, however improvements in total ankle replacements (TAR) are making this a more viable treatment option. The primary aim of this meta-analysis was to evaluate the survivorship of total ankle replacement implants currently in use.

An extensive search strategy initially captured 20,842 citations which were evaluated for relevance. Abstract screening produced 97 articles to be read in entirety, of which 10 articles studying 1963 implants met all prospective inclusion criteria for analysis.

Overall survivorship of all implants was 93.0% [95% confidence interval (85.2%-96.9%)] using a random effect model. There was significant heterogeneity between the studies (Q=131.504). Meta-regression identified an inverse relationship between survivorship and study follow-up duration ($p<0.0001$). Furthermore, age ($p=0.36$) and implant type [fixed-bearing (95.6%, 95% confidence interval 85.9%-98.7%) versus mobile-bearing (89.4%, 95% confidence interval 79.6%-94.8%)] did not have a statistically significant impact on survivorship, $p=0.213$. However patients with higher pre-operative functional scores had improved survivorship, $p=0.001$. Complications were inconsistently reported with varied definitions. In order of reported frequency, complications were classified into technical error (28.15%), subsidence (16.89%), implant failure (13.28%), aseptic loosening (6.3%), intra-operative fracture (5.67%), wound problems (4.3%), deep infection (1%) and post-operative fracture (0.0001%). Overall study quality was low with only 10% being prospective and 90% from non-registry data.

The results from this meta-analysis revealed a promising overall survivorship of current implants in use for total ankle replacement, however higher quality studies with standardized outcomes measures are needed.

**Level of Clinical Evidence:** Level 1

***Early Post-operative Physical Therapy is Associated with Improved Recovery after Hallux Valgus Surgery***

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Chloe Sakow, MPH
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**Abstract**

Obtaining optimal patient outcomes is an important part of elective outpatient surgery. Although literature has identified that physical therapy after hip, knee and hindfoot surgery can improve patient function, physical therapy is not well studied or well understood for patients undergoing forefoot procedures. The purpose of this study was to explore the relationship between patient reported outcome measures after undergoing hallux valgus surgery and formal physical therapy.

112 consecutive patients (112 feet) who underwent surgical correction of hallux valgus were included in this study. All patients were assessed pre and post-operatively utilizing the Foot and Ankle Outcome Score (FAOS), a validated patient-centered outcome measure for hallux valgus surgery. Patients then underwent a physical therapy program utilizing a protocol tailored for hallux valgus surgical correction. 100/112 (89.2%) of patients completed the course of therapy as prescribed by the treating surgeon.

On average, physical therapy started 10 days $\pm$ 3.1 days (range 6 – 15 days) after the surgical procedure and patients were in therapy for an average of 8.6 $\pm$ 5.3 weeks (median: 6.9 weeks; range 1.5 – 27.8 weeks). Patients attending 10 or more physical therapy sessions reported less pain, better function and higher foot-related quality of life at their final follow up compared to those attending less than 9 physical therapy sessions. Plantarflexion of the 1st MTP joint was identified as being related to higher post-operative FAOS pain subscale scores.

Formal physical therapy appears to be associated with enhanced outcomes after bunion surgery and 10 – 12 sessions appear to be the ideal number of sessions to obtain improved outcomes. While it is difficult to know from our data how these improvements are occurring, it is reasonable to assume that improved 1st ray function and improved patient confidence likely play a role.

**Level of Clinical Evidence:** 3

## Honorable Mention

***Dual Plating Technique: Outcome Comparisons in Complex Ankle Fractures and Concurrent Complex Comorbidities***

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Devin S. Bland, DPM, AACFAS
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Devin Wahlen, DPM, AACFAS
Adebola T. Adeleke, DPM, AACFAS
Brooke Lynn Anderson, BS

**Abstract**

Ankle fractures are a common orthopedic injury which often require open reduction internal fixation (ORIF) in order to decrease the risk of posttraumatic arthritis. There are certain instances when more rigid fixation is needed i.e. osteopenia, neuropathy, and obesity.

Dual/orthogonal plating of the fibula has been shown to be a promising adjunct in previous studies. The authors report on 181 dual plated fibulas and their postoperative outcomes vs standard single plating of the fibula. One thousand four hundred seventy-seven bimalleolar and trimalleolar ankle fractures were identified for this study. Retrospective chart review was performed for obesity, osteopenia, as well as neuropathy. Of the 1477 ankle fractures, 611 (41.37%) patients qualified for the study, 181 (29.62%) dual plate and 430 (70.38%) single plate constructs.

In these records the areas that were compared were the following: dehiscence, failure of hardware fixation, loss of mortise length, height or width, loss of fibular length, catastrophic hardware failure, mal-unions, non-unions, and peroneal tendonitis. There were statistically significant P values when comparing single plate vs dual plating of the fibula in these areas: hardware failure (0.007), revisional surgery (0.007), hardware removal (0.034), Loss of fibula length (0.005), Loss of Mortise width (0.010), non-union/malunion (0.002), in the single plate group. Peroneal tendonitis, and postoperative cellulitis were not significant (0.10) and (0.94) respectively in either group.

Single-plate fixation is significantly associated with increased post-operative complications in a population of patients with and without morbid obesity, osteoporosis, and/or neuropathy.

Level of Clinical Evidence: Therapeutic
Level 3- Retrospective comparative study

## Honorable Mention

***Patient Personality, Aggression and Psychological Profile in Bunion Surgery Outcomes***

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Rachel Greeley
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Adam E. Fleischer, DPM, MPH, FACFAS

**Abstract**

Patient satisfaction in surgical outcome is complex and not well understood. Previous literature has identified that radiographic parameters, range of motion and pressure measurements are poorly correlated with post-operative patient satisfaction. In this work, the contribution of patient personality trait, aggression and psychosocial characteristics in patients undergoing surgical correction of hallux valgus are examined.

80 consecutive adult subjects undergoing surgical correction for hallux valgus with a first metatarsal osteotomy (scarf) were included. Pre-operatively, patients were evaluated with a Foot and Ankle Outcome Score (FAOS), Brief Battery for Health Improvement 2 (BBHI 2), TIPI and BAQ. The patient's completed these same outcome measures at 1 year post-operatively. The change in FAOS and patient satisfaction as the study's primary outcome measure. Subjects' biopsychosocial attributes were assessed preoperatively using Correlation analyses and linear and logistic regression models were used to examine variable associations.

All biopsychosocial characteristics achieved weak correlations with the FOAS scores at 1 year post-operatively (all $r<0.03$). The study's most correlated variables were aggression and FAOS Sports/Rec ($r=0.295$, $p=0.008$) and conscientiousness and FAOS Pain ($r=0.291$, $p=0.009$). In the multivariable regression analyses utilizing the best model of predictive variables, the addition of personality and other psychosocial predictor variables was found to be significant in the FAOS Sports & Recreation subscale ($p<0.05$). Multiple combinations of predictor variable models were created, however, none of them explained more than 18.5% of the variance in the 12 month FAOS scores (range: 6.1 – 18.5%).

The complexity of how radiographic parameters, surgical correction and biopsychosocial traits requires more study as the variables modelled here were unable to explain the vast majority of outcomes after hallux valgus surgery.

**Level of Clinical Evidence:** Level 1, Prognostic

## Honorable Mention

***Radiographic Deformity is Not Well Correlated with Disability or Symptom Severity in Patients Seeking Operative Correction for Hallux Valgus Deformity***

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Adam E. Fleischer, DPM, MPH, FACFAS

**Abstract**

Recently, some US insurance companies have started to define minimum angular measurement guidelines before they will be willing to pay for osseous work in patients seeking operative intervention for hallux valgus deformity. This logic assumes that the magnitude of radiographic bunion deformity is closely related to the magnitude of patient's symptoms and/or disability. This is problematic as literature which correlates patient symptoms/disability with radiographic findings is lacking.

We conducted an analysis of pre-existing data in our practice to examine whether patient-reported symptoms and disability prior to bunion surgery correlated with several radiographic parameters commonly used to quantify hallux valgus deformity. Symptoms and disability were determined using patient preoperative Foot and Ankle Outcome Scores [FAOS], a validated instrument in hallux valgus assessment. Spearman's correlation statistics were used to identify correlations observed between radiographic predictors and individual FAOS subscale scores. 107 patients (107 feet) with mean age of 49.3 ± 13.8 years underwent osseous hallux valgus corrective surgery for their symptomatic bunion during the study time frame.

No radiographic variable achieved even a moderate correlation with any of the FAOS subscales with the exception being sesamoid position with FAOS Pain (rho=0.402, p=0.01) in patients 56 years and older. The direction of this correlation was positive, indicating that greater sesamoid abnormalities were associated with less pain (i.e., higher FAOS Pain scores).

Based on our findings, it would appear that radiographic severity of bunion deformity should not play a role in coverage decisions for patients presenting for hallux valgus surgery.

**Level of Clinical Evidence:** III

## Honorable Mention

***Assessing Modifiable Risk Factors in Total Ankle Arthroplasty***

Jesse R. Wolfe, DPM
Joshua J. Wolfe, DPM
Matt VanNatta, MPH
H. John Visser, DPM, FACFAS

**Abstract**

Total ankle arthroplasty continues to be addressed within the literature as a progressively more reliable procedure for ankle arthritis. It has been established that total ankle arthroplasty has similar costs and long term outcomes compared to other total joint arthroplasty. Controversy continues to be identified in relation to the relative contraindications of total ankle arthroplasty, specifically related to comorbidities and modifiable risk factors. In addition, there remains a gap in the literature related to the cost of modifiable risk factors and comorbidities in total joint arthroplasty, with total ankle arthroplasty having the greatest paucity of literature.

We investigated the relationship between preoperative modifiable risk factors and comorbidities with the cost of total ankle arthroplasty in 141 patients over a 10 year period in a multi-centered health system. Patient medical records were evaluated using ICD-9 and ICD-10 codes and were analyzed for diabetes mellitus, elevated HbA1C, blood glucose, obesity, smoking, hypoalbuminemia, anemia, and vitamin D deficiency.

We established that a direct correlation exists between the cost of total ankle arthroplasty and diabetes, obesity, and smoking. Moreover, we evaluated patients with multiple modifiable risk factors and were able to evaluate combinations of these risk factors and demonstrate the synergistic and compounding effects these have on the cost of total ankle arthroplasty.

It is imperative that the foot and ankle surgeon effectively evaluate their patient in the preoperative setting for these modifiable risk factors.

**LEVEL OF CLINICAL EVIDENCE:** II Prognostic

***Meta-Analysis of Surgical Site Infections in Elective Foot and Ankle Surgery***

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Emily A. Cook, DPM, MPH, FACFAS

**Abstract**

The incidence of surgical site infections (SSI) is well documented in orthopedic surgery. Benchmarking is necessary for elective foot and ankle surgery due to the limited data on this topic. The economic burden of surgical site infection management is high. Identifying the epidemiology and potential risk factors of surgical site infections is critical to prevention.

The primary aim of this meta-analysis was to perform a comprehensive and systematic review of the literature in an attempt to identify the surgical site infection rate and risk factors for elective foot and ankle surgery**.** A meta-analysis was performed of elective foot and ankle SSI articles between 1999 to 2017. The CDC definition for SSIs was utilized for the metameter. Exclusion criteria included history of infection, revision, pediatric cases, case studies and non-elective surgeries. Seven articles met selection criteria which included 7,310 procedures in 6,257 patients. Meta-analysis of the data using a random effects model demonstrated a surgical site infection rate of 2.5% (0.025) and using a fixed effects model 2.4% (0.024) with a Q=39.847.

An established benchmark for infection rates for elective foot and ankle surgery is needed. Our results show that surgical site infection rates with elective foot and ankle surgery are comparable to those documented in the literature. Due to the large amount of heterogeneity between studies, there is a need for higher quality studies examining the infection rate in elective foot and ankle surgery. This is complicated by a multitude of confounding factors affecting the incidence of infection rate.

**Level of Clinical Evidence:** Level 1, Meta-Analysis systematic review

***CRISPR-Cas9 Transcriptional Up-Regulation of PDGFR-beta in Primary Neonatal Fibroblasts following Lance Array Nanoinjection***

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Sandra Hope, PhD
Brian D. Jensen, PhD

**Abstract**

Chronic wounds affect over 50 million people worldwide and continue to be a major challenge to close with the use of traditional wound care therapies. This work provides a proof-of-concept gene medicine approach to wound healing by using CRISPR-Cas9 with a non-viral, micro-electromechanical based method known as Lance Array Nanoinjection to simulate primary neonatal fibroblasts (BJ ATTC® CRL-2522™) to increase expression of platelet-derived growth factor receptor-beta, a critical receptor required for wound healing.

Experimentation utilized both electro-mechanical stimulation alone and in conjunction with a transcriptional activation CRISPR-Cas9 plasmid for platelet-derived growth factor receptor-beta. Results show that 48 hours post nanoinjection treatment that both the up-regulation of platelet-derived growth factor receptor-beta as well as living cell counts increased significantly. Maximum mean platelet-derived growth factor receptor-beta expression cell counts were achieved using both electro-mechanical stimulation and the platelet-derived growth factor receptor-beta CRISPR-Cas9 plasmid, reaching levels as high as 15.3-fold higher than non-treated controls.

These results are distinctive in the context of wound healing and gene medicine because: one, it demonstrates that through a carrier-free electro-mechanical stimulation method alone, both cell growth and platelet-derived growth factor receptor-beta up-regulation can occur, and two, it shows that the magnitude of these effects can be amplified greatly by CRISPR-Cas9.

Implications of this proof-of-concept work have potential for great impact on chronic wound healing since the potential to alter other growth factor genetic targets could be accomplished with simply modifying the guide-RNA targets prescribed by the investigator.

**Level of Evidence: Level 1, Randomized Control Trial**

***Evaluation of Polymerase Chain Reaction in the Identification and Quantification of Clinically Relevant Bacterial Species in Lower Extremity Wound Infections***

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Ariya Mobaraki, BS
Karen K. Evans, MD
Christopher E. Attinger, MD
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Paul J. Kim, DPM, MS, FACFAS

**Abstract**

**Introduction**
Identification of bacteria by polymerase chain reaction (PCR) is known to be more sensitive than culture, which brings to question the applicability of the results. In this study, we evaluate the ability of PCR to detect clinically relevant bacterial species in lower extremity wound infections requiring operative debridement, as well as the quantitative change in biodiversity and bacterial load reflected by PCR during the course of treatment.

**Methods**
34 infected lower extremity were examined by analysis of 16S ribosomal RNA subunit and by culture. McNemar's test was used to measure the concordance of clinically relevant bacterial species identified by PCR compared to culture during each debridement. Change in wound biodiversity from initial presentation to final closure was evaluated by Wilcoxon signed-rank test. Kaplan-Meier survival curve was used to characterize change in measured bacterial load over the course of operative debridement.

**Results**
A total of 15 and 12 clinically relevant bacterial species were identified by PCR and culture, respectively. The most common bacterial species identified were Coagulase-negative Staphylococcus, *Staphylococcus aureus,* and *Enterococcus spp.* PCR was less likely to detect *Enterococcus spp.* on initial debridement and Coagulase-negative Staphylococcus on closure in this study population. A significant decrease in mean number of clinically relevant species detected from initial debridement to closure was reflected by culture (*p=0.0188*) but not by PCR (*p=0.1848*). Both PCR (*p=0.0128*) and culture (*p=0.0001*) depicted significant reduction in mean bacterial load from initial debridement to closure.

**Conclusion**
PCR is able to adequately identify clinically relevant bacterial species in lower extremity surgical wound infections. PCR displays increased sensitivity compared to culture with relation to detection of biodiversity, rather than bacterial load. Molecular diagnostics and conventional culture may serve a joint purpose to assist with rendering clinical judgment in complex wound infections.

**Level of Evidence**: Level I

***Allograft Bone as an Alternative to Autograft in Foot and Ankle Arthrodesis and Nonunion Repair***

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Shane M. Hollawell, DPM, FACFAS
Brendan Kane, DPM

**Abstract:**

Bone graft augmentation for arthrodesis and nonunion repair is common in foot and ankle surgery. Autograft serves as the gold standard for bone graft material because it has osteoconductive, osteoinductive, and osteogenic properties, ideal for increasing healing potential. However, autograft harvesting can be associated with significant donor-site morbidity and other related complications. Therefore, the present retrospective study evaluated the efficacy of an allogenic cancellous/cortical/periosteal cellular bone matrix with mesenchymal stem cells and angiogenic growth factors.

The population consisted of 34 patients and 35 procedures with varied comorbidities that historically have increased risk of delayed union or nonunion. Age, body mass index, diabetes, and nicotine use were evaluated as potential risk factors. In addition, many of the included patients were injured while at work which has been shown as a risk factor leading to suboptimal outcomes and delayed healing times in prior studies. Radiographic consolidation at the fracture or fusion site was reviewed at regular intervals until healing was confirmed.

The retrospective study indicated that allograft bone, particularly an allograft with mesenchymal stem cells, has the potential to produce successful consolidation and high union rates when applied to foot and ankle arthrodesis and nonunion repair. Overall 34/35 (97.1%) procedures successfully progressed to full osseous consolidation at the fracture or arthrodesis site.

The use of allograft is an effective way to achieve high union rates and can be used as an alternative to autograft.

**Level of Evidence:** IV

***Relationship between Charcot Neuroarthropathy and Peripheral Arterial Disease in Diabetes Mellitus Patients***

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**Abstract**

Purpose: The primary aim was to determine the rate of complications in patients with peripheral arterial disease and diabetic Charcot neuroarthropathy who underwent osseous reconstruction. Complications included delayed healing, dehiscence, and major lower extremity amputation.

Materials and Methods: A retrospective review of patients with Charcot neuroarthropathy requiring reconstruction secondary to ulceration or acute infection. Descriptive analysis compared outcomes between those with and without peripheral arterial disease. Bivariate analysis and multivariate logistic regression were analyzed for delayed healing, dehiscence, and major lower extremity amputation.

Results: In a cohort of 284 patients with diabetic Charcot neuroarthropathy who underwent osseous reconstruction, the rate of peripheral arterial disease was 21.8% (62/284). Bivariate analysis for delayed healing found hypertension (p=0.0352), peripheral arterial disease (p=0.0051), and smoking history (p=0.0276) to be statistically significant factors. Delayed healing was 2.012 times more likely in the presence of peripheral arterial disease [OR 2.012 (95% CI 1.088-3.720)]. Bivariate analysis for major lower extremity amputation found renal disease (0.0003), and peripheral arterial disease (0.0001) to be statistically significant factors. Major amputation was 4.414 times more likely in the presence of peripheral arterial disease [OR 4.414 (95% CI 2.087-9.334)].

Conclusion: Peripheral arterial disease was identified in 21.8% (62/284) of diabetic Charcot neuroarthropathy patients who underwent osseous reconstruction. Peripheral arterial disease increased the risk of delayed healing by 2.012 folds, and major lower extremity amputation by 4.414 folds. Peripheral arterial disease was found to have an impact on delayed healing and major lower extremity amputation, and no impact on dehiscence.

**Level of Evidence:** 2

***Early Weightbearing Following Foot and Ankle Surgery: A Systematic Review with Meta-Analysis***

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**Abstract:**

Early weightbearing following foot and ankle surgery has gained greater acceptance in recent years, with improvements in fixation constructs and surgical techniques. The objective of our study was to perform a systematic review and meta-analysis of the efficacy of early weightbearing following a variety of foot and ankle procedures.

Electronic databases were searched, including PubMed and Ovid MEDLINE, to identify original prospective or retrospective studies reporting on early weightbearing following foot and ankle surgery published between 2000-2017. Fourteen studies comprising 620 subjects were included in our review. We found that early weightbearing is a safe, effective alternative to traditional non-weightbearing postoperative protocols following foot and ankle surgery, as made evident by the random effects model used for this study, which showed that 96.4% (95% CI 93.9 to 98.3) of patients that underwent surgical intervention involving elective joint fusions, traumas, and soft tissue procedures had successful outcomes with respect to early weightbearing.

In conclusion, the currently published literature supports early weightbearing following several foot and ankle surgeries involving the forefoot, midfoot, hindfoot, and ankle. However, extrapolating that it is acceptable to allow early weightbearing following all of our surgeries must be cautioned.

Additional studies, including more complex procedures, should be performed, as fixation methods and surgical techniques continue to improve.

**Level of Evidence:** III – A Systematic Review of Level-3 Studies

***Disparities in Inpatient Management and Outcomes of Diabetic Foot Infections***

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Kirsten C. Concha-Moore, BS
Muhanad M. Diri, BS
Bo Hu, PhD
David Marrero, PhD
Wei Zhou, MD, FACS
David G. Armstrong, DPM, PhD, FACFAS

**Abstract**

**Introduction**

Disparities among minority patients with diabetic foot management are not well understood. This study aimed to evaluate the disparities in the inpatient management and outcomes of African American, Hispanics and Native Americans and White patients with the diagnosis of diabetic foot infection.

**Patients and Methods**

National Inpatient Sample from 2002 to 2015 was queried from the Healthcare Cost and Utilization Project to identify patients who were admitted for the management of diabetic foot infection using International Classification of Diseases-9 codes. Amputations, revascularizations, and hospital length of stay were the outcome measures. Associations between ethnicities and outcomes were assessed via multivariable regression analyses.

**Results**

Among 150,701 admissions, 30% underwent a minor amputation, 6% underwent a major amputation, 2% underwent an open bypass, and 5.7% had an endovascular procedure. There was a decreasing trend in major amputations and an increasing trend of minor amputations ($P<0.05$). The risks for major amputation were significantly higher for minority patients compared to White ($p<0.05$). Hispanics (OR 1.3, 95%CI 1.2-1.5) and African Americans (OR 1.2, 95%CI 1.1-1.4) were more likely to receive vascular interventions than Whites ($p<0.05$). Native Americans with DFI were less likely to receive revascularization procedures (OR 0.6, 95%CI 0.3- 0.9, $p=0.03$) than Whites. The mean length of stay was significantly longer for African Americans and Hispanics than Whites ($p<0.001$).

**Conclusions**

This present study suggested the necessity to address and limit racial and ethnic disparities in the treatment and outcomes of these at-risk patients and to further promote equity in care.

**Level of Clinical Evidence:** II (Prognostic Study)

A Scientific Approach to Surgery of the Foot

***Management of Calcaneal Fracture Malunion with Bone Block Distraction Arthrodesis: A Systematic Review and Meta-Analysis***

Mitchell J. Thompson, DPM
Thomas S. Roukis, DPM, PhD, FACFAS

**Abstract**

Calcaneal fractures remain one of the most difficult fractures to treat with the possibility of life altering complications. One of the more severe complications is malunion of the calcaneus. When a malunion occurs, subtalar bone block distraction arthrodesis provides restoration of calcaneal height, length, correction of varus deformity and elimination of subtalar joint arthritis.

We undertook a systematic review and meta-analysis to determine the complications and union rates of subtalar bone block arthrodesis for calcaneal malunions. The databases used for the present review included Cochrane Database of Systematic Review®, PubMed, Ovid SP and Google® scholar. After screening for inclusion and exclusion criteria, we identified 16 relevant studies with 278 procedures and a weighted mean follow-up of 40.3-months. Our quantitative synthesis showed the union rate for all procedures was 95.78% (95% confidence interval of 92.35% to 98.41%) with a non-significant heterogeneity (Q=4.1, p-value=0.9974).

The overall complication rate was 38% for all procedures. We determined that the incidence of complications encountered significantly correlated with the number of procedures performed by the publication authors. Specifically, the incidence of all bone complications was 2.4 times higher and soft-tissue complications was 6.3 times higher in those studies with $\leq$ 15 procedures included.

This is the first study to categorically break down complications and report on rates for these complications with statistical analysis. The data presented indicates the level of difficulty of the subtalar distraction bone block arthrodesis for calcaneal malunions and may even suggest the need for newer techniques.

**Level of Evidence:** Level IV, Systematic Review with Meta-analysis of Level IV Studies

***Surgical Trends in the Treatment of Lisfranc Injuries using the American Board of Orthopaedic Surgery (ABOS) Certification Examination Database***

Avais Raja, MD
Fernando Pena, MD

**Abstract**

**Purpose:** Lisfranc joint complex injury may be managed surgically by either an open reduction internal fixation (ORIF) or primary arthrodesis (PA). Published literature advocates PA for purely ligamentous injuries, but in actuality, many surgeons refrain from performing PA. The purpose of the study is to assess surgeon practices and behavior in managing Lisfranc injuries due to the influence of peer reviewed literature with the help of the ABOS database.

**Methodology & Procedure:** Data was requested from the ABOS database of cases on Lisfranc joint injury requiring either an ORIF or PA from examination year 2004 to 2017 for both Part II and maintenance of certification (MOC) examinees. Cases with ICD-9 code 838.03 only were considered as primarily-ligamentous and all fracture codes classified under 825 with 838.03 were considered as fracture-dislocation. The number of PA and ORIF were recorded for both types of examinees and specific type of Lisfranc joint injury (primarily-ligamentous and fracture-dislocation).

**Results:** 2010 cases of Lisfranc joint injuries managed surgically by 1230 board eligible orthopaedic surgeons. Open fractures (ninety-three) and non-/mal-union fractures were excluded. One thousand and sixteen primarily-ligamentous and four hundred seventy-four fracture-dislocation cases were performed by Part II examinees, respectively. Two hundred eighty-eight primarily-ligamentous and one hundred thirty-nine fracture-dislocation cases were performed by MOC Examinees. A total of twenty-seven PA were performed in the primarily-ligamentous and seventeen were performed on fracture-dislocation cases.

**Analysis & Discussion:** ORIF is commonly performed by newly trained orthopaedic surgeons. There was no change in the number of PA performed on primarily-ligamentous injuries in spite of the published literature.

**Level of Evidence:** Level III (Therapeutic)

***Early Post-operative Physical Therapy is Associated with Improved Recovery after Hallux Valgus Surgery***

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Ioulia Christopoulos, PT, DPT
Christine Butz, PT, DPT
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Adam E. Fleischer, DPM, MPH, FACFAS

**Abstract**

Obtaining optimal patient outcomes is an important part of elective outpatient surgery. Although literature has identified that physical therapy after hip, knee and hindfoot surgery can improve patient function, physical therapy is not well studied or well understood for patients undergoing forefoot procedures. The purpose of this study was to explore the relationship between patient reported outcome measures after undergoing hallux valgus surgery and formal physical therapy.

112 consecutive patients (112 feet) who underwent surgical correction of hallux valgus were included in this study. All patients were assessed pre and post-operatively utilizing the Foot and Ankle Outcome Score (FAOS), a validated patient-centered outcome measure for hallux valgus surgery. Patients then underwent a physical therapy program utilizing a protocol tailored for hallux valgus surgical correction. 100/112 (89.2%) of patients completed the course of therapy as prescribed by the treating surgeon. On average, physical therapy started 10 days $\pm$ 3.1 days (range 6 – 15 days) after the surgical procedure and patients were in therapy for an average of 8.6 $\pm$ 5.3 weeks (median: 6.9 weeks; range 1.5 – 27.8 weeks). Patients attending 10 or more physical therapy sessions reported less pain, better function and higher foot-related quality of life at their final follow up compared to those attending less than 9 physical therapy sessions. Plantarflexion of the 1st MTP joint was identified as being related to higher post-operative FAOS pain subscale scores.

Formal physical therapy appears to be associated with enhanced outcomes after bunion surgery and 10 – 12 sessions appear to be the ideal number of sessions to obtain improved outcomes. While it is difficult to know from our data how these improvements are occurring, it is reasonable to assume that improved 1st ray function and improved patient confidence likely play a role.

**Level of Clinical Evidence:** 3

***Conservative Versus Surgical Management of Fifth Metatarsal Diaphyseal Fractures: A Retrospective Review***

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Cynthia A. Luu, DPM, AACFAS
Kerry J. Sweet, DPM, FACFAS

**Abstract**

Historically, distal fifth metatarsal diaphyseal fractures have been treated with conservative management with only limited research evaluating surgical treatment of these fractures. This study was performed to compare surgical versus conservative treatment of distal fifth metatarsal diaphyseal fractures in both athletes and non-athletes.

A retrospective review of 53 patients with surgical or conservative treatment of isolated fifth metatarsal diaphyseal fractures was performed. Data recorded included age, sex, tobacco use, time to clinical union, time to radiographic union, athletic versus non-athletic status, time to return to full activity, surgical fixation method and complications.

Patients treated surgically had a mean clinical union time of 8.2 weeks, radiographs union time of 13.5 weeks, and returned to activity in 12.9 weeks. Patients treated conservatively had a mean clinical union time of 16.3 weeks, a radiographic union of 25.2 weeks and return to activity time of 20.7 weeks. Delayed and/or nonunions occurred in 27.0% (10/37) of the patients treated conservatively and 0% in the surgical group.

Surgical treatment significantly decreases time to radiographic union, clinical union and return to activity by at least 8 weeks as compared to conservative treatment. We recommend surgical treatment of distal fifth metatarsal shaft fractures in patients that do not have other contraindications to surgery.

**Level of Clinical Evidence:** 3

***Effect of the 1st Tarsometatarsal (Modified Lapidus) Arthrodesis on Hindfoot Alignment***

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Alan R. Catanzariti, DPM, FACFAS

**Abstract**

The purpose of this study is to demonstrate the effect of 1st tarsometatarsal (modified Lapidus) arthrodesis on hindfoot alignment. We reviewed the radiographs of 39 patients, 40 feet (16 right feet and 24 left feet in 6 males and 34 females; mean age 43 years) who underwent hallux valgus reconstruction and isolated 1st tarsometatarsal arthrodesis. Patients who had ancillary osseous procedures were excluded from the study, with the exception of proximal phalangeal osteotomy to address hallux interphalangeus.

The mean time to follow up was 33.78 weeks (8.45 months), median 21.5 weeks. Statistically significant differences were found between pre-operative and post-operative measurements for talar declination (-3.3 $\pm$ 3.5), lateral talocalcaneal angle (-3.1 $\pm$ 3.9), lateral Meary's angle (-4.2 $\pm$ 4.9), medial cuneiform height (3.5 $\pm$ 4.6), medial cuneiform to fifth metatarsal distance (4.7 $\pm$ 4.5), AP talocalcaneal angle (-2.8 $\pm$ 5.3), and percentage of talar head uncovering (-6.6 $\pm$ 7.6). Our results suggest that 1st tarsometatarsal arthrodesis can affect hindfoot alignment on AP and lateral radiographs.

**Level of Evidence:** Therapeutic, Level IV: Case Series

***Is There Any Added Value of the Akin Osteotomy in Hallux Valgus Corrective Surgery? An Analysis of Patient-Centered Outcomes in 92 Subjects***

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Matthew D. Sorensen, DPM, FACFAS
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**Abstract**

The Akin proximal phalanx osteotomy is a relatively common adjunctive procedure performed during hallux valgus surgery; however, few studies validating its indications, efficacy, and/or long-term value have been reported. Furthermore, no studies have yet explored whether there are meaningful differences in patient-reported outcomes among patients undergoing hallux valgus correction that includes an Akin osteotomy versus those that do not.

In this work we retrospectively compared patient outcomes in our urban-based foot and ankle specialty practice between patients who underwent hallux valgus correction consisting of Scarf osteotomy only (n=26) and Scarf osteotomy plus Akin osteotomy (n=66) from January 2013 to December 2015. The mean age of the cohort was 51.2 ± 13.0 years, with mean BMI of 24.9 ± 3.1 kg/$m^2$ and mean follow up of 57.4 ± 11.7 weeks. The Akin group had slightly larger hallux abductus interphalangeus angles preoperatively (8.0 ± 3.5° versus 10.5 ± 3.5°, p=0.003), but both groups achieved comparable radiographic correction at final follow up ($p > 0.05$ for all angles). There were no significant group differences with respect to pain, symptoms, ADLs, sports/rec, or foot-related QoL (all p value > 0.05) preoperatively or at 12 months postoperatively as assessed using the Foot and Ankle Outcome Scores (FAOS) – a patient-centered outcome measure that has been validated for use in hallux valgus surgery.

Our study suggests there may be little added benefit outside of aesthetics when using Akin osteotomies adjunctively during hallux valgus surgery.

**Level of Clinical Evidence:** 3

## Surgery of the Ankle

***Osseous and Soft Tissue Complications Associated with Foot and Ankle Surgery in Patients with Rheumatoid Arthritis Taking A Variety of Anti-Rheumatic Medications***

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**Abstract**

There are multiple anti-rheumatic drug modalities available for patients with symptomatic rheumatoid arthritis that function to suppress the overactive immune system, but the inflammatory and immune suppression may contribute to postoperative complications. The purpose of this study was to determine if anti-rheumatic medications increased the risk of both soft tissue and osseous postoperative complications in patients with rheumatoid arthritis that underwent foot and ankle surgery.

Patients with rheumatoid arthritis, aged 18 years and older, who underwent either an elective or non-elective foot or ankle surgery involving an osseous procedure between 2009 and 2014 were reviewed. Chart review was conducted to document procedure type, active medications, and postoperative complications. Of the final 110 subjects meeting inclusion criteria, thirty-one (28%) patients had a postoperative complication (thirteen soft tissue, nine osseous, and nine with both a soft tissue and bone).

There was no statistically significant association between taking anti-rheumatic medications in the perioperative period and postoperative complications. Increased surgery duration and peripheral neuropathy were associated with a statistically significant increase in postoperative complications. Every fifteen minutes of increased surgery time lead to a 1.2-fold increase in complication risk. Non-elective versus elective procedures had a higher risk of soft tissue complications (OR=4.2; 95% CI: 1.1-16.0). While there was no statistically significant association with the specific medication and complications, some medications trended toward statistical significance.

When working with patients with rheumatoid arthritis, our findings suggest the importance of considering the risk of surgery duration and the potential risk of anti-rheumatic medications in the perioperative period.

**Level of Evidence**: 2, Retrospective

***Assessing Modifiable Risk Factors in Total Ankle Arthroplasty***

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**Abstract**

Total ankle arthroplasty continues to be addressed within the literature as a progressively more reliable procedure for ankle arthritis. It has been established that total ankle arthroplasty has similar costs and long term outcomes compared to other total joint arthroplasty. Controversy continues to be identified in relation to the relative contraindications of total ankle arthroplasty, specifically related to comorbidities and modifiable risk factors. In addition, there remains a gap in the literature related to the cost of modifiable risk factors and comorbidities in total joint arthroplasty, with total ankle arthroplasty having the greatest paucity of literature.

We investigated the relationship between preoperative modifiable risk factors and comorbidities with the cost of total ankle arthroplasty in 141 patients over a 10 year period in a multi-centered health system. Patient medical records were evaluated using ICD-9 and ICD-10 codes and were analyzed for diabetes mellitus, elevated HbA1C, blood glucose, obesity, smoking, hypoalbuminemia, anemia, and vitamin D deficiency. We established that a direct correlation exists between the cost of total ankle arthroplasty and diabetes, obesity, and smoking. Moreover, we evaluated patients with multiple modifiable risk factors and were able to evaluate combinations of these risk factors and demonstrate the synergistic and compounding effects these have on the cost of total ankle arthroplasty.

It is imperative that the foot and ankle surgeon effectively evaluate their patient in the preoperative setting for these modifiable risk factors.

**LEVEL OF CLINICAL EVIDENCE:** II Prognostic

***A Comparison of Outcomes of Revision Surgical Options for the Treatment of Failed Bulk Talar Allograft Transfer: A Systematic Review***

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Jeffrey Holmes, DPM, FACFAS
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**ABSTRACT**

Talar bulk osteochondral allograft transplantation is a useful treatment strategy for large, uncontained osteochondral lesions of talus. Complications and high revision rates from osteochondral talar allograft transfer can be common. Talar graft failure is a devastating complication that results from failure of allograft incorporation within the host bone and subsequent resorption and sometimes subsidence can occur. Treatment options and outcomes for graft failure have rarely been reported. The purpose of this study is to evaluate treatment options and their outcomes for treating talar allograft failure.

A systematic review was completed to find all reports of salvage treatments for talar graft failure and outcomes of these reports were analyzed. Nine studies involving a total of 199 ankles, in 197 patients, met the inclusion criteria. The allograft failure rate was 24.6% in these studies with a reoperation rate of 27.6%. With limited reports, satisfactory outcomes for treatment of graft failure with ankle arthrodesis was 71.4% (10/14 patients), 60% (6/10 patients) for revision allograft procedures, and 50% (1/2 patients) for total ankle arthroplasty.

Considering the large failure rate and reoperation rate for bulk talar allograft transplantations, superior revision and salvage options are needed. More prospective cohort studies focusing on consistent and standard outcome measures are needed to further assess revision options for failed talar allograft procedures.

**Level of Clinical Evidence**: IV

***The Effect of Varying Magnitudes of Applied Clamp Force on the Coronal Plane Reduction of the Ankle Syndesmosis: A Cadaveric Study***

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Viraj Rathnayake, DPM
Gerald Merritt, IV, DPM
Derrick Roland, DPM
Steven M. Spinner, DPM, FACFAS
Albert V. Armstrong, DPM
Patrick Hardigan, PhD

**Abstract**

**Background:** Overcompression of the ankle syndesmosis is considered improbable by many, owing to an oft-cadaveric study. Recent studies utilizing computerized tomography (CT) however, have demonstrated otherwise. The purpose of the present study was to evaluate the effect of varying magnitudes of applied clamp force on the coronal plane reduction of the ankle syndesmosis.

**Methods**: Eight through the knee cadaveric specimens were obtained. Fiducial screws were placed in the tibia and fibula to standardize placement of the reduction clamp's tines. CT scans were obtained as controls, followed by destabilization of the syndesmosis. Reductions were performed utilizing a clamp equipped with an in-line load cell, and objective forces applied sequentially (60N, 80N, 100N, 120N, 140N, 160N) to each specimen. The syndesmosis was fixated with a single quadricortical screw, and CT scans repeated for assessment.

**Results**: Applied clamp forces of 60N and 80N resulted in varying degrees of lateral fibular displacement (p=0.999) and undercompression (42.9%, 57.1%); while forces of 140N and 160N resulted in significant degrees of medial fibular displacement (p=0.011, p=0.001) and overcompression (100%). Overall, clamp forces of 100N and 120N resulted in the smallest fibular displacements compared to the intact state. No correlation was identified between CT parameter "c" and the tibiofibular clearspace [r(54) = 0.22, (95% CI:-0.04,0.45), p = 0.101].

**Conclusion:** The ideal applied force to minimize iatrogenic coronal plane malreduction of the ankle syndesmosis from under/overcompression ranged from 100 to 120N in our cadaveric model. CT assessment of the mediolateral displacement of the fibula proved superior to radiographic assessment.

**Level of Evidence**: 5

***Total Ankle Arthroplasty Survivorship: A Meta-analysis***

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Philip Basile, DPM, FACFAS

**Abstract**

The gold standard for management of end-stage ankle arthritis was previously ankle arthrodesis, however improvements in total ankle replacements (TAR) are making this a more viable treatment option. The primary aim of this meta-analysis was to evaluate the survivorship of total ankle replacement implants currently in use.

An extensive search strategy initially captured 20,842 citations which were evaluated for relevance. Abstract screening produced 97 articles to be read in entirety, of which 10 articles studying 1963 implants met all prospective inclusion criteria for analysis.

Overall survivorship of all implants was 93.0% [95% confidence interval (85.2%-96.9%)] using a random effect model. There was significant heterogeneity between the studies (Q=131.504). Meta-regression identified an inverse relationship between survivorship and study follow-up duration ($p<0.0001$). Furthermore, age ($p=0.36$) and implant type [fixed-bearing (95.6%, 95% confidence interval 85.9%-98.7%) versus mobile-bearing (89.4%, 95% confidence interval 79.6%-94.8%)] did not have a statistically significant impact on survivorship, $p=0.213$. However patients with higher pre-operative functional scores had improved survivorship, $p=0.001$.

Complications were inconsistently reported with varied definitions. In order of reported frequency, complications were classified into technical error (28.15%), subsidence (16.89%), implant failure (13.28%), aseptic loosening (6.3%), intra-operative fracture (5.67%), wound problems (4.3%), deep infection (1%) and post-operative fracture (0.0001%). Overall study quality was low with only 10% being prospective and 90% from non-registry data.

The results from this meta-analysis revealed a promising overall survivorship of current implants in use for total ankle replacement, however higher quality studies with standardized outcomes measures are needed.

**Level of Clinical Evidence:** Level 1

***Complications and Consequence: Odds For 30 Day Postoperative Complications and Disposition Following Ankle Fracture Surgery in Patients with Diabetes Mellitus in a Large-Scale Population Cohort***

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Jennifer W. Liu
Junho Ahn
Katherine M. Raspovic, DPM, FACFAS
Dane K. Wukich, MD

**Abstract**

**Background**
The purpose of this study was to evaluate the rate of complications in patients with and without diabetes mellitus (DM) in the 30-day postoperative period following ankle fracture surgery.

**Methods**
Patients who underwent operative management for ankle fractures between 2012 and 2016 were identified in the American College of Surgeons National Surgical Quality Improvement Program® database using Current Procedural Terminology codes for ankle fracture surgery.

**Results**
A total of 19,547 patients undergoing ankle fracture surgery were identified. A total of 19,547 patients undergoing ankle ORIF were identified from the years 2012 through 2016. Of these, 2,245 (11.49%) patients had DM, and 17,302 (88.51%) patients did not have DM.

Compared to patients without DM, patients with DM had significantly higher rates of organ/space SSI, pneumonia, unplanned intubation, on mechanical ventilation >48 hours, acute renal failure, urinary tract infection, cardiac arrest requiring CPR, myocardial infarction, bleeding requiring transfusion, sepsis, and septic shock. Patients with DM did not have significantly higher rates of superficial surgical site infection, deep surgical site infection, wound dehiscence, pulmonary embolism, renal insufficiency, cerebrovascular accident, or deep vein thrombosis.

Patients with DM were 2.45 times more likely to undergo unplanned readmission, 2.85 times more likely to undergo unplanned reoperation, and 4.21 times more likely to die within 30 days of operation than patients without DM.

**Conclusion**
In this large-scale population analysis, we demonstrate that DM is a strong predictor of 30-day postoperative complications and subsequent unplanned readmission, unplanned reoperation, length of stay and mortality following ankle fracture surgery.

**LEVEL OF EVIDENCE:** Level III, retrospective cohort study

***Proximal Placement of the Syndesmotic Reduction Clamp Affects the Optimal Position of the Medial Tine: A Cadaveric Study***

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Viraj Rathnayake, DPM
Gerald Merritt, IV, DPM
Derrick Roland, DPM
Steven M. Spinner, DPM, FACFAS
Albert V. Armstrong, Jr., DPM
Patrick Hardigan, PhD

**Abstract**

**Background**: Sagittal plane syndesmotic malreduction is associated with off-axis, eccentric reduction clamping; and preferential placement of the medial tine anteriorly on the tibia has been proposed to minimize the malreduction risk. The purpose of the present study was to evaluate whether proximal placement of the reduction clamp affects the optimal position of the medial tine.

**Methods**: Six through the knee cadaveric specimens were obtained. Kirschner wires and a maker were used to denote placement for the syndesmotic reduction clamp laterally on the peroneal ridge of the fibula, and medially within the anterior, middle, and posterior thirds (Zones A, B, C) of tibia's width; 1cm and 2cm proximal to the ankle. CT scans were obtained as controls, followed by destabilization of the ankle syndesmosis. Reductions were then performed sequentially at each level (1cm, 2cm) and zone (A, B, C); and CT scans repeated for assessment.

**Results:** For all positions of the medial tine, proximal placement of the reduction clamp resulted in a trend toward malreduction. The Sagittal and axial plane malreduction's were significantly correlated (p=0.004), but the coronal plane malreduction's were not (p=1.000). Overall, positions B1/2 resulted in the lowest malreduction rates (0%, 17%); compared to positions A1/2 (17%, 33%), and C1/C2 (66%, 83%).

**Conclusions:** Proximal placement of the reduction clamp resulted in higher malreduction rates for all positions in our cadaveric model. Placement along the neutral anatomical axis (B1/B2) reduced the syndesmosis most accurately.

**Level of Evidence**: 5

***The Relationship Between Polyethylene Insert Size and Complications in Total Ankle Replacement***

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Kelly K. McConnell, DPM, AACFAS
Britton S. Plemmons, DPM, AACFAS

**Abstract**

The purpose of this study was to compare complication rates after total ankle replacement in two groups of patients based on polyethylene insert size.

The total cohort was divided into two groups based upon insert size. Group one included patients with polyethylene insert size of less than 10 mm in thickness. Group two included patients with polyethylene insert sizes 10 and greater. Available charts were reviewed for patients who underwent primary total ankle arthroplasty by one surgeon. Patient demographics, polyethylene insert size, implant used, concomitant procedures, postoperative complications, and patient reported outcome scores were recorded. 100 patients were available for follow-up and were included in this study which ranged from March 2012 to July 2017. The average follow-up was 31.3 months (10-60). 48 females and 52 males were included in this study.

There were a total of 63 patients in group one, and 37 patients in group two. The total complication rate for group one was 11.1% (7/63) and 16.2% (6/32) for group two. There was no statistical significance in complication rates when comparing the two groups (p=0.5427). All patients underwent at least one concomitant procedure at the time of initial ankle replacement.

Our findings show that total ankle replacement complication rates are equal when comparing large polyethylene inserts commonly utilized to correct deformities, versus small polyethylene inserts commonly utilized in primary resurfacing.

**Level of Clinical Evidence:** 3 Retrospective comparative study

***Dual Plating Technique: Outcome Comparisons in Complex Ankle Fractures and Concurrent Complex Comorbidities***

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Devin S. Bland, DPM, AACFAS
Loren Spencer, DPM, FACFAS
Devin Wahlen, DPM, AACFAS
Adebola T. Adeleke, DPM, AACFAS
Brooke Lynn Anderson, BS

**Abstract**

Ankle fractures are a common orthopedic injury which often require open reduction internal fixation (ORIF) in order to decrease the risk of posttraumatic arthritis. There are certain instances when more rigid fixation is needed i.e. osteopenia, neuropathy, and obesity.

Dual/orthogonal plating of the fibula has been shown to be a promising adjunct in previous studies. The authors report on 181 dual plated fibulas and their postoperative outcomes vs standard single plating of the fibula. One thousand four hundred seventy-seven bimalleolar and trimalleolar ankle fractures were identified for this study. Retrospective chart review was performed for obesity, osteopenia, as well as neuropathy. Of the 1477 ankle fractures, 611 (41.37%) patients qualified for the study, 181 (29.62%) dual plate and 430 (70.38%) single plate constructs.

In these records the areas that were compared were the following: dehiscence, failure of hardware fixation, loss of mortise length, height or width, loss of fibular length, catastrophic hardware failure, mal-unions, non-unions, and peroneal tendonitis. There were statistically significant P values when comparing single plate vs dual plating of the fibula in these areas: hardware failure (0.007), revisional surgery (0.007), hardware removal (0.034), Loss of fibula length (0.005), Loss of Mortise width (0.010), non-union/malunion (0.002), in the single plate group. Peroneal tendonitis, and postoperative cellulitis were not significant (0.10) and (0.94) respectively in either group.

Single-plate fixation is significantly associated with increased post-operative complications in a population of patients with and without morbid obesity, osteoporosis, and/or neuropathy.

Level of Clinical Evidence: Therapeutic
Level 3- Retrospective comparative study

***Supramalleolar Osteotomy for Treatment of Varus Ankle Arthritis: A Systematic Review***

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Said Atway, DPM, FACFAS

**Abstract**

A systemic review of all the current literature on the use of Supramalleolar Osteotomy in varus ankle deformity was performed to determine the outcomes, angular improvements, non-union rate, and revision rates associated with the procedure.

17 studies involving 465 supramalleolar osteotomies met the inclusion criteria. The weighted average AOFAS score improved from 55.1 to 78.5 at a weighted mean follow-up of 50.5 months. There was a weighted mean non/delayed union rate of 5.4% with a weighted mean revision rate of 9%. Revision was strictly defined as progression to total ankle arthroplasty or ankle arthrodesis.

Our systemic review revealed that supramalleolar osteotomy for treatment of early to moderate-degree ankle arthritis is an effective procedure with relatively predictable results that can delay or prevent eventual end-stage treatment options.

**Level of Clinical Evidence:** 3

***A Comparison of Split Peroneus Brevis Tendon and Semitendinosus Allograft Tendon for Lateral Ankle Ligament Reconstruction***

Roland S. Ramdass, DPM
Kevin R. Grierson, DPM

**Abstract:**

Lateral ankle instability is a debilitating condition that is often unresponsive to conservative therapy. Many techniques for operative repair have been proposed, most commonly performed as the Brostrom or modified Brostrom procedure. In patients with failed primary repair, hereditary collagen disorders, strenuous work activity, obesity, or ligamentous laxity, the Brostrom repair is less likely to be successful, and anatomic or non-anatomic reconstruction should be considered.

The purpose of this study is to compare the functional outcomes and patient satisfaction between anatomic and non-anatomic reconstruction of the lateral ankle ligament complex for lateral ankle instability using a retrospective cohort study.

We evaluated 64 ankles in 62 patients who underwent either a split peroneus brevis tendon or semitendinosus allograft tendon reconstruction for lateral ankle instability performed by the same surgeon. Post-operative AOFAS ($p=0.943$) and patient satisfaction ($p=0.279$) found no significant difference between either technique.

Our results suggest that both split peroneus brevis and semitendinosus allograft may be viable alternatives for lateral ankle instability when primary ligamentous repair is not attainable.

**Level of clinical evidence:** 3