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research article

Walk On, Australia: An Exceptional Approach to Spinal Cord Injury

—Amanda Randall (Edited by Bethany Gordon)

Walking through the San Francisco International Airport to board a plane for Sydney, Australia, was the scariest yet most exciting moment of my life. I was about to embark on a 14-hour flight to a country I knew about only through travel books, Google Earth, and stereotypical dialogue popularized by Steve Irwin and Paul Hogan. Although going such a great distance from home was a challenge in itself, I was eager to learn all that I could about exercise-based recovery for spinal cord injury (SCI) at a newly formed program called Walk On. With funding from the International Research Opportunities Program (IROP) at the University of New Hampshire, I was on my way to Brisbane, Australia, to study a field that interests me both academically and personally.

My interest in spinal cord injury recovery began in 2007 when my cousin sustained a SCI from a lumbering accident. He spent three months fighting for his life in the hospital, and was released having lost his finger dexterity, most of his arm function, and all voluntary function below his shoulders. His physicians told him that he was not likely to fully recover from his injury. However, his mindset was quite the opposite.

I wish I could complete this story by stating that my cousin proved his physicians wrong, but I can't. Today, he is at home in an electric-powered wheelchair after many months of traditional SCI rehabilitation and has regained little function since his accident. While he can still enjoy some things as an active outdoorsman, and is working towards moving from his electric-powered wheelchair to a manual wheelchair, he faces the many obstacles and frustrations that come with being one of the thousands of people in the United States who live with a spinal cord injury (1).



At the Lone Pine Koala Sanctuary near Brisbane, Australia

Overview of the Spine and Spinal Cord Injury

Following a spinal cord injury, a physician diagnoses the injury as either “complete” or “incomplete.” A “complete” injury means that the patient’s spinal cord was completely severed, and he or she has no voluntary function below the lesion on the spinal cord. The lesion, which prevents information from traveling from the brain further down the spinal cord, develops when the immune system removes damaged tissue in response to the injury. An “incomplete” injury indicates that the patient’s spinal cord has been partially bruised or damaged, and that person may have partial function and/or sensation below their injury.

Starting at the most superior portion of vertebrae at the neck, or cervical region, there are seven cervical vertebrae (C1–C7). The cervical area of the spine is the one that is most susceptible to injury. A person who sustains a C-level spinal cord injury can range from needing life support devices (C1–C2) to having limited arm function and little to no finger dexterity (C6–C7). Individuals with C-level injuries are commonly referred to as “quadriplegic.” The thoracic vertebrae (T1–T12) run from the upper back down to the mid-lower back. A person with a T-level injury is typically able to push

themselves in a manual wheelchair and is classified as "paraplegic." The lower the injury in their thoracic spine (i.e.: T12), the greater the level of voluntary function that person will have in their trunk and abdomen. The clients I worked with at Walk On had levels of spinal cord injury ranging from C-4/5 to T-12.

My Journey Forward to Walk On

While my cousin was in the hospital, I was in the midst of my athletic training curriculum at UNH. In the summer of 2008, I was hired to work for Shake-A-Leg, a program in Newport, Rhode Island, for people suffering from neurological injuries and disease, primarily SCI. There, clients receive advice on how to acquire a more independent lifestyle and can spend the summer sailing on specially equipped boats. (2).



The sailboats used for the Shake-A-Leg program

At Shake-A-Leg, I became a personal care and administrative assistant to the program's recreation director, a twenty-six-year-old woman with a cervical spinal cord injury. This woman, who has since become a close friend, introduced me to the world of exercise-based recovery for SCI. Twice a week I accompanied her to Journey Forward in Canton, Massachusetts, one of several programs worldwide that have been inspired by Project Walk in Carlsbad, California. Ted Dardzinski founded Project Walk in 1999 in an effort to provide an "improved quality of life for people with SCI through intense exercise-based recovery programs, education, support, and encouragement" (4). Dardzinski developed the methodology used at Project Walk while working as a personal trainer for a quadriplegic. Branches of Project Walk now exist in Australia, Canada, Spain, the United Kingdom, Norway, and Japan (5). In order for a facility to bear the "Certified by Project Walk" insignia, they must first send prospective trainers to the California

center to learn the Dardzinski Method and receive supervised training working with clients. The five stages of the Method are reactivation of the nervous system, development/stabilization, strength training, function and coordination; and gait training (6). In order for clients to begin an exercise program at a Project Walk certified facility, they must first receive medical approval. The primary goals of each client's program include building muscle mass, maintaining bone mineral density, and regaining as much function as possible.

My time at Journey Forward sparked a strong desire to better understand this exercise-based recovery program. I was especially interested to learn more about the Walk On program in Australia, which had just recently opened to much acclaim. What made Walk On so unique? Was Walk On promising its clients that they would walk again if they committed their time and money to this program? I wanted to answer these questions and to explore how exercise-based recovery differs from traditional rehabilitation. I was equally interested in learning how the body's response to the program and the design of individual programs differ depending on the severity of a person's injury. One of the most important lessons I took away from this experience was that even though people may have the same diagnosis, each person is affected by their spinal cord injury differently.

Walk On: Brisbane, Australia

With the assistance of my Athletic Training Program Director, Dan Sedory, and my UNH mentor, Dr. Dain LaRoche, I applied for and was awarded an IROP grant, and left for Walk On in June 2009. My foreign mentor, Emma Dayman, who has a degree in Human Movement, is the leading recovery specialist at Walk On. Emma helped me decide which exercise equipment I should use for the data collection portion of my research. I chose to study the effects of these three exercises on calf muscle activity. I also registered as a student-volunteer so that I could gain more hands-on experience with each of the fourteen clients' individual programs. I wanted a clear understanding of each client's program and perceptions of his/her journey into exercise-based recovery.

My first day at Walk On, I saw clients out of their wheelchairs working with the recovery specialists in hands-and-knees positions, using an arm-leg bike to propel their legs; using their upper bodies and torsos to help them stand at a chest-high bar; doing assisted leg presses, leg extensions, sit-ups, and push-ups; and boxing while being supported by a standing frame. Some clients were practicing walking. This program is unique because it works on the basis that new

pathways can be formed in the body and that a damaged nervous system can be retrained, both with complete and incomplete injuries (6). Clients work with recovery specialists throughout each two-hour workout session and are asked to focus on the body parts being moved. The recovery specialists act as the client's nervous system, moving their body parts through the desired range of motion. This theory and methodology has sparked much research and interest at the Walk On and Project Walk facilities. As stated by a Project Walk recovery specialist on television while I was in Australia, "While walking is something that we [Project Walk] do not guarantee, it is certainly a goal that we have (7)."

The trainers at Walk On practice the walking pattern with all of their clients who have shown the ability to partially initiate muscular movement in the hips or legs. When a client begins "walking" as a part of his or her workout routine, it usually requires the assistance of three or more trainers who help the client move his/her legs through a full range of motion while ensuring the client's balance and safety. While walking, the client is supported by a metal frame on wheels called a gait-trainer. Practicing the patterns of crawling, sitting with good posture, trunk rotation, kneeling, standing, and walking are all important stages in the Dardzinski Method. More than one client expressed that they chose to come to Walk On because they felt this was the most cutting-edge program out there for SCI.

Results of EMG Readings and Interviews

To measure the electrical activity of the clients' calf muscles, I used a portable electromyography (EMG) unit. I did this by connecting two electrodes to the calf and recording the muscle activity while the client performed each of the three exercises: doing 90-degree squats on a Total Gym machine; pedaling on a recumbent bicycle with the resistance level set to "moderate"; and moving the clients' foot from the heel-down to toe-up position on a multi-planar vibration machine called a Power Plate. The Power Plate is an exercise machine that offers varying intensities of vibration movement to stimulate muscle activity.



The Power Plate is a machine that creates multi-planar vibrations that cause and magnify muscle contraction. This is the machine that yielded the highest muscle activation.

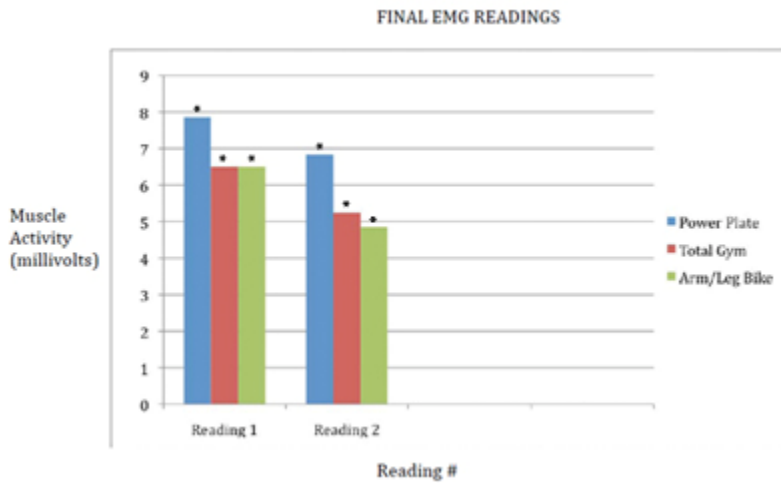


The Myotrac Ininiti Portable EMG Unit was used to measure calf muscle activity. (8)

My research subjects included nine men and one woman, aged sixteen to seventy-one, with varying levels of spinal cord injury. If the clients were capable of initiating some muscle movement on their own, they were asked to do so for each of the exercises. I recorded the clients' calf muscle activity during the first two weeks of my arrival, and once more within the final two weeks before my departure.

While the long-term effects of these exercises was my primary interest, nine weeks was simply not enough time to measure significant changes in muscle activity using the EMG unit. However, the measurements I did take revealed that the Power Plate yielded significantly higher EMG readings than either the Total Gym or the recumbent bicycle exercises. While some clients clearly had higher muscle activation than others, my results, shown in Figure 1, were based on the highest scoring exercise for each person.

In addition to the data collection, interviews were a critical component to my project at Walk On. Because each client was working so hard toward their individual goals through the time commitment and physical effort put into their program, I was interested in clients' motives to participate in this particular program and how it had physically and mentally changed them since they had begun. More specifically, I interviewed clients individually about how the Walk On program had shaped their goals, overall attitude, and outlook on life, and how they had seen themselves physically improve throughout their time in the program.



*Figure 1. MEAN EMG READINGS The Power Plate exercise yielded the highest individual score for the clients overall. The second highest scoring exercise was the squats on the Total Gym, and the lowest scoring exercise regarding calf muscle activation was the recumbent bicycle. Individuals scores varied due to different levels of muscle initiation and the presence of muscle spasms or contractures that the client was having on the day of the reading. * = different from total gym and arm/leg bike, $P < 0.05$*

I learned that clients' individual goals included recovering enough to perform activities of daily living; preventing their injury from creating secondary health problems; and maintaining healthy bone mineral density. Some were even pursuing the ultimate goal of full recovery. Clients reported physical improvements including better sleep, significant muscle gain, decreased nerve pain, improved posture, and increased range of motion of joints. My interviews revealed that clients were overall very happy with their experience at Walk On because they felt that they were doing their bodies a service by not becoming accustomed to a lifestyle within the confines of a wheelchair.

Through our conversations, I also learned that many were taking measures outside of Walk On. One client in particular was regularly receiving massage, acupuncture, hyperbaric chamber treatment, and hydrotherapy. In addition, he traveled to Texas to have stem cells surgically injected into his body. Another client participated in similar alternative therapies; he told me that he basically goes to therapy, sleeps, and wakes up to do it again the next day. Why do these people do it? As one client said, "Because I want to get better. It's simple. Nobody wants to be in a wheelchair."

A third client, a very determined woman with an incomplete C-level injury, also received acupuncture and attended hydrotherapy weekly. She had a gracious attitude toward the Walk On trainers and others in her life who supported her drive to succeed. Two weeks before I left Australia, she informed us that during her hydrotherapy session, she had initiated voluntary movement in her leg for the first time since her injury. After five months participating in the Walk On program, this client, who could not sit upright on her own and had no control of her neck immediately following her injury, and who had spent the majority of her days in bed, is also now able to type, write, and push her own wheelchair.

One of my most fascinating experiences at Walk On was meeting a 62-year-old client who sustained a C-4/C-5 incomplete injury when he was a teenager and was able to walk, unassisted, following his release from the hospital just months later. Today, that same client is at Walk On working to strengthen his weaker leg so that he may achieve a more desirable walking pattern. It is virtually unheard of for someone who has a C-level injury to be able to recover in this way. On the contrary, one client with a C5/C6 incomplete spinal cord injury has been at Walk On for one year and four months and is still in an electric-powered wheelchair. These two particular examples confirmed what I had learned about each person's body responding differently to what may be diagnosed as a very similar injury.

Life Outside of Walk On

As uplifting and inspiring as I found the Walk On clients to be, what struck me most about Australia was how the country as a whole seemed filled with optimistic and cheerful individuals. The bus drivers would more often than not greet me with a “Hello, love” or “Hello darling... how ya goin’ today?” At the park down the road, I would see huge gatherings of



Scuba diving near Cairns in the Great Barrier Reef

families and friends each weekend having an Aussie barbeque and playing a game of rugby, basketball, or soccer. I traveled north to the tropical city of Cairns to go scuba diving and snorkeling on the Great Barrier Reef and met an amazing crew who invited the whole ship out for dinner. There is an overall sense of fellowship, hospitality, and light-heartedness in Australia that makes it a truly wonderful place.

During weekend mini-vacations with friends from Walk On, a fellow IROP student, and my older brother, I met many of Australia’s famous animals. I came across a wild wallaby in the Glass Mountains, hand fed kangaroos at the Steve Irwin Australia Zoo, walked in a field of emus, saw some very large crocodiles in the Daintree River, and cuddled with a koala bear at a local reserve. Later, I was told that wild koalas, with their large black claws and territorial behavior, are not too cuddly in nature.



“Cuddling” with a koala at Lone Pine Koala Sanctuary

These adventures around the country and in the city of Brisbane helped me assimilate to Australian culture and enriched my learning experience at Walk On. Clients were glad to hear that I was interested in sightseeing and learning about their country. Through talking with the trainers and clients, we did find that, beyond differences in certain aspects of our health care systems, our two countries’ medical communities have a similar mindset toward the possibility of recovering from spinal cord injury. Like my cousin, many Walk On clients had left the hospital with very little hope for long-term improvements. The Walk On clients, however, consisted of a dedicated and hard-working group who were certain that their bodies could be physically capable of much more.

The Take-Home Message

Coming home from Australia, I was eager to tell my cousin about this experience. While he is not involved with exercise-based recovery, he remains hopeful that he will eventually be out of a wheelchair. He regularly uses a standing frame at home and has also been involved with playing quad rugby here at UNH. He is also currently working hard to move from his electric-powered wheelchair to a manual wheelchair, a very difficult transition for someone who has a C-level injury. Exercise-based recovery is not for everyone, as it is a physically demanding approach to SCI that is not covered by insurance and is quite expensive.

From this experience, I learned that promoting exercise-based recovery does not give a person with an SCI false hope that they will walk again. Nor does it promise that someone will regain any function below his or her point of injury. Although some clients have been able to achieve the ultimate goal of full recovery (6), Walk On works on the premise that exercise is important for everyone, even able-bodied persons, but especially important for a person whose physical activity is extremely limited following a spinal cord injury. Being in a wheelchair for an extended period of time will lead to muscle atrophy, osteoporosis, and a decrease in overall cardio-respiratory health. Physical activity helps to build and maintain muscle, bone, and cardio-respiratory health. Regaining complete function is not the focus of each client; rather, the focus may be the small changes that are making them mentally and physically stronger individuals.

As many Americans are now beginning to acknowledge, being a sedentary able-bodied person will negatively impact one's health. If you were to enter Walk On, you would see quadriplegic and paraplegic clients with muscle definition in their arms, abdomen, and legs. The clients who regularly engage in these physically-demanding two hour sessions are likely to be in a healthier cardio-respiratory state than others, either with or without an SCI, who are inactive. The whole-body workout program inspired by Project Walk is specially designed for people with spinal cord injury. Some who have not yet seen the results firsthand may feel that this program is attempting the impossible; but who is to say that improving your mental and physical fitness is an unattainable goal when you have a spinal cord injury? Not the clients at Walk On, that's for sure.

A special thank you to the Walk On clients and staff; the Hamel Center staff and those who helped fund my IROP grant (Ms. Margaret Clarke Norman, Dean John Kirkpatrick, and Mr. Dana Hamel); Dr. Dain LaRoche, Kinesiology Department, UNH; Dan Sedory, Athletic Training Program Director, UNH; Ms. Emma Dayman, Walk On Recovery Specialist; Eric Harness, Project Walk Director of Research and Development; and David Prast, Walk On Program Director.

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Author Bio

Some people find their passions early in life. Amanda Randall developed enthusiasm for sports medicine during high school, where she was a three-sport athlete. Several years later, this native of Milton, New Hampshire, is a senior year athletic training major and nutrition minor at the University of New Hampshire. Through her classes she has received training in injury prevention, management, and rehabilitation, and has chosen to focus on working with those with spinal cord injuries. To support this interest, in 2009 she was awarded a grant by the International Research Opportunities Program (IROP) to conduct research at Walk On, an exercise-based recovery facility for those with spinal cord injuries located in Brisbane, Australia. Amanda's IROP experience enriched her life both personally and academically, allowing her to experience the people and culture of Australia while also confirming her desire to work in this field. After graduating from UNH in May 2010, Amanda wishes to go to graduate school for physical therapy. Her goal is to continue working with individuals with neurological disorders or injuries by promoting a lifestyle that they are capable of achieving through physical activity.

Mentor Bios

Dr. Dain LaRoche is an assistant professor in the University of New Hampshire's Department Of Kinesiology, where he joined the faculty in 2007. While he enjoys teaching physiology of exercise and metabolism, his personal research interest focuses on how physical activity can be used as a tool to maintain function and reduce fall risk in older adults. Dr. LaRoche found working on Amanda's project very rewarding because it allowed him to learn more about a research area he had not considered previously. However, despite viewing Amanda's experience in Australia as a wonderful opportunity, he missed the daily contact and interaction that comes from conducting a project with a student in his lab. Dr. LaRoche has served as a mentor to undergraduates at UNH and at Johnson State College in Vermont, where he was assistant professor in the Department of Environmental and Health Sciences.

Emma Dayman, Amanda Randall's foreign mentor, has a degree in human movement and is the leading recovery specialist at Walk On. Dayman helped the program's current director, David Prast, found Walk On in March 2008.