

MUSCULOSKELETAL MATTERS

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HEALING WITH MOVEMENT: AN INTERVIEW WITH DR. ROODY JOSEPH

By: Evelyn Echevarria Cruz and Aila Cordero

In Ancient Greece, figures like Hippocrates (460–370 BCE) are often considered pioneers of Western medicine. Hippocrates is famous for his Hippocratic Oath, which many medical students across the nation recite during the white coat ceremony and uphold throughout their medical careers. Hippocrates not only made contributions to medicine by establishing a systematic approach to medical diagnosis and treatment, a groundbreaking achievement that still influences medical practice today, but he was also a visionary. His quote, **“Eating alone will not keep a man well; he must also take exercise,”** is applicable even today in a world where exercise, fitness, and recovery are more widely discussed and practiced than in the past.

In this interview, Dr. Roody Joseph, PT, DPT, OCS, shares below his journey into exercise, how exercise and rehabilitation shape his patients' lives, and his views of the future of the field.

Dr. Joseph is the Vice Chair of the Sports Medicine Department, Associate Professor, and board-certified **orthopedic physical therapy clinician** at Nova Southeastern University (NSU). He graduated from Florida International University, receiving his Bachelor of Science and Doctor of Physical Therapy degrees in 2009 and 2012. Dr. Joseph completed an orthopedic residency at The Ohio State University in 2014. He is a published researcher, journal editor, and entrepreneur who holds leadership positions within the Florida Physical Therapy Association and Broward County Athletics Association. Dr. Joseph joined the **NSU Florida Dr. Kiran C. Patel College of Osteopathic Medicine** in 2016. He is the course director for the musculoskeletal course and holds additional teaching duties within the Osteopathic Principles and Practice (OPP) and research practicum courses. Clinically, he works at the NSU Florida Sports Medicine Clinic with recreational, college, and professional athletes with general orthopedic problems and sports-related injuries.

What does exercise mean to you, and how do

you incorporate it into your daily life?

Exercise is woven into my life. I think activity in that realm is one of the best uses of time, our most valuable resource. I can't go more than two days without exercise before the yearning to move my body becomes unbearable, thank you brain-derived neurotropic factor (BDNF).

What is your personal philosophy regarding the role of exercise in maintaining health and preventing illness?

From mental acuity to physical function, the benefits of exercise are well known. For example, variable training patterns are wonderful in minimizing the risk of musculoskeletal injury with general exercise and sport, impact training is great for bone health, aerobic training drives the ship and has profound influence on the autonomic system, while strength training helps to combat the progressive decline in muscle mass we experience decade to decade. It is for some of these reasons that Thomas Edison's quote, “The doctor of the future will give no medication. But will interest his patients in the care of the human frame, diet and in the cause and prevention of disease.” serves as one of the key tenets of my career.

What techniques do you employ in your personal recovery from exercise?

Active recovery is one, I avoid prolonged rest or disuse of a given muscle group or body region after strenuous exercise. Furthermore, there was a period where Yoga interspersed once during the week afforded me the benefits of grounding and mindfulness while focusing on flexibility and core strengthening.

What are the most common injuries in your patients?

I would say strains and sprains; think of patients attempting to lift a heavy object around the house, causing a lower back strain or your common ankle sprains during sport. Overuse tendon injuries (tendinitis, tendinosis, etc.) are another. Then there are the operative cases (e.g., knee microfracture surgery,

meniscus repair, achilles tear and repair).

What methods and techniques do you advise your patients regarding recovery and rehabilitation?

The soreness rules are good. They basically dictate the progression of exercise by one variable based on the presence or lack of soreness from the previous day's exercise.

Explore your views on the importance of injury prevention and recovery education for patients.

I think there needs to be greater emphasis placed on injury prevention program implementation in schools, gyms, and sports teams, especially as the population engages more and more in physical activity. Whether through youth sports or the social media gym/fitness influencer culture, there is generally greater interest in exercise within society, and with that, you will have individuals motivated to exercise who may not have the exposure and experience in the movement who thus place themselves at greater risk of injury. For certain musculoskeletal conditions and injuries and certain sports, there are established studies on injury risk reduction programs (with more being studied) known to be preventative. So, it is on the expert and licensed individuals in these spaces to better educate the populous on how to protect themselves amidst the glitz and glamour.

Address common challenges faced when promoting/recommending at-home recovery and rehab techniques to patients. Explore the strategies you employ to overcome these challenges and motivate patients to adopt healthy habits.

Honestly, the biggest one is compliance. Due to their life roles (e.g., work, parent, partner, caregiver), committing to the recommended dosage of at-home exercise is a struggle for patients. Calendaring and scheduling a set time, integrating recovery and exercise with other established routines (e.g., during a lunch break), and communal accountability (via a spouse/significant other or friend) are strategies I've

used in the past to combat these challenges.

Discuss emerging trends and future directions in exercise, rehabilitation, and patient education as a vital component of healthcare.

To start, telehealth has had a major resurgence or rather push since the pandemic (telemedicine has been around since the 2000's and 2010's). That period highlighted the utility of the internet and two-way communication, helping to bring providers to patients wherever they may be rather than the other way around. Secondly, precision medicine is an approach that aims to tailor medicine, even physical medicine and rehabilitation, to a patient's individual genetic makeup. This is an area I view as rehab's moonshot idea.

Injury risk reduction programs are also a major area of focus for me in my role as an academician and an avenue to practice preventative care rather than tertiary as is the norm in healthcare. Thus, collaboration with even non-health professionals such as engineers, coders, and informaticists affords us a chance to innovate and problem-solve present issues and work towards the unknowns of an ever-changing society.



INNOVATIONS IN HEALING: INTEGRATING ULTRASOUND WITH REGENERATIVE MEDICINE

By: Quintin Norris, Lisa Valastro, DO

Regenerative medicine is a transformative field focused on repairing or replacing damaged tissues and organs using the body's natural healing capabilities. This area of medicine employs a range of advanced therapies, particularly in the treatment of musculoskeletal conditions such as joint pain, arthritis, and sports injuries.

Platelet-rich plasma (PRP) and bone marrow concentrate (BMC) injections are central regenerative therapies that promote tissue healing and reduce pain in musculoskeletal conditions, such as joint degeneration, tendon injuries, and osteoarthritis. PRP involves concentrating a patient's platelets and injecting them into injured tissue to release growth factors that stimulate repair, while BMC, derived from the patient's bone marrow, contains stem cells and healing factors to support repair and reduce inflammation.^{1,2} Ultrasound technology enhances these therapies by providing real-time imaging that guides injections, increasing treatment precision and minimizing risks, leading to safer and more effective patient outcomes.³

To gain deeper insight into the impact of regenerative medicine as well as a personal testament of its results, I interviewed Dr. Lisa Valastro, a fellowship-trained interventional physiatrist at Regenexx in Tampa Bay, FL, who specializes in regenerative medicine and ultrasound image-guided injections.

Q: What inspired you to specialize in regenerative medicine and image-guided injections, and how has your background shaped your approach to patient care in this field?

A: "My path to regenerative medicine wasn't straightforward. In medical school, I was drawn to musculoskeletal (MSK) medicine because it helps people return to what they love, unlike fields centered on survival. Initially, I explored orthopedics and shadowed surgeons but noticed that some

patients underwent surgeries they didn't necessarily need. A hip arthroscopy I had in my 20s, which in hindsight might have been avoidable, highlighted the lack of alternative options. Discovering PM&R showed me the body's capacity to heal with the right rehab and minimally invasive treatments, aligning with my osteopathic training. I ultimately chose PM&R, specializing in MSK, and discovered my passion for regenerative medicine during my fellowship through the benefits of diagnostic ultrasounds."

Q: In your experience, what are the most significant advancements in regenerative medicine that you've observed recently, and how are they changing the landscape of treatment for musculoskeletal conditions?

A: "Two recent advancements in regenerative medicine have had a significant impact. For patients with knee arthritis, traditional treatments like physical therapy, steroid injections, and surgery are common. However, regenerative options such as PRP and bone marrow concentrate are healthier for cartilage and can slow wear and tear. A major advancement is the use of intraosseous bone marrow concentrate injections, where bone marrow is injected into the bone above and below severely arthritic knees. Studies indicate this can help patients avoid knee replacement for 15 years or more, significantly improving recovery time, reducing costs, and minimizing the need for future surgeries.

Another advancement addresses discogenic back pain caused by disc degeneration. Standard treatments like steroid injections or surgery are often ineffective, but injecting PRP around or into the disc can stimulate healing, stabilize the disc, and help patients return to their activities. Both techniques significantly reduce pain and improve function without major surgeries."

Q: Can you share a particularly memorable case where regenerative medicine had a transformative effect on a patient's outcome? What did that experience teach you about the potential of these therapies?

A: "One memorable patient, a healthy man in his mid-30s, had struggled with disc tears and degeneration since his mid-20s. He tried everything—chiropractic care, physical therapy, steroid injections—and eventually had a discectomy, which relieved pain for a few years, but the pain returned. By 35, he faced debilitating low back pain. I treated him with intradiscal PRP injections, and within eight weeks, his pain was 50% better. Off pain meds and back to exercising, he even canceled a planned disc replacement surgery, avoiding further complications down the road."

Q: What are some of the biggest challenges you face in promoting regenerative medicine, both in terms of patient education and within the broader medical community?

A: "Regenerative medicine is new and promising, but patients often struggle to understand how it works. It requires time during appointments to explain the body's repair process and how treatments can aid it. Another challenge is that some providers overhype regenerative medicine as a miracle cure, leading patients to become skeptical or view it as ineffective. It's essential to educate patients on the potential and limitations of regenerative medicine, as it is just one of several options—such as physical therapy or surgery—each with its own advantages. This balanced approach helps patients decide if it's right for them without unrealistic expectations."

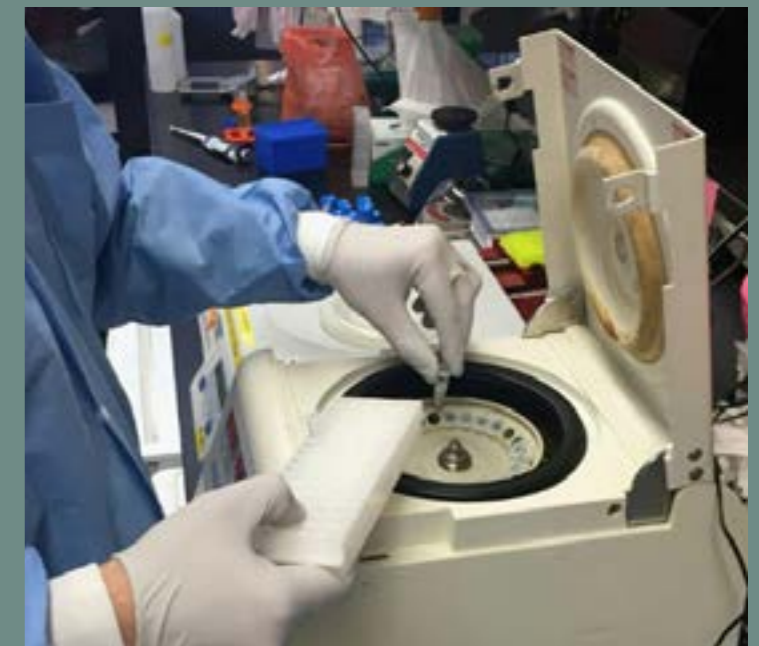


Q: How do you see the future of regenerative medicine evolving over the next five to ten years, and what role do you believe it will play in mainstream medical practice?

A: "I anticipate that regenerative medicine will continue to grow as more positive impacts are discovered. The specifics of how treatments are prepared and administered are crucial, but when done correctly, patients can achieve life-changing results, avoiding surgeries and reducing reliance on pain medications.

I hope practitioners will become more responsible, learning proper techniques and managing patient expectations, moving away from the current 'wild west' approach to a more regulated, evidence-based field. Many in the community could benefit from regenerative options instead of unnecessary steroid injections or surgeries. We're committed to educating people about these treatments, and as more patients share their positive experiences, I believe regenerative medicine will gain wider recognition and acceptance."

REFERENCES



CHRONIC TRAUMATIC ENCEPHALOPATHY: BRIDGING NEUROLOGICAL DAMAGE AND MUSCULOSKELETAL HEALTH

By: Jenny T. Makhoul MBS, Anastasia G. Nasr MBS, Zemar G. Qazi MBS, Areeba N. Ahmed MBS, Amna Javeed MBS, Brian J. Piper PhD

Chronic Traumatic Encephalopathy (CTE) has increasingly become a focal point in the medical community, particularly as reports mount of athletes and individuals in contact sports experiencing unexplained behavioral shifts (1). CTE, a progressive neurodegenerative disorder, is primarily associated with repeated head injuries (RHI) that lead to the accumulation of abnormal tau proteins in the brain. This condition was first named by Dr. Bennet Omalu, who identified it as a distinct neurodegenerative disease stemming from repetitive brain trauma (1).

CTE affects neurological and neurobehavioral functions, leading to challenges such as memory loss, cognitive impairment, mood disturbances, and motor control issues. As research advances, it has become evident that CTE's impact is not limited to the brain; the musculoskeletal system is also at risk, creating a multifaceted challenge for healthcare professionals in managing its progression. One of the most direct ways CTE affects musculoskeletal health is through the undermining of motor control. Conditions such as Motor Neuron Disease and Parkinsonism are also related to CTE, further highlighting this connection. Additionally, CTE and its relation to depression have linked the disease to numerous musculoskeletal deficiencies, compounding the effects this disease has on one's musculoskeletal health. Lastly, CTE and its indirect linkage to osteoarthritis share many similar risk factors that may leave individuals developing osteoarthritis in the future.

Motor Control / Muscle Imbalances

CTE disrupts the brain's ability to coordinate movement and maintain muscle balance. Athletes with CTE demonstrate neurofibrillary degeneration of the insular, entorhinal, and frontal cortexes (2). These three cortexes are known to play a role in motor control and navigation (3, 4, 5). With degeneration in these spaces of the brain, symptoms such as compromised balance & coordination, abnormal gait (such as limping), and trem-

ors (6, 7). The long-term musculoskeletal effects of these symptoms could be detrimental to patient outcomes. For example, a patient with an abnormal gait would be subjecting certain muscles to abnormal strains. Over time these additional strains could lead to a slew of musculoskeletal issues. The neurological impact of CTE can result in musculoskeletal complications, emphasizing the need to address both neural and physical issues in affected patients.

Motor Neuron Disease & Parkinson's Disease

CTE has been associated with motor neuron disease, Parkinson's disease, and Parkinsonism through a shared pathological feature, especially the accumulation of TDP-43 protein. Parkinsonism shares similar symptoms to Parkinson's Disease, such as tremors and abnormal slowness or stiffness. However, unlike Parkinson's disease, which has a buildup of Lewy bodies, those with Parkinsonism do not have this protein buildup (8). Since there is a high accumulation of TDP-43 in the blood and a correlation to latent CTE, this demonstrates a potential link between CTE and other neurodegenerative conditions such as amyotrophic lateral sclerosis (ALS) and Alzheimer's disease, suggesting that the pathological process observed in CTE may contribute or overlap with those seen in these conditions (9). Over a long period of time in these contact sports, there is an increase in CTE by 50%, especially in the brainstem area that controls movement (8). In some cases, TDP-43 extends to the spinal cord, and it shows symptoms of a motor neuron disease that is like ALS.

Linkage Between CTE Patients Developing Osteoarthritis

CTE and osteoarthritis (OA) do not share a direct linkage, however many of their risk factors coincide among certain demographics such as individuals who have experienced physical trauma and athletes. Osteoarthritis is a type of arthritis where the cartilage within a

joint degenerates and causes pain and swelling (10). Athletes are known to be at risk for CTE as well as joint trauma which over time raises the risk of OA diagnosis. Many athletes participate in high collision activities which lead the individual to experience joint degeneration. Clinical observations have indicated that neck pain and musculoskeletal conditions in individuals who have been diagnosed with CTE share a relationship between brain dyscrasia and joint problems. Repetitive trauma to the brain and body leads to a variety of indirect risk factors such as extensive inflammation and pain management. Extensive inflammation occurs within the brain after an athlete has had repetitive trauma. Proinflammatory cytokines, glial cell activation, and chemokines tend to be the base of immune response during the brain's traumatic injury (11).

Inflammation tends to be the major factor in the development of OA through the impaired cartilage that activates the synovial lining to cause cytokines to produce inflammation within the body's joints (12). The sight of pain for an individual who is suffering from CTE or OA may have a delayed response due to neurological changes. OA and CTE can lead to the decline of the neurological system causing neuroreceptors to interfere with the pain transmission receptor causing the body to have a delay in pain response (13).

Secondary Effects of Depression

Research has shown that individuals with CTE often experience severe depressive symptoms, including mood swings, and there is a significant correlation between CTE and the development of depression (7,14). As the condition progresses, symptoms may worsen, leading to hopelessness, suicidal thoughts, and, in some cases, aggressive behavior. CTE plays a critical role in depression, particularly in individuals who have experienced repetitive head trauma (7,14). Depression often leads to physical inactivity, which can have a negative impact on musculoskeletal health. Physical inactivity can result in weaker muscles, reduced flexibility, increased joint pain, and a higher likelihood of musculoskeletal issues (15). Throughout the U.S., musculoskeletal disorders (MSDs) are the leading cause of pain and disability and contribute significantly to the global burden of disability (16). Research has also identified a strong association between MSDs and the development of depressive symptoms (16).

Conclusion

To prevent CTE, healthcare professionals should focus on implementing safety measures, raising awareness about the risks of repetitive head trauma, encouraging lifestyle modifications, and applying established interventions. Our current understanding of CTE and its connection to musculoskeletal health highlights the disease's effect on motor control. Conditions such as Motor Neuron Disease and Parkinsonism emphasize this connection between CTE and worsened musculoskeletal health. The secondary effects of depression in individuals with CTE also stress this connection through physical inactivity, leading to weak musculature. Although CTE and osteoarthritis do not share a direct connection, they share similar risk factors. Such a connection should be alarming and underscored when dealing with living patients diagnosed with OA. As research on CTE advances, so should our understanding of its effects on musculoskeletal health.

References



FROM TOTAL DEPENDENCE TO INDEPENDENCE: A JOURNEY OF REHABILITATION IN AN OCTOGENARIAN WITH PELVIC FRACTURE

By: Ravi C. Shah, OMS4 and Puja C. Shah, DO

According to the CDC, falls are the leading cause of injury for adults aged 65 and older, with 1 in 4 reporting a fall annually. In our acute inpatient rehabilitation hospital, an 80-year-old female with a history of osteoporosis was admitted following an unwitnessed ground-level mechanical fall at home. A pelvic X-ray revealed a subacute left obturator ring fracture and a nondisplaced left sacral alar fracture. Conservative management was chosen, allowing weight-bearing as tolerated on bilateral lower extremities. On admission, the patient required total assistance for activities of daily living (ADLs) and ambulation. Prior to the incident, she resided in a single-story home with her niece and nephew, with three steps at entry.

Over a 14-day rehabilitation course, the patient participated in a comprehensive program aimed at enhancing her functional independence. Rehabilitation techniques were carefully tailored to meet the specific needs of the patient. The physical therapy regimen emphasized gait training, which included practicing walking with a rolling walker to ensure stability and safety. Strengthening exercises and balance training targeted the lower extremity muscles to enhance support and prevent future falls. Functional mobility training included practicing transfers from sitting to standing and navigating the three steps at the home's entrance, which were particularly challenging for the patient.

Occupational therapy played a crucial role in re-training the patient in ADLs. This included essential activities such as dressing, bathing, and grooming, all of which the patient struggled with initially. Energy conservation techniques were taught to help the patient manage fatigue, an important aspect of her recovery. The use of adaptive equipment, such as grab bars and shower chairs, was introduced to enhance safety and independence in daily tasks.

Patient and family education was a critical component of the rehabilitation process. The education program focused on fall prevention strategies, including the safe use of assistive devices and necessary home modifications to improve safety. Family members were taught how to support the patient's mobility and ADLs without risking injury to themselves or the patient.

By the end of the rehabilitation program, she had made

significant progress, achieving modified independence in both ADLs and ambulation. She could ambulate 150 feet with a rolling walker, navigate the three steps at her home's entrance with supervision, and perform ADLs with minimal to no assistance. This remarkable recovery emphasizes the importance of early and regimented rehabilitation in elderly patients with fractures. Despite her initial total dependence, the structured and multidisciplinary rehabilitation approach facilitated significant functional gains.

This case highlights the potential for substantial recovery in elderly patients with comprehensive rehabilitation, even when surgical intervention is not pursued. Early rehabilitation can lead to significant improvements in functional independence, emphasizing the critical role of Physical Medicine and Rehabilitation in optimizing patient outcomes.



ADVANCEMENTS IN BREAST CANCER REHABILITATION

By: Ceilia Severini

Cancer rehabilitation is a subspecialty of rehabilitation medicine dedicated to restoring and maintaining the highest possible quality of life, independence, and functionality for patients at any stage of their cancer journey. This type of rehabilitation also includes patients who may be undergoing potentially curative therapies, those who are receiving palliative care, and those who are cancer survivors (1). Cancer rehabilitation typically focuses on managing physical, mobility, and cognitive challenges resulting from cancer and its treatment. To comprehensively address these issues, it involves collaboration with a range of specialists, including dietitians, occupational therapists, physical therapists, physiatrists, psychologists, speech therapists, and others. Increasingly, research has focused on the early implementation of exercise to support recovery following cancer surgeries and enhance the overall cancer rehabilitation process. The early implementation of exercise has been explored following various surgical procedures, with a primary focus on breast cancer.

Restoring shoulder function after breast surgery is crucial for both physical functioning and quality of life, highlighting the importance of studying early exercise interventions in this population. One study investigated whether an early exercise intervention, initiated 1 day post-surgery and continued for 1 month, could improve shoulder function, including range of motion and strength, in patients who have breast cancer. This study was conducted with a parallel-group, 2-arm randomized clinical trial from June 2020 to October 2021 at the Breast Cancer Center in Seoul, South Korea (2).

The participants included 56 patients with early stage breast cancer who were scheduled for either partial or total mastectomy were randomly divided equally into two groups, including the tailored resistance exercise group and the usual care group (2). For the exercise group, the intervention started day 1 post-operation and included four supervised exercise education sessions, which aligned with surgeon visits and daily at-home exercises for the first month after the surgery (2). Shoulder range of motion and strength were benchmarks tracked at 1 and 6 months after surgery, along with physical activity, body composition, and quality of life also measured at 6 months.

Researchers concluded at 1 month, 19 in the tailored exercise program had fully recovered shoulder strength compared to 1 in the other group, and at 6 months, 22 had

recovered shoulder ROM and 24 had completely recovered strength compared to 6 and 5 in the other group, respectively (2). Another similar study conducted in England on this patient population found that early exercise implementation following breast cancer surgery enhanced shoulder function and was linked to reduced healthcare costs and improved health-related quality of life.

Cancer rehabilitation is essential for enhancing quality of life, independence, and functionality in patients across all stages of their cancer journey. Evidence strongly supports the benefits of early exercise implementation, particularly in improving recovery outcomes after breast cancer surgery. Tailored exercise programs have been shown to significantly enhance shoulder function, reduce recovery times, and improve health-related quality of life while lowering healthcare costs. These findings highlight the value of incorporating structured early exercise interventions into cancer care to optimize both physical recovery and overall patient well-being. [References](#)



FOOTBALL GLORY TO INJURED KNEES: MY ATHLETIC ODYSSEY

By Kaustov Chakrabarti

The roar of the crowd, the thrill of victory, and the camaraderie of teammates are the memories of my time playing football at the University of Georgia. I was fortunate to be part of two national championship-winning teams, and those moments of triumph defined my experiences as a student-athlete. But an athlete's path is rarely smooth, and my journey was no exception. Injuries are one thing that caused these bumps for me. Several concussions left me grappling with lingering effects - headaches, memory lapses, and moments of disorientation that would creep up unexpectedly. The accumulation of injuries, from sprains to fractures, served as a constant reminder of the physical demands of the game. Sometimes, injuries in football can become severe. In 2020, I felt a sickening pop in my left knee during a game. I fell to the ground and lost sight for a brief moment. The athletic training staff assisted me and carted me to the hospital. The diagnosis was devastating: a left torn ACL and a torn meniscus. The road to recovery was painful and long, filled with aggressive physical therapy to get back on the field. Yet, I persevered, driven by the dream of returning to the field and the support of my teammates, coaches, and family. After 15 months of rehabilitation, I made my comeback during my junior season. However, I was seemingly destined to face the cruel twist of fate once again in 2022. Another torn ACL in the same knee. Another torn meniscus. The familiar pain, both physical and emotional, washed over me. But this time, the journey was different. Having two torn ACLs on the same knee raised serious questions about not only my football ability but also my body mechanics. The whispers of concern about my early retirement grew louder, and I couldn't help but wonder if my body was trying to tell me something. This time, the rehabilitation and recovery took longer. I spent 18 months getting back to full strength. At that point, I had graduated and needed to find a passion or refuel an old one. I set my sights on the next level - professional football. I threw myself into training, pushing my battle-tested body to its limits. When tryouts came, I gave it my all, leaving everything on the field. As the tryout process continued, a harsh reality began to set in. My body, once my greatest asset, had become my biggest liability. The speed wasn't quite there, agility a step behind, and durability a constant question mark. With each passing workout and on-field drill, it became clearer that I wasn't going to make the final roster. As I walked away from tryouts, I anticipated a phone call or an email citing my knee health as the reason I was not good enough to play. I got that notification

the next morning. The realization was bitter and getting cut hurt no less than if I was fully healthy. I had given everything to football. I had given everything to the university I played for. Now, as I reflect on my journey, I am reminded of the resilience of the human body and the human spirit. Each setback, each injury, each moment of doubt - they all contributed to shaping who I am today. My body pushed through surgeries and stood by me when my mind could not. My mind took me out of the lowest point of my life when my body could not. While my path didn't lead to a professional football career as I had once dreamed, it has opened up new opportunities. The same determination that drove me to push through injuries now fuels my pursuits in other areas of life. It was at my lowest moment that I found the resolve to pursue a goal I had forgotten many years ago - becoming a physician. That was when I was introduced to Geisinger's MBS program. Leonard Farber and Peggy Farley helped me make the transition from an athlete to a student. My journey in sports may have come to an end, but the spirit of the game - the drive to always push forward, to get back up when knocked down, to be part of something bigger than myself - lives on.



HEALING BEYOND THE INJURY: THE TRANSFORMATIVE POWER OF REHABILITATION

By: Rachel Yim

Rehabilitation is a journey that challenges individuals to rebuild not only their physical abilities but also their mental and emotional resilience. The medical specialty of physical medicine and rehabilitation (PM&R) focuses on enabling patients to regain independence, to improve patient quality of life, and to allow patients to return to their hobbies and careers. My personal experience in rehabilitation showed me that a comprehensive and personal approach to recovery is vital.

After a wrist injury when I was unable to continue my competitive tennis career, I felt that an important part of my identity had been taken away from me. Tennis was my passion, my outlet for stress, and an important part of how I used to maintain my fitness. Not only did the loss of the ability to play affect me physically, but it also left me feeling disconnected from my normal lifestyle. However, rehabilitation gave me the opportunity not only to rebuild my body, but also to restore my confidence and balance I had lost.

My rehabilitation process allowed me to learn the importance of a multifaceted approach to recovery, which combines physical therapy with both mental and emotional support. Rather than simply treating an injury or condition, the goal is to consider the whole person—how they move, how they feel, and how their physical limitations affect their overall well-being. Through this process, it became clear to me that recovery is not only to heal my wrist but also to regain my ability to enjoy the things I love.

As part of my rehabilitation, I was introduced to Pilates by my doctor in order to improve my core strength and posture, and reduce the pain without putting too much stress on my wrists. At first, Pilates felt foreign to me. As a former athlete, I usually did high intensity training. Pilates, which focuses on low impact and controlled movements, was a unique challenge for me. It required me to slow down, focus on my body in a different way, and engage smaller muscles to reduce stress on bigger muscles.

Over time, Pilates became central to my recovery. The full body routine, which was less strenuous, strengthened me and helped me readjust my posture. More than that, it taught me attention to movement—a fundamental principle of rehabilitation. Pilates taught me that recovery does not have to be a tedious process; recovery should be about working smart-

er. Pilates helped me rebuild the foundation of my body during the recovery process, and the progress I made through Pilates is something I now see and feel in my daily life.

This recovery experience embodied the great principles of PM&R that values flexible rehabilitation programs that meet the patient where he or she is. The goal is not only to incorporate physical therapy for the patient but also to work with them to determine what interventions and treatments work best for their specific situation. Whether through physical therapy, adaptive exercises like Pilates, or pain management techniques, PM&R physiatrists aim to restore function while respecting the person's movement and needs. The goal is to create a sustainable approach that will continually improve his long-term recovery and quality of life.

Even after recovering enough to return to tennis, Pilates has remained a constant in my routine. It has helped me maintain the strength and flexibility I gained during recovery, and is a reminder of the importance of simple, mindful movement. Pilates also builds on the PM&R philosophy that recovery is not a straight path. It is a process that requires constant monitoring, focus, and a willingness to adapt.

For many, PM&R provides the tools needed to regain independence and restore physical function after injury or illness. But more than that, it offers a roadmap for how a patient will look after themselves moving forward. Whether it's learning to walk again after surgery, managing chronic pain, or recovering from a sports injury, the PM&R field empowers patients to rebuild their lives—not just physically but in all aspects.

Rehabilitation is a lifelong commitment to understanding the body, recognizing its needs, and managing them effectively. The journey may be difficult, but it is also very rewarding. PM&R provides the structure, support, and personal care one needs to make that journey successful.



THE ROAD TO RECOVERY: HOW PHYSICAL THERAPY HELPED ME WALK AGAIN

By: Dhiya Ram

Five years ago, if you had asked me what the one thing I could do without a second thought is, I would have said walking. It seemed so effortless—something so deeply woven into our existence. Walking is a rhythm we all share, ingrained in us from the moment we first found our feet. Whether we're lost in the bustle of a city or quietly going about our day, walking is something we do without thinking, it's as automatic as the act of breathing itself. It's the simplest of movements, almost invisible in its ease. At least, that's what I believed—until everything changed.

In 2020, during the depths of the pandemic, I suffered an episode of rhabdomyolysis after attending an intense dance workshop. Due to the widespread fear of the virus, I stayed home, pushing through the pain for five days of almost complete immobility before finally seeking medical attention. While a night in the ER was enough to treat the kidney injury caused by the condition, my legs didn't return to normal. For an entire year, I struggled with walking. Some days, I could only make it five houses

down the block before the pain forced me to turn back. I saw multiple specialists, all of whom agreed that the muscle atrophy from the rhabdomyolysis episode was severe. However, no one could offer me a concrete plan to regain the lost muscle. I was given suggestions like increasing my caloric intake and taking pain medication, but they were not sufficient to restore my strength. Despite the challenges, I eventually returned to my daily routine, finding ways to adapt. During medical school, taking mental health walks helped to regain some physical strength, but the setback had taken a toll both physically and mentally. It wasn't until 2023 when I was referred to physical therapy, that my journey toward recovery truly shifted.

Over the past year, physical therapy truly transformed my recovery. The sessions focused on strengthening key muscle groups—my quadriceps, hamstrings, and glutes—through carefully tailored exercises. I wasn't just prescribed routines; each movement was personalized to ensure I was safely rebuilding strength without

overloading my muscles. We incorporated osteopathic treatments like muscle energy and counterstrain to restore balance in my body. This holistic approach to physical therapy was crucial, as it wasn't just about regaining strength, but also about retraining my mind and body to function as a whole again. In addition to in-clinic sessions, I was given a set of home exercises to continue my progress. Though I wasn't always diligent, I noticed improvements after just a few weeks. The shaking in my legs diminished, my strength gradually returned, and my motivation to keep going was reignited. I looked forward to every session, not only for the physical gains but also for the mental relief provided through an encouraging and supportive approach. I involved my loved ones in my rehab making it a collaborative process. Eventually even the more challenging exercises—like resistance band crab walks and tip-toe movements with a yoga ball—became easier over time. Physical therapy became a source of empowerment,

helping me rebuild not just my body, but my confidence as well.

From my personal experience, the work physical therapists do is truly transformative. After a year of consistent physical therapy, my legs are much stronger, and I'm now navigating the streets of New York City and taking dance classes every week. It's because of physical therapy that I can walk again.



A SWEDISH TRADITION AND CONTRAST BATH THERAPY

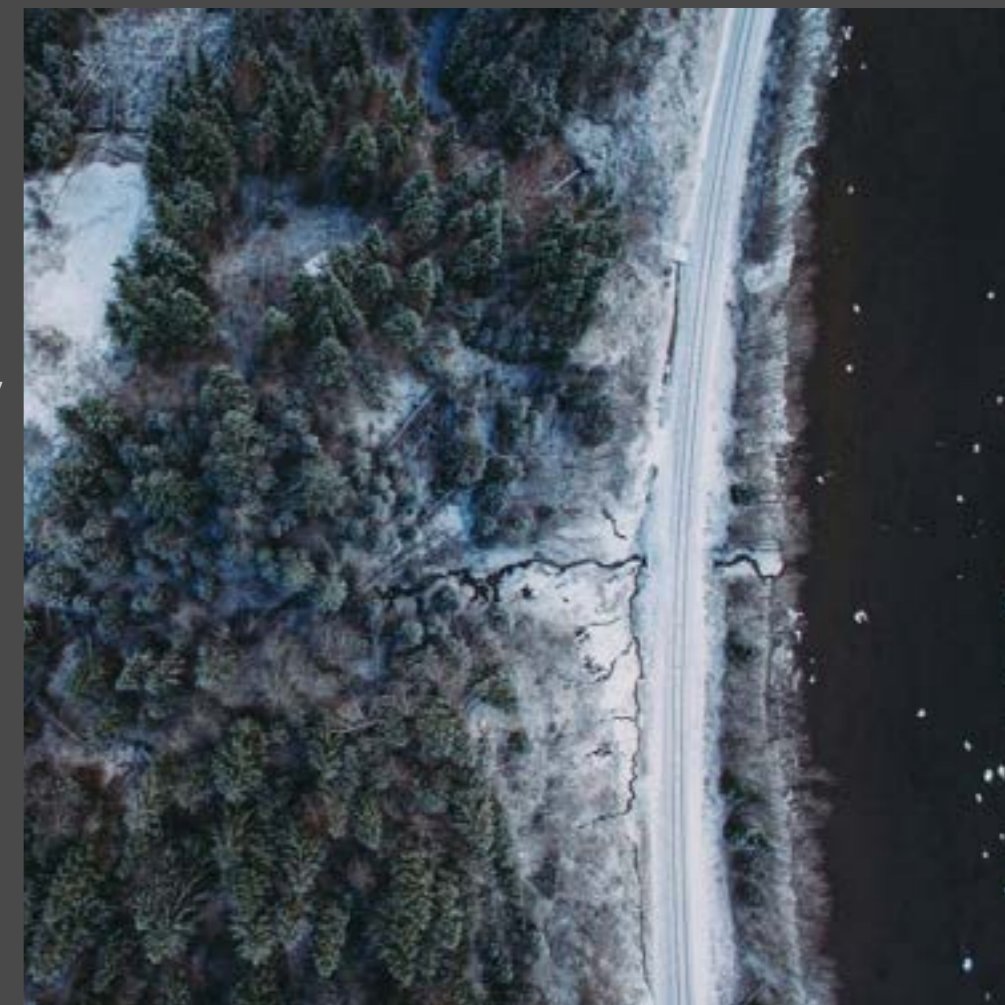
By: Mary Tran and Henry Ash

It was a frigid winter in Sweden, deep in the Arctic Circle. I stood there, clad only in my bathing suit, gazing at a hole carved into the thick, frozen surface of a lake. Moments earlier, I had emerged from the intense heat of a traditional Swedish sauna, known as *bastu*, and was preparing to plunge into the icy waters before retreating back to the comforting warmth. Afterward, my sinuses were clear, my muscles were relaxed, and I felt revitalized.

The tradition of *bastu* in Sweden dates back thousands of years and remains a cherished pastime among locals. Often paired with a brisk dip in freezing waters, this practice is believed to enhance the sauna's restorative effects, invigorating both body and mind. Upon returning to the States, I learned that this age-old tradition has a modern counterpart known as 'contrast bath therapy'.

Contrast bath therapy is a widely used method for rehabilitation and recovery most commonly seen in sports medicine [1]. It is a thermal treatment modality that involves alternating between cold and hot baths [1, 2]. There are many variations of contrast bath therapy routines including various times and bath temperatures. An example of a typical routine can involve starting in a warm bath for 3-4 minutes and following with a cold bath for 1 minute, alternating between the two for 20 minutes total [1]. As aforementioned, it is commonly used in sports medicine, however, applications for contrast bath therapy have also been explored for other applications such as osteoarthritis [3]. Contrast bath therapy is believed to help improve circulation and reduce inflammation, indicating it as a method for faster recovery and adjunct therapy for inflammatory pathologies [1, 3].

The warm baths lead to vasodilation and increased muscle elasticity [2]. The cold baths lead to vasoconstriction and decreased metabolite production [2]. Both mechanisms have been shown to reduce inflammation and improve skin and muscle circulation [1, 2]. Studies have also shown improved oxygenation of the muscle post contrast bath therapy which indicates it as a possible therapy for improved tissue repair [2]. When applied to cases of osteoarthritis, pain symptoms were reduced and the patient's quality of life improved [3]. Contrast bath therapy proved to be an accessible adjunct therapy with positive outcomes in osteoarthritis patients [3]. Considering the anti-inflammatory and circulatory benefits, contrast bath therapy likely has strong indications for rehabilitation and recovery purposes even beyond the scope of sports medicine. **References**



MARIJUANA MISCONCEPTIONS AND MYTHS

By: Amy L. Kennalley MBS, Maria Tian MBS, Ahmad Higazy, Spencer Blank MBS, Elena L. Stains, Brian J. Piper PhD

Misconceptions and myths surrounding the use of medicinal cannabis are commonplace today. Alongside growing acceptance and legalization, myths about its use have wafted throughout society. For those dealing with musculoskeletal health conditions, such as chronic pain from arthritis or injuries, it is important to understand the truth about cannabis. Here, we will break down five common misconceptions and myths, exploring the potential impacts of cannabis use on musculoskeletal health.

Myth 1: “Cannabis Is Not Addictive”

One of the most widespread myths surrounding cannabis is that it cannot cause addiction. Although cannabis use disorder may not be as common as other substance use disorders, dependence can still develop, especially with regular or early use. Approximately 9% of individuals who ever use cannabis go on to develop cannabis dependence at some point in their lives (1). Prior research has also noted a debated rise in cannabis use disorder prevalence (2). For individuals using cannabis to manage musculoskeletal pain, it is important to recognize that overuse may lead to dependence in a small subset of patients.

Cannabis is also undergoing a momentous drug classification shift. Currently, it is classified as a Schedule I drug, indicating a high potential for abuse and no accepted medical use. However, medical cannabis is moving toward being classified as a Schedule III drug, a designation reflecting lower potential for abuse and recognized medical benefits (3). Notably, cannabis is bypassing Schedule II, which includes substances with a moderate potential for abuse. This dramatic reclassification reflects its increasing approval for medical use.

Myth 2: “It’s Safe to Drive After Using Cannabis”

Some people believe that cannabis does not impair their driving ability, but this is far from the truth. Cannabis use affects motor coordination, reaction time, and judgment, which are all essential for safe driving. A randomized controlled clinical trial of 191 regular cannabis users published in the *Journal of the American Medical Association* found that performance on a driving simula-

tor remained impaired for up to 4.5 hours after smoking cannabis (4). Despite many subjects believing they were no longer impaired after 1.5 hours, their performance was still impaired relative to the placebo group. Similar findings have also been reported in studies specifically looking at older populations (5). This should be particularly concerning for individuals who need to drive as part of their daily routine and use cannabis for pain management.

Myth 3: “Cannabis Is Harmless to Your Lungs”

Many believe that smoking cannabis is not as harmful as smoking tobacco (6). However, cannabis smoke contains many of the same harmful chemicals in tobacco smoke, such as nitrosamines and polycyclic aromatic hydrocarbons (7). A unique risk for cannabis is the presence of contaminants in recreational and medical preparations. A recent *Wall Street Journal* analysis uncovered alarming rates of mold content in samples sold throughout the United States (8). Additionally, a review of insurance claims by the Center for Disease Control found that cannabis users were 3.5 times more likely to have fungal infections in 2016 (9). For individuals with musculoskeletal conditions, maintaining lung health is critical. Compromised lung function due to smoke and contaminant inhalation may interfere with exercise, which is an important part of managing and treating musculoskeletal conditions.

Myth 4: “Medical Cannabis Is Prescribed by Physicians”

There is often confusion about how medical cannabis is accessed or obtained. While doctors cannot “prescribe” cannabis like traditional prescription medications, they can “certify” patients for specific conditions. This is particularly true for conditions like chronic musculoskeletal pain. In states such as Pennsylvania, patients can receive a medical cannabis card if they qualify.

A recent study in Pennsylvania explored how access to cannabis dispensaries impacts cannabis certification rates (10). Their findings showed that closer proximity to dispensaries leads to higher certification rates, even

for conditions like epilepsy and anxiety where the efficacy of cannabis is less supported than in other conditions like chronic pain (11).

Myth 5: “Cannabis Is a Cure-All”

Cannabis is often touted as a cure-all for many health conditions, including musculoskeletal disorders. While it may be effective in managing certain symptoms, particularly chronic pain, it is not a universal remedy. The National Academies of Sciences, Engineering, and Medicine has previously published a comprehensive literature review on the therapeutic effects of medical cannabis (11). The report highlighted several medical conditions where there is substantial scientific evidence supporting the use of cannabis, namely chronic pain and chemotherapy-induced nausea. However, it also noted that most other conditions lack robust evidence supporting the use of cannabis and, in some cases, cannabis use may even be harmful.

For individuals with musculoskeletal conditions, cannabis can be part of a broader treatment plan, but it should not replace evidence-based therapies like physical therapy, lifestyle modifications, or medication tailored to the patient’s needs. Relying solely on cannabis may lead to delays in more effective treatments.

The Role of Cannabis in Musculoskeletal Health

With growing research on cannabis across the Geisinger Medical System, we focused on the qualifying conditions for cannabis certification in Montour County, Pennsylvania, home to the Geisinger Medical Center in Danville. We categorized these qualifying conditions into two groups: neuromuscular conditions (e.g., multiple sclerosis, amyotrophic lateral sclerosis, Parkinson’s disease) and non-neuromuscular conditions (e.g., anxiety, cancer, Crohn’s disease). From 2018 to 2023, our findings show an increasing proportion of patients being certified for non-neuromuscular conditions (Figure 1).

While cannabis can offer relief for individuals managing musculoskeletal pain, it should be approached thoughtfully. Misconceptions about its safety, potential for addiction, and effectiveness can lead to adverse



outcomes. Research underscores that cannabis may benefit certain medical conditions, yet it carries its own set of risks (11).

To ensure cannabis is used appropriately, healthcare professionals and patients should work together to come up with a comprehensive treatment plan that includes physical therapy, lifestyle modifications, and other established interventions. As cannabis research progresses, so should our understanding of its role in managing musculoskeletal health.

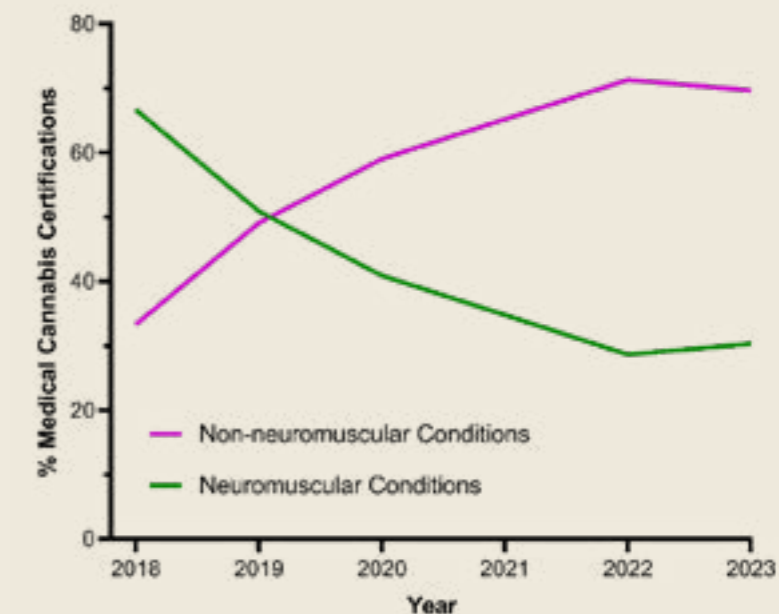


Figure 1. Percent of patients who are certified to use medical cannabis with neuromuscular conditions (Parkinson’s disease, Huntington’s disease, amyotrophic lateral sclerosis) vs. non-neuromuscular conditions (autism, sickle cell anemia, cancer) from 2018 (N = 35 MSK, 60 total) to 2023 (N = 272 MSK, 983 total) in Montour County, Pennsylvania (population = 18,091).

References

THE NAME YOU KNOW, THE DOCTOR YOU DON'T

By: Parker Smith

In 1974 Dr. Frank Jobe performed a first-of-its-kind Ulnar Collateral Ligament (UCL) surgical repair on the Los Angeles Dodgers Pitcher, Tommy John. Before this, UCL tears were thought to be a career-ending injury for professional pitchers, however through Dr. Jobe's efforts, Tommy John was able to continue pitching for another 14 MLB seasons. Now in 2024, it is estimated that nearly one-third of all MLB pitchers have undergone what is better known as "Tommy John Surgery". While Dr. Jobe's impact on the world of MSK is undeniable, it is his patient's name that is much more widely recognized. This serves as a testament to the role of a musculoskeletal physician: to aid in a patient's return to peak performance and give all the credit to them for their perseverance.

In order to properly appreciate the work of Dr. Jobe it is important to note precisely how the UCL repair procedure is conducted. The repair process uses a grafted ligament from the patient's own body to replace the damaged UCL. Most commonly the graft comes from the palmaris longus tendon, but the gracilis tendon may also be used if the palmaris longus tendon is too small or is absent. Once the graft has been harvested, damaged UCL tissue is removed by the surgeon and the graft is secured into the humerus and ulna by sutures, buttons, or screws. Postoperatively, recovery from the procedure takes two to four months in order to regain full elbow extension with throwing athletes returning to competition between six and

nine months.

While the prevalence of this procedure is widespread, it could easily be argued that it is not even the top contribution Dr. Jobe gave to the world and to medicine. Prior to becoming an orthopedic surgeon, Jobe served as a medical staff sergeant in World War II for the 101st Airborne Division. His military service included landing at Normandy by glider and seeing action at the Battle of the Bulge in Bastogne. During this time he was briefly captured by German soldiers before escaping back into American territory. Because of this harrowing experience, he eventually received the Bronze Star Medal. After he returned from the war, Frank was inspired by his experiences and began his collegiate career, setting him on the path to becoming a physician.

In his professional career he accomplished a great deal. Along with Dr. Robert Kerlan, Dr. Jobe co-founded the Kerlan-Jobe Orthopaedic Clinic. Additionally, he worked as a clinical professor in the Department of Orthopaedics at USC School of Medicine, founder and medical director of the Biomechanics Laboratory at Centinela Hospital Medical Center in Inglewood, Chairman of the American Orthopaedic Society for Sports Medicine, founding member and subsequent President of the American Shoulder and Elbow Society, President of the Major League Baseball Physicians Association, and Program Chair of the Western Orthopaedic Association. Furthermore, he was a consultant to the President's Council on Physical Fitness and Sports as well as

a Diplomate of the American Board of Orthopaedic Surgeons.

Despite his illustrious career, he still kept his sense of humility throughout. It has been noted by many friends and family of Dr. Jobe's that when the conversation about the "Tommy John" surgery came up or the larger conversation on the impact of his work on sports medicine as a whole that it was evident that he was made uncomfortable by it, simply stating, "Well, I'm just an ordinary doctor. I'm Lucky."

Looking at the impact of Dr. Jobe on the MLB alone is more than impressive. The widespread adoption of Dr. Jobe's technique has saved countless pitchers careers and has contributed to multiple players who underwent UCL repair going on to win the Cy Young Award, given out to the best pitchers in the MLB. Although Dr. Jobe accomplished a large amount of feats during his career and in his lifetime as a whole, it is names like Shohei Ohtani, Jacob deGrom, and Justin Verlander that will remain much more widely known, but I believe that this is exactly how Dr. Jobe wanted it to be. At his core, the giant in sports medicine was a humble and kind southern gentleman who sought to help others and never thought of anyone as beneath him or undeserving of his insight. While it is his insight that has contributed to his impact, his character and embodiment of what a musculoskeletal physician should be is also deserving of being widely celebrated.

Dr. Frank Jobe's contributions to musculoskeletal medicine have had a profound impact on the treatment of UCL injuries. In 1974 Dr. Jobe did not just save one baseball player's career but perhaps thousands since then all while setting new standards in orthopedic surgery. Jobe's legacy is a testament to the vital role of musculoskeletal physicians: aid in the recovery, honor the patient's resilience, and allow the recognition to go to the patient's efforts rather than your own. As we look to the future, Dr. Jobe's contributions continue to guide and inspire orthopedic surgeons and all musculoskeletal doctors alike in their mission to support and heal athletes around the globe.

References



BEHIND THE WHEEL: A LOOK AT THE PHYSICAL DEMANDS OF RACING

By Katherine Furey

Between social media and sports documentaries, like Netflix's Formula 1: Drive to Survive and NASCAR: Full Speed, fans are closer than ever to the behind-the-scenes of what it is like to be a professional racecar driver. Drivers are often shown training their neck muscles, especially in a series like Formula 1. But why is this important? What are the physical demands of driving a race car?

During a race, drivers are subject to physical, mental, and heat-related stress. Today's race cars are designed with high downforce in mind, allowing the cars to have higher speeds around the corners. This in turn, however, increases the lateral forces on the driver¹. According to an article by the Mercedes

AMG Petronas Formula 1 team, drivers can experience up to around 5Gs going around a high-speed corner². These forces require drivers to use techniques also used by fighter pilots to protect their core and maintain blood flow³. Drivers must strengthen their neck muscles to produce isometric force in order to stabilize their heads while turning and braking¹. The force required for braking alone is between 600 and 1200 N³. In an interview with ex-IndyCar driver Dario Franchitti, he states that moving the steering wheel of an IndyCar (which does not have power steering) requires about 35 pounds of force⁴. This amount of exertion adds up throughout the race, as there are multiple turns and braking points throughout a single lap. Not to mention, vibration in the car also adds to the

physical demands, especially during longer races. Vibration has been shown to increase muscle fatigue, heart rate, and cardiac output³.

A study from 2002 analyzed heart rate and oxygen consumption in professional, open-wheel race car drivers. VO₂, a measure of cardiovascular fitness, and heart rate responses while driving were similar to individuals running a mile at 8 to 10 minutes pace and were comparable to sports like basketball and handball⁵. A more recent study in 2019 comparing data from racing series IndyCar, Formula 1, NASCAR, and IMSA GTD showed an increase in VO₂ values compared to the 2002 Jacobs et al. study, indicating the effect of the emphasis on drivers' physical training¹.

Heat also adds to the physical demands in the car. The engine itself produces significant heat, and races are held outdoors often on asphalt tracks³. Drivers also face something known

as "uncompensable heat stress" since their fire-protective layers negatively affect their bodies from losing heat during races⁵. Although it may appear that racecar drivers sit in their cars and drive in circles, it is clear that driving a racecar requires a level of physical fitness to deal with high speeds, heat, and handling the car. As the sport evolves and cars become more advanced, there is an opportunity for further research on the physiology of racing. **References**



20 THE ROLE OF NEUROMUSCULAR RE-EDUCATION IN POST-INJURY RECOVERY

By: Younis Sutari

Introduction

Musculoskeletal injury breaks down both the structure of tissues and the neuromuscular networks that drive movement, which is problematic for clinicians seeking to make recovery as efficient as possible. Compensatory movements follow injury or surgery, delaying recovery and exposing the body to further injury. Neuromuscular re-education (NMR) is needed to reconnect the brain-muscle communication for effective movement and full recovery. The knowledge of how and why NMR is used to improve patient outcomes and decrease reinjury can prove invaluable for PTs and rehab professionals.

What is Neuromuscular Re-Education?

Neuromuscular re-education is a form of therapy that attempts to re-teach the brain and muscles to communicate after injury. Through trauma, proprioception (the sense that the body has of joint position and movement) can become impaired, which can affect motor control. This impairment can appear as unbalanced movement or struggle in performing errands such as walking or lifting, and affect quality of life. NMR addresses these disruptions by restoring proprioceptive pathways, allowing for improved balance, coordination, and functional movement (1). Beyond physical recovery, NMR reduces the risk of chronic pain or compensatory injuries that can develop from prolonged improper movement patterns. By focusing on the brain-muscle connection, NMR helps patients achieve a thorough recovery that emphasizes movement quality alongside strength.

Why Neuromuscular Re-Education is Critical for Recovery

Musculoskeletal injuries, such as ACL tears, ankle sprains, or spinal injuries, disrupt motor control and proprioception in ways that simple strengthening exercises alone cannot fully address. While restoring muscle strength is crucial, neuromuscular deficits—such as faulty movement patterns or delayed muscle activation—can remain long after patients have regained muscle strength. These issues can result in compensatory movements, where the body shifts the workload to other muscles or joints to protect the injured area, which can lead to long-term dysfunction (2). Addressing these movement deficits early in the rehabilitation process helps patients avoid secondary issues, such as joint degeneration or recurrent injury.

During ACL rehab, for instance, patients will tend to prefer one leg over another, putting them at a higher risk of re-injury. After ACL surgery, many individuals continue to experience neuromuscular deficits, which leave them vulnerable to future injuries, especially when returning to high-demand activities like sports (3). This emphasizes the importance of targeted neuromuscular re-education to help patients regain their strength and learn normal movement. This improves their overall function and minimizes the risk of setbacks, supporting

a more resilient recovery and enabling a safer return to activity.

Techniques Used in Neuromuscular Re-Education

Several approaches are used to retrain neuromuscular function, each targeting specific movement coordination, balance, and control aspects. These techniques are especially effective for patients at different stages of healing, and can be modified for diverse clinical settings.

- **Balance and Proprioceptive Training:** Exercises incorporating unstable surfaces, such as wobble boards or balance pads, stimulate the proprioceptive system by challenging the body's equilibrium and stability. These exercises efficiently recover joint stability and control, especially in ankle sprains or knee trauma, where balance deficits are common (4). Clinicians can incorporate these exercises early in rehabilitation to restore stability and build patient confidence in performing everyday activities.
- **Gait Retraining:** After lower-limb injuries, abnormal gait patterns may develop, often as a protective mechanism. These abnormalities, if left unaddressed, can lead to further musculoskeletal issues, including hip or lower back pain. Gait retraining, involving visual, tactile, and auditory feedback, helps patients relearn walking mechanics (5). This approach improves gait symmetry and restores the natural biomechanics of movement, enhancing patient mobility and preventing compensatory strain elsewhere in the body. Clinicians may employ this method to address underlying movement impairments and improve long-term functional outcomes.
- **Functional Electrical Stimulation (FES):** FES benefits patients with significant neuromuscular impairment, such as those recovering from strokes or severe injuries. By delivering electrical impulses to the muscles, FES stimulates muscle contractions, helping to retrain muscles to respond to neural input. This method is especially effective for individuals with neurological impairments, promoting muscle activation and enhancing neuroplasticity when incorporated into a comprehensive rehabilitation program (6). In clinical practice, FES can supplement voluntary movement, gradually reestablishing control in affected areas.
- **Dynamic Movement Training:** Functional exercises, such as squats, lunges, and sports-specific drills, replicate real-world activities and apply neuromuscular control in practical settings. These exercises are essential for athletes and active individuals as they prepare for complex movements encountered in sports or daily life (7). Dynamic training supports safe multidirectional movement by enhancing coordination between muscle groups, providing a foundation for injury prevention

and sustained performance. Clinicians can progressively integrate these exercises, matching the patient's functional goals and activity demands.

Each of these techniques addresses a unique aspect of neuromuscular recovery, helping patients regain functional independence and build confidence in their movements.

Clinical Evidence Supporting Neuromuscular Re-Education

Evidence supports a strong role for neuromuscular re-education in whole-body rehabilitation and, especially, in treating challenging motor control dysfunctions. In patients following ACL reconstruction, incorporating neuromuscular re-education in rehab has provided greater knee stability and improved function. By focusing on restoring coordinated movement patterns and targeting specific neuromuscular deficits, such training reduces the risk of reinjury, particularly during high-impact or dynamic activities. The combination of precise feedback techniques and progressive strength development ensures patients can return to physical activities with greater confidence and resilience (3). These advancements emphasize the need to go beyond traditional strengthening exercises, addressing the neurological components of recovery to optimize outcomes.

In chronic ankle instability, incorporating balance and proprioceptive training has demonstrated substantial benefits for patients aiming to regain stability and prevent recurrent injuries. These exercises challenge postural control and joint awareness, improve functional movement, and strengthen the neuromuscular pathways that govern ankle stability. This approach minimizes compensatory mechanics that can exacerbate strain on surrounding structures, reducing the long-term risk of additional injuries (4). For patients, this means improved confidence in their movements and the ability to engage in daily activities without fear of instability or discomfort, highlighting the far-reaching implications of proprioceptive-focused interventions.

In neurologically disadvantaged patients (eg, stroke victims, spinal cord injuries), the combination of neuromuscular re-education with functional electrical stimulation (FES) has been transformative. FES stimulates weakened or paralyzed muscles, facilitating motor recovery by reinforcing neural pathways and enabling more effective muscle activation. This dual approach enhances voluntary motor control and promotes neuroplasticity, allowing patients to regain functional independence over time. By addressing the unique needs of this population, neuromuscular re-education proves its versatility and adaptability in both orthopedic and neurological rehabilitation settings (6). These targeted interventions enable a level of recovery that supports a return to meaningful daily activities.

Together, these clinical applications demonstrate the essen-

tial role of neuromuscular re-education in recovery strategies. Evidence-based treatments that address structural and neurological causes of dysfunction provide patients with an overall comprehensive pathway to regain strength, stability, and functional mobility. This integrative therapy helps to promote rehabilitative outcomes while giving people the tools they need to maintain optimal physical function.

Tailoring Neuromuscular Re-Education to the Patient

Neuromuscular re-education must be individualized, as age, injury severity, and overall health influence program design. For younger athletes, high-intensity dynamic exercises may be necessary to regain full function, while elderly patients recovering from falls or joint replacements may benefit from lower-intensity balance and proprioceptive exercises (8). Personalizing exercise intensity and complexity allows patients to be challenged appropriately, ensuring that recovery progresses without risking reinjury or overexertion.

Clinicians should aim for a gradual progression of NMR exercises, challenging the patient's neuromuscular system without overwhelming it. This customized approach enables patients to rebuild motor control, coordination, and strength in a way that aligns with their personal goals. Adjustments to the program based on the patient's progress provide a balance between safety and development, optimizing rehabilitation for efficient and effective recovery.

Conclusion

Neuromuscular re-education is integral to musculoskeletal rehabilitation, addressing motor control disruptions that often accompany trauma. By retraining proprioception, balance, and muscle activation patterns, NMR empowers patients to regain movement confidence and reduce reinjury risk. The method's adaptability makes it appropriate for orthopedic and neurological rehabilitation and a useful tool in today's clinical practice.

Incorporating NMR into rehabilitation protocols provides a path to complete recovery that restores strength and mobility and reinforces the mind-body connection essential for long-term health and functional performance. This comprehensive approach ensures patients achieve sustainable recovery and maintain optimal function in their daily lives. **References**



22 AN EVALUATION OF THE SHORT- AND LONG-TERM IMPACT OF REHABILITATION PROGRAMS ON POST-OPERATIVE LUMBAR SPINE PATIENTS

By: Maria Fioletova

More than 313 million surgeries are performed globally each year (1), with over 13 million carried out annually in the United States alone (2). Among these, lumbar spine surgeries are among the most common neurological procedures, with approximately 500,000 such surgeries performed annually in the United States. This trend has been steadily rising, particularly among older adults, as expanded Medicare coverage has made these procedures more accessible to a broader population (3). Despite advancements in surgical techniques, up to 80% of patients report post-operative discomfort, and around 20% experience persistent post-surgical pain (1).

To alleviate this discomfort and pain, physical rehabilitation is a critical component of post-operative care. Surgeons emphasize that rehabilitation offers both short- and long-term benefits, including improved overall comfort, enhanced mobility, and the ability to resume demanding activities such as sports (4).

Although there is no universally accepted timeline for initiating a structured postoperative rehabilitation

protocol, most programs commence approximately one month after surgery. Evidence suggests significant improvements in patient outcomes with rehabilitation, particularly when high-intensity exercises are incorporated. Patients who engage in high-intensity exercises generally experience faster recovery and better functional outcomes compared to those who follow low-intensity programs (5). For instance, a 2018 study examining the effects of early strength training—beginning three weeks post-surgery—on 27 patients revealed that participants in the early rehabilitation group achieved superior results in walking and muscle strength tests compared to those in standard programs (6).

Since then, numerous randomized controlled trials (RCTs) have been conducted to provide analytical evidence of rehabilitation's efficacy. A review article analyzing 18 RCTs conducted since 2003, with a total of 1,402 participants aged 43 to 61, concluded that exercise



therapy effectively reduced pain and discomfort up to six months after surgery, although the evidence quality was rated as low (7).

However, the long-term benefits of rehabilitation remain uncertain. Research indicates that two years post-surgery, many patients continue to experience moderate disabilities in their daily lives. It is unclear whether earlier or more intensive rehabilitation programs could mitigate these long-term challenges (8).

Despite its physical benefits, the adherence rates to rehabilitation programs are not high. There are several barriers to accessing these, such as lack of coverage, transportation challenges, lack of awareness, physical pain, and depression. Socioeconomic disparities such as geographical limitations and inefficient social systems further decrease access to the programs. A review article analyzing 20 high-quality studies showed

concrete evidence that these physical, psychological, and socioeconomic factors explain the low adherence to the programs. Therefore, addressing these barriers will require better healthcare policies and infrastructural investment, and will be key to ensuring the rehabilitation programs are universally accessible (9).

In conclusion, while numerous studies highlight the positive effects of rehabilitation programs on short-term recovery in lumbar spine surgery patients, there is limited evidence regarding their long-term benefits. This underscores the urgent need for further research to evaluate the sustained impact of post-surgical rehabilitation on patient outcomes. Longitudinal studies with robust methodologies are essential to establish whether earlier initiation or higher intensity of rehabilitation programs can improve long-term well-being and functional independence (10). Additionally, addressing socioeconomic barriers, such as transportation and cost, is critical to ensuring equitable access to these beneficial programs and maximizing their impact. **References**

FOOT DROP SECONDARY TO A PERONEAL INTRANEURAL GANGLION: A CASE REPORT

By: Emily Deehan BS, Elie Christoforides BS, Lauren Stern MPH¹, Colin Burnette BS, Dr. Shaun Rodgers MD, Dr. Michael Deehan MD

INTRO: Pathology which affects the common peroneal nerve leads to deficits in ankle dorsiflexion, great toe extension, foot eversion, and sensory loss to the dorsum of the foot, informally referred to as “foot drop” (1). Foot drop most commonly occurs following traumatic injury to the peroneal nerve, lumbar nerve root compression, neuropathy, or certain upper motor neuron pathologies (cerebrovascular accident, multiple sclerosis, amyotrophic lateral sclerosis). Intraneural ganglion of the peroneal nerve is a rare cause that presents insidiously. Peroneal nerve compression is the leading neuropathy of the lower extremity. However, the development of a cyst as the cause of compression is a rare occurrence that has no definitive course of treatment. It is scarcely studied and is largely relegated to case reports. We review our experience with a case treated surgically and combine the available data to determine the optimal plan of care.

METHOD: A 57-year-old man with a history of osteoarthritis, presented with a dense left foot drop and severe radiating pain in the peroneal nerve distribution. Arthritis developed subsequent to a 40-year history of military service, coaching, and construction work. Initial work-up ruled out lumbar spine involvement. MRI of the left knee indicated peroneal intraneural ganglion. Subsequent nerve conduction studies confirmed common peroneal nerve compression. Peroneal neuroplasty for decompression revealed a tubular ganglion of the common peroneal nerve. Decompression and cyst drainage were performed.

RESULTS: Patient was seen at a 1-year follow-up for total knee replacement. Decompression and cyst drainage resulted in complete pain relief, improved paresthesia, and alleviated ab-

normal sensation. No motor function recovery was observed at follow up and sensory loss persisted. Patient remained unable to dorsiflex the ankle and extend the great toe. The patient manages loss of motor function with a custom-molded ankle foot orthotic, which is worn daily.

DISCUSSION and CONCLUSION: The peroneal nerve is the most frequent site of intraneural ganglia. Ultrasound-guided aspiration, cyst resection, neurolysis, and surgical nerve decompression are among the current treatment options, with surgical nerve decompression serving as the most frequently used method (2). Cases of surgically treated ulnar intraneural ganglia report favorable outcomes, while cases of common peroneal nerve compression are as not well defined. Nevertheless, surgical nerve decompression, including articular branch ligation, emerges as the optimal choice in reducing the recurrence rate to 6% (3). The optimal treatment for motor deficits remains undefined. Further research is needed to determine the precise extent of recovery and to better define treatment options for optimal outcomes.

References



By: Elena Myalo

Concussion, also known as a mild traumatic brain injury (TBI), is a terribly common occurrence where the head is struck by an object/surface or experiences a non-contact inertial force [6]. Most people have heard of concussions, but the mechanical threshold needed to cause cell death and changes in function leading to concussion symptoms is understudied. A force that might cause a concussion in one individual might fail to cause the same effect in another [1]. Once a concussion occurs, the individual might experience symptoms including but not limited to headaches, neck pain, dizziness, nausea, visual changes, and confusion [2]. These symptoms can be present for a few weeks, a month, or longer. Individuals with a concussion are also at risk for post-concussion syndrome, which may cause symptoms to persist for multiple months or years. Shortening the recovery period is the goal in concussion treatment and exercise has shown to do just that.

The effect of physical exercise after a concussion: a systematic review and meta-analysis looked at 14 studies comparing exercise

and non-exercise groups of both sports and non-sports related concussions [4]. The Post-Concussion Symptom Scale (PCSS) showed a decrease in the exercise groups compared to the non-exercise groups in both sports and non-sports related concussions. It was also found that female patients had higher, more severe concussions compared to male counterparts. This article also hypothesized that the reason exercise may benefit concussion recovery is due to it increasing blood flow, oxygenation, and neuroplasticity. In addition, removing individuals from their daily lives by increasing bed rest may increase depression and anxiety leading to a higher PCSS score.

Another article: Rest and exercise early after sport-related concussion: a systematic review and meta-analysis reviewed 9432 participants across studies that compared physical activity to stretching or resting controls in individuals recovering from a sport related concussion [5]. It was found that light physical activity like walking can shorten recovery period when started within 48 hours of injury, and a more intense exercise

treatment plan based on individual tolerance is beneficial after 48 hours. Tolerance of exercise can be tested if an individual reports a visual analogue scale (VAS) score of resting symptoms of less than 7/10. Exercise done should only mildly exacerbate symptoms by not increasing score more than 2 points. Overall, prescribing exercise during the 14 days post concussion can reduce persistent postconcussion symptoms.

Prescribing exercise to aid in post-concussion recovery doesn't come without its challenges. What exercises should be done? Should exercise be done in individuals who are already experiencing the discomfort of headaches and nausea associated with concussions? Could starting exercise too soon lead to a second concussion? The types of exercises done post-concussion in the sub-acute phase (72 hours to 7 days) can vary but usually include items like treadmills and stationary bikes. High intensity exercise that significantly worsen symptoms and aerobic exercises for longer than 45 minutes is generally not recommended [8]. Resistance training has to be approached carefully because

some individuals may struggle with coordination. Low intensity exercises that are 40% of maximum heart rate for a duration of 10-15 minutes can be a starting point for most individuals in the sub-acute concussion period [8]. Additionally, while testing individuals with tests like the Buffalo Concussion Treadmill Test (BCTT) can help tailor management, it can also provoke and increase discomfort, so using controlled low-intensity aerobic exercise is a good alternative. When considering returning to sports, gradual increase of the intensity and duration of the exercise regime is important to avoid second impact syndrome. Second impact syndrome is when another concussion occurs before the recovery is complete from the first concussion. Since both concussion symptoms and recovery are not identical for every person, a physician and patient needs to work together to find the best treatment protocol for every individual. The recovery journey of a concussion can be frustrating, and aerobic exercise can shorten the recovery period and allow individuals to return to their pre-concussion lives quicker, but gradual progression of exercise regimen is crucial to prevent further complications. **References**



MUSCLING THROUGH PREGNANCY

By: Amy L. Kennalley

Pregnancy brings immense joy and hope, but it also introduces a multitude of physical changes that can surprise many expectant mothers. These changes, particularly those affecting the musculoskeletal (MSK) system, can lead to discomfort and other challenges. Dr. Chris Lewis provides valuable insights and practical advice to help pregnant women better understand these changes.

Hormones like relaxin and progesterone are essential during pregnancy, preparing the body for childbirth by loosening the joints. Dr. Lewis explains, "The hips, SI joints, and pubic symphysis seem to be especially affected. The extra forward weight of pregnancy leads to lumbar lordosis, so low back pain is pretty universal for pregnant women." This joint laxity, while necessary, can make pregnancy quite uncomfortable.

Maintaining good fitness can help women better cope with the demands of pregnancy. Dr. Lewis emphasizes that women with

a good baseline fitness fare better with the changes of pregnancy. Women's bodies also do best with regular maintenance like incorporating exercise, stretching, and good sleep even throughout the pregnancy.

Most women can continue their pre-pregnancy exercise routines with some modifications. Low-impact activities like walking, swimming, and prenatal yoga are particularly beneficial. These exercises help maintain muscle tone, improve flexibility, and reduce stress on the joints. Specific exercises targeting the pelvic floor and core muscles provide support and stability, alleviating some of the discomfort associated with pregnancy-related changes.

One persistent myth about pregnancy that Dr. Lewis addresses is the idea of bed rest. "One idea that was previously popular but has thankfully fallen out of favor is bedrest. Except for a few really rare circumstances, pregnant women should contin-

ue to be active to avoid deconditioning."

Dr. Lewis explains, "MSK complaints in pregnancy are usually, thankfully, self-resolving, but durable relief prior to delivery is usually not available," says Dr. Lewis. "Occasionally, an issue like pubic symphysis or sciatic nerve pain improves with targeted exercise or physical therapy." The American College of Obstetricians and Gynecologists recommends exercise to reduce low back pain, physical therapy if needed, and acetaminophen as the first-line pain medication.

The postpartum period is challenging on both the body and the mind, and Dr. Lewis emphasizes the importance of social support during this time. "Postpartum is really demanding physically and emotionally. Family and other social support is such a gift; I encourage women to accept help with childcare and other domestic or professional responsibilities when it's available to try to optimize sleep and rest." One practical piece of advice is to sleep when the baby sleeps, allowing for more consecutive hours of rest.

Navigating the changes of pregnancy can be challenging, but with the right knowledge and proactive measures, expectant mothers can better manage their physical health. Dr. Chris Lewis's insights highlight the importance of maintaining fitness, staying active, and seeking appropriate care to ensure a healthier, more comfortable pregnancy and postpartum experience. By understanding and addressing these changes, women can focus more on the joy of pregnancy, ultimately leading to a more positive journey into motherhood.

References



By: Nikita Sood and Snigdha Marivada

The journey of recovering from an injury or illness is multifaceted, it requires both physical and mental rehabilitation. Both factors are integral in the healing process and an individual is unable to recover completely without addressing both components. Traditionally, in comparison to mental health, physical rehabilitation has been at the forefront of medical treatment. However, there has been an increased understanding of the role of mental health in the recovery process throughout the years.

Mental rehabilitation encompasses numerous therapies such as support groups, mindfulness practices, psychotherapy, and cognitive-behavioral therapy to help individuals cope with the trauma associated with an illness or injury. PTSD, depression, or anxiety can result from an illness or injury and ultimately impede one's physical recovery if not addressed properly. For example, a person who is recovering from a severe leg injury may feel extremely anxious and hopeless about their ability to recover. They may doubt their ability to complete daily tasks that were once second nature to them and fear that they may never return to their previous level of functioning. This mindset may decrease their involvement in physical therapy and in turn, slow recovery even further. This perpetuates a cycle of doubt and negativity. Setbacks often happen during recovery, and it is important to remind your patient that setbacks are part of the healing process. Strive to highlight any improvements in recovery to reinforce a sense of continuity and progress. For these reasons, it is important to monitor your patient's mental health by screening for depression, anxiety, or PTSD. If needed, collaborate with other providers, like therapists, to ensure that the needs of the patient are met.

A key component of ensuring successful rehabilitation lies in the patient's motivation to commit to the treatment plan. One technique that has proven to be integral in increasing patient motivation is motivational interviewing. Motivational interviewing is a counseling style method that relies on a patient's exploration and resolve toward enacting a change. This method is especially effective in patients who are ambivalent about change. There are four core principles that comprise motivational interviewing: expression of empathy, develop discrepancy, roll with resistance, and support of self-efficacy. Expressing empathy towards a patient involves showing understanding of the patient's feelings and acknowledging their feelings with no judgment. The second principle, develop discrepancy, helps patients recognize the gap between their behavior and their goals for themselves. Visualizing this discrepancy can help patients see that change is needed for them to reach their vision for the future.

Undergoing an injury or illness can be a very traumatic experience for an individual and it is very important to navigate and address any resistance to treatment delicately. The principle of roll with resistance outlines how to handle patients who are resistant to change. The key to finding answers and solutions lies within the participant. As a healthcare provider, it is important to not confront resistance directly and instead offer new perspectives without imposing them on patients. Finally, the patient must believe that they have the ability to change. If an individual believes they are self-sufficient and that they can succeed, then they will be able to push through the challenges that come along throughout the recovery process.

The mind and body are deeply intertwined. The mind-body connection is a key component of rehabilitation. It is important to encourage patients to practice implementing positive thought, effective coping mechanisms, and developing mental fortitude as they progress in their physical healing journey. Recovery is not easy and obstacles such as lack of access to resources and a support system can make this a very challenging process. An optimistic outlook is crucial to encourage hope and keep moving forward with physical rehabilitation. As future physicians, we can encourage this by explaining the recovery process and its timeline in a realistic and easy-to-understand way. This will avoid unnecessary anxiety if a patient is not aware of when they will meet certain recovery milestones. Recovery is not an individual journey. We, as future providers, must work with our patients to acknowledge and tackle the mental and physical challenges patients face in their journey to recovery. A team-based approach while recognizing the individual needs of a patient will go a long way in recovery outcomes.



A SUBDURAL HEMORRHAGE

By: Marianna Koleng

Something most people do not know about me is that I am ambidextrous, something even fewer people know about me is why. Growing up I played many sports for over ten years and had a bit of a reputation of being a "wild child." I have suffered countless concussions as a result. Some of these even led to hospitalizations, time out from playing, and the straw that broke the camel's back, a traumatic subdural hemorrhage – a brain bleed straight out of a medical school test question. It was not until years later of healing physically and emotionally, and then learning about subdural hemorrhages in medical school and seeing one in clinic, did I process how severe this injury was. I am grateful not only to be alive, as subdural hemorrhages carry an almost 20% mortality rate, but also for the almost unreal amount of recovery I have achieved. It seems eerie even as I write this, that one can go from slurring most of their sentences to being on the cusp of becoming a physician.

Oddly enough, I remember a fair amount of the day it hapened. Thankfully I was near a hospital and was able to receive immediate care. Apparently, I fainted and fell backwards, hitting my head first and smacking onto the concrete floor. I was taken to the hospital immediately, and after vomiting twice, they took a CT scan of my brain. There was blood. They did a second CT-scan with contrast, which feels warm going in, if you've ever wondered, to figure out where the bleed was. In hindsight, I realize they were aiming to rule out a subarachnoid hemorrhage, a bleed on the brain's surface, and highly fatal if not treated immediately. Thankfully, my bleed was subdural- small enough not to require an emergency open craniotomy. Rather, the increased pressure could be lowered using non-surgical techniques over a couple of days in the ICU. Which, if I may add, was an unpleasant stay. Given my fall, bleeding, and condition, I was not allowed to use the bathroom, and I could not wait to leave. At that point, all I could do was wait. The blood had pooled between my brain and my skull, but thankfully I was young, and it would drain slowly on its own if I avoided triggers.

As a result, I suffered brain fog and an omnipresent dull headache. It began to impact my ability to learn, speak and I suffered frequent headaches. I specifically recall my first exam in my pre-med biology class, where I could not process the information I had just read the night before and was left with what felt like literal "gaps" in my thinking. The blood did drain, but repeat CT scans showed that I had encephalomalacia (cerebral softening), or in layman's terms, a sign of permanent brain damage, in my temporal lobe.

As I learned what was going on I spent countless hours re-

searching how to get better. One thing that stuck out to me was the concept of neuroplasticity. Neuroplasticity is the brain's ability to adapt and change. I decided that the best chance I had to heal was to attempt to utilize neuroplasticity. I have always been able to do most things with both hands fairly equally, but I always wrote with my left hand. After watching a documentary on "brain-training" I decided to learn to write with and use my right hand more. It took months to become comfortable to write with my right hand, but over time, I improved. I also began teaching myself to play the piano and use my second language, German, more frequently. In fact, to this day, I still use both German and English daily.

Over time, I stopped having fogs and I no longer suffer from headaches. Understanding the novelties of the brain and healing is one key factor that has influenced my passion for medicine and helping others both young and old recover from illness, injury, or disease through novel methods. Learning to write with my right hand has shown me how each person, including myself, requires a unique treatment, sometimes going "out of the box". My experiences have also given me an increased empathy because at any time I do not know what scars or pain one is carrying. What appears on the surface of the ocean is not indicative of the conditions beneath. This has shown me there is beauty to be found in all things and that the journey often matters more than the destination. I carry this with me, even today as I think this will not only help me see novel approaches as a physician to treatment, but also remembering to live each day to the fullest and not allow past scars to inhibit my future potential.





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