

Acute:Chronic Workload Groundbreaking Developments in Physical Medicine

A New Approach To Sports Medicine

At Nevada Physical Therapy, we pride ourselves on being up-to-date on the best current evidence in physical therapy. We strive to evolve and improve our model based off this research; clinical expertise without evidence can all too often become confirmation bias after all. If you've run into us in the halls or at a game, we may have used those few minutes to tell you about the Acute:Chronic loading model we are employing at the U! While we were lucky enough to be introduced to it over a year ago, it was one of the hallmark themes at the national PT convention last month. It's always a nice confirmation that the model we tirelessly work on to improve is also in-line with the national conversation on best practice. We hope you enjoy this resource we have put together for you on all things Acute:Chronic!

Spotlight: Dr. Tim Gabbett (gabbettperformance.com)

- **Dr. Gabbett holds a PhD in Human Physiology (2000) and has completed a second PhD in the Applied Science of Professional Football (2011), with special reference to physical demands, injury prevention, and skill acquisition.**
- **Tim has worked with elite international athletes over several Commonwealth Games (2002 and 2006) and Olympic Games (2000, 2004, and 2008) cycles. He continues to work as a sport science and coaching consultant for several high performance teams around the world.**
- **Tim has published over 200 peer-reviewed articles and has presented at over 200 national and international conferences. He is committed to performing world-leading research that can be applied in the 'real world' to benefit high performance coaches and athletes.**



Inside this issue

Definitions and Terms2
 Establishing Risk2
 Ideal RTS and Reality3
 What Have We Been Missing?3
 How to's4

NVPT NEWS

- Website redesign! For all things Nevada Physical Therapy, please visit NEVPT.COM
- We are 50% funded for our team effort with the U to refurbish the rehab space and install a biomechanical lab!
- New installation of Keiser strength equipment to allow us improved ACL RTS testing (i.e. quad:hamstring, knee extensor power, hamstring power, etc.)

Nearly half of second knee / ACL injuries occur within 2-3 months following return to sport

Spike in Acute Load Following Upon RTS?
Acute : Chronic Load > 1.5

1 – 10 RPE Scale

0	Rest	
1	Extremely Easy	Restful breathing, can sing
2	Very Easy	Can talk in complete sentences
3	Easy	Can maintain for hours
4	Moderate	Talking first becomes broken
5	Somewhat Hard	Heavier breathing begins
6	Moderately Hard	Deep breaths, talking is avoided
7	Hard	Deep forceful breathing (but still sustainable)
8	Very Hard	Labored, cannot talk, cannot maintain beyond a few minutes
9	Very, very hard	Very labored, breathless, can only hold ~1 min
10	Extremely Hard – max!	Gasping for air, 5-20 second maximum

Tendon Injuries and Workload

While we have discussed the idea of Acute to Chronic workload, we feel it has even broader applications than just RTS or pre-season injury modification. In previous newsletters we have discussed tendinopathy and the slow, heavy approach Nevada Physical Therapy takes in managing these injuries. What is tendinopathy other than the chronic exceeding of the tissue's maximum recoverable volume (MRV)? In strength and conditioning, it is well-established that the load must be strong enough to elicit change but not so heavy to become detrimental yet this concept continues to be missed in rehabilitation. To take the tendon analogy further, what is a tendon *strain* if not an excessive acute workload to what the tendon can tolerate? While Gabbett's work often looks at several weeks at a time, we believe we will see more and more evidence looking at chronic workload as the last several months or even years. (cont'd page 3)

What is the Acute:Chronic Model?

To better understand Dr. Gabbett's research, we must define a few terms. The first: **Chronic Workload**—the average workload of the previous four weeks. **Acute workload**—the current week's workload. **Internal Load**—time or volume of workload. **External Load**—the rate of perceived exertion (RPE, see left). **Arbitrary Units (AU)**—External Load x Internal Load. This is the measurement value used in this scale. An example would be if an athlete completes practice 1 for 60 min at an RPE of 7 (60x7=420 AU), practice 2 for 60 min at RPE of 8 (60x8=480 AU), and practice 3 for 30 min at RPE 9 (30x9=270 AU) which would give a *week* total of 1170 AU. This is one week's work load which is an *acute* load. If this was repeated for 4 weeks, we now have a *chron-*

ic workload established with an average of 1170 AU. This is where the model shows value. Gabbett et al. demonstrated that if the acute load (week 5 in this example) exceeds 1.5x of the chronic workload, the athlete moves into an unacceptable level of risk for re-injury. These are not arbitrary values but rather discrete numbers pulled from pools of team data (see graph below). It is imperative that the therapist, coach or trainer monitors an athlete's chronic workload volume when beginning the return to sport progression. As shown in this study, when athletes exceeded that 1.5 qualifier, their rate of re-injury greatly increased. We offer a simple tracking solution on page 4 that we hope shows how simple implementation of this model is!

Blanch & Gabbett 2015

Chronic workload	110	4.7	4.1	3.6	3.4	3.2	3.3	3.5
(% of normal average)	100	4.3	3.7	3.4	3.3	3.3	3.6	4.0
90	3.9	3.5	3.3	3.3	3.6	4.2	4.9	
80	3.5	3.3	3.3	3.7	4.3	5.3	6.6	
70	3.3	3.3	3.7	4.6	5.8	7.5	9.5	
60	3.3	3.8	4.9	6.6	8.8	11.6	14.9	
50	4.0	5.5	7.9	11.0	14.9	19.6	25.1	
40	6.6	10.1	14.9	20.9	28.2	36.7	46.5	
30	14.9	23.2	33.7	46.5	61.4	78.6	98.0	
		60	70	80	90	100	110	120
		Acute workload (% of normal average)						

For example, if an athlete returned to sport and had a normal 100% loading week (acute workload) but if over the past 4 weeks due to the rehabilitation of their injury had only averaged 40% of their normal load (chronic workload), we could expect the likelihood of suffering an injury in the following week to be 28%.

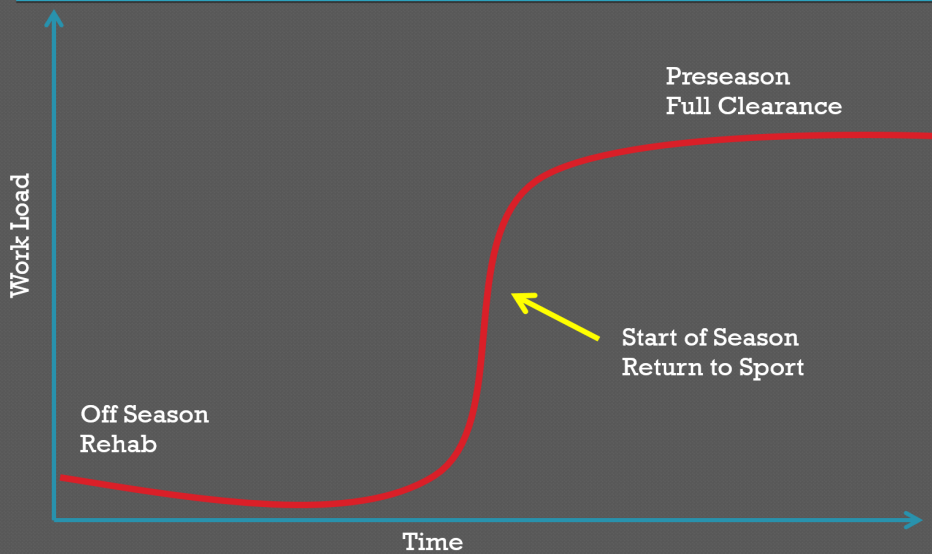
The graph above shows an athlete's risk for re-injury based off their acute:chronic workload. If the athlete is Kyle Schwarber and it's game 5 of the World Series, we can understand accepting the 28.2% risk of re-injury. I mean, *it IS the World Series* (better luck next year Cleveland). If it's week 2 of a 16 week season, we'd likely be smarter playing the long game and getting their chronic workload to greater than 70% of the expected acute workload seen in a typical mid-season week. As far as we know, Nevada Physical Therapy is the only facility in Reno implementing a chronic workload variable in the Return to Sport (RTS) criteria but we hope to see more follow in our footsteps. Based not only off of the work by Gabbett and his crew, but also by other recently published articles such as the work by Hulin et al. showing "**chronic load more strongly associated with injury than absolute load**" (*Br J Sports Med*, 2016) or "**training spikes precede injury**" (Cross et al., *Int J Sports Physiol Perform*, 2016) and "**athletes with low chronic load have higher risk of injury**" (Orchard et al., *Br J Sports Med*, 2015). We will continue to update our model based off the best research evidence available and, as always, will continue to share this with our referring physicians, colleagues, and patients.

Latent Effect of Loading Spike

↑ Injury risk for next 4-weeks

Orchard et al, *Am J Sports Med*, 2009

Acute on Chronic Training Load (Reality)



Ideal vs Reality

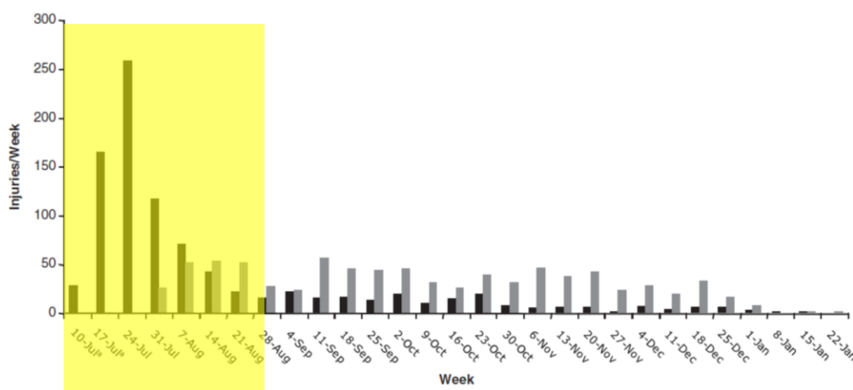
The graph to the left shows what a typical rehab model looks like. Whether it is an avid recreational runner gearing up for marathon season or an elite wide receiver coming back from an ACL reconstruction, this graph is all too familiar.

By now, it should be clear that this steep increase in workload needs to be mitigated to within the parameters we have discussed. We need to avoid spikes in load and implement a model that allows the athlete, weekend warrior and collegiate alike, the time to build a foundation and decrease their risk of re-injury.

While we may not be able to modify getting pancaked by a 270lb linebacker, we can do our best to make sure they have all the tools to avoid non-contact injuries. It is our opinion that non-contact injuries are often training injuries; the athlete just wasn't ready to do what they were being asked to do.

What Have We Been Missing?

With an understanding of the Acute:Chronic Workload evidence, we are able to review past published literature with a more focused lens. Take for example the Preseason Paradox. In 2011, Elliot et al. published a 10-year review on NFL injuries showing more than half (53%) of hamstring injuries occurred in the preseason (image below) and also within pre-season compared to in-season practice. While Gabbett's work had not yet made it into the conversation, it may confirm that even elite athletes are not immune to the Acute:Chronic Workload model. It is likely most athletes, in both professional and collegiate sports, do not arrive to preseason or fall camp with an acceptable chronic workload.



Too often rehab is under-dosed for what an athlete's needs are for in-season participation. At Nevada PT we work off percentage progressions of a 10-rep max effort but all too often, the gap from rehab to performance is far too wide. Without a foundation in basic strength theory, it will be very difficult to build that chronic workload. **More than half of ACL re-injuries occur within the first 2 months of being cleared for return to sport participation** (Grindem et al., 2016) which further supports the broad application of this model. Evidence continues to emerge showing reduced chronic workload capacity may be more of an injury risk factor than previously thought.

[\(Cont'd from page 2\)](#)

This is an extension of the "Envelope of Function" concept popularized by Dr. Scott Dye with the key difference being the addition of discrete values to quantify risk. This may be a "common sense" idea yet we *continue* to see physical therapists prescribing borderline homeopathic doses for rehab. Every patient has the ability to be appropriately loaded, ***the key is in the dosage!***

How to Calculate Workload

We employ the KISS rule (Keep It Simple, Stupid) when determining workload with both athletes and patients alike. We are looking for a way to quantify what the athlete or patient has been going through, how they have been tolerating and how we can program the coming week based off this knowledge. If working with multiple groups (strength, PT, coaches, ATCs) then it is important each group communicates to avoid underestimating workload. In team settings, we recommend utilizing team captains to rate the training session (30 min after).

- 1) Have athlete or patient rate their workout within 30 min post (but not right after).
- 2) Multiply by duration of session.
- 3) Enter into Excel and establish 4 week average.
- 4) Establish projected week's workload, ensure under 1.5x previous 4-week rolling average.

Repeat Daily

Athlete		mm.dd.yyyy			mm.dd.yyyy			mm.dd.yyyy			mm.dd.yyyy		
Last	First	rpe (0-10)	duration (min)	load	rpe (0-10)	duration (min)	load	rpe (0-10)	duration (min)	load	rpe (0-10)	duration (min)	load
<i>last</i>	<i>first</i>	8	90	720	8	120	960	7	90	630	5	45	225

Nevada Physical Therapy

UNR Sports Medicine Complex
Reno, Nv 89577

5255 Longley Lane
Reno, Nv 89511
Phone: 775-784-1999
Fax: 775-784-1995
WWW.NEVPT.COM

PLEASE
PLACE
STAMP
HERE

