

## SUBTALAR JOINT ARTHRODESIS

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### ABSTRACT

Forty patients (12 men and 28 women) who were treated with an isolated subtalar joint arthrodesis were retrospectively reviewed. The average patient age was 50 years (range 21 to 76). Preoperative diagnoses included posterior tibial tendon dysfunction, post-traumatic arthritis, nontraumatic arthritis, and subtalar joint middle facet coalition. The average follow up period was 15 months (range 12-74 months).

Subjective postoperative questionnaire results were obtained and classified as satisfied (n=32), satisfied with reservations (n=4), or dissatisfied (n=4). Eight-two percent the patients (n=33) stated that they would have the procedure performed again. The minor complications, those complications that resolved with nonoperative treatment, occurred in 55% of patients. However, the major complication rate was only 12.5%.

This study compared the preoperative diagnosis with the postoperative outcomes showed no statistical correlation. In summary, isolated subtalar joint arthrodesis is an effective treatment for pain and deformity of the hindfoot. Our results suggest that the prevalence of complications is slightly greater than previously reported.

Keywords: isolated subtalar joint arthrodesis, posterior tibial tendon dysfunction, arthritis, coalition, complication.

### INTRODUCTION

Isolated subtalar joint arthrodesis has been recommended for posttraumatic arthropathy, neurologic disorders, primary osteoarthritis, talocalcaneal coalition, posterior tibial tendon insufficiency, and inflammatory arthritis. The goals of this procedure are to eliminate pain, restore stability, and realign the hindfoot. High patient satisfaction and low complication rates have been reported with this procedure.<sup>1-9</sup> Isolated subtalar joint

arthrodesis has been recommended as an alternative to triple arthrodesis for pathology confined to the subtalar joint. Isolated subtalar joint arthrodesis preserves approximately 50% of the midtarsal joint motion relative to triple arthrodesis.<sup>7,10,11</sup>

Although isolated subtalar joint arthrodesis is well documented, most reports neglect to evaluate how the preoperative diagnosis influences postoperative outcomes and complications. The purpose of this study was to identify the complications and patient satisfaction associated with isolated subtalar joint arthrodesis. In addition, the authors will attempt to correlate these complications to the preoperative diagnosis.

### METHODS

Forty consecutive patients who underwent isolated subtalar joint arthrodesis from 1994-2000 were retrospectively reviewed at the Western Pennsylvania Hospital. Isolated subtalar joint arthrodeses were performed in patients with a preoperative diagnosis of adult acquired flatfoot secondary to posterior tibial tendon dysfunction, tarsal coalition, and primary and posttraumatic subtalar joint osteoarthritis. Patients were excluded from this study if any additional arthrodesis procedures were concomitantly performed. Medical records and radiographs were evaluated. The collected clinical data included sex, age, preoperative diagnosis, occupation, history of systemic illness, previous surgery, type and duration of nonoperative care, concomitant procedures, type of fixation, type of bone graft, time to osseous union, follow up time, time to full weight bearing, smoking history, and postoperative complications. Nonoperative therapy included modification of activities or occupational status, non-steroidal anti-inflammatory medication, immobilization, orthoses, ankle-foot orthoses, various types of braces, physical therapy, and arthrocentesis with corticosteroid. All patients in this

study failed nonoperative care.

The diagnostic tools utilized to evaluate the subtalar joint included standard foot and ankle radiographs, advanced imaging (computer tomography (CT) and magnetic resonance imaging (MRI)), and diagnostic intra-articular injections. Preoperative and postoperative weightbearing anterior-posterior and lateral foot and ankle radiographs, and calcaneal axial radiographs were evaluated for degenerative joint disease, tarsal coalition, and osseous union of the subtalar joint. Osseous union following subtalar joint arthrodesis was recorded when no subtalar joint motion was detected on clinical exam and evidence of trabeculation across the arthrodesis site was observed on plain radiographs (Fig 1A,B). Patients who did not meet these criteria were evaluated with the use of CT. A delayed union was defined as a successful fusion between 6-9

months postoperatively with the same aforementioned clinical and radiographic union characteristics. Radiographic angles were not analyzed due to the wide variety of preoperative foot pathology. Additionally, a postoperative subjective questionnaire was obtained at the last follow-up visit to determine patient satisfaction. Patients were questioned about their level of pain, cosmesis, functional capacities, use of walking aids, and ability to wear shoes (Table 1).

This study evaluated minor and major postoperative complications. Minor complications were defined as transient postoperative symptomatology that was resolved with nonoperative treatment. Major complications were defined as continued postoperative symptoms, which were recalcitrant to nonoperative treatment or required revisional surgery. These types of complications were

Table 1

### PATIENT SATISFACTION QUESTIONNAIRE

Questions	Number of patients	Percentage
<b>1. Pain – Over the past month, how has your foot pain limited your daily activities?</b>		
I have no pain with normal activities	5	12.5
I have slight/occasional pain, no compromise in activities	20	50
I have moderate pain, slight effect on activities	9	22.5
I have pain with serious limitation of activities	5	12.5
I have severe pain with total limitation of activities	1	2.5
<b>2. Cosmesis - How do you rate the appearance of your foot?</b>		
I like it very much	14	35
I mostly like it	12	30
I'm not sure either way (neutral)	9	22.5
I mostly don't like it	5	12.5
I dislike it very much	0	0
<b>3. Functional Capacities - Ability to function on one flight of stairs, inclines, uneven terrain?</b>		
I have no difficulty	14	35
I have some difficulty	23	57.5
I have significant difficulty	3	7.5
<b>4. Walking Aids</b>		
I don't use any	29	72.5
I wear a prescription brace above my ankle	2	5
I use one cane or one crutch	7	17.5
I use either crutches, a walker or a wheelchair	2	5
<b>5. Shoes</b>		
I can wear normal shoes	23	57.5
I am able to wear only walking or athletic shoes	15	37.5
I am able to wear only special order, orthopedic or custom shoes	2	5
<b>6. Overall Patient Satisfaction</b>		
I am satisfied with my surgery	32	80
I am satisfied with reservations	4	10
I am dissatisfied with my surgery	4	10
<b>7. Would you have this procedure performed again?</b>		
Yes	33	82.5
No	7	17.5

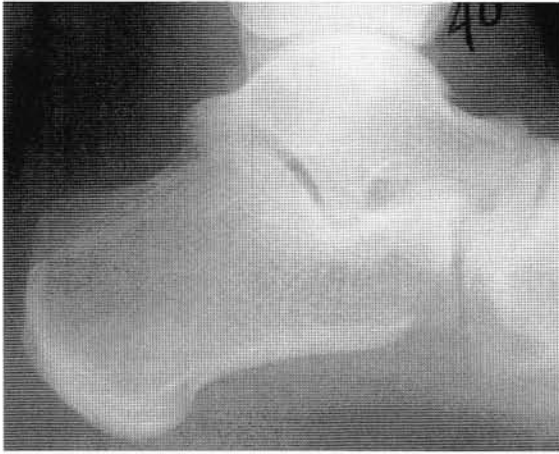


Figure 1A. Preoperative.

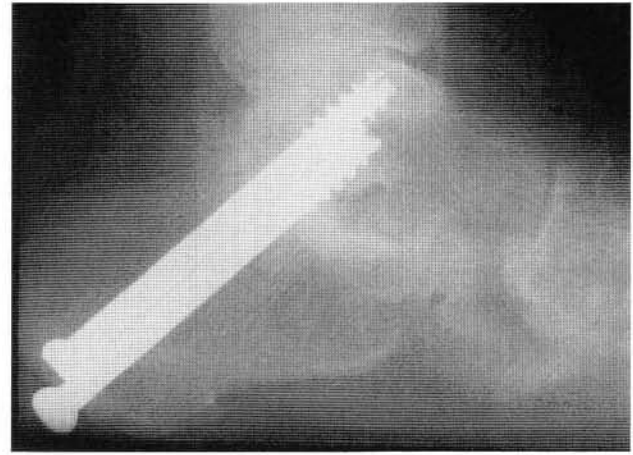


Figure 1B. Postoperative radiographs demonstrating a successful subtalar joint arthrodesis.

compared to the type of preoperative diagnoses.

The procedure was performed with the patients placed in a supine position utilizing a bump under the ipsilateral hip to gain access to the lateral hindfoot. General or spinal anesthesia was administered and a thigh tourniquet was used for hemostasis. An incision was made from the tip of the fibula extending over the sinus tarsi toward the fourth metatarsal base with care taken to identify all neurovascular structures. A communicating branch from the intermediate dorsal cutaneous nerve to the sural nerve was sometimes encountered. The peroneal tendon sheath was incised just distal to the tip of the fibula and the tendons were retracted plantarly. A deep fascial incision was made beginning just inferior to the lateral malleolus and extending distally just inferior to the extensor digitorum brevis muscle belly. A vertical deep fascia-periosteal incision was made along the sinus tarsi extending inferiorly to meet the horizontal incision. All further dissection was subperiosteal. The soft tissue contents of the sinus tarsi were evacuated. This permitted visualization of the subtalar joint middle and posterior facets and allowed access to the underlying cortical bone for decortication. The subtalar joint was mobilized and a lamina spreader was placed within the sinus tarsi region. The articular cartilage was debrided from the posterior and middle facets. Emphasis was placed on developing a healthy cancellous substrate conducive to primary arthrodesis while maintaining joint contour and talar height. Limited debridement techniques were employed. This permitted positional realignment without large deficits and prevented lateral fibular impingement from excessive loss of talar height. Additionally, maintaining a portion of the subchondral plate enhanced the stiffness of the fixation construct. The surgical site was irrigated of all cartilaginous debris and the subchondral surface was

prepared with fenestration and scaling. The subtalar joint was then positioned and provisional fixation was obtained with large cannulated guide-pins. This maneuver was performed under image intensification. Large-diameter cancellous screws were then delivered over the guide pins. Placement was confirmed with intraoperative imaging. The dorsal aspect of the calcaneus and undersurface of the talus in the sinus tarsi were then decorticated. Bone graft was packed into the sinus tarsi to augment the primary arthrodesis site. Postoperative management included 6-9 weeks in a short leg non-weightbearing cast. Patients were then advanced into weightbearing casts, rocker bottom braces, and then standard footwear. Progression to weightbearing depended on radiographic evidence of consolidation at the arthrodesis site.

Descriptive and inferential statistical procedures were used to analyze the resulting data. For each variable collected, the number and percentages or means and standard deviations were calculated. To analyze predictors of complications a chi-square analysis was performed. A statistical significance difference was defined as  $p < 0.05$ .

## RESULTS

There were 12 men (30%) and 28 women (70%) with an average age of 50 years (range 21 to 76). Preoperative diagnoses included posterior tibial tendon dysfunction ( $n = 19$ ), post-traumatic arthritis ( $n = 11$ ), nontraumatic arthritis ( $n = 6$ ), and subtalar joint middle facet coalition ( $n = 4$ ). A total of 17 patients were smokers (42.5%) and 23 patients were non-smokers (57.5%). There was one patient who had a revisional subtalar joint arthrodesis for a previous nonunion. One patient had a past medical history of psoriatic arthritis. The average follow-up period was 15 months (range 12 to 74 months) and the

mean time to full weightbearing was 14 weeks (range 7 to 60 weeks).

Radiographic and clinical assessment demonstrated that all but 4 feet went on to primary union, which lead to an overall union rate of 90%. The overall time to union ranged from 7 to 45 weeks with an average 12.6 weeks. Two of the nonunions underwent revisional arthrodesis and went on to successful union. One nonunion was lost to follow-up. One patient with a nonunion refused any further surgical intervention, and

at the time of follow-up was symptomatic, wore a brace and was on disability (Fig 2a,b,c,d,e). Three of the four nonunions (75%) were patients who smoked. There was a 17.6% non-union rate for the smoking group and a 4.6% non-union rate for the non-smoking group. Delayed unions only occurred in 3 patients. None of these patients were augmented with bone graft.

Bone grafts were utilized in 18 (45%) patients to enhance primary union, provide and maintain structural realignment, or to fill a defect. The bone grafts that were



Figure 2A. Case study of a 40 year old man with non-traumatic arthritis of subtalar joint. Preoperative lateral radiograph (a) and proton density MRI (b, c) demonstrates severe arthritic changes. CT (d) and a lateral radiograph (e) one year postoperatively confirming a nonunion.

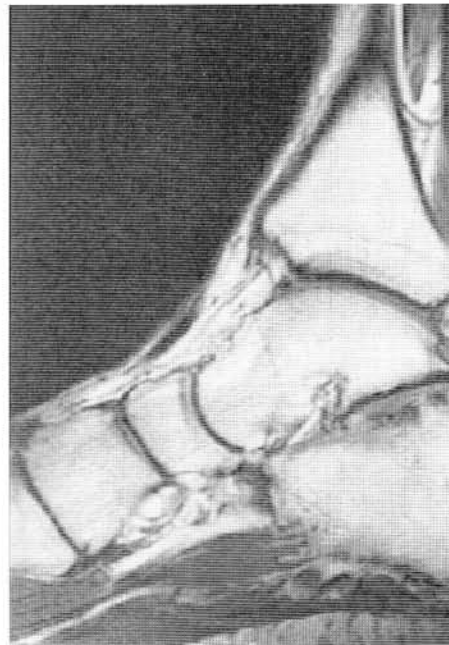


Figure 2B.

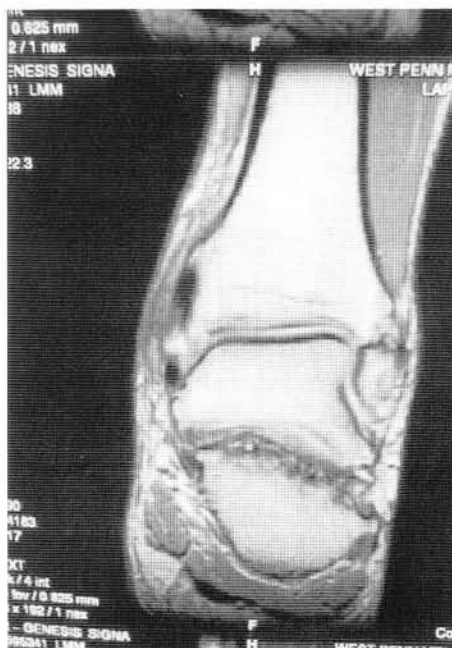


Figure 2C.



Figure 2D.

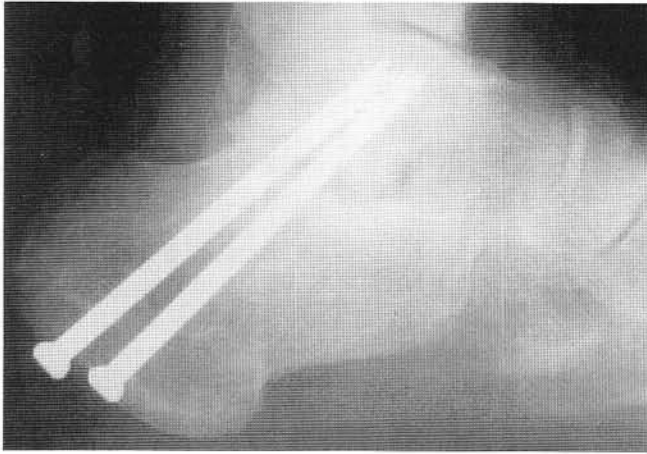


Figure 2E.

implanted included: autogenous anterior iliac crest grafts,<sup>4</sup> autogenous tibial strut grafts<sup>3</sup>, allogenic cancellous grafts<sup>5</sup> and autogenous cancellous grafts.<sup>6</sup> A total of 7 patients received a structural bone graft. Ancillary surgical procedures that were performed included: achilles tendon lengthening,<sup>12</sup> flexor digitorum longus tendon transfer,<sup>13</sup> direct repair of the tibialis posterior tendon,<sup>2</sup> subtalar joint middle facet coalition resection,<sup>4</sup> and excision of an os tibiale externum.<sup>2</sup> Large cannulated (7.0mm or 7.3mm) screws were used for internal fixation in all patients. Thirty-three patients had screws oriented from the plantar proximal calcaneal tuberosity distal dorsally into the talus while in 7 patients the screws were directed from the dorsal neck of the talus plantar posteriorly into the calcaneus.

The overall complication rate for an isolated subtalar joint fusion was 37.5% (15 of 40 patients). Nine of these patients had both minor and major complications. The minor complication rate was 55%, which included: nine painful internal fixation, six residual post-operative pain, one sural neuritis, three delayed unions, one stress fracture of the talus, stress fracture at the distal tibial metaphysis, which was the harvest site of a bone graft, and one wound dehiscence. The major complication rate was 12.5%, which included: one complex regional pain syndrome (CRPS) and four nonunions (Table 2).

The nine patients with painful internal fixation had the screws removed, which provided immediate relief of symptoms. All other minor complications went on to resolve uneventfully with the use of conservative treatment consisting of extended periods of non-weightbearing, anti-inflammatory medications, corticosteroid injections, and local wound care. The patient with CRPS failed all treatment options and was referred to a

pain management center. One patient with residual post-operative pain related continued mild to moderate pain with activity that was controlled with anti-inflammatory medications.

Patients were grouped based on the preoperative diagnosis: posterior tibial tendon dysfunction (PTTD), post-traumatic arthritis, non-traumatic arthritis, and middle facet talocalcaneal coalition. 12 of the 19 patients (63%) with PTTD had minor complications which included painful internal fixation (n = 3), sural neuritis (n = 1), delayed union (n = 3), and stress fracture at the tibial graft site (n = 1), wound dehiscence (n = 1), and residual post-operative pain (n = 3). Two of the 19 patients (10.5%) with PTTD had major complications both of which had non-unions (n = 2). Three of the 11 patients (27%) with post-traumatic arthritis had minor complications including painful internal fixation (n = 2), stress fracture of the talus (n = 1), and residual post-operative pain (n = 1). Eighteen percent (2 of the 11 patients) with post-traumatic arthritis had major complications including, CRPS (n = 1), and non-union (n = 1). Two of the four patients (50%) with a middle facet talocalcaneal coalition experienced minor complications including residual post-operative pain (n = 1) and painful internal fixation (n = 2). There were no non-unions or major complications in the coalition group. Three of the six patients (50%) with non-traumatic arthritis had minor complications which included painful internal fixation (n = 2) and residual post-operative pain (n = 1). A non-union (n = 1) was the only major complication recorded in this group (16.7%) (Table 3).

All 40 patients were evaluated by the use of a subjective questionnaire at the last follow-up visit. Fifteen percent of the patients had pain with limitation of activities. Sixty-five percent of the patients were satisfied with the resultant appearance of their foot. The ability to function on uneven terrain was somewhat difficult in 57.5% of the patients. Ninety-five percent of the patients were able to wear either normal or athletic footwear. Thirty-two patients (80%) were satisfied with the procedure, four patients (10%) were satisfied with reservations, and four patients (10%) were dissatisfied with the results of their surgery. Thirty-three patients (82.5%) responded that they would have the procedure performed again. Seven patients (17.5%) stated that they would not have the procedure performed again (Table 1).

A statistical analysis was performed to compare all the above data. No statistical significance was found due to the small sample size. However, the authors discovered a trend that showed patients who smoked had a greater chance of a non-union.

Table 2

## STJ ARTHRODESIS PATIENT PROFILE

Diagnosis	Age (yrs)	Smoker	F/U (wks)	Union	Complications
Coalition	41	No	68	Yes	None
Coalition	32	Yes	57	Yes	None
Coalition	41	Yes	56	Yes	Residual pain, Painful fixation
Coalition	42	No	61	Yes	Painful fixation
Non-traumatic DJD	40	No	66	Yes	Painful fixation
Non-traumatic DJD	59	Yes	64	Yes	None
Non-traumatic DJD	37	No	80	Yes	Residual pain
Non-traumatic DJD	62	yes	48	Yes	None
Non-traumatic DJD	42	Yes	74	No	Non-union, Painful fixation
Non-traumatic DJD	47	Yes	48	Yes	None
Traumatic DJD	35	No	66	Yes	None
Traumatic DJD	35	Yes	53	Yes	None
Traumatic DJD	35	Yes	158	Yes	None
Traumatic DJD	53	Yes	54	Yes	None
Traumatic DJD	38	Yes	48	Yes	Stress fx talus, Painful fixation
Traumatic DJD	49	No	188	No	Non-union
Traumatic DJD	21	Yes	66	Yes	None
Traumatic DJD	49	No	52	Yes	None
Traumatic DJD	61	Yes	44	Yes	Residual pain, CRPS, painful fixation
Traumatic DJD	58	No	78	Yes	None
Traumatic DJD	69	No	44	Yes	None
PTTD	68	No	64	Yes	None
PTTD	55	No	66	Yes	Dehiscence, Residual pain, Painful fixation
PTTD	67	No	277	Yes	Delayed union, painful fixation
PTTD	46	No	136	Yes	None
PTTD	58	No	42	Yes	Delayed union, Residual pain
PTTD	56	No	58	Yes	None
PTTD	56	No	68	Yes	None
PTTD	57	No	67	Yes	None
PTTD	42	Yes	61	No	Non-Union
PTTD	43	Yes	51	No	Non-Union
PTTD	27	No	47	Yes	None
PTTD	72	No	48	Yes	None
PTTD	38	Yes	40	Yes	Delayed union, painful fixation, residual pain
PTTD	65	No	43	Yes	none
PTTD	65	Yes	55	Yes	None
PTTD	45	Yes	40	Yes	Sural neuritis, Stress fx tibia
PTTD	76	No	56	Yes	None
PTTD	59	No	40	Yes	None
PTTD	60	No	36	Yes	None

Coalition = Middle Facet Coalition of Subtalar Joint; DJD = Degenerative Joint Disease; F/U = Follow-up weeks; PTTD = Posterior Tibial Tendon Dysfunction; fx = Fracture; CRPS = Complex Regional Pain Syndrome.

## DISCUSSION

There were 12 men (30%) and 28 women (70%) in our review. The high female to male ratio was similar to other isolated subtalar joint arthrodesis series that had a large number of patients with posterior tibial tendon dysfunction.<sup>5</sup> Several studies report the opposite, which can be attributed to the larger number of posttraumatic

etiologies in these series.<sup>2, 12-15</sup> The average patient age of 50 was comparable to Mangone et al.<sup>6</sup> whose average age was 53 years old. However, our patient population was approximately a decade older than previous studies whose preoperative diagnoses included mostly traumatic etiologies.<sup>7, 13</sup>

The average follow-up period was 15 months, which is a short follow up period in comparison to other

Table 3

## COMPLICATIONS OF STJ ARTHRODESIS IN RELATION TO DIAGNOSIS

Complications	PREOPERATIVE DIAGNOSIS				Total
	PTTD	Traumatic DJD	Non-traumatic DJD	Coalition	
Major					
Non-union	2	1	1	0	4
CRPS	0	1	0	0	1
Minor					
Stress fx talus	0	1	0	0	1
Stress fx tibia	1	0	0	0	1
Delayed union	3	0	0	0	3
Sural neuritis	1	0	0	0	1
Dehiscence	1	0	0	0	1
Painful fixation	3	2	2	2	9
Residual pain	3	1	1	1	6
<b>Total</b>	<b>14 (52%)</b>	<b>6 (22%)</b>	<b>4 (15%)</b>	<b>3 (11%)</b>	<b>27</b>

PTTD = Posterior Tibial Tendon Dysfunction; DJD = Degenerative Joint Disease; fx = Fracture; Coalition = Middle Facet Coalition of Subtalar Joint; CRPS = Complex Regional Pain Syndrome.

studies.<sup>5,7,8</sup> Due to the short-term follow up, radiographic evaluation of angular measures and adjacent joint arthritis were not analyzed. Adjacent joint arthrosis has been a reported long-term follow up finding after hind-foot arthrodesis procedures.<sup>7,16</sup>

Proponents of isolated subtalar joint arthrodesis agree that this arthrodesis will increase stress on the adjacent joints, but preserves the majority of motion at the midtarsal joint. Thus, the incidence of clinically significant arthrosis at the ankle joint may be less in comparison to a triple arthrodesis.<sup>11,15</sup> Talonavicular joint motion has been shown to decrease from 13-45% in vitro and 40% in vivo following an isolated subtalar joint arthrodesis.<sup>7,10</sup> Mild to moderate degenerative changes within the ankle joint (36%) and midtarsal joint (41%) has also been demonstrated following subtalar joint arthrodesis.<sup>7</sup> It is well known that neither slight varus nor excessive valgus is well-tolerated following hindfoot surgical procedures.<sup>7,10,17-20</sup> The authors believe that positional realignment of the subtalar joint is critical and may be the most significant factor relative to outcome.

There were 36 feet that went on to primary union, therefore our overall union rate was 90%. The union rates reported in the literature vary from 84% to 100%.<sup>5-8,13</sup> The overall time to union averaged 12.6 weeks, which is comparable to other studies.<sup>7</sup> The mean time to full weightbearing was 14 weeks, which is similar to previous reports of approximately 12 weeks until unprotected weightbearing.<sup>6</sup>

The impact of smoking on arthrodesis has been clearly shown to impede bone healing.<sup>1,13,21</sup> The results of our retrospective study demonstrated three of four nonunions (75%) occurred in smokers. Also, one of the

three delayed unions in our study was a smoker. Cobb et al.<sup>22</sup> reported that the relative risk of nonunion was increased 3.75 times for the active smoker undergoing ankle joint arthrodesis. Bednarz et al.<sup>1</sup> reported that four of 28 isolated subtalar joint arthrodeses resulted in a nonunion, of which all were smokers. Another study reviewed 184 isolated subtalar joint arthrodeses and reported that 73% of these 30 nonunions occurred in smokers.<sup>13</sup> Haverstock and Mandracchia<sup>21</sup> recommend that patients who smoke should seek medical treatment for nicotine addiction prior to elective foot and ankle surgery, due to the risk of delayed healing and nonunions.

Bone grafts were utilized in 45% of our patients to enhance fusion of the arthrodesis site. All seven patients treated with structural bone grafts (autogenous anterior iliac crest grafts and autogenous tibial strut grafts) went on to primary fusion. This differs from a study by Easley et al.,<sup>13</sup> which showed only 83% of the structural autogenous grafting cases when on to union. In this same study, 40% of patients that received structural allograft went on to a nonunion. In contrast, none of our patients had a structural allograft utilized. The use of structural allogenic bone graft in joint arthrodesis is a relative contraindication.<sup>23</sup> Non-structural, autogenous bone grafting in subtalar joint arthrodesis was used in a study of 45 fusions with only one patient developing a nonunion.<sup>8</sup> Kitaoka and Patzer<sup>5</sup> stated that bone grafting is unnecessary when fusing the subtalar joint in patients with posterior tibial tendon dysfunction.

Our study revealed a 37.5% overall complication rate, both major and minor complications. Some of the isolated subtalar joint arthrodesis literature indicates high union rates and low complication rates.<sup>5,6</sup> However, these

studies were only concentrated on correcting flatfoot deformities. In contrast, Easley et al.<sup>13</sup> reported markedly higher complication rates for the correction of a variety of preoperative diagnoses. Our study reflected similar findings.

Our major complications (12.5%) were CRPS and nonunions. CRPS occurred in one patient who had a subtalar joint fusion secondary to a traumatic degeneration of the joint. Similarly, Amendola and Lammens<sup>12</sup> reported CRPS as a complication after subtalar arthrodesis following a calcaneal fracture. Delayed unions occurred in two patients with a preoperative diagnosis of posterior tendon dysfunction. To the authors knowledge, delayed unions have been unreported in the literature and few studies have mentioned malunion as a post-operative complication.<sup>7</sup> No malunions were identified in our study. Four nonunions occurred in our series, and like Easley et al.'s<sup>13</sup> study we found that neither the preoperative diagnosis nor the complexity of the fusion (bone grafting or revisional arthrodesis) had any relationship to the nonunion rate. Like previous reports, our study showed that smoking greatly increased the risk of nonunions in subtalar joint fusions.

Minor complications (55%) included the following: painful internal fixation, sural neuritis, wound dehiscence, stress fractures, and residual post-operative pain. Although stress fractures occurred in two patients, post-operatively these healed uneventfully. These minor complications are frequently encountered in any foot and ankle surgical procedure and were treated successfully with conservative care. Although defined as a minor complication, painful internal fixation can lead to additional interventions, either operative or advanced imaging. Similar to our results, Easley et al.<sup>13</sup> and Carr et al.<sup>2</sup> found painful fixation or heel pad irritation in approximately 20% of their patients. Therefore, the authors of this manuscript have modified their screw placement to avoid the weightbearing area of the plantar calcaneus. Residual postoperative pain was common in our study and in many other reports.<sup>5,7,13</sup> The authors theorize this may be the result of an unrecognized suprastructural deformity and currently utilize a radiographic protocol to evaluate hindfoot alignment to prevent this oversight.

Most manuscripts that discuss subtalar joint arthrodesis use a modified version of the American Orthopaedic Foot and Ankle Society ankle-hindfoot scoring system.<sup>5,7,13</sup> Easley et al.<sup>13</sup> found that 84% of their patients returned to normal daily activities following arthrodesis. Mangone et al.<sup>6</sup> reported an 82% of their patients would have the procedure performed again. Kitaoka and Patzer<sup>5</sup> discovered that some of their patients had ankle pain when walking on uneven surfaces. The results of our subjective questionnaire are difficult to

compare, however the majority of our patients were satisfied with their result and would have the procedure performed again.

Subtalar joint pathology is variable and includes posttraumatic talocalcaneal arthritis, calcaneal fracture, talocalcaneal arthritis, nontraumatic arthritis, talocalcaneal coalition and posterior tibial tendon dysfunction. Many studies have reviewed the outcome of isolated subtalar joint fusions, however most studies fail to mention the significance of the preoperative etiology in determining outcome. Similar to studies by Mann et al.<sup>7</sup> and Russotti et al.,<sup>8</sup> our study included a variety of preoperative diagnoses.

Isolated subtalar joint arthrodesis has been advocated for traumatic hindfoot arthrosis.<sup>24-28</sup> Easley et al.<sup>13</sup> reviewed 174 subtalar joint fusions of which 138 (80%) were secondary to a traumatic event. They found that the majority of these traumatic cases went on to a successful arthrodesis. Similarly, our patients with traumatic etiologies had mostly favorable results.

Kitaoka and Patzer<sup>5</sup> looked specifically at subtalar joint arthrodesis in 21 patients with posterior tibial tendon dysfunction. Our 19 patients with flatfoot deformities had a higher number of complications compared to their results. The authors theorize that the increased complication rate may be due to the lack of staging flatfoot deformities in both studies.

Easley et al.<sup>13</sup> looked at subtalar joint coalitions and found that only 75% went on to union. However, our study showed all patients with coalitions had primary union with no major complications. Although the investigators have not had success with subtalar coalition resection, some authors favor this method over primary arthrodesis.<sup>29,30</sup>

Our results show that complication rates vary depending on the preoperative subtalar joint etiology. Unfortunately, this study was limited due to the small sample sizes for each etiology. Therefore, the authors were unable to statistically correlate the preoperative diagnosis to the type or rate of postoperative complications.

## CONCLUSION

Isolated subtalar joint arthrodesis with or without an adjunctive soft tissue procedure is an effective treatment for pain and deformity of the hindfoot. Our study suggests that complications are not uncommon following isolated subtalar joint arthrodesis and have a greater prevalence than some previous reports. Isolated subtalar joint arthrodesis should be considered as a salvage procedure for painful hindfoot pathology.



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