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CASE REPORT

RETURN TO SPORT FOLLOWING SURGERY FOR A COMPLICATED TIBIA AND FIBULA FRACTURE IN A COLLEGIATE WOMEN'S SOCCER PLAYER WITH A LOW LEVEL OF KINESIOPHOBIA

Luis A. Feigenbaum, PT, DPT, SCS, ATC, LAT, CSCS[1]
Michael Baraga, MD[1]
Lee D. Kaplan, MD[1]
Kathryn E. Roach, PT, PhD[2]
Kathryn M. Calpino, SPT[2]
Katie Dorsey, SPT[2]
Cristina Martorelli, SPT[2]
Beatriz Sagarduy, SPT[2]
Lesley-Anne King, ATC, LAT[3]
Vincent A. Scavo, ATC, LAT[3]

ABSTRACT

Background & Purpose: Much attention has been solely paid to physical outcome measures for return to sport after injury in the past. However, current research shows that the psychological component of these injuries can be more predictive of return to sport than physical outcome measures. The purpose of this case report is to describe the successful return to sport following surgery of a complicated tibia and fibula fracture of a Division I collegiate women's soccer player with a low level of kinesiophobia.

Case Description: A 22-year-old female sustained a closed traumatic mid-shaft fracture of her tibia and fibula. During a high velocity play she sustained a direct blow while colliding with an opposing player's cleats. As a result of the play, her distal tibia was displaced 90° to the rest of her leg. She underwent a closed reduction and tibial internal fixation with an intramedullary rod. Outcome scores were tracked using the IKDC and TSK-11. The IKDC measures symptoms, function, and sport activity related to knee injuries. The TSK-11 measures fear of movement and re-injury, which was important to assess during this case due to the gruesome nature of the injury.

Outcomes: At 4 months, the subject became symptomatic over the fibula and was diagnosed with a fibular nonunion fracture. This was unexpected due to the low incidence of and usual asymptomatic nature of fibular nonunion fractures, which required an additional surgery. TSK-11 scores ranged from 19-20 throughout, signifying low levels of kinesiophobia. IKDC scores improved from 8.05 to 60.92. The subject ultimately signed a professional soccer contract.

Discussion: The rehabilitation of this subject was complex due to her low levels of kinesiophobia, self-guided overtraining, and the potential role they may have had in her fibular nonunion fracture. This case study demonstrates a successful outcome despite a unique injury presentation, multiple surgeries, and low levels of kinesiophobia. While a low level of kinesiophobia can be detrimental to rehabilitation compliance, it may have benefited her in the long-term.

Level of Evidence: 5

Keywords: Fracture, kinesiophobia, soccer

CORRESPONDING AUTHOR

Luis A. Feigenbaum, PT, DPT, SCS, ATC, LAT, CSCS
UHealth Sports Performance and Wellness Institute
Department of Physical Therapy, University of Miami (FL), Miller School of Medicine
5915 Ponce de Leon Boulevard, 5th Floor
Coral Gables, FL 33146 (USA)
Phone: (305) 284-4876
Fax: (305) 284-6128
E-mail: lfeigenbaum@med.miami.edu

[1] UHealth Sports Performance and Wellness Institute, University of Miami (FL), Miller School of Medicine, Miami, FL, USA
[2] Department of Physical Therapy, University of Miami (FL), Miller School of Medicine, Coral Gables, FL, USA
[3] Department of Athletics, Athletic Training, University of Miami (FL), Coral Gables, FL, USA

BACKGROUND AND PURPOSE

There is a high prevalence of fractures in Division I college sports, especially in athletes participating in contact sports such as soccer.[1] In fact, the majority of injuries that soccer players experience are high impact traumas, with slide tackles being the most common lower extremity fracture mechanism.[2] While lower extremity fractures are common in soccer, research regarding prognosis and outcomes for high impact fractures is lacking.[3-4] This is problematic due to the variables associated with making a safe return to play decision. Therefore, prognostic factors that may positively or negatively affect the rehabilitation process and ultimately return to sport must be recognized.

Previous attention has been paid to physical outcome measures for return to sport. However, current research shows that the psychological component of these injuries can be more predictive of return to play than physical outcome measures.[5-10] Athletes that sustain traumatic injuries may never return to their sport due to fear of re-injury.[5-10] This fear of re-injury is an example of how a negative psychological state can hinder an outcome. Inversely, a positive psychological response to injury and rehabilitation correlates with a more rapid return to sport within a year.[5-10]

Kinesiophobia has been defined as an "excessive, irrational, and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or re-injury." [11] The fear associated with kinesiophobia can be heightened in injuries due to trauma.[11] Behavior that is guided by kinesiophobia has the potential to negatively impact outcomes for patients with pain.[12-13] According to the fear avoidance model (FAM) of exaggerated pain perception proposed by Lethem et al[14], pain perception involves both a sensory and an emotional reaction component. Fear of pain is an important feature of the emotional reaction in that it can bring out two different forms of coping responses: confrontation or avoidance. An individual motivated by fear typically avoids both painful experiences and activities. Fear avoidance behaviors can also be indicative of high psychological distress, which has further been associated with poor clinical outcomes.[14]

Evidence supports the assessment of pain-related fear in patients across multiple musculoskeletal conditions ranging from sub-acute to chronic conditions.[5-8,12-13,15-26] Higher levels of pain have been shown to be predictive of higher levels of disability, and fear of pain has been associated with kinesiophobia.[5-8,12-13,15-26] In order to help produce the best clinical outcomes it is important to identify patients who are at risk for kinesiophobia. Outcome tools such as the Tampa Scale for Kinesiophobia (TSK) and its shortened-version the TSK-11, can be used to better understand the psychological impact of an injury. The TSK questionnaire involves items that incorporate fear of injury, fear of pain and a person's ability to perceive and report symptoms.[11]The combination of both physical and psychological outcome tools can help to facilitate a safe return to play.

The purpose of this case report is to describe the successful return to sport following surgery of a complicated tibia and fibula fracture of a Division I collegiate women's soccer player with a low level of kinesiophobia.

CASE DESCRIPTION: PATIENT HISTORY AND SYSTEMS REVIEW

A 22 year-old female Division I collegiate soccer player with no previous significant medical history or history of injury sustained a displaced, closed mid-shaft right tibia and fibula fracture while playing in a soccer game. During a high-velocity play, she received a direct impact to her anteromedial tibia by an opponent in an attempt to win a 50/50 ball. Despite the use of shin guards, the force of the impact was so great that they did not prevent this injury from occurring. As a result, her distal tibia was medially displaced 90° to the rest of her leg. She was immediately transported to the local emergency department.

Radiographs confirmed a comminuted and displaced fracture of her right tibia and fibula (Figure 1). She was immediately admitted and underwent closed reduction and intramedullary nailing of the tibia, which is considered to be more advantageous for closed tibial fracture healing and function than casting (Figure 2).[27-28] The fibula was reduced but was not fixated. There were no surgical complications.

Clinical Impression #1

At the time of her initial physical therapy evaluation the subject was informed that the data concerning her case would be submitted for publication. Subject

Figure 1. *Lateral view radiograph of the tibia and fibula depicting a displaced fracture of both bones.*

Figure 2. *Lateral view radiograph showing a non-union of the fibula and near-complete healing of the tibia.*

confidentiality was protected according to the U.S. Health Insurance Portability and Accountability Act (HIPPA) and IRB approval for this case report was granted. The subject participated in a sport-specific physical therapy program in the university athletic training facility days after being discharged from the hospital (Table 1). Rehabilitation for this injury follows a plan of care that is predicated on progressions through weight-bearing activities, gradually increasing physiologic responses to exercise, and limiting any pain-inducing activity. Impairments were assessed at the time of the initial evaluation and in conjunction with her physician's order.

Her post-operative presentation was normal for after this procedure. Due to the surgical sites for the procedure, most of her impairments were present at the knee (Figure 3). The subject participated in daily treatment sessions under the supervision of her physical therapist and athletic trainer. She was extremely eager to get back to soccer and was thus progressed quickly within the constraints of the protocol.

Due to the traumatic nature of her injury, the treating therapist believed the subject may have been at an increased risk for developing kinesiophobia. However, this subject's extreme desire to return to soccer as soon as possible, as well as her intense work ethic, made her clinical impression unique. For these reasons, her kinesiophobia was assessed and tracked throughout her treatment.

EXAMINATION

The IKDC Subjective Knee Form measures pain, symptoms, function, and sport activity related to knee injuries.[29-31] The survey contains 18 items with a maximum of 87 points related to these domains. A score of 0 on an item demonstrates the least amount of function for the specified activity. Once a final score is determined, it can be plugged into an equation to give a percentile based on the person's age and gender category if the individual is between 18 and 65 years of age.[32] Scoring is achieved through the summation of the first four subtest scores. These scores are then transformed into a scale ranging from 0 to 100 through a formula:

$$\text{IKDC Score} = \frac{\text{sum of all questions} - \text{lowest possible total score}}{\text{range of possible scores}} \times 100$$

Higher scores are indicative of less disability.[31] A score of 100 would indicate no disability.[31] A change

Table 1. *Rehabilitation Protocol for Post-Operative Leg Fractures*

PHASE	ACUTE	SUBACUTE	CHRONIC	FUNCTIONAL
Goals	Protect surgery Control inflammatory response Control pain, edema, spasm	Full AROM 5/5 MMT Normalized gait SLS ≥ 30 seconds	Pain-free jogging Return to modified soccer specific activities Progression to plyometrics	Return to sport
Weight-bearing	WBAT	FWB		
External Support	Axillary crutches Wrapping	Aircast Ankle lace-up	Taping or bracing PRN	PRN
ROM	PROM → AAROM → AROM	Static stretching PNF stretching	PNF stretching Ballistic stretching Self-stretching	Ballistic stretching Self-stretching
Strengthening	Isometrics	Isotonics OKC Ankle Foot Hip Knee CKC Leg Press Squats Lunges	Isotonics Olympic lifts OKC Ankle Foot Hip Knee CKC Leg Press Squats Lunges	Olympic lifts Soccer program
PBA		SLS Tilt board	Soccer-specific ball drills Plyometrics	Plyometrics
Complimentary	Hip/ knee isotonic strengthening Upper body ergometry	Core strengthening Stationary cycling Elliptical	Treadmill Stair climber Jogging → Running	Soccer conditioning
Modalities	Ice HVGS Effleurage	Scar massage Contrast baths	PRN	PRN

AROM= Active range of motion; MMT= Manual muscle test;SLS= single limb stance; WBAT= weight bearing as tolerated; FWB= full weight bearing; PROM= passive range of motion; AAROM= active assisted range of motion; PNF= proprioceptive neuromuscular facilitation; OKC= open kinetic chain; CKC= closed kinetic chain; HVGS= high voltage galvanic stimulation.

Figure 3. *Overhead view of post-operative knee following IM fixation of the tibia.*

in score of greater than 9 points marks the threshold for the minimal detectable change of the IKDC.[30] To distinguish between those who were or were not improved across a wide variety of knee conditions using the IKDC, revealed that a change score of 11.5 points had the highest sensitivity (.82), and a change score of 20.5 points had the highest specificity (.84).[29] The IKDC has been shown to be reliable across a broad range of knee pathologies including ligament and meniscal injuries, articular cartilage lesions, and patellofemoral pain.[31,33-38] The test battery of questions that comprise the IKDC give reliable results across all age ranges and genders.[30]

The TSK-11 is a self-report questionnaire used to measure fear associated with pain and fear associated with re-injury.[11] The TSK-11 is scored on a 4-point scale from 1 (strongly disagree) to 4 (strongly agree). Scores range from 11 to 44 points. Higher scores (>22) are indicative of fear-related pain or re-injury. Initially the (17-item) Tampa Scale for Kinesiophobia (TSK) was used as a fear-avoidance predictor for chronic low back pain, but it has been more

recently studied as a strong predictor of knee, ankle, and shoulder reinjury. [8-9,12,16-18,24-25,39] The TSK-11 has been proven to have similar reliability and validity to the original TSK.[39] Kvist et al[9] demonstrated that those patients who did not return to their previous level of activity were more afraid of re-injury due to movement and had a worse knee-related quality of life than those who had returned to their previous level of activity, as measured by the TSK. Woby et al[39] found that a decrease in score by four points on the TSK increases the likelihood of identifying patients who have undergone an important reduction in fear or movement (sensitivity = 66%; specificity = 67%). A change of 3 points on the TSK-11 is needed to be 95% confident that a change has occurred.[7] Furthermore, a reduction of 4 or more points maximizes the likelihood of correctly identifying patients with an important decrease in their fear of movement or re-injury.

Clinical Impression #2

The subject's extreme work ethic and strong desire to return to soccer became more evident as time progressed. Only days after her physical therapy began, it became clear that she was independently exercising beyond what was prescribed. Against medical advice, the subject was simultaneously involved in a self-directed and intensive conditioning program. The conditioning program took place at the University Wellness Center and involved several hours of weight-bearing activities on machines such as the elliptical, Jacobs Ladder™, stair climbers, and treadmills. While the subject did not freely admit to her extra conditioning activity, her teammates did report to the medical staff that it indeed was taking place.

The subject began reporting lateral leg pain during the 11th post-operative week. Radiographs were taken at that time and revealed incomplete healing of both fractures. The subject was advised to reduce her workload and would be re-evaluated if her symptoms persisted. However, the authors believe she again acted against medical advice and continued on her self-directed conditioning program. During the 17th post-operative week, the subject reported worsening of her symptoms and was revaluated. Radiographs showed a one centimeter translational deformity of the fibula and an intervening butterfly fragment revealing nonunion of the fibular fracture.

Figure 4. *AP view radiograph after removal of interlocking screws in the tibial nail and bone grafting with internal fixation of the fibula.*

The nonunion required a second surgical intervention to fixate the fibula (Figure 4). This procedure was performed in the 21st week after her initial procedure. This time however, her recovery became complicated due to a surgical site infection with an eventual hospital admission for medical treatment. The subject was instructed to remain non-weight bearing for the subsequent four weeks after the second surgical procedure. The authors believe this time the subject was compliant with her care and adhered to all precautions. She continued a rehabilitation program at the university training facility until eight months after the incident before leaving to coach and train independently without orthopedic restrictions. One year after the initial incident the subject was able to return to play internationally at the professional level without restrictions. For a detailed timeline of events throughout the course of her recovery, see Table 2.

Outcome

In addition to typical impairment and physical function tests and measures, the main outcome measures discussed in this case study include the TSK-11 and the IKDC (Table 3). The subject improved 52.87 points on the IKDC over the course of four months indicating a high reliability for improved self-reported function.

Table 2. *Timeline of Events*

Week	Relevant Events
Week 0	- Initial incident - Hospitalization - Surgical Intervention: tibia reduction and fixation, fibula reduction
Week 1	- Weight bearing as tolerated
Week 11	- Reports pain with movement in the lateral aspect of the leg - Radiographs show interval healing of both fractures
Week 17	- Patient reports movement and pain on the lateral leg - Recommended for surgical intervention
Week 18	- Radiographs show complete union of tibia and a translation deformity of fibular with more than 1 cm translation and intervening butterfly fragment
Week 21	- Surgical reduction and fixation of fibula - Tibia screws removed
Week 23	- Surgical site infection - Admitted to hospital for IV antibiotics, discharged with home antibiotics
Week 24	- Infection resolved - Radiographs show fibula and mortise in alignment, tibia healing - Cleared to begin full weight bearing
Week 29	- Radiographs show early bridging of nonunion site and integration of bone graft - Cleared to begin strength training as tolerated

Table 3. *Post-Operative TSK-11 and IKDC Scores*

Post-Operative TSK-11 and IKDC Scores				
	Week 3	Week 7	Week 17	Week 21
TSK-11	20/44	19/44	19/44	n/a †
IKDC*	8.05 (<5%)	45.98 (5%)	36.78 (<5%)	60.92 (10%)

*Percentages based on the same age and gender group of the athlete.
†Score was not taken due to her consistency with previous scores.
TSK= Tampa Scale for Kinesiophobia;
IKDC= International Knee Documentation Committee

The decrease seen from November, 2012 to January, 2013 was a result of the second surgery performed to fixate the fibular head. Total TSK scores can range from between 11-44. In this case, the patient's TSK-11 scores ranged from 19-20 throughout the treatment process. Although her scores did not decrease by four points her scores throughout were low, which is indicative of low kinesiophobia.

DISCUSSION

High velocity traumatic injuries are common in high level contact sports.[4] Tibia-fibula fractures are seen in soccer players.[2,4] Researchers have found that surgical fixation of the tibia followed by physical therapy have been efficient in promoting successful union of the fibula.[28,40-41] Specifically, immediate weight bearing of the lower extremity without discomfort or loss of position following lower leg fracture has been proven to have definite advantages in non-surgical patients.[42] Despite fractures of both the tibia and fibula, surgical fixation of the tibia without surgical intervention of the fibula is an acceptable protocol.[40-41] Tyllianakis et al[28] indicated that interlocking intramedullary nailing of the tibia is a reliable method of treatment associated with high rates of union and low incidence of complications. Nonunion fractures are often the result of non-optimal healing environments (mechanical or biological).[40] Excess movement at the fracture site, due to excess weight bearing in non-physical therapy activities chosen by the subject of this case report may have

inhibited the fibula's ability to heal properly.

Prognosis for return to sport in a tibia-fibula fracture due to a soccer injury is approximately 40 weeks, however many factors can influence the outcome.[2] Kinesiophobia, or pain related fear of movement, has recently received attention as a psychological factor that contributes to the timeline for progression of rehabilitation. An athlete's level of kinesiophobia, either high or low, may greatly impact their recovery timeline and their prognosis for return to competitive sport.[7,9] Athletes with low levels of kinesiophobia should be monitored for signs of overtraining and lack of adherence to physical therapy restrictions. However, these athletes may also be more likely to ultimately return to their sport.

Athletes with high levels of kinesiophobia will likely be more hesitant to return to sport.[7,9] These athletes may need special attention in order to encourage them throughout therapy and reassure them that it is safe to return to activities. At either extreme, an athlete may also benefit from sports psychological counseling during injury rehabilitation as an adjunct to physical therapy. The TSK-11 can be a helpful tool in identifying and monitoring an athlete's level of kinesiophobia throughout rehabilitation.

The TSK and TSK-11 are currently being used across a wide array of diverse patient populations. [5-8,12-13,15-26] Chmielewski et al[7] used the TSK-11 to measure fear of movement in patients undergoing ACL reconstruction rehabilitation and found that it was highest shortly after surgery and gradually decreased as more time passed. They also discovered that as the athletes started to return to sport the lower TSK scores were recorded in the higher functioning patients. Prugh et al[10] studied TSK-11 in throwing athletes with elbow injuries and found that a specific subscale of the TSK-11 dealing with 'fear of re-injury' has the potential to accurately depict fear of movement, however it was concluded that more research is required to better understand the scale's accuracy as well as the psychological component of an athlete's return to play.[10]

While the current study did not focus on performing psychometric tests related to the TSK-11, the results shed light on how it can be clinically used in the rehabilitation of high-level athletes. The subject's low level of fear after such a gruesome injury could have contributed to her desire to vigorously train outside of rehabilitation and ultimately could have led to the fibular nonunion fracture. This case report suggests a new use for the TSK-11 in the athletic population. The TSK-11 can help clinicians monitor how each individual psychologically perceives their injury in order to ensure the proper guidance and education necessary for optimal physical outcomes as needed.

CONCLUSION

While the subject's psychological state may have been contributory to be a setback initially, it ultimately contributed to her return to sport. Her low level of kinesiophobia may have negatively impacted her compliance with weight bearing restrictions. This non-compliance may have been what led to her nonunion fracture and the need for a second surgery. Previous studies have found that psychological affect is more predictive of return to sport after injury than physical outcome measures.[5] However, it is possible this subject's low level of kinesiophobia allowed her to return to a high level of play following a traumatic injury and subsequent complicated rehabilitation.

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