Return to Sport and Radiographic Postoperative Outcomes After Grade 3 Turf Toe Surgical Repair

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Background: Turf toe is a plantar plate injury of the first metatarsophalangeal joint that commonly occurs in athletes participating in outdoor cutting sports. However, there is a lack of evidence-based consensus on treatment guidelines and surgical outcomes in the current literature.

Purpose/Hypothesis: The purpose of this study was to report on postoperative clinical outcomes and return to sport for athletic patients treated for both acute and chronic grade 3 turf toe injuries at the authors' institution. It was hypothesized that patients would have significant improvement in pre- to postoperative clinical outcomes and quickly return to sport after surgical repair.

Study Design: Case series; Level of evidence, 4.

Methods: The records of patients who received plantar plate repair at the first metatarsophalangeal joint between February 2016 to July 2022 by 3 fellowship-trained foot and ankle orthopaedic surgeons were reviewed. Inclusion criteria included athletes of at least high school–level competition who underwent plantar plate repair for a primary diagnosis of turf toe injury. Excluded were patients with histories of ipsilateral forefoot surgeries, rheumatoid arthritis, or gout. In total, 28 patients were identified and screened for inclusion. Patient-reported outcomes via Patient-Reported Outcomes Measurement Information System (PROMIS) scores were collected preoperatively and at least 1 year postoperatively for all patients. Return-to-sport data were collected via telephone call. Bilateral preoperative and postoperative radiographs were analyzed to measure preoperative and postoperative sesamoid diastasis.

Results: The improvement in pre- to postoperative PROMIS scores was found to be significant for Physical Function, Pain Interference, Pain Intensity, and Global Physical Health. A total of 21 return-to-sport surveys were completed from the patient cohort. Nineteen of 21 (90.5%) of patients were able to return to preinjury levels of physical competition. The mean time to return to sport was 20.4 weeks (range, 12-32 weeks). Both medial and lateral sesamoids demonstrated a significant pre- to postoperative improvement in sesamoid diastasis. No difference in outcomes was observed between acute and chronic injuries.

Conclusion: Patients who received plantar plate repair for a grade 3 turf toe injury demonstrated significant improvement in patient-reported outcomes and were able to quickly return to sport at a high rate.

Keywords: turf toe; first metatarsophalangeal joint; return to sport; clinical outcomes

Turf toe refers to a variety of injuries to the plantar capsule, plantar muscles, and sesamoid complex that typically result from a hyperextension injury to the first metatarsophalangeal (MTP) joint. While most turf toe injuries can be successfully managed nonoperatively, severe injuries or complete ruptures typically require operative intervention to restore stability of the joint and continuity of the plantar plate structures.

The current classification system is a 3-grade system rated for severity as well as symptomatology.[6] Grade 1 consists of a sprain of the capsule with continued weightbearing ability, normal radiographs, and normal motion.[6] Grade 2 is a more severe injury involving partial tears of the plantar plate and capsule.[6,17] Individuals with this grade of injury will also have trouble with weightbearing.[6] A grade 3 injury involves a complete tear of the plantar

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plate with significant swelling and instability.[6] Operative management is typically indicated for a grade 3 injury.[6,16,17]

While turf toe injuries are relatively common, surgery is rare for such injuries. George et al[12] reported that only 1.7% of turf toe injuries among collegiate football players required surgical intervention. To our knowledge, this study reports on the largest cohort of patients evaluated with a turf toe injury. The purpose of this study was to evaluate postoperative clinical outcomes and return to sport for athletic patients treated for a grade 3 turf toe injury at our institution. We hypothesized that patients would have significant improvement in pre- to postoperative clinical outcomes and return to sport after surgical repair.

METHODS

For this single-center retrospective study, data were collected from the institutional review board–approved Foot and Ankle Registry, and the protocol was approved by the steering committee at the investigators' institution. The records of patients who received plantar plate repair at the first MTP joint between February 2016 to July 2022 by 3 fellowship-trained foot and ankle orthopaedic surgeons (M.C.D., M.O., A.H.J.) were reviewed. Inclusion criteria included athletes of at least high school–level competition who underwent plantar plate repair for a primary diagnosis of turf toe injury. In addition, patients required preoperative and a minimum of 1-year postoperative patient-reported outcome measures via Patient-Reported Outcomes Measurement Information System (PROMIS) scores. Excluded were patients without preoperative radiographs and patients with concomitant procedures and histories of ipsilateral forefoot surgeries, rheumatoid arthritis, or gout. Preoperative examination included standing anteroposterior, oblique, and lateral plain radiographs as well as clinical evaluation. Either a great toe dorsiflexion stress radiograph or magnetic resonance imaging scan was used to confirm a grade 3 plantar plate injury by the surgeon preoperatively (Figure 1). Operative notes were retrospectively reviewed, and all procedures performed were noted. Retrospective review of the registry was performed, and 57 patients were identified and screened for inclusion. Of these, 28 patients were excluded due to the presence of concomitant procedures. Four patients were excluded due to insufficient clinical follow-up. One patient was excluded due to a history of ipsilateral foot surgery. In total, 24 patients were included.

Surgical Technique

General indications for surgery include a large capsular avulsion with an unstable MTP joint, evidence of at least 2 mm of diastasis of the sesamoids compared with the contralateral side, diastasis of bipartite sesamoids, diastasis of sesamoid fracture, retraction of sesamoid, vertical instability (positive Lachman test result), and failed nonoperative treatment. The goal of surgery is to restore the normal, stable anatomy of the hallux MTP joint (Figure 2).

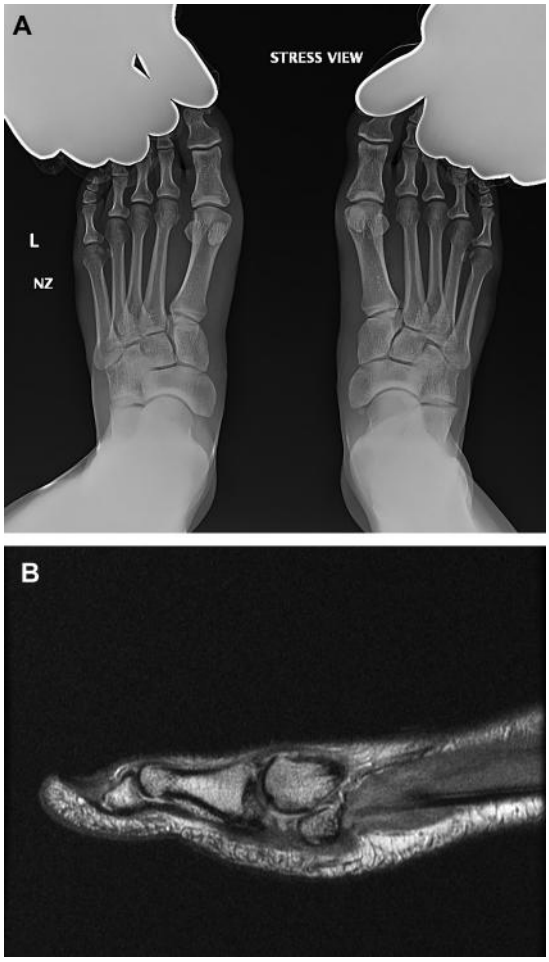

Figure 1. Presentation of acute grade 3 turf toe injury. (A) Example of great toe dorsiflexion stress radiograph indicative of asymmetric proximal migration of hallux sesamoids. (B) Example of complete disruption of the medial sesamoid phalangeal ligament with proximal retraction of the hallux sesamoid and disruption of the plantar plate.

Treatment is guided by the specific pathology during evaluation. If there is no fragmentation of the sesamoid and capsular disruption is the only injury, the plantar soft tissue structures can be repaired using nonabsorbable sutures through a medial approach.

If there is complete avulsion of the sesamoid apparatus, including both slips of the flexor hallucis brevis, a second plantar incision can be performed to repair the lateral aspect of the flexor hallucis brevis tendon. In complete plantar plate ruptures, a dual-incision technique allows access to the medial and lateral aspects of the plantar capsular ligamentous complex. Repair of the medial and lateral soft tissue structures should avoid injury to the flexor hallucis longus tendon as well as the plantar sensory nerves. If a traumatic hallux valgus occurs with a medial soft tissue injury and traumatic bunion, an adductor tenotomy can be performed percutaneously to balance the hallux MTP joint. In this scenario, the medial eminence may

Figure 2. Example of primary repair of the plantar plate with the suture-anchor technique, showing satisfactory alignment of the first MTP joint 6 months after repair.

also be resected to allow a capsulodesis, as with a standard bunion procedure.

If the sesamoid has been fractured or fragmented, one pole of the sesamoid should be preserved, if possible. A smaller distal pole is amenable to excision. A drill hole in the larger proximal pole may allow soft tissue repair to the sesamoid bone. A Kirshner wire can be used to hold the toe in plantarflexion to relax the soft tissue repair. One can consider open reduction and internal fixation of the sesamoid if pieces are large enough. If bipartite fragmentation is presented, the smaller sesamoid can be excised.

Postoperatively, the patient is placed in a splint and is nonweightbearing for 2 weeks. Passive range of motion (ROM) exercises begin at postoperative week 2. Physical therapy and active motion exercise can begin at 6 weeks postoperatively. Return to full physical activity usually averages 4 to 5 months.

Study Population

Chart review was performed to collect demographic information and record any postoperative complications. Baseline patient characteristics are listed in Table 1. Our patient cohort included both acute and chronic injuries; for the purposes of this study, we defined an acute injury as trauma with no greater than 6 weeks between injury and operation. Thirteen patients had acute injuries with a mean of 13.4 days (range, 4-32 days) between injury and surgery, while 11 patients had chronic injuries with a mean of 212.8 days (range, 62-365 days) between injury and surgery. The mean time from injury to surgery for the entire cohort was 98.9 days (range, 4-365 days). The mean age for all patients was 23 years (range, 14-40 years). The mean body mass index for all patients was 25.2 kg/m^2 (range, 19.7-36 kg/m^2). Six of 24 patients were female. The mean clinical follow-up was 2.8 years (range, 1-5.3 years).

TABLE 1
Baseline Patient Characteristics[a]

	Value
Total patients	24
Age, y	23 (14-40)
Sex, male/female	18:6
BMI, kg/m^2	25.2 (19.7-36)
Injury to surgery, days	98.9 (4-365)
Acute	13
Chronic	11
Clinical follow-up, y	2.8 (1-5.3)

[a]Data are presented as number or mean (range). BMI, body mass index.

Clinical Outcomes

Patient-reported outcomes were assessed using PROMIS scores. PROMIS is a computerized adaptive test used to assess functional outcomes in the following domains: Physical Function, Pain Interference, Pain Intensity, Global Physical Health, Global Mental Health, and Depression. Scores have a standardized mean of 50, the reference population average, with a standard deviation score (T score) of 10. Higher scores indicate greater Physical Function, Pain Interference, Pain Intensity, Global Mental Health, and Depression. In our patient cohort, clinical outcomes were collected preoperatively and at a minimum of 1-year postoperative follow-up. All patients received PROMIS surveys at 1 and 2 years postoperatively through the Foot and Ankle Registry at our institution, and for the purposes of this study, an attempt was made to collect the most recent PROMIS scores for all patients. In total, 24 patients had both preoperative and minimum 1-year postoperative PROMIS scores.

Return to Sport

Return to sport was assessed using patient-provided surveys. Questionnaire surveys were distributed to patients via email or they were interviewed during a telephone call to gauge the competitive level and frequency of sport participation before and after surgery. The survey included questions asking which sport the athlete participated in before the injury, whether they were able to return to preinjury levels of competition, and how long they waited before returning to sport. In total, 21 of 24 patients responded to surveys.

TABLE 2
Comparison of Preoperative and Postoperative PROMIS Scores With Minimum Follow-up of 1 Year[a]

	Preoperative Scores	Postoperative Scores	*P* Value
Physical Function	36.2 ± 6.6	66.5 ± 7.1	**<.01**
Pain Interference	61.4 ± 6.3	40.6 ± 5.4	**<.01**
Pain Intensity	50.5 ± 5.3	34.5 ± 6.8	**<.01**
Global Physical Health	49.8 ± 9.4	62.8 ± 4.4	**<.01**
Global Mental Health	57.7 ± 10.3	61.9 ± 6.7	.25
Depression	47.4 ± 9.1	40.8 ± 6.8	.07

[a]Data are presented as mean ± SD. Bold *P* values indicate statistical significance ($P < .05$). PROMIS, Patient-Reported Outcomes Measurement Information System.

Radiographic Outcomes

Bilateral preoperative and postoperative radiographs were reviewed for all patients to measure the diastasis between the distal point of each sesamoid and the distal point of the first MTP joint. Bilateral postoperative radiographs were not readily available for all patients, so we used bilateral preoperative radiographs to compare with the operative side. In addition, some patients did not have a minimum of 3 months of postoperative radiographs available due to scheduling conflicts, so an attempt was made to collect the most recent radiographs available.

Statistical Analysis

Descriptive statistics are reported as means and standard deviations for continuous variables and counts and percentages for categorical variables. Variables were tested and confirmed for normality using Shapiro-Wilk tests. An a priori power analysis found that a minimum of 24 patients were needed for each preoperative and postoperative cohort to achieve 80% power, given a minimum detectable difference on the PROMIS Physical Function scale of 5.8 points and a standard deviation of 8 points. These values were taken from previous literature on clinically important differences in foot and ankle patients for PROMIS scores.[1] Because the comparisons between acute and chronic injuries did not meet the requisite sample size, descriptive analysis was conducted to compare group outcomes. Preoperative and postoperative radiographic comparisons of the same foot were conducted with paired *t* tests, and comparisons between operative and contralateral feet were conducted with Student *t* tests. Clinical outcomes via preoperative and postoperative PROMIS measures were compared with paired *t* tests. Listwise deletion was conducted for patients with missing data. An alpha of .05 was established as statistically significant for this study. The analysis was conducted using R (R Core Team 2021).

RESULTS

Clinical Outcomes

In total, 24 patients with preoperative and a minimum of 1 year of follow-up scores were available for inclusion. The mean time from surgery to follow-up was 2.8 years (range, 1.0-5.3 years). Preoperative and postoperative PROMIS scores are summarized in Table 2. The improvement in pre- to postoperative PROMIS scores was found to be significant for Physical Function (36.2 vs 66.5; $P < .01$), Pain Interference (61.4 vs 40.6; $P < .01$), Pain Intensity (50.5 vs 34.5; $P < .01$), and Global Physical Health (49.8 vs 62.8; $P < .01$). The scores in the Global Mental Health and Depression domains improved, but not significantly.

Differences in preoperative and postoperative PROMIS scores between acute and chronic injuries were also tested but there were no significant findings (Table 3). The acute group responded to surveys at a mean of 2.8 years (range, 1-5.3 years), and the chronic group responded to surveys at a mean of 2.6 years (range, 1.0-4.7 years). Notably, postoperative Pain Intensity (31.5 vs 38.2; $P = .07$) and Global Mental Health (64.4 vs 57.2; $P = .06$) between the acute and chronic groups demonstrated improved albeit insignificant outcomes for acute injuries.

Return to Play

In total, 21 return-to-play (RTP) surveys were available for review (Table 3). Nineteen of 21 (90.5%) of patients were able to return to preinjury levels of physical competition (Table 4). The mean time to RTP was 20.4 weeks (range, 12-32 weeks). The 2 participants who were unable to return to play were college seniors who did not return before the season ended but were able to continue recreational athletic activity.

No significant differences in RTP frequency or time to RTP were observed between acute and chronic injuries in our cohort. All acute injuries returned to physical competition at a mean of 20.3 weeks (range, 12-27 weeks), while 7 of 9 chronic injuries returned at a mean of 20.5 weeks (range, 14-32 weeks).

Radiographic Outcomes

The mean time from surgery to the most recent radiograph was 5.2 months (range, 1.1-12.0 months) for acute injuries and 12.5 months (range, 3.2-30.9 months) for chronic injuries. The mean improvements in sesamoid diastasis after operation are reported in Table 5. Contralateral sesamoid diastasis was measured as a landmark to compare with

TABLE 3
Comparison of Postoperative PROMIS Scores Between Acute and Chronic Injuries With Minimum Follow-up of 1 Year[a]

	Acute Injuries	Chronic Injuries	*P* Value
Physical Function	67.1 ± 4.5	63.0 ± 10.5	.34
Pain Interference	38.7 ± 2.0	43.1 ± 8.6	.17
Pain Intensity	31.5 ± 1.4	38.2 ± 9.4	.07
Global Physical Health	63.8 ± 4.5	61.2 ± 4.1	.33
Global Mental Health	64.4 ± 6.0	57.2 ± 5.9	.06
Depression	39.5 ± 7.5	42.1 ± 6.5	.53

[a]Data are presented as mean ± SD. PROMIS, Patient-Reported Outcomes Measurement Information System.

TABLE 4
Return-to-Sport Characteristics[a]

Patient No.	Laterality	Sport	Level of Competition	RTP	Time to Clearance, wk
1	R	Soccer	Professional	Yes	16
2	R	Pole Vault	Collegiate	Yes	21
3	L	Baseball	Professional	Yes	24
4	R	Football	Professional	Yes	24
5	R	Lacrosse	Collegiate	No	NA
6	R	Basketball	Professional	Yes	24
7	L	Football	High school	Yes	16
8	L	Motorcycle	Professional	Yes	14
9	R	Lacrosse	Collegiate	Yes	14
10	L	Jiujitsu	High school	Yes	32
11	L	Tennis	Collegiate	No	NA
12	R	UFC	Professional	Yes	16
13	L	Football	Collegiate	Yes	18
14	R	Basketball	Professional	Yes	24
15	L	Gymnastics	High school	Yes	12
16	R	Soccer	Collegiate	Yes	20
17	L	Lacrosse	Collegiate	Yes	24
18	L	Lacrosse	Collegiate	Yes	20
19	L	Football	High school	Yes	24
20	R	Football	Collegiate	Yes	24
21	R	Football	Collegiate	Yes	20

[a]Summary of patient athletic activity and return to play after repair. The 2 participants who were unable to return were college seniors who did not return before the season ended but were able to continue recreational athletic activity. L, left; NA, not applicable; R, right; RTP, return to play.

postoperative measurements in Table 6 (Figure 3). Our patient cohort demonstrated significant pre- to postoperative reductions in lateral and medial sesamoid diastasis and postoperative restoration of sesamoid diastasis to contralateral preoperative distances for both acute and chronic injuries.

Complications

One patient required a return to the operating room after the initial repair procedure. This patient was a collegiate lacrosse player who continued to have medial sesamoid pain a year after her initial surgery. Nonoperative measures via shockwave and laser were implemented but did not resolve symptoms. A postoperative magnetic resonance imaging indicated multifocal bone marrow edema with surrounding soft tissue hyperintensity around the medial hallux sesamoid along with a stress reaction of the ipsilateral fifth metatarsal. She received a debridement with bone marrow aspirate concentrate injection 2 years after her initial surgery but continued to express pain and discomfort around her first MTP. Five months later, the patient underwent a second revision procedure to remove the sesamoid, which resolved issues by her most recent postoperative 1-year clinical follow-up.

DISCUSSION

This study reviewed clinical outcomes, radiographic improvement, and return to play for athletes after surgical

TABLE 5
Pre- to Postoperative Improvement in Sesamoid Diastasis[a]

	Preoperative, mm	Postoperative, mm	Δ Diastasis, mm	*P* Value
Acute				
Medial	8.5 ± 2.3	6.8 ± 2.1	–1.7	>**.01**
Lateral	12.3 ± 3.5	8.7 ± 2.5	–4.1	>**.01**
Chronic				
Medial	9.2 ± 1.7	6.3 ± 2.4	–2.9	>**.01**
Lateral	9.5 ± 1.9	6.2 ± 1.9	–2.8	>**.01**

[a]Comparison of preoperative and postoperative sesamoid diastasis in acute and chronic turf toe injuries. Data are presented as mean ± SD. Bold *P* values indicate statistical significance ($P < .05$).

TABLE 6
Contralateral and Operative Side Comparison in Sesamoid Diastasis[a]

	Contralateral Preoperative, mm	Operative Postoperative, mm	Δ Diastasis, mm	*P* Value
Acute				
Medial	4.9 ± 1.3	6.8 ± 2.1	+ 1.9	.08
Lateral	6.9 ± 2.1	8.7 ± 2.5	+ 1.8	.14
Chronic				
Medial	5.3 ± 2.2	6.3 ± 2.4	+ 1.0	.44
Lateral	6.7 ± 1.7	6.2 ± 1.9	–0.5	.72

[a]Comparison of contralateral and operative side sesamoid diastasis in acute and chronic injuries. Data are presented as mean ± SD. Bold *P* values indicate statistical significance ($P < .05$).

Figure 3. Preoperative (A) to 6 months postoperative (B) comparison of sesamoid diastasis in an acute injury. Suture anchors are identified within the plantar aspect of the base of the first proximal phalanx related to plantar plate repair. Joint spaces are preserved and alignment is maintained.

repair of grade 3 turf toe injuries. Our results demonstrated an improvement in clinical outcome scores 2 years after surgical repair, an improvement in pre- to postoperative sesamoid diastasis and a return to contralateral sesamoid diastasis, and a nearly 91% return-to-sport rate with a timeline of approximately 5 months.

To contextualize our discussion with a review of the relevant anatomic biomechanics, the first MTP joint relies primarily on a soft tissue complex to maintain stability. The shallow socket of the proximal phalanx articulating with the convex surface of the metatarsal head allows for a wide ROM of approximately 80°, on average, while providing minimal stability.[5] In addition, the joint complex must also support 40% to 60% of the body weight during the normal gait cycle.[5] This force can triple with athletic activities and increase up to 8-fold with a running jump.[5] As such, the ligamentous structures surrounding the first MTP joint are vital for movement and physical activity, and damage to these structures can cause significant weightbearing issues. With so few case reports and investigative studies, it is still unclear what treatments should be used and in what scenarios. Anderson et al[2] suggested considering an operative approach if the joint is unstable, if there is a sesamoid fracture, if there is retraction of the sesamoid, if a loose body is present, or if there is a positive vertical Lachman.

Recent decades have seen a decrease in reported rates of turf toe injuries among athletic populations. In the 1970s, the incidence of turf toe in collegiate football was reported to be as high as 5 to 6 injuries per team per season.[3,7] Studies of professional football players in the National Football League (NFL) around a similar time frame have also found that between 30% and 45% of players claimed to have experienced a turf toe injury.[4,21] However, a more recent 2011 NFL Combine study demonstrated that only 11% of combine participants reported a history of MTP dislocation/turf toe injuries.[14] Similarly, George et al[12] reported 147 turf toe injuries across 630 collegiate football teams from 2004 to 2009, translating to an incidence rate of 0.46 to 0.53 turf toe injuries per team per season. The perceived decline in the incidence of turf toe injuries has been hypothesized to be secondary to improved artificial surfaces and/or new shoe designs with increased forefoot stiffness.[5,9,25] Clanton et al[5] observed 13 collegiate football athletes with reduced motion (<60° of dorsiflexion) in the first MTP joints or injury during the previous year who were managed with modified shoes with a stiffened forefoot and reported 4 minor turf toe injuries with no loss of playing time.

In our study, we reported a significant improvement in clinical outcomes via PROMIS scores after turf toe repair. Improvements in functional outcomes among patients who return to high-level activity after surgical repair of the first MTP have been reported in the literature. Smith and Waldrop[23] reported a mean postoperative American Orthopaedic Foot & Ankle Society (AOFAS) hallux score of 91.3 (range, 82-100) and a mean visual analog scale (VAS) pain score of 0.7 at rest and 0.8 with physical activity among 15 competitive football players. In the study of Nery et al,[18] 14 patients treated operatively reported significantly improved AOFAS hallux scores after surgery (range, 36-81; $P < .001$). Our study corroborates these findings to demonstrate that patients who receive surgery for turf toe injuries can expect positive improvement in pain and physical function.

Our study also reported an RTP rate of nearly 91%, requiring roughly 5 months to return to full activity. Other authors have demonstrated an RTP rate of 71% to 90%, supporting our findings.[2,8,13,18,23] A wide range of RTP timelines have also been reported for turf toe injuries with a mean of approximately 4 to 7 months.[15,22,24] Smith and Waldrop[23] demonstrated an RTP rate of 11 of 14 (79%) athletes with a mean playing time missed of 16.5 weeks. Drakos et al[10] reported a mean RTP of 6 months for 2 collegiate football players who received surgical repair for turf toe injuries. In a systematic review, Vopat et al[24] reported a median time to RTP of 14.7 weeks (range, 6.0-156.4 weeks). While several rehabilitation protocols have been proposed for postoperative turf toe repair, we recommend an aggressive physical therapy protocol with a passive ROM beginning at postoperative week 2 and active physical therapy beginning at postoperative week 6.

Radiographic analysis of turf toe injuries and sesamoid diastasis is sparse in the literature. While no protocol has been established to radiographically diagnose a turf toe, it is generally suggested that a small avulsion fragment arising from the proximal phalanx or proximal migration of one or both sesamoid bones is indicative of an injury to the sesamoid-ligament complex.[17] A forced dorsiflexion view has been advocated in the assessment of turf toe, which can reveal a lack of normal distal migration of the sesamoid bones during hallux extension to suggest a plantar plate rupture.[21] Prieskorn et al[20] reported that an absolute measurement $\geq$10.4 mm from the base of the proximal phalanx to the distal aspect of the medial sesamoid and $\geq$13.3 mm for the lateral sesamoid on a neutral weightbearing radiograph was 99.7% sensitive for a plantar plate rupture. In cases with bi- or multipartite sesamoid diastasis, Favinger et al[11] examined 76 patients with at least 1 bi-/multipartite hallux sesamoid bone and reported a normal sesamoid mean interval of 0.79 mm (range, 0-2 mm). Therefore, the authors suggest that if the interval separating a bi-/multipartite sesamoid bone exceeds 2 mm on a routine frontal radiograph with a recent first MTP hyperextension injury, one can consider traumatic diastasis.[11]

Outcomes between acute and chronic injuries were also compared in our statistical analysis, demonstrating no significant differences between clinical, radiographic, and RTP outcomes based on injury type. While there is a paucity of data comparing acute versus chronic turf toe injuries, it is generally accepted that delaying treatment increases the risk of long-term joint disease. Evidence of this may be interpreted from the reported difference in pain intensity perception, in which acute injuries reported positive albeit insignificant scores compared with chronic injuries at approximately 2.5 years after surgery. Because this analysis was underpowered, it stands to reason that a study with a larger cohort of acute and chronic turf toe patients could elucidate potential differences. Studies reporting outcomes for chronic turf toe injuries have reported favorable results.[8,13,19] Covell et al[8] reported a mean time of 4.5 months (range, 1-8 months) from injury to surgery for 6 football players along with 7 players reporting progressing great toe pain for at least 1 year. The authors demonstrated that 75% returned to sport at a mean of 3.4 months (range, 2-4 months). Pinter et al[19] assembled a cohort of 12 nonathlete patients with chronic

turf toe injury and demonstrated a pre- to postoperative improvement in mean VAS scores and mean Foot Function Index scores, which is consistent with our findings that chronic turf toe injuries requiring surgical intervention can still achieve good outcomes.

Limitations

Finally, this study is not without limitations. First, it is a relatively small retrospective case series lacking the experimental rigor and statistical power required to make stronger claims about postoperative outcomes. Notably, the analysis between acute and chronic subgroups was descriptive because of a lack of statistical power, limiting the conclusions that could be drawn from this study. Second, the methodology of collecting RTP data leaves a possibility of response bias, wherein patients who successfully returned to sport may have been more likely to respond to surveys and/or overexaggerate their RTP timeline. Third, the study included patients from multiple surgeons; as such, the selection of patients, indications for surgery, and surgical technique may have varied. The inclusion criteria attempted to control for this by requiring radiographic confirmation for a grade 3 turf toe injury; however, unknown biases may have still occurred. Fourth, the patient cohort consisted of acute and chronic injuries, which may have overgeneralized the outcomes reported in this study. To combat this, we separated and analyzed our patient cohort based on injury chronicity, albeit with an underpowered sample size. Lastly, other factors that can affect RTP, such as physical intensity, level of competition, and foot shape, were not included in the analysis, limiting the generalizability of our study's results.

CONCLUSION

Patients who received plantar plate repair for a grade 3 turf toe injury in our patient cohort demonstrated significant improvement in patient-reported outcomes and achieved a nearly 91% return-to-sport rate within approximately 5 months after surgery.

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