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Graduate Research Symposium

Xavier University (Cincinnati, Ohio). College of Professional Sciences

Graduate Research Symposium

College of Professional Sciences

Xavier University

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Welcome Note

Welcome to the 2022 College of Professional Sciences Graduate Research Symposium. As an institution of higher learning, Xavier is committed to supporting the pursuit of knowledge and disseminating knowledge through research publications, presentations, and in the classroom. The scholarly work presented today represents contributions to many disciplines. Research requires coursework, literature reviews, instrument creation, and data analysis. Through our students' academic journeys, they acquired knowledge, applied it, and are now creating it.

Students, I hope your research experience was impactful and that you will continue to make contributions to your profession through scholarly presentations and publications. Although it may seem your work is a small fragment, it helps to inform practice, pedagogy, and future research efforts.

I want to thank the faculty members whose mentorship efforts are represented in the work being presented at today's symposium. Time, effort, and expertise are required to guide students during the research process. Thank you for your commitment to this work.

For all of you that are attending today's College of Professional Sciences Graduate Research Symposium, please join in celebrating our students' accomplishments. I am both pleased and proud to see the breadth and depth of scholarly inquiry represented here today. Congratulations students!

Sincerely,

Cynthia Geer, EdD
Dean, College of Professional Sciences

Department of Occupational Therapy

COST-EFFECTIVENESS OF SMART HOMES AND ITS IMPACT ON INDEPENDENT LIVING FOR ADULTS WITH DEVELOPMENTAL DISABILITIES

Ashlyn Denault, Isabel Ferreira, Grace Fuller, Shannon Turnley, Lauren Winslow (Dr. Claire Morress)

Department of Occupational Therapy

Adults with developmental disabilities (DD) often experience barriers to independent living. This three year longitudinal study examined the effectiveness of a smart home in increasing performance of IL skills, while reducing caregiver costs, for adults with DD. Participants were four adults with DD living in a smart home, and their caregivers. This study utilized the Canadian Occupational Performance Measure (COPM), caregiver logs, and cost data analysis to obtain results over three years. Results were analyzed using descriptive statistics. The results showed clinically significant increases in average COPM performance and satisfaction scores over the three years for all residents' self-identified tasks. Furthermore, the hours of direct caregiving decreased by 75%, which resulted in a decrease in cost of caregiving. Smart homes have the potential to decrease cost and improve independent living for individuals with DD and their caregivers. The specific technology utilized by the individuals should be further researched. *Keywords:* smart home technology, independent living, developmental disabilities, caregiver costs

EVIDENCE-BASED PRACTICE INTERVENTION TRENDS FOR CHILDREN WITH CEREBRAL PALSY

Kelli Currin, Nicholas Hembree, Lauren Pressler, Nicole Turich, Elizabeth Winterod (Dr. Claire Morress)

Department of Occupational Therapy

The aim of this study was to explore occupational therapists' use of evidence to improve motor outcomes for children 0-3 years old with cerebral palsy. An anonymous online survey was sent to occupational therapists across the United States. One hundred and ten respondents completed the survey and rated their expertise using evidence-based practice as intermediate or expert (82.61%). The majority of therapists indicated implementing parent coaching, joint goal setting, and home activity programs "frequently" or "always" in practice. On the other hand, only 24.39% of therapists reported using CIMT or mCIMT with children with unilateral hemiplegia, while 80.49% of therapists reported using sensory integration frequently or always with this population. Sufficient time within the workday was the most frequently reported barrier (78.26%) to using evidence in practice. Evidence-based practice is critical to improve motor outcomes for pediatric cerebral palsy clients, however, some newer evidence-based interventions for this population are not being implemented by occupational therapists.

Keywords: cerebral palsy, evidence-based practice, occupational therapy, interdisciplinary team

METAMORPHOSIS TOWARDS INDEPENDENCE: EXPERIENCES WITH DEVELOPMENTAL DISABILITIES IN SMART HOME LIVING

Allison Antonaccio, Olivia Campbell, Caitlin Regan, Rory Thomas (Dr. Joan Tunningley)

Department of Occupational Therapy

Due to recent technological advances, smart homes are continuing to gain support as a safe, autonomous living option for adults with developmental disabilities (DD). Limited research has documented residents' perceptions of assistive technology (AT) or personal satisfaction within smart homes. This qualitative study explored the lived experiences and quality of life (QoL) among adults with DD after living one year in a smart home. Stakeholders from all perspectives (residents, parents, and caregivers) provided their personal feedback through individual interviews, and residents participated in an additional focus group for data collection. The data yielded five themes: Life is easier with smart components; Spreading their wings within the community; Navigating roommate boundaries; Metamorphosis towards independent adults; and Understanding what independence really means. The themes reflect substantial growth, when compared to two prior studies of this population, from planning and then moving into the smart home. Researchers shared anticipation for future growth. *Keywords:* developmental disabilities/intellectual disabilities, smart homes, assistive technology, supported living, quality of life

OUTCOMES OF A SCHOOL-BASED SOCIAL-EMOTIONAL LEARNING PROGRAM ON EARLY ELEMENTARY STUDENTS' BEHAVIORS: A CASE STUDY

Danielle Eilerman, Ruthie Johnson, Kara Langenkamp, Abby Quick (Dr. Carol Scheerer)

Department of Occupational Therapy

Social-emotional learning (SEL) programs foster students' development of skills necessary for success in learning and school participation. This case study compiled retrospective data and assessed behavioral outcomes of eight early elementary students involved in a SEL program at one, Midwestern, suburban school. Data were collected for each student during two intervention periods. From Intervention Period 1 to 2, group averages showed a decrease in duration of problematic behavioral incidents, number of incidents, and incidents with aggression and elopement. Group averages exhibited an increase in incidents with destruction and number of removals from the general education environment. All students progressed or maintained their progress toward educational goals. The school utilized a multidisciplinary team to develop and implement the program, the role of occupational therapy within the SEL program development was notable.

Keywords: occupational therapy, mental health, early childhood center, quantitative research

PATIENT PERCEPTIONS OF OCCUPATIONAL THERAPY STROKE INTERVENTIONS: A QUALITATIVE PILOT STUDY

Kara Horning, Haven Miller, Meghan Perrin, Alexis Sibbio (Dr. Joan Tunningley)

Department of Occupational Therapy

This study aimed to explore patient engagement and satisfaction, and the potential relationship between the two, for occupational therapy (OT) services to patients admitted to an inpatient rehabilitation (IPR) hospital following a recent stroke. This study used a qualitative descriptive method through semi-standardized interviews, including a pre-therapy interview and post-therapy interview, to collect data. The researchers applied their findings through an iterative review process to the original research queries, resulting in four themes: Hopes for Therapy Outcomes, Support Systems, Readiness for Discharge, and Satisfaction with OT. This pilot study of five patients from one site in southwestern Ohio contributed to literature that explores patient satisfaction at an IPR hospital. The results expanded on previous studies by analyzing patient engagement and patient satisfaction within the same study. Overall, this study found a possible connection between patient engagement and patient satisfaction with the outcomes of their OT IPR services. *Keywords:* occupational therapy, patient satisfaction, patient engagement, stroke, inpatient rehabilitation

SCHOOL-BASED PROFESSIONALS' PERCEPTIONS OF SOCIAL-EMOTIONAL LEARNING (SEL) PROGRAMS IN THE EDUCATIONAL CONTEXT

Tyler Anzelmo, Kristen Coyle, Laurel Pendergest, Abigail Yelton (Dr. Carol Scheerer)

Department of Occupational Therapy

This study explored the perceptions of 11 school-based professionals who supported the work of a social-emotional learning (SEL) program at an early elementary childhood center located in their school. Data were collected through an online survey, interviews, and focus group. Five themes emerged from the voices of the professionals involved in the study: All About Perceptions; Success Starts with a Plan; The Road to Success; Resources and Reassurances; Teamwork Makes the Dream Work. Participants noted their desire to expand the Program throughout the school district and nationwide. The findings from the study were congruent with the preliminary research on this topic. Further research is needed to determine the long-term benefits and success of the Program on student mental wellness and academic success. *Keywords:* Social-Emotional Learning (SEL), collaboration, school, children, mental wellness

STUDENT VOICES LEAD THE WAY: MINORITY OCCUPATIONAL THERAPY STUDENTS SPEAK UP AND OUT

Julia Daanen, Jess Lanty, Ally Orth, Kyra Saade, CeCe Schul (Dr. Carol Scheerer)

Department of Occupational Therapy

The aim of this study was to understand the lived experience of minority occupational therapy students and/or alumni in order to support diversifying efforts at one Midwestern private university. Interviews and focus groups were conducted with five male or non-white female occupational therapy students and/or alumni from the Program. Six themes emerged from the voices of the participants in this study: University Process, Favorable Experiences, Unfavorable Experiences, Lack of Diversity, Challenges Faced by Minority Students, and Future Suggestions for Reaching Minority Students. Clinical implications suggest actively hiring more diverse faculty to increase sense of belonging among minority students and amplifying awareness of the profession of occupational therapy to diverse high school students and communities to garner their interest. Diversifying occupational therapy programs will lead to a more diverse profession better fulfilling the healthcare needs of the clients with whom future occupational therapy students will serve. Further research is needed on this topic, however, this study can be used as a basis for future research to increase diversity in this Program and in turn the profession. *Keywords:* healthcare, diversity, male, non-white

Department of Sport Science and Management

SUBLIME TUBERCLE STRESS REACTION IN A COLLEGIATE BASEBALL PLAYER: A LEVEL 3 CASE REPORT

Cassidy Baker (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: Sublime tubercle stress reactions in young athletes is a very rare occurrence according to modern literature. When they do occur, it is realized in overhead throwing athletes more than any other subjects. Stress reactions around the elbow occur mostly in overhead throwing athletes, they are also seen in sports involving repetitive weight-bearing through the elbow, such as gymnastics. The injury presentation is dependent on the patient's age along with the biomechanics and loading characteristics of the sport involved, leading to pathology most commonly in the distal humerus, olecranon process of the ulna, coronoid process of the ulna, sublime tubercle and in some cases the radial head. In certain situations, a diagnosis can be obtained based on clinical history, examination, and radiography, while magnetic resonance imaging is frequently necessary for a conclusive diagnosis. Patient: A 20-year-old male, collegiate baseball player, sustained a sublime tubercle stress reaction in his right elbow. The patient reported to the athletic trainer complaining of pain in the posterior aspect of the right elbow. He reported he felt a "different" sensation in his elbow. He complained of having "dead-arm" after ten pitches in his 25-pitch session; however, he had no known

history of having elbow injuries. During the initial evaluation there was no deformity, ecchymosis, discoloration, or severe pain with palpation. The patient only complained of pain during active full extension and end-range of passive extension. Intervention or Treatment: Patient was referred to a physician and x-rays were unremarkable. They were then referred for magnetic resonance imaging; MRI detected a sublime tubercle stress reaction at the proximal ulna. The patient did not undergo surgery and they were prescribed Diclofenac by their physician to treat mild inflammation and pain. They also received treatment, such as infrared light pads, instrument assisted soft tissue manipulation, and blood flow restriction. These rehabilitation techniques were continued through the remainder of the semester and until the patient continued to feel pain in the medial elbow; furthermore, the medical staff wanted to make sure they did not lose their pitching endurance, so they returned to a full throwing progression within two months of the initial injury. Outcomes or Other Comparisons: The patient's progression was slowed intentionally to ensure no other injuries, yet they still progressed more quickly than the literature presents. Protocols estimate that the patient rests for two-three weeks; however, with this patient clinicians used an active recovery instead of two-three weeks of complete rest. They returned to a full throwing progression and lifting in a timeframe that isn't as consistent because the medical staff wanted to ensure they did not lose the pitching endurance from being a D-I collegiate athlete. Conclusion: The mainstay of management is rest and activity modification; however advanced pathology often requires surgical

management for successful resolution and return to play. Activity modification, according to standard care, is the only treatment with sustained positive results. Without many other cases to compare, it's improbable to say whether this is common or if the patient healed at an unusually fast rate. During the rehabilitation process, the athletic trainer and athletic training students did not come into contact with any issues or complications that would not have been expected. Clinical Bottom Line: According to the literature there is no well-defined treatment for sublime tubercle stress reactions. In accordance with standard care, modified activity worked the best for the patient.

GASTROCNEMIUS STRAIN WITH SUSPECTED TEAR IN PROFESSIONAL BALLET DANCER

Danielle Brewin (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: Gastrocnemius strains typically occur during maximal extension of the knee with the ankle in full dorsiflexion causing the tension to overload the muscle to the point of a strain and/or tear. Studies have shown that the medial head is more susceptible to injury as it is more responsible for muscular activity. Khalfaoui et al. recommends using the PRICE principles of protection, rest, ice, compression, and elevation, followed by passive stretching and isometric strengthening exercises focusing on mobility and stability. The purpose of this Level-1 case report is to validate the treatment protocol for medial head

gastrocnemius strains with a medial head tear. Patient: A 30-year-old, female, professional ballet dancer developed a medial head gastrocnemius strain with suspected tear from overuse and cross-training during her/the performance season. The patient has a history of lower extremity muscular strains. The patient reported to the athletic training facility 3 days after the pain became significantly worse with complaints and symptoms of pain, swelling, cramping, warmth, and trouble weight-bearing on her left gastrocnemius. A dent in the medial gastrocnemius could be palpated where the patient complained of point tenderness. ROM of dorsiflexion and plantarflexion was limited and painful, but MMT of the gastrocnemius was found to be full strength. The patient was found to have a positive squeeze test. Due to the symptoms worsening, the patient was referred out to the emergency department to check for deep vein thrombosis. A blood panel with D-dimer showed normal results and a lower extremity duplex was negative for blood clots. No further imaging was taken. The patient was then diagnosed with a medial head gastrocnemius strain with suspected tear. Intervention: The patient was immediately placed on a steroid dose pack and in a walking boot. She was removed from performances to help reduce inflammation and pain. Interventions included therapeutic exercises, manual therapy, cryotherapy, blood flow restriction exercises, electrical stimulation, taping, and patient education. During the first 4 weeks, the therapeutic exercises started with non-weight bearing exercises and light strengthening before progressing to weighted strengthening and proprioceptive exercises. Around week 5, the patient began training in sport specific exercises,

including barre work. At week 8, the patient was allowed to begin pointe work using the support of the ballet barre before she progressed during week 9 to unsupported pointe work. At week 10, the patient was cleared for full return to dance after she was cleared to begin jumps. The patient continues to seek maintenance treatment but has not reinjured her gastrocnemius. Outcomes or other Comparisons: Khalfaoui et. al. recommends using the principles of PRICE before progressing to recommended therapeutic exercises over 6-8 weeks before patients will be cleared for full return. This patient used a program with the same aspects as Khalfaoui's et. al's recommendations throughout a 10-week program. While Khalfaoui et. al's protocol is only for 8 weeks, this patient took longer to fully return to play as her sport requires more gastrocnemius stability to have proper technique on pointe. Comparatively, the patient in Khalfaoui et. al.'s study was cleared for full return to dance during week 6 of their recovery. This patient was cleared after 10 weeks of rehabilitation after her return to full pointe work. Both patients completed a similar rehabilitation plan focusing on the PRICE principles and therapeutic exercises. Conclusion: In terms of the intervention used, it is well supported that the intervention of PRICE and therapeutic exercises that focus on mobility, strength, and stability is an effective rehabilitation technique. Clinical Bottom Line: This Level-1 case study validated that patients with medial gastrocnemius strains with partial tears can be rehabilitated using the principles of PRICE and therapeutic exercises focused on proprioception and strength.

REHABILITATION GUIDELINES OF AN ANTERIOR CRUCIATE LIGAMENT TEAR WITH ASSOCIATED PARTIAL POSTERIOR CRUCIATE LIGAMENT TEAR: TYPE-3 CASE STUDY

Tevin Burdette (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: The ACL rehabilitation protocol created by Wisconsin University sports medicine, is broken up into five phases focusing on surgical recovery, strength and neuromuscular control, agility and jumping, return to sport, and reinjury prevention. Throughout each phase, the patients returning from ACLR try to accomplish set goals that lead to a healthy return to activity. Even though clinicians should approach the exercise rehabilitation program following evidence-based recommendations, each program should be individualized to assure the patients meet their set RTP goals. ACL injuries are common in soccer athletes due to the biomechanics of the sport (landing, cutting, and decelerating), and frequency of collisions with players. Contact ACL injuries are often accompanied by additional structural damage which can factor in how the rehabilitation can be programmed. Patient: A 22-year-old male intercollegiate soccer player sustained a right knee injury in a collision during a game. During the initial evaluation, the team's athletic trainer evaluated the patient and treated for possible knee ligament tears and a proximal tibia stress fracture. The team physician ordered an MRI, which confirmed an ACL tear, partial PCL tear, medial meniscal tear, and tibial plateau stress fracture.

Intervention: The PCL tear was treated conservatively for 6 weeks until surgery to repair the ACL and meniscus. After the surgery, the patient wore a straight leg brace to prevent hyperextension and posterior tibial translation. The patient's ACL was repaired using a patellar tendon graft and his meniscal tear with a partial synovectomy. Post-operation the patient used a straight leg brace for protection during sleep. Initially the patient's rehabilitation plan focused on regaining full ROM and building up quadriceps strength through blood flow restriction exercises. After gaining full knee extension and flexion, the patient progressed to single leg neuromuscular control and single leg press strength. As the patient progressed to phase 3, he returned to running, landing, and making lateral cuts. Outcomes & Other Comparisons: Due to the conservative treatment of the partial PCL tear, the ACL reconstruction was delayed 6 weeks compared to a typical ACL-R timeline. Most patients with ACL tears wait about 2-4 weeks after injury for their surgical repair, but timing is more dependent on the patient's ROM, swelling, leg strength and control. During phase one, the patient regained full passive knee flexion and extension one-month post-ACL-R. This patient tested well on the functional alignment test, an outcome measure for the single leg squat two months post-op. This successful testing proves the patient has proper balance and strength with no observed deformities throughout the first few months of rehabilitation. This patient has progressed through each phase without any major setbacks and is on schedule to return to full activity in 2-3 months. Conclusions: Due to the partial PCL tear, this patient couldn't follow standard ACL-R protocol and delayed surgery to allow the PCL to heal.

Although surgery was delayed four weeks, the conservative treatment allowed the patient to gain normal ROM and leg strength prior to surgery. Once the PCL tear healed and successful surgery occurred, the patient progressed through each phase of the ACL protocol without any setbacks and currently has 80% of full strength in his right quadriceps. Clinical Bottom Line: When managing an athlete with an ACL injury, it is important to follow each phase of the protocol safely and timely for the individual. Even though the collateral ligament damage occurred along with the ACL tear, conservative treatment still allowed the athlete to successfully rehabilitate their knee following surgery. Although the protocol for RTP on ACL injuries is standard practice for clinicians, each patient's case presents unique challenges and setbacks to regaining full strength, ROM, and proper neuromuscular control.

POST TEAR OF ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION

Ashley Costa (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: An Anterior Cruciate Ligament (ACL) injury is among the most common knee injuries that athletes are sustaining. Around 50% of knee injuries involve an ACL tear. The timeline for a patient to return to play (RTP) is 9 to 12 months. Even with proper care and rehabilitation, it is still possible for the athlete to sustain another ACL tear within 6

months to 2 years post reconstruction. The protocol that is put in place contains 4 stages to build up strength, increase stability, and regaining ROM. Although, patients that pass this and return to play have a 20% risk of retearing the ACL. Patient: A 17-year-old, high school, multisport athlete sustained two ACL tears within a single year. The patient torn his ACL the first time while wrestling, along with the lateral collateral ligament and the medial collateral ligament. The physician suspected that the patient would sustain surgery to fix all the ligaments. After surgery, the patient completed a rehabilitation program and return to play with no restrictions in just seven months. However, at eleven months post-op the patient sustain another, isolated, ACL tear. This indication was with a positive anterior drawer test and a positive Lachman's test. The team physician referred the patient for a MRI to confirm, and it was torn. The patient, again, underwent surgery in December 2021 for another full ACL reconstruction. Intervention or Treatment: The patient underwent surgery in March of 2021, performed by the team physician. The surgery was a full ACL reconstruction, with a graft from the semimembranosus along with a MCL and LCL repair. The patient completed a standard rehabilitation that help to regain ROM and overall strength in the involved knee. After a follow up at the 5 ½ month mark the team physician started, the patient on the rehabilitation program called the Bridge program that progressed him back to sports activity. The Bridge program has the patient doing sports specific activity 2-3 times a week for 6 weeks for an hour to an hour and a half. During this program, they are working with the patient on things such as cutting, jumping properly, and other things specific to their sport or activity all

in a clinical setting. After the patient complete the Bridge program, the team physician made him perform a series of task to test his strength, range of motion, and overall the stability of the joint. The patient completed the 4-stage rehabilitation program fasted than the average athlete, giving him full clearance to RTP in just seven months post-op. Outcomes or other Comparisons: The normal return to play protocol is 9 to 12 months to recover from a full ACL reconstruction. The patient fully recovered and cleared for sporting activities at the 7-month mark. On average patients reach the Bridge program around the 7-month mark, however, the patient reached this step of the rehabilitation process at 5 ½ months post-op. Conclusion: The average time for a patient to recover from an ACLR is eight to twelve months. However, with about 20% of patient will sustain a retear within the first two years of the initial clearance to RTP. Clinical Bottom Line: Rehabilitation programs can limit the chances of sustaining an ACL tear from reoccurring, however, there is still a chance for that to happen. There needs to be an adjustment to rehabilitation programs that will allow a patient to progress into sports activity at the volume and intensity they would be experiencing in a high-pressure game.

ARTHROSCOPIC STABILIZATION LABRUM SURGERY TO REPAIR AN ANTERIOR INFERIOR LABRAL TEAR: LEVEL 1 CLINICAL CASE STUDY

Derek DeMaison (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: Labral injuries are common in the world of sports, especially in overhead athletes. However, they are not as common in basketball although the sport contains overhead components. The main treatment used for this is an arthroscopic stabilization of the joint capsule. The alternate treatment for this injury is rehabilitation and strengthening of the surrounding musculature throughout the patient's shoulder. Patient: The patient was a 22-year-old, female, collegiate basketball player, who is right hand dominant. She is an experienced basketball player who has been playing since she was about 5 years old. During a game the patient jumped for a loose ball when an opposing player grabbed the ball from behind, forcing her shoulder into external rotation and extreme flexion. The patient continued to play with the torn labrum for the remaining 3-weeks of the season wearing a Sully brace. After imaging done with MR Arthrogram the patient was diagnosed with an anterior-inferior labrum tear from 6'o-clock to 11'o-clock with a glad articular cartilage shear injury to the inferior glenoid, as well as a posterior labrum tear from 6'o-clock to 4'o-clock. The patient elected arthroscopic surgery on the injured shoulder to restabilize the joint. During the arthroscopy the physician found multiple chondral loose bodies in the subscapularis recess, as well as a chondral

defect on the inferior humeral head. Interventions or Treatment: The patient underwent an arthroscopic labrum stabilization surgery in order to repair the injured shoulder. The arthroscopy confirmed the labral tear seen on the MRI as well as a chondral defect on the inferior humeral head 1.5x2cm full-thickness, with no significant Hill-Sachs lesion. Surgeons completed an arthroscopy of the left shoulder with removal of chondral loose bodies, anterior inferior labral repair, and posterior labral repair. The patient was placed into a well-padded lateral decubitus position. Physicians then used two portals both anterior and posterior to debride the frayed labral tissue and complete the procedure. After the surgery the physicians implemented a 7–9-month rehab plan in order to get the patient back into full contact basketball without compromising the anatomic repair. Outcomes or other Comparisons: The desired outcomes the physicians created for the patient were to continue to play basketball while having an increase in shoulder stability, and to have minimal symptoms and treat them as they come. On the patient's last checkup, 5 months post-surgery passive ROM was measured, and the clinician reported that she had shoulder abduction of 90°, external rotation of 70°, and internal rotation of 20°. Her strength for abduction and flexion was listed as a 4/5 as well. Clinically, there was good stability in the glenohumeral joint from anterior to posterior translation. The patient went on to play the following season in a Sully brace and rarely had any issues with the involved shoulder. Conclusion: The use of arthroscopic stabilization labrum surgery instead of other interventions is the best and most efficient way to get our patients back onto the court, Moeller et al. found the procedure had a 92.4% favorable

outcome. Edwards SL et al. found 71% of patients who completed nonoperative treatment were able to return to their sport at preparticipation levels. The rehabilitation alone does not decrease the risk of reinjury, increase stabilization, and increase quality of life like arthroscopic stabilization labrum surgery. Clinical Bottom Line: Arthroscopic stabilization labrum surgery is the most efficient way to repair the injury and improve the symptoms of pain and stability in the athlete. It is considered the “gold standard” treatment. If financially possible, arthroscopic stabilization surgery is the recommended treatment.

SHOULDER LABRUM TEAR IN A HIGH SCHOOL FOOTBALL/SOCCER PLAYER, A LEVEL 1 VALIDATION CASE

Morgan Dreyer (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: There are four types of SLAP tears. Type two tear are the most common tear among SLAP tears. This type of tear shows fraying, and the superior labrum is torn off the glenoid, which leaves a gap in the articular cartilage with anterior and posterior lesions. SLAP tears are normally diagnosed by an MRI, because there is usually more damaged than just the patient’s labrum. The patient’s chief complaint is anterior shoulder pain with clicking or popping of the shoulder. The anterior slide test, apprehension test, Jerk test and the Yergason’s test are used to help diagnose a SLAP tear. Patient: The 17-year-old, football/soccer

player had shoulder pain after landing on his shoulder when he dove for a ball. The patient continued to play through the pain for about two-three weeks before the pain worsened, and the patient saw the athletic trainer. The athletic trainer suspected a labrum tear due to the positive Jerk and apprehension tests. The athletic trainer sent the patient to a physician for further evaluation and possible imaging. The physician found that the patient had weak supraspinatus, infraspinatus, and subscapularis muscle strength and anterior instability. This led the physician to perform the Jerk test and apprehension test, which had positive signs of pain clicking and popping. An MRI was ordered and confirmed: posterior instability, reverse Hills-Sachs contusion, tear posterior inferior labrum, posterior inferior glenoid rim periosteum stripping and capsular sprain, mild bursitis, and intact cuff tendons. Treatment or Intervention: The physician allowed the patient to continue to play football pain tolerated and had the patient wear a brace while playing and throughout the day at school. The patient used cryotherapy on his shoulder three times for 15 minutes throughout the day and twice for 15 minutes after practice. After the football season was over, the patient received an anterior and posterior labral repair. He was immobilized with a sling for 10 days and was then sent to physical therapy 10 days after surgery. The patient started with PROM exercises in physical therapy including supported elbow flexion. The patient then moved to ROM exercises on week five, which included external rotation and horizontal exercises. On week eight the patient started strengthening exercises for the supraspinatus, infraspinatus and subscapularis muscles, an exercise example included rows. On week 12

the patient started with sport specific exercises, and begin to weight train, an exercise example is push up progression. Outcomes or other Comparisons Thayaparan suggested patients use a sling for six weeks and start passive range of motion exercises during the first six weeks post-surgery. The patient in this case progressed in a similar fashion that was reported by Thayaparan and did similar exercises including PROM, ROM and strengthening exercises. Neither patient experienced any complications post-surgery. Conclusion: There are five phases of rehabilitation, this patient is on phase four of rehabilitation, this patient is progressing on the correct timeline. Rehabilitation is a key to the process and to have a patient progress with no complications. Based on my findings I suggest a patient receive SLAP repair surgery and to start physical therapy right away to avoid any future complications. Clinical Bottom Line Throughout this research I found that type-2 labrum tear, it is better to get a SLAP repair surgery especially if the patient wants to continue to be active and play sports. After surgery it is best to start physical therapy right after to avoid complications. It is recommended that rehabilitation occur over five phases, and it may take up to six months until the shoulder is fully healed.

ABNORMAL PRESENTATION OF KIDNEY LACERATION IN A HIGH SCHOOL FOOTBALL PLAYER

Caitlin Hilberg (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: Solid organ lacerations, specifically kidney lacerations, occur infrequently in athletic populations. However, when these types of injuries do occur in athletes, the injury is typically result of blunt force trauma and the affected athlete presents with severe, recognizable symptoms from onset. This level 3 case study explores an abnormal presentation of such injury, despite the athlete suffering a typical MOI. Patient: A 16-year old high school football defensive lineman was participating in a Saturday morning junior varsity (JV) football game. He presented to the AT on the sideline complaining of mild flank pain. The athlete stated they laid out to make a tackle and landed on an opponent's helmet. He was tender to palpation in the left flank and ribs, though palpation showed no indication the athlete sustained severe internal trauma with no rebound tenderness, rigidity, obvious crepitus, false joint, deformity, immediate swelling, nor bruising, etc. After quick sideline evaluation, it was suspected the athlete sustained a contusion from collision. He received bio-freeze spray to attenuate pain and was permitted to return to play for two quarters following initial injury. The athlete then returned to the AT complaining that pain had increased, with mild trouble breathing, tightness in the affected area, and light-headedness. At this time, the AT suspected possible rib

fracture or displacement, and removed the athlete from the remainder of the game. After the athlete was terminated from play, pain was mitigated enough that he, and his parent, felt he could wait to see the team physician at the varsity football game that evening. Between leaving the JV game and arriving at the varsity game, his condition significantly deteriorated. The team physician immediately sent the athlete to the emergency department. Upon arrival, he was admitted to the ICU and underwent several MRIs, CT scans, etc. where it was discovered he suffered a grade 4/5 kidney laceration, 5 being most severe. Intervention: Twenty-four hours after admittance, the patient began urinating blood and vomiting. He then spent 6 days in the ICU, although he didn't require surgical intervention. He was cleared for discharge on day 6 with the following treatment plan: no activity—outside of ADLs—for 6-8 weeks, and several follow-up CT scans to ensure proper healing—which is the typical intervention for this type of injury. The kidney showed sufficient healing at approximately the 8-week mark, at which time the athlete was cleared to return to light activity and enter return to play protocol. Outcomes: The comparative outcomes for this case relate to initial presentation. While this patient suffered typical MOI, they didn't present with typical symptoms (severe difficulty breathing, immediate bloody urine, abdominal rigidity, hematuria, ecchymosis, debilitating pain, etc.). Comparatively, this patient presented with few of those symptoms and was able to continue participating in a high-impact sport for two additional quarters. Conclusion: This is the first known case report in which a patient from an athletic population with solid organ laceration presented these

symptoms (or lack thereof). The current case demonstrates that, despite unusual presentation, typical treatment is sufficient in returning the patient to their sport. Additionally, this case presents ATs with alternate signs and symptoms to consider when internal injury is of concern with similar MOI. Clinical Bottom Line: Athletic trainers may not often be faced with blunt force trauma internal organ injuries; however, this case provides framework for recognizing unique presentation of such injury. It is important for ATs to understand that certain sports, and positions within those sports—such as football tackling positions—are at higher risk of sustaining internal organ laceration due to repeated exposure of the flank during tackling impacts.

REHABILITATION OF OS TRIGONUM AND METATARSAL STRESS FRACTURE IN HIGH SCHOOL BASKETBALL PLAYER: LEVEL 3 CASE STUDY

Brad Jodice (Dr. Lisa Jutte)

Department of Sport Science and Management

Background: Stress fractures of the lower extremity are common in athletes and usually classified as overuse injuries. Stress fractures are common in people who do activities that put a lot of load on their feet such as running, jumping. Os Trigonum is an extra bone that causes problem when repeated ankle sprains occur. The main treatment for this both stress fractures and Os trigonum is conservative rehabilitation and rest, while severe injuries do not respond to conservative treatment involve a surgical intervention.

Patient: A 17-year-old, basketball player began experiencing ankle pain after rolling his ankle during his junior year otherwise his medical history was unremarkable. The patient denied tenderness with palpation of calcaneus and over the 5th metatarsal of his left foot. He was evaluated by an orthopedic surgeon who appreciated a negative piano key test and order an X-ray and MRI. The X-ray imagining revealed Os trigonum in the involved limb. MRI scans show edema of the calcaneus and the lateral three metatarsals. One more month later MRI scan found similar findings confirming diagnoses of Os trigonum. This deformity can cause the posterior ankle impingement leading to abnormal loading of the midfoot which has since caused the stress marrow reaction of the 5th, 4th and 3rd metatarsals. Intervention or Treatments: The patient was immobilized in non-weight bearing plaster cast for six weeks. When re-evaluated at six weeks, patient still reported tenderness over the fracture site. The patient was then placed in an immobilization boot for two weeks prior to his Os trigonum surgery. The orthopedic surgeon suggested an incision of the Os trigonum after the patient attempted conservative options including bracing, icing and medications. The patient and his parents elected to have the procedure done. Post-surgery the patient was casted for two weeks. Patient was expected to attend therapy two visits/week for an expected duration of four weeks. Patient was instructed in the independent performance of a home exercise program that addresses the problems and achieving the goals outlined in plan of care, which included improvement of left ankle ROM and strength. He was progress slowly out of the boot per physician protocol and pain tolerance. Therapeutic

modalities used included cryotherapy, vasopneumatic compression, electrical stimulation (e-stim). Outcomes or other Comparisons: Surgical and nonsurgical treatments begin both with rice, ice, compression, and elevation (RICE) which allow to decrease activity and immobilize the affected areas. Rest and modified activity are the standard of care for a treatment of stress fractures. Queen R.M. et al., found that 86% of patients return to previous function after following this plan of care. Return to play is monitored and the patient gradually increases their activity. Protective footwear, including orthotics and taping to support a fixed position can help reduce stress on the foot. Most stress fractures respond well to conservative treatment; however, a small group of patients fail to respond even after prolonged immobilization, requiring surgical intervention. Though with conservative treatment, the average time needed to return to activity is six weeks. Conservative treatment allowed this patient to avoid a surgical intervention for his stress reactions. The patient did strengthen and mobility exercises that are not explained in literature. Those exercises include isotonic, flexibility and dynamic training. The patient did not receive orthotics to help with absorption. Conclusion: The increased frequency of stress fractures demands a nonoperative treatment options that allows individuals to successfully return. Although this patient may have benefited from a longer period of immobilization. Clinical Bottom Line: This level 3 case study validated that patients with stress fractures can successfully return to pain free activities by following a 6 week rehabilitation program.

VERTEBRAL STRESS FRACTURE IN A HIGH SCHOOL ATHLETE WITH NUTRIENT DEFICIENCIES. LEVEL 3 CASE REPORT

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Background: Chronic overuse injuries are very common with high school athletes due to the amount of time they spend being active, diet, and those that train year-round for their respective sport. Bilateral fractures of the lumbar however, are a rare phenomenon that usually arise from other underlying issues. It may take several weeks to diagnose a stress fracture because they usually begin with x-ray imaging, while stress fractures usually show up on MRI's and CT scans. As a result, these stress fractures can often be misdiagnosed at first as a lower back strain. Stress fractures are also a risk factor for people with calcium and vitamin D deficiencies. Vitamin D and calcium are known to be important for bone growth and health. These deficiencies can be attributed to a multitude of things but usually can be pinpointed to not getting enough sunlight and not eating a proper diet. Due to the rarity of the bilateral vertebral stress fractures and the physician not following any protocol, this is a level 3 case report. Patient: The patient is a 17- year- old, male, high school basketball player who complained of low back pain. The patient stands 7 feet and 2 inches tall. The patient has played basketball for most of the year, competing on his high school team as well as AAU. His CT scan showed a bilateral stress fracture on the L5 lumbar vertebrae. Blood

sampling were taken, and it was noted that he had deficiencies in calcium and vitamin D, but the exact values were not in the physician's report. He has been known to have nutrient deficiencies since he was 12 years old. Intervention: The patient's physician created a plan of conservative treatment of rest and daily supplementation of calcium (4000units) and vitamin D supplementation for 6 weeks. The main goal of this treatment was to see enough progress to prevent surgery so he would be able to compete in his upcoming basketball season. After the original six weeks, new CT scans showed that the bilateral fractures were healed, and his calcium and vitamin D levels were in normal limits (vitamin D was at 62ng/ml). There was some mild disc bulging at L4-L5 and L5-S1, however there was no nerve compression present. Outcomes: After the 6 weeks a new CT scan showed that both of his fractures on his vertebrae were fully healed. At that time, he was experiencing some minor bulging at L4-L5 and L5-S1 with no nerve compression. He was able to begin cardiovascular training in two weeks and begin resistance training in four weeks. His physician anticipated for him to be cleared for non-contact basketball drills after the four weeks as well. When compared to other vertebral stress fractures, authors and clinicians noted that conservative treatment was a valid first course of action for healing. Knechtle et al. noted that the prevalence of stress fractures decreased when athletes are supplemented daily vitamin D and calcium. A study performed on military recruits concluded that improving vitamin D and calcium status with 800 IU/day vitamin D and 2,000 mg of calcium supplementation has been shown to reduce the risk of

developing stress fractures. Clinical Bottom Line: Research suggests that conservative treatment may be the best original intervention, especially if the patient is adolescent. If a lumbar stress fracture fails to heal or if the patient continually reinjures the same vertebrae, then surgical options should be explored. Vitamin D and calcium levels should be recorded as well, especially in adolescents, this could be a preventable measure if they have any deficiencies. It should be considered to include blood sampling in pre-participation exams to find the values of nutrients like vitamin D and calcium for preventative measures. Though it might be difficult to implement in high school settings due to parental consent.

TIBIAL STRESS FRACTURE IN COLLEGIATE BASKETBALL ATHLETE

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Background: This case report reviews a Division-1 collegiate basketball player who was diagnosed with two separate stress fractures on his left tibia. Stress fractures usually occur from cumulative microtrauma and most patients cannot remember a simple event that caused the pain. The pain from a typical stress fracture has a specific spot of point tenderness over the fracture site. This pain tends to radiate from the involved fracture site. Symptoms increase as activity level and duration increase. There are many different treatment options for lower leg and foot stress fractures, most of them center around rest and cross

training. Surgery is used occasionally when the stress fracture is incomplete after attempting conservative treatment. One of these surgeries is intramedullary rodding, and it uses plates, screws and/or pins to correct the defects in the bone. Patient: The patient, a junior in college on the division-1 school's basketball team, reported he was injured over the summer, with two stress fractures on the anterior surface of his left tibia. When the patient was re-assessed the following December, the smaller stress fracture had healed, while the larger, 8mm long, stress fracture was still incomplete. Near the end of the next month, the patient was kicked in the tibia during practice, started to report pain along the left medial tibia, therefore he was scheduled for bone imaging. Based on the results of the imaging and the patient's symptoms, he was removed from basketball, and it was then decided he would receive surgical intervention for his incomplete stress fracture. Intervention/Treatment: The surgery began with an incision over the proximal patellar pole and a longitudinal split was made in the quadriceps tendon. A trocar was inserted into the joint and was inserted down in the medial aspect of the lateral tibial spine, just off the anterior articular margin. The trocar was fixed into place with two screws, one proximally and one distally. The quadriceps tendon and skin were sutured after the completion of the surgery. Post-surgery, the patient completed care and rehabilitation with the team's athletic trainer and had multiple check-ups with the team physician. At about ten weeks post-surgery, the patient complains of discomfort along the posterior medial aspect of the left knee, near the proximal screw insertion from the surgery. The patient and team physician decided to have a second

surgery to remove the screw causing the patient's discomfort. This surgery took place in June. At the three week follow up, the patient was cleared to participate in activities as tolerated. Outcomes: The patient in this case report received surgery eight months after his initial injury when his original, conservative, treatment of rest, bone stimulation and vitamins were ineffective. This is two months later than the literature's recommendation of 6 months. Also, the patient in this case study had to have a second surgery to remove the screws in the rod, as they were causing discomfort and some pain. This is one of the more common side-effects, but it is not the standard. Conclusions: This patient presented with typical signs and symptoms of a stress fracture. The patient completed conservative treatment for eight months before opting for surgery. This patient had the typical surgical intervention of intramedullary rodding completed for his stress fractures. This process forms an internal splint to help the bone heal completely and correctly. This form of surgical intervention also helps the patient weight-bear faster than usual. Clinical Bottom Line: The recommendation is to attempt treatment of stress fractures with conservative treatment for 6 months, and if that does not heal the stress fracture, surgical intervention should be used.

A VALIDATION CASE REPORT OF A CLAVICLE FRACTURE IN A HIGH SCHOOL FOOTBALL ATHLETE

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Background: Males ages 10-19 years old are at greater risk for clavicle fracture than any other age group or sex. Clavicle fractures account for 10% of all sports related fracture and 85% of adolescent clavicle fractures occur in sports. Clavicle fractures most commonly occur in bicycling and football. The incidence of clavicle fractures in males ages 10- 19 years old is 91.7 per 100,000. The most common mechanism of injury is falling on the shoulder causing axial loading of the clavicle. Immobilization is the key to conservative treatment. Use of a figure 8 bandage, shoulder immobilizer, or sling can be used to minimize movement. A sling is the most common treatment used because it does not put pressure on the fractured clavicle while keeping the shoulder stable and preventing movement. Patient: The patient is a 16-year-old high school football athlete with a greenstick clavicular fracture. The fracture occurred in a practice setting while performing a catching drill. The athlete dove for the ball and landed on their shoulder. The athletic trainer saw no visual deformity and piano key sign was negative. The patient was given ice and anatomically splinted until his parent arrived. The patient was referred to an orthopedic walk-in clinic for pain management and an x-ray. Intervention or Treatment: The clinic confirmed the fracture with an x-ray and provided the patient with a sling. The clinic referred the patient to the

team physician for further treatment. The team physician determined that no surgery was needed because the fracture was not displaced. At first the patient reported discomfort with use of the sling and would try to wear the sling improperly by placing pressure on the fractured clavicle with the strap. Proper use of the sling was emphasized, and the patient was more compliant. The patient wore the sling for three weeks. At six weeks post injury the physician followed up with the patient to confirm union with an x-ray, full shoulder ROM, full strength of shoulder musculature, and no point tenderness. The patient was cleared to return to play gradually. The patient started participating in team workouts and worked his way up to full contact practice. At seven weeks post injury the patient was comfortably participating in full contact. Outcomes and other Comparison: Most nondisplaced clavicle fractures are treated conservatively as they will heal without reduction or internal fixation. General treatment guidelines suggest return to sport can occur when x-ray confirms fracture union, full ROM is achieved, strength is returned, and there is no point tenderness over the fracture. Complete ROM and no point tenderness can be achieved as early as 3-5 weeks. Full strength is regained around 6-10 weeks in adolescent populations, and no physical therapy is needed. Gradual return to full contact is suggested to acclimatize the patient. This patient followed the expected timeline for return to play and is an example of a typical case. Conclusion: This patient has full ROM, strength, and no point tenderness. After his acclimatization period he successfully returned to football. Although conservative treatment with a sling seems simple, it is the most effective treatment method in the case of

nondisplaced clavicle fractures. Critical Bottom Line: Conservative treatment of greenstick clavicular fractures in adolescence using a sling is effective. The rate of nonunion after conservative treatment of nondisplaced fractures is 7.9% and surgical fixation would be unnecessarily invasive and considerably more costly.

A SALTER-HARRIS DISTAL FEMUR FRACTURE IN A HIGH SCHOOL FOOTBALL PLAYER: LEVEL 3 CLINICAL CASE STUDY

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Background: A Salter-Harris fracture refers to a fracture that occurs through a growth plate. Salter-Harris fractures are unique to children because they involve a growing structure. This type of injury makes up 15 to 30 percent of bone injuries in adolescents. Salter-Harris fractures are common in the femoral head, but the patient's fracture occurred in the distal epiphysis of the femur. The fractures can be classified into 5 types. This patient was placed into the type III category. Type three is an intra-articular fracture extending from the distal physis into the distal epiphysis of the femur. These fractures are considered uncommon since the epiphysis is involved. Ten percent of Salter-Harris fractures are type III. The level-3 case study describes the treatment provided to a patient with a type III fracture. Patient: The patient is a 16-year-old high school football player that sustained a Salter-Harris fracture to the distal femoral epiphysis during a

tackle. The collision caused the athlete to land in a figure four position, while the opponent applied pressure on top of the patient's body. This patient had sharp point tenderness proximal to the MCL. No deformity, ecchymosis or edema was present immediately following injury. Special tests ruled out ligament damage and laxity, but it did create pain. This patient was referred to the team physician the next day for an evaluation and x-rays. Intervention or Treatment: This patient was not a candidate for surgical repair because it was a clean fracture. The fracture did not cross the epiphysis, nor was it displaced. This means the bone could fuse together properly with casting. This patient was placed in a full leg cast for eight weeks, non-weight bearing. Once the cast was removed he was cleared for rehabilitation. The athletic trainer began with therapeutic modalities like cryotherapy, thermotherapy and electrical stimulation to control pain. This patient completed quadricep and hamstring strengthening exercises to diminish atrophy and increase ROM. Resistance was added as well, once the patient's strength increased. The next step included balance and athletic related exercises. This involved single leg balance, running, cutting, and jumping agilities on the field. Outcomes or Comparisons: The patient is now fully recovered and has returned to play for the lacrosse season. The American Academy of Orthopedic Surgeons (AAOS) created guidelines on the treatment of pediatric epiphysis femur fractures. The rehabilitation programs of the AAOS and St. Xavier's athletic trainers were comparative. The therapeutic modalities, RICE, NSAIDS, and strengthening exercises completed exhibited similarities between both of the programs. The difference between the programs were

the surgical treatment and progression. Surgical treatment is common for type III fractures. The patient did not require surgical repair because the fracture didn't cross the epiphysis completely, nor was the bone displaced. If the fracture did completely cross the epiphysis then surgery would be needed immediately because the fracture would be detrimental to the patient's growth. Another contrasting aspect was the patient's progression. AAOS stated full ROM and strength takes up to a six-month recovery. This patient returned to full contact in the matter of four-months. Conclusion: The patient now has full ROM and strength of the knee joint, hamstrings and quadriceps. This conservative rehabilitation program, resulted in this patient's speedy recovery. Clinical Bottom Line: This case study is unique because distal femur fractures of the epiphysis account for less than 1% of all fractures and typically requires surgery. This patient's swift recovery was distinct and probably related to the lack of surgical intervention.

VERTEBRAL STRESS FRACTURES IN ADOLESCENTS, A LEVEL 1 CASE REPORT

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Background: Injuries that result from overuse are common among high school athletes, especially those who participate in sports year-round or are on multiple teams during the same season. Special tests and X-ray imaging

are often not enough to diagnose stress fractures, and further imaging is needed. Patient: The patient is a 16-year-old high school male athlete, who participated in year-round sports playing on the high school soccer, basketball, and baseball team as well as playing on a basketball team outside of school. The patient was healthy with no previous injury or predisposing conditions such as malalignment of the back. During his basketball season, he developed low back pain, seemingly from overuse. The patient was initially diagnosed with a back strain and treated conservatively with stretching, rehabilitative exercises, and participation restrictions. As the pain persisted through the treatment, the patient was referred for imaging. The initial X-Rays were inconclusive, so he was sent for an MRI which showed a stress fracture on the pedicle of his L4 vertebrae. Intervention: When the extent of the injury was determined, the patient's sport participation and contact activity was halted for six weeks. During these six weeks the patient participated in rehabilitation exercises with both his school's athletic trainer and a physical therapist. The purpose of the rehabilitation was to improve the flexibility and strength of the muscles in the patient's back, core, and legs to improve the function of the whole back so there was less of a chance that the injury would get any worse. Examples of these exercises include hamstring stretching, 4-way hip strengthening, and lower trunk rotations. As the patient progressed the exercises grew more complex and dynamic preparing him for return to play such as moving from simple closed chain exercises to plyometrics and sport specific movements. After the six weeks of rest and rehabilitation, the patient was sent for a CAT scan which showed a union

of the previously fractured bone. Outcomes: In this particular case, the patient was shown to have a union of the fractured bone and return to full sport participation within 6 weeks of the initial diagnosis. When comparing the return to participation timeline in this case to others described in the literature, it was clear that this injury healed much quicker than normal. A similar case of a 14-year-old male ballet dancer with stress fractures of the pedicles of his L4 vertebrae treated conservatively, was only shown to have a union of the bone after three months. Another case of a 17-year-old male football player with a stress fracture of his L2 vertebrae, who was also treated conservatively, returned to participation 16 weeks after injury. There were no apparent reasons the patients in these two studies healed at normal rate whereas the patient from this case study healed much more rapidly as they all were of a similar age, gender, and participated in similar rehabilitative exercises. It is unknown if the different sports or specific exercises of the athletes had any effect on their healing timeline. Conclusion: Stress fractures of the vertebrae that result from overuse can be treated conservatively and return the injured patient to full participation. The initial rest after the diagnosis is critical for the healing of the damaged bone. The rehabilitative exercises to stretch and strengthen the surrounding soft tissue is critical for the prevention of re-injury. Clinical Bottom Line: The current guidelines of conservative interventions for the treatment of vertebral stress fractures, however the healing timelines of these injuries should be re-examined.

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