



# REHAB CASE STUDY: FINDING JUST THE RIGHT EQUIPMENT FOR ADAPTIVE DRIVING CAN BE TRICKY

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There are various levels of complexity with a driving evaluation, and when it comes to a high-tech evaluation, no two will ever be the same. If you sit down with a Certified Driver Rehabilitation Specialist (CDRS) who has experience with high-tech evaluations, they likely will be able to tell thrilling stories of accomplishment that both excite the listener and convince them they never want to do that job. For those of us who are fortunate enough to complete these types of evaluations, yes, there are adrenaline-filled thrills, but it gives us the best opportunity to tap into our clinical and creative selves.

The following case study is an example of utilizing clinical reasoning and creativity to determine and execute a plan to facilitate independent driving with high-tech equipment. It is also an example of why it is necessary for a CDRS to be open to changing the plan and willing to discover options for equipment one would never have thought to use.

Tyler is a 27-year-old male injured in a motor vehicle accident at the age of 15 as a restrained passenger. He was originally diagnosed with a motor complete C4 ASIA B spinal cord injury. Following cervical fusions and tethering surgery, as well as a long inpatient rehabilitation course, his discharge diagnosis was a motor incomplete C4 ASIA C spinal cord injury. He was first referred to the driving program at Craig Hospital two years post injury with an interest in pursuing independent driving.

Tyler was experiencing significant spasticity in bilateral upper extremities (BUE) affecting function, coordination and fluidity of movement. He was seen in a high-tech training vehicle with equipment called electronic mobility controls (EMC) to determine his ability to utilize various input devices for gas/brake and steering. The demands of the task for independent operation of the primary controls were too great, and he did not demonstrate readiness to pursue an evaluation. Spasticity was observed to be the biggest barrier at that time.

At the time of his second referral, one year later, Tyler was able to complete stand pivot transfers into a standard minivan and able to ambulate short distances with a front wheel walker. He utilized a

## THE FOLLOWING CASE STUDY IS AN EXAMPLE OF UTILIZING CLINICAL REASONING AND CREATIVITY TO DETERMINE AND EXECUTE A PLAN TO FACILITATE INDEPENDENT DRIVING WITH HIGH-TECH EQUIPMENT.

power chair for community access as well as public transportation. He had a central cord presentation. Tyler still experienced spasticity in his upper extremities, but demonstrated more coordination and fluidity of movement indicating a potential readiness to pursue a driving evaluation. The clinical assessment indicated the potential to utilize his right lower extremity (RLE) for operation of the original equipment manufacturer (OEM) gas and brake pedal and a high-tech input device for operation of steering with his right upper extremity (RUE).

Tyler's physical reaction time for use of his RLE on the gas and brake was tested as well as observed in the vehicle during a stationary evaluation. His average physical reaction time was below the expected level. His movement between pedals and ability to grade pressure was observed to be inconsistent. Strength, range of motion, coordination and difficulty with proprioception were barriers at that time for use of the

RLE on the OEM gas and brake pedals. Tyler was able to operate steering successfully with his RUE using the EMC two-way joystick. However, spasticity remained a barrier to readiness. Disappointment ensued, but the door was not shut. Based on his prognosis and trend of improvement, there was still hope.

Tyler returned one year later to try again. He was now four years post injury. He worked extremely hard to overcome the barriers identified during his previous assessments and consequently, demonstrated improvements in all areas. Tyler's functional picture and readiness were beginning to look much better. He was able to complete a stand pivot transfer inside the training van simulating the use of a six-way transfer seat with standby assistance. This became our first crossroad — to transfer inside a modified minivan, or not to transfer and attempt to drive from his power wheelchair instead. Tyler always intended to improve enough physically and functionally to access the community as normally as possible. And for him, that meant driving from the standard driver's seat. He was capable and with time may be able to achieve independence with that transfer. However, Tyler's performance with transfers is safest and most consistent when he can stand up with full extension prior to pivoting. Just because someone "can" complete the task, doesn't mean they "should." Should he or should he not complete the transfer multiple times a day? It was determined, with Tyler's acceptance, that conservation of time and energy would win out after repeated attempts and observation of clinical judgment. We decided to move forward with driving from the power wheelchair.

Unfortunately, this decision created our second crossroad – now his RLE would be in a different position relative to the gas and brake pedal, and he would not be able to utilize his wheelchair footrest as a base of stabilization. The foot rest would be too low even if we could get it close enough. And I had never heard of anyone driving from their power wheelchair and using their RLE to operate the OEM gas and brake. Looking back on this crossroad, I realized I jumped to a decision without completing a full task analysis. If I had, I do

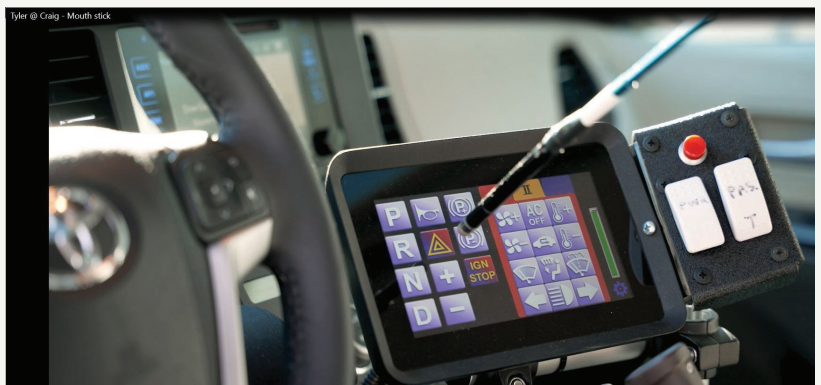
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**PHOTO 1** Joysteer Steering Input Device called the "Pistol Grip"



**PHOTO 2** Spec switch activated by Tyler's head for access to secondary controls



**PHOTO 3** Touch Screen accessed by a mouth stick for starting, stopping the vehicle and changing gears



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believe I would have discovered the solution at that time. Luckily, Tyler is a good advocate for himself, and we didn't waste too much time before he sparked the just right solution.

The conclusion I jumped to was that Tyler would need to operate gas/brake and steering using a four-way joystick, similar to his power wheelchair joystick. He initially agreed, and we began the evaluation. However, while I was making adjustments to the system, sitting in a parking lot, Tyler helped us both see the solution to the barrier of positioning. He elevated his RLE from his foot rest and was able to access the OEM gas and brake pedals. At first glance, the position did not appear to be appropriate as he would need to hold his foot in the air to use the pedals. But as he continued to demonstrate the ability to move between pedals with good coordination and accuracy, the picture of independence became clear. I simply needed to provide a platform, secured to the vehicle floor that would be his base of stabilization. I proceeded to mock-up the platform using my old occupational therapy text books, duct tape and dycem. I knew I kept those textbooks, for a good reason! The high-tech input device was switched to a two-way joystick for operation of steering only, and Tyler quickly progressed through the evaluation.

I evaluated Tyler using the EMC system but prescribed a system called Joysteer due to increased safety with a high-tech steering input. My prescription included a low-force joystick, like what we used during the evaluation and requiring the same functional skills. However, the manufacturer recommended also attempting to use a forced feedback joystick with a "pistol grip" that required more supination and pronation (Photo 1). I had never thought to use this device with Tyler because his functional grasp was limited to his thumb and pointer finger. But this time I did complete a more thorough task analysis. The suggestion from the manufacturer, the task analysis and my openness to alternative options paid off. Tyler performed well with the low force joystick, but he absolutely took off with the pistol grip input device for steering.

The final setup is very unique and very cool. Tyler uses a head switch for secondary controls (Photo 2), a touch screen accessed with a mouth stick for ignition, transmission and other various vehicle functions



**PHOTO 4** Removable platform to provide foot stability while accessing gas and brake

(Photo 3), and a quick release platform for stabilizing his right heel, just to name a few of the cool things (Photo 4).

Being open to alternative options, task analysis, clinical reasoning and listening to my patient resulted in a consistent and safe opportunity for access to the community and, ultimately, a more productive life. Tyler has been an independent driver without incident for nearly seven years now. And he loves his ride!

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Barry Doyle has been an occupational therapist for 18 years. He obtained a master's degree in occupational therapy from Colorado State University in 2005. He has one year experience working with children in a sensory integration clinic and 10 years of experience working in acute rehab for neurological injuries at Spalding Rehabilitation

Hospital. Doyle began the process of obtaining supervised experience in the field of driving rehabilitation the final two years at Spalding Rehabilitation Hospital. He became certified in 2014 and accepted a full-time position in the Adaptive Transportation/Driving Department at Craig Hospital in 2015. Doyle has 10 years of experience as DRS/CDRS completing evaluation and training for return to driving with low-tech controls and modifications and return to driving following traumatic brain injury as well as acquired brain injury. He has eight years of experience with evaluation for return to driving with high-tech controls and modifications following spinal cord injury. He completed a EMC high-tech training course in 2016, DSI training in 2017 and Joysteer training in 2021. Doyle accepted the position of supervisor for the Community Reintegration and Adaptive Transportation programs at Craig Hospital in 2021 and is excited to help both programs continue to grow and maintain their excellence.