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'My Whole Life Was A Mess': Rehabbing Vision After Concussions

By Joe Lemire (<https://www.sporttechie.com/author/joe-lemire/>) / October 3, 2017

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'Life Was A Mess': Rehabbing Vision After Concussions in
Adam Greenberg (left) and Jared Schwartz, who bonded over their severe post-concussion symptoms, pose for a photo in Camden, N.J. ([http://www.linkedin.com/shareArticle?mini=true&url=https://www.sporttechie.com/technology-vision-concussion-vizual-edge-brock-holt-adam-greenberg-king-devick/&title=My Whole Life Was A Mess': Rehabbing Vision After](http://www.linkedin.com/shareArticle?mini=true&url=https://www.sporttechie.com/technology-vision-concussion-vizual-edge-brock-holt-adam-greenberg-king-devick/&title=My%20Whole%20Life%20Was%20A%20Mess%27%3A%20Rehabbing%20Vision%20After)

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Concussions & summary & source - Sport
 Schwartz's memory "Are you OK, Jared?"
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For months afterwards, while recovering from a concussion and persisting post-concussion symptoms, Jared couldn't walk straight or upstairs without holding onto something for support. A trip to the end of the driveway would leave him conked out for three, four hours of sleep. He wore sunglasses everywhere, even in the classroom the next fall when the teacher played a video. During gym class, he napped in the nurse's office. He ate lunch in the quiet of the guidance office. He reviewed handouts at his desk because moving his head up and down to see the Smartboard triggered headaches. "And I had a million other accommodations," Jared said.

Home life was similarly halted. He stopped asking his father to play catch or shoot hoops. He couldn't play the drums but only strike pads while wearing noise-reduction headphones. The daily 10-minute ride to the hospital for therapy left him nauseous. He set small goals, pleased if he remembered even one or two out of three instructions given. Depression set in. Jared hid in a dark closet. Vision problems were particularly profound and persistent.

"Mostly all of it," he said. Hope and wellness would come

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— from unexpected sources: a big leaguer's phone call and a computer program requiring 3-D glasses — but progress was plodding and painstaking.

"This injury doesn't give you a cast," Jared, now 17 and a high school senior, added. "There's no physical sight of any injury. If you were to look at me, I'd look completely normal, but it's what's on the inside that was causing all the problems. No one can see that. It's such a hard injury to recover from."

Awareness of concussions and brain injuries has risen dramatically over the past decade. One area that several medical experts say is still lacking, however, is recognition and treatment for concussion-induced impairments to the interconnected visual and vestibular systems. (One's vestibular system includes the inner ear and brain function that regulates eye movements, balance and spatial awareness.)

Boston Red Sox utility man Brock Holt, an All-Star in 2015, has endured three concussions in the last four seasons and said he never had headaches, the injury's signature symptom. "Mine was just all vision, balance type stuff," he said. Holt could see clearly when standing still and looking at stationary objects but had trouble tracking moving targets or keeping focus when his head swiveled.

Dr. Danielle Leong, an optometrist and executive vice president for research at King-Devick technologies, said some studies

(<https://www.ncbi.nlm.nih.gov/pubmed/27505624>) have

indicated that as many as 80 percent of concussions

patients have some sort of visual deficit requiring therapy. After all, some 55 percent of brain pathways are vision-related from the retinas to the visual cortex.

“It’s hard to find some area of the brain that ends up getting damaged or affected by the concussion that doesn’t touch any of the vision-related pathways,” Leong said.

Shaun Logan, a doctor of physical therapy (DPT) who has served as a concussion rehab consultant for the Philadelphia Phillies, wrote (<https://mikereinold.com/concussion-treatment-convergence-insufficiency/>) that “the system that seems to be affected [by concussion] more often and consistently than the others is the visual system.” A 2016 paper published in *Clinical Pediatrics* (<https://www.ncbi.nlm.nih.gov/pubmed/26156977>) including an evaluation of 100 adolescents who had recently suffered a concussion, finding that 69 percent had a diagnosis of at least one of three visual dysfunctions: accommodative disorders (problems with focusing), convergence insufficiency (difficulty with seeing near objects) or saccadic dysfunctions (issues with tracking). While most people think of vision only from the dimension of acuity — i.e. whether one sees 20-20 or not — most of the issues are in the motor system, i.e. how the eyes move together, said Anne Mucha, DPT, who serves as the coordinator of vestibular rehabilitation for the University of Pittsburgh Medical Center Sports Concussion Program.

“Usually you look at concussions through cognitive testing or you look at concussion through symptoms, but if you don’t actually evaluate the visual system, you’re missing it,”

Mucha said. “We’re just at the infancy of really understanding how it affects your eyes and how they’re working together.”

Leong and Mucha are among the health-care providers who recommend post-concussion vision rehab for many patients — an area where technology is proving a useful tool to fill the void.

In describing the injury to Jared, Dr. Howard Schwartz said there was a famous example “almost identical” to what his son endured: Adam Greenberg, who with the Chicago Cubs in 2005, was hit in the head on the very first pitch of his very first big league at bat. The aftermath of his concussion was devastating. Greenberg would ache when bending over to tie his shoes, put his head down, lean his head back, focus in conversations or remember what just happened.

“My whole life was a mess,” Greenberg said.



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Adam Greenberg of the Chicago Cubs poses during Spring Training Photo Day on February 25, 2005 in Mesa, Arizona. (Photo by Jed Jacobsohn/Getty Images)

Greenberg split the next season between the farm systems of the Cubs and Dodgers and batted .209 despite spending as much or more time hitting in the cage, off pitches, flips or a tee. “It was just a real big struggle for me,” he said, “and I couldn’t pinpoint why.” His career in sports taught him to brush off injuries and compensate, so he kept plugging away despite his poor results.

The following spring, Greenberg reported to Royals camp in Arizona where he was introduced to Dr. Barry Seiller, an ophthalmologist whose vision-training performance program, Vizual Edge (<http://www.vizualedge.com/>), has been used by a dozen big league clubs. The patented computer application (<https://www.sporttechie.com/vizual-edge-is-weight-training-for-athletes-eyes/>) trains the eyes in a number of skills such as alignment, convergence, divergence and peripheral awareness — but not visual acuity, which is static without the intervention of LASIK — while the user wears 3-D glasses.

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Vizual Edge



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One of the tasks during Greenberg's initial evaluation was to line up a red triangle and blue square, each visible only from one side. When he took the glasses off, the program reported that the two shapes were 13 steps away. "Oh my God," Greenberg exclaimed, "my eyes are *that* bad." Given the severity of his nystagmus — a difficulty controlling eye movements that compromises the ability to fixate on a target — Seiller said many patients would be unable to function in daily life and that it would be dangerous for them to drive. Suddenly, that .209 batting average seemed impressive.

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“Imagine: hitting a baseball is hard enough, let alone if your eyes are not converging on a contact point that is anywhere close to where you think,” Greenberg said, adding: “That was the moment that it hit me. Otherwise, I potentially could have gone through the rest of my life — certainly, career — and my [baseball] career would have ended much quicker. It would have been a real, real strain on my life not knowing what the heck was wrong with me.”

In his first season on the Vizual Edge program, Greenberg had his best offensive performance: 30 doubles, eight home runs and an .802 on-base plus slugging percentage (OPS) while playing for Double A Wichita. The baseball results were great, but as his performance in the computer program ticked upward, so too was his overall well-being.

“I slowly started noticing, obviously my scores were improving, but I also started noticing that my memory was improving and my focus was improving and how I was feeling — literally, like, emotionally — was starting to improve,” said Greenberg, who wrote a memoir (<https://www.amazon.com/Get-Up-Perseverance-Adam-Greenberg/dp/0998718300>) and now does motivational speaking.

Greenberg felt he had regained a degree of control over his life.

“Vizual Edge just saved me in so many regards,” he said.

Any patient that's concussed, if examined properly, will present problems with ocular movement. That's the assessment of leading sports neurologist Dr. Francis X.
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Conidi, who notes that the difference between vision and ocular movement is one of semantics. Conidi, who is the team neurologist for the NHL's Florida Panthers among his many affiliations (<http://fxneuro.org/neuro/dr-frank-conidi>), said the eyes of concussed patients will jerk and not track smoothly. A recent topic in conferences he's attended has been the exacerbation of concussion symptoms with eye movements.

"The ocular reflex is extremely complicated anatomically and not fully understood, honestly, but it has to do with these projections to certain areas of the frontal motor cortex that are affected by the metabolic process of concussion," Conidi said.

Assessing eye movement has been an area of advancement in the diagnosis of concussions. Conidi touts the efficacy of the iPad-administered King-Devick test (<https://www.sporttechie.com/eye-tracking-technology-added-king-devick-concussion-test/>) for sideline screening and triage, to be done in conjunction with a clinical examination. He is less robust on the estimates of those concussion patients needing vision therapy, although does recommend it for those whose symptoms have not resolved after three months.

Other practitioners are more adamant about the shock concussions have on the visual system. One particular issue is the vestibulo-ocular reflex, which is how one's eyes maintain focus on a target while the head is moving. Convergence insufficiencies or spasms are also possible, not to mention light sensitivity and symmetrical eye movement, said Bara Alsalaheen, an assistant professor at the University of Michigan. <https://www.sporttechie.com/technology-vision-concussion-vizual-edge-brock-holt-adam-greenberg-king-devick/>

rehabilitation sciences at the University of Pittsburgh and has authored research with Mucha on concussion symptoms.

“It has an impact on everything,” Alsalaheen said, adding: “You need to be able to move your eye muscles symmetrically in order to complete a basic function such as reading.”

“And that’s before we deal with any of the athletic performance issues,” he said.

Holt, for one, said his visual acuity “was always pretty clear,” but trouble would arise when he moved his head or started running. “Everything wouldn’t settle right away,” he said. “I would be moving and stuff would still feeling like it was taking a while to settle back in.”



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Brock Holt of the Boston Red Sox during a 2016 regular season game

(Photo by Scott Clarke / ESPN Images)

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One low-tech exercise Holt was prescribed was to focus on a stationary wall-mounted target while moving his head back and forth or up and down while using a metronome app. The goal would be to keep the target in focus as he swiveled his head; he sped up the metronome as he improved.

Elite athletics, especially the act of hitting a baseball, demand superior visual skills. If one's binocular vision is affected, a patient would have trouble shifting focus from near to far and back, as well as detecting rotation, trajectory and speed.

"This set of skills impacts concentration, consistency, confidence," Kathy Pulchalski, a nurse who helped develop Vizual Edge with Seiller, said. "They all work in harmony, but if I had to suss out a couple [that are affected], it would be depth perception and convergence."

King-Devick's Recovery Acceleration Program (<https://kingdevicktest.com/product-category/sideline-concussion-screening/#RecoveryAccelerationProgram>) is another computer program with similar goals as Vizual Edge. Pittsburgh's Mucha said Vision Therapy Solutions' HTS (<http://www.visiontherapysolutions.net/hts.php>) and Computer Orthoptics' CVS (<http://computerorthoptics.com/cvs/>) programs are often used in treatment, while various eye-scanning apps are useful for retraining the eyes for smooth pursuits and saccades. She said researchers have also started looking into the possibility of using Nike's discontinued Sparq Vapor Strobe glasses (<https://www.youtube.com/watch?v=xM7i2OSUyFY>) and similar derivations (like the **50 Free Strokes** remaining - **Click to SUBSCRIBE (/signup)**)

(<http://www.senaptec.com/index.php/products/senaptec-strobe>) glasses) for rehab, though there is insufficient evidence at this time.

“You almost need to retrain the brain and the visual system how the eyes need to move efficiently and accurately,” Leong, the King-Devick researcher, said, adding about the broader traumatic brain injury field: “Traditionally, in TBI a lot of providers have looked at the vestibular system, or balance. But the vestibular system is tied right in with your visual system so if you’re only treating one system when the two are tied together, you’re not going to be able to get the same gains.”

While some vision enhancement programs can aid concussion patients, Mucha emphasized that rehab exercises often aren’t as sophisticated as enhancement work. She said she recommends some concussion patients use the activities on the website EyeCanLearn.com (<http://eyecanlearn.com>), which is targeted toward children with developmental visual deficits but can help after a concussion, too.

“Can [vision] get better? Absolutely,” Mucha said. “Does it get better, do we expect it to get better if it’s given the right intervention? Absolutely. That’s the word we need to get out. Look, there’s no reason, if you’ve had a concussion, to expect that your visual function should be permanently impaired. You need to make sure that it’s given the right activity to be able to recover.”

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About five months after Jared Schwartz's injury, his father was googling more information about Adam Greenberg's injury and his motivational speaking when he came across a newspaper story about an upcoming appearance at a Connecticut high school. The distance was too far to drive given Jared's condition, so Howard Schwartz emailed the principal in hopes of relaying a note to Greenberg, requesting maybe an autographed picture or baseball card to wish Jared well. Better yet: Greenberg called Howard, asking the best time he could speak to Jared directly.



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Jared Schwartz in a recent photo

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That night, the family phone rang just before Jared's bedtime. After initially protesting that no one would call him at that hour, Jared answered and a moment later exclaimed, "Adam Greenberg!" The two spoke for well over an hour, ending with Greenberg dictating his cell number and email with the instructions not to hesitate to use them should Jared ever feel depressed or need to talk about something.

The conversations would continue now and again, including Greenberg's recommendation that Jared try the Vizual Edge program. The same accuracy exercise with the triangle and square flummoxed Jared initially, too. "That was not my friend when I first started," he said. Improvement was gradual but, after several months, ultimately significant. Jared could read small print in books. His eyes converged and diverged more effectively, and his focus got better.

"It was able to work both my memory and my eyes," Jared said, adding: "I'm really happy this thing exists."

Jared took an interest in his own rehab process, learning why his vision was so badly impacted. He was struck in the back of the head where the occipital lobe resides and controls the eyes. So intrigued by neuroscience, Jared, a distinguished honors student, now wants to study the discipline in college with the ultimate aspiration of going to medical school and training to become a neurosurgeon — a curiosity about medicine that didn't exist before his injury.

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“I didn’t have any interest at all,” he said. “My goal was to play baseball. But my concussion set me on a new road and a new path. I really think that this is what I’m supposed to do.”



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Jared Schwartz plays the drums in a 2014 Memorial Day parade.

When other children in the neighborhood have had bad injuries, Jared has taken to knocking on the door and offering guidance. After getting cleared for sports three years after the original concussion, Jared tried out for his high school team and made the roster but ran into recurring scheduling conflicts with band practice and opted for drumsticks over baseball bats. Instead, he plays community softball with his father in a weekly game organized by their synagogue. “I still love the sport,” he said.

By the time Jared and Adam Greenberg first connected in fall 2012, Greenberg had just made his return to the majors with the Miami Marlins — seven years after his

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injury — at the behest of a public campaign. Greenberg struck out but, seven years later, finally had an official major league at bat.



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Adam Greenberg of the Miami Marlins bats for the first time since being hit in the head by a pitch in 2005 in his first major league at-bat. (Photo by Marc Serota/Getty Images)


Since late 2008, Greenberg had been playing for the Bridgeport Bluefish in an independent league unaffiliated with the majors or minors and returned to them for the 2013 season. One of their league opponents was the

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Camden Riversharks, not too far from the Schwartz's home. Greenberg told Howard and Jared to arrive an hour before the park opens with instructions to tell security that they were his cousins.

After texting Greenberg to say they had arrived, the ballplayer popped out of the dugout, hugged Jared and asked, "Are you OK to have a catch?" Minutes later, Jared followed the ballplayer onto the outfield grass, gently tossing back and forth a baseball, the same instrument that had injured and connected these unlikely friends. Five years after that first phone call, the slip of paper with Greenberg's number remains by Jared's bedside.

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