

What is greatness?

One of the most insightful definitions I've ever heard of greatness was presented a few years ago by Seattle Mariners Director of Player Development, Andy McKay who said, "Greatness is simply the state of being consistently and predictably good over an extended period of time."



Consistency is the key to greatness!

In the major leagues a starting pitcher will get on the average 30-35

chances to perform over the course of any given season. College pitchers might get only 15-20 outings per campaign, and high school guys might only get 10-12 turns. High school and college starters typically get only 6 days of recovery before they must post again. For



professionals, that time is compressed to only 4 days, and relievers often have to bounce back in less than 24 hours.

Given the limited number of opportunities and the rapid turn around between appearances, having his best stuff with regard to velocity, command and

arm health becomes vitally important to a pitcher's success. If he's going to be consistently and predictably good, a pitcher will need to execute a highly efficient recovery process to ensure the greatest level of readiness is achieved as soon as possible after every outing. This will allow him to rapidly get on with the business of executing his conditioning and training plans in preparation for his next start. The quality and speed of his recovery is one of the most important cogs in the process. So what should a pitcher do after an outing to expedite and optimize his recovery?

To get a better understanding of recovery, one must first examine the variables contributing to inconsistent performance. Why do some pitcher experience wide variances in velocity form day to day? Why do some pitchers unpredictably lose their "stuff" (sinkers don't sink, sliders aren't crisp, etc...). And why do many pitchers continue to have pain after every outing. The answer can be found by examining the factors influencing recovery:

1) Conditioning and Preparation of Connective Tissue.

Developing resilient tendons, ligaments and muscles takes time and a sensible process. Have you done the work in the off- season to condition your body appropriately? Total rest for 3 months, then working out for 6 weeks before the season is not a good plan. It simply doesn't allow enough time for the development of robust connective tissue.

2) Work Load Ramp Up:

Every year in Florida high school baseball opens around the first week of February. Every year 4-8 pitchers in our county will come out of the gate with 7 inning complete game outings in the first week. Preseason work should be ramped up and periodized to allow the athlete to be ready by opening day, but there is no substitute for the stresses of competition level pitches. Gradually increasing exposure to actual game reps is vital to recovery, and consistency.

3) **Physical Constraints (mobility and stability):**

Physical constraints such as scapular dyskinesia, GIRD, thoracic mobility deficits, hip mobility limitations, inadequate ankle mobility, core stability issues or poor motor control can create tension and/or abnormal joint forces that lead to stress in the delivery. Added stress delays recovery and leads to inconsistent performance.

4) **Biomechanical Stresses While Throwing:**

Aberrant movementpatterns often impart undue stress on connective tissue. If the deviations are significant, abnormal stresses can produce pain. If you're having overt pain after every outing, your ability to begin training for your next one is severely hampered. Even if the abnormality doesn't produce pain, it may manifest itself in lack of recovery and inconsistent "stuff".

5) Nutrition, hydration, sleep, hydration and psychological stresses:

This area is frequently overlooked. Your body needs fuel to rebuild damaged tissue, and most of the healing occurs while you are sleeping. It has been well documented that over- consumption of alcohol, poor nutrition, sleep depravation, and emotional/psychological distress all increase injury risk and delay healing time.

6) **Post Throwing Process:**

Once the outing is done, recovery and preparation for the next appearance should begin immediately. So what should a pitcher do to ensure rapid recovery?

Historically, efforts have been largely anecdotal and certainly not based in science. Everything from flush runs, to total rest, to ice, has been suggested and practiced. At The Florida Baseball ARMory® we have been studying the science of recovery for quite sometime, and the following summary and recommendations are based on our research and experience.

First, let's tackle the most common question I get. Should pitchers ice their arms after pitching? The short answer is ... no.

A few years ago, I watched my oldest son pitch in a game for Florida International University. After 7 strong innings he gave way to a reliever who came in and threw eight pitches to close out the 8th. That was this guy's entire day - 8 pitches. After the game, the parents of the players were ushered outside the stadium gates. We all huddled around, and waited for the coach to release the players from the locker room. When the post game meeting adjourned, our 8 pitch reliever came out with his arm wrapped from wrist to shoulder in cellophane and ice. I immediately rushed to him and asked, "Dude! Are you hurt? You looked great for 8 pitches! Are you having pain?" To which he responded, "Naw, I just always ice after I throw."

As I walked away I concluded that there are 3 possibilities for why this workhorse reliever ices after throwing.

I) His training staff doesn't completely understand the physiology of tissue healing. That is highly probable and completely understandable. In my own physical therapy practice I have battled to get our therapists off the ice wagon for a while. The practice of administering RICE (Rest, Ice, Compression, Elevation) has been a mainstay in physical therapy clinics and training rooms for a long time. However, emerging research is revealing the possibility that ice might not be the best answer. According to Dr. Gabe Mirkin, the man who coined the acronym RICE , "When I wrote my best-selling *Sports Medicine Book in* 1978, I coined the teram RICE (Rest, Ice, Compression, Elevation) for the treatment o athletic injuries. Ice has been a standard treatment for injuries ... but it now appears that both Ice and Complete Rest may delay healing, instead of helping."

2) The possibility arose that maybe our guy is the type who thinks chick dig pitchers, so he wanted everyone know he had pitched. If that was the case, I lost a little respect for the dude. Listen, if that's your only game with the ladies... come on man!

3) Then it hit me... It was Saturday. The guy was a college kid Maybe he was on his on his way to a kegger and found a clever way to smuggle ice from the training room. It that was correct, I'd say, "Well played young man...well played."

The fact is, ice may delay your recovery and could be detrimental to your consistency. Here's why: The practice of prophylactic icing probably began with the assumption that the soreness after throwing is either due to delayed onset of muscle soreness (DOMS) caused by lactic acid build up, or to an acute inflammatory response. Some studies have indeed shown that the application of ice for 20 minutes immediately after an anaerobic activity like heavy weight lifting can reduce the symptoms of DOMS caused by lactic acid build up.

However, we know from a 2004 study that after 7 innings of pitching there is absolutely zero increase in lactate in the blood, so that myth has definitely been debunked. To understand the physiology of lactate build up, it is necessary to discuss the methods by which energy is produced to actuate muscle activity. There are 3 basic energy systems in the body. The ATP/CP system is responsible for the initial fight or flight mechanism, and it utilizes the ATP and Creatine Phosphate stored in the muscles. This system is exhausted after about 12 seconds and is utilized by sprinters, cheetahs, and baseball players. The second system is called anaerobic and aerobic glycolysis. It burns the glucose in your blood to create a slightly greater amount of energy than the ATP/CP system. This second system kicks in after 14 seconds and expires after about 2 minutes. Anaerobic glycolysis is the only system that produces lactate as a byproduct. The third system, called the oxidative phosphorylation is for more long distance/endurance activities. It uses oxygen to convert fats stored in the body into energy.

Think of the three energy systems as:



A thimble full of jet fuel, for immediate high intensity missions



A mason jar full of unleaded gasoline, for the intermediate trips



A 55-gallon drum of diesel fuel for the long distance journeys

In baseball, the longest possible play lasts about 12-14 seconds, and the only guy running that long is the one who hit the inside the park homerun. Most plays in baseball last less than 4 seconds, and a pitch takes less than 2 seconds from start to finish. So in a baseball game we never enter the second or third systems. Recall that energy system number 2 (anaerobic glycolysis) is the only one that produces lactate as a byproduct, and since we never enter that system, there cannot be any increase in blood lactic acid.

Additionally, I rarely see pitchers with classic signs of acute inflammation after throwing. The signs of acute inflammation are: severe pain, redness, swelling, and heat. Much like the young man I saw this weekend, the pitchers I see are not usually experiencing severe pain or swelling after throwing. And the only redness I see is from the ice they have applied.

So if lactic acid build up and/or inflammation are not the causes of post pitching soreness, the only remaining explanation would be micro trauma to the muscles, tendons and, ligaments. The soreness pitchers feel is most likely due to the cumulative effect of microscopic tears in the fibers of the muscles, tendons, and ligaments.

To begin rebuilding tissues damaged by micro trauma, you need blood flow. Ice is an inhibitor of blood flow

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Let me explain a little about the physiology of tissue healing.

Floating around throughout the circulatory system, in the platelets of the blood, are trillions of cells called *undifferentiated mesenchymal cells* (UMCs). UMCs are very similar to the highly controversial embryonic stem cells in their function and behavior, except that embryonic stem cells are way more prolific. In fact, embryonic stem cells are like UMCs on major steroids.

These UMCs are like unlabeled white-coated utility men. They have no specific function or character until tissue damage occurs. Then they rush to the scene of an injury and wait for orders as to what exactly is needed to start the



repair process. When they receive their instructions they are miraculously able to morph themselves into whatever type of cell they need

to become to repair the injured tissue. For example, if the injury is to a bone they change themselves into osteoblasts (or bone cells). If the injury is to a muscle, they become a muscle cell. If then injury is to a tendon they become a tendon cell, and so on. This process is known as *cell differentiation*.

Note: In the past 10-15 years or so, some orthopedic doctors have been taking advantage of the healing properties of UMCs by performing PRP (Platelet Rich Plasma) injections as a hotly debated treatment for injured athletes. In this procedure, physicians draw blood for the uninvolved limb and spin it in a centrifuge to isolate and extract the platelets (which is where most of the healing agents are located). The platelet rich plasma contains tons of the UMCs. Once isolated, the platelets are then injected directly into the injured tissue to accelerate the healing process.

There are 2 factors that must be present to enact the repair phase of tissue healing:

1) UMC delivery

UMCs are transported in the platelets of the blood. So their delivery to the area depends on blood flow. No blood equals no healing and no repair. For this reason I do not advocate ice after pitching. Ice is a vasoconstrictor, which means it causes blood vessels to close up, and it reduces the amount of blood flow to the effected tissue. Less blood flow means fewer UMCs in the area.

2) Activating Cell Differentiation

So now we know that we need blood flow to deliver UMCs. The next step is to activate the differentiation process. To do this we must understand how the UMCs receive their instructions? How do they know what kind of cell they need to become? There are 2 processes for damaged tissue to communicate with UMCs: Chemical and Mechanical.

Damaged cells release chemical flares that communicate with UMCs to activate cell differentiation. Those happen automatically and are completely out of our control.

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Once the UMCs morph into whatever kind of cell is required for repair they form a scar on the muscle, tendon or ligament.

Initially fibers lay down on the muscle in a random, chaotic pattern like a disorganized plate of spaghetti. This is a nonfunctional scar that could delay recovery for the pitcher. But researchers have found that when you apply a low intensity mechanical stimulus to that scar, the newly morphed UMCs





reorganize themselves and stand in formation along the lines of tension applied. In physiology, This is known as Davis's law. According to Farlex Free Dictionary,

"Davis's law is used in anatomy and physiology to describe how soft tissue models along imposed demands. It is the corollary to Wolff's law, which applies to osseous tissue."

So how do we manage mechanical stimulation of damaged tissue?

What I recommend for recovery is to stimulate blood flow and to activate cell differentiation through restorative functional movement. To have the greatest effect, restorative movement must be very specific. As closely as possible, it should mimic the exact movement required for the performance of the activity that produced the damage. But the movement must be at a very low intensity.

The pain is your guide.



If restorative movement elicits any pain at all, it is too intense and should be avoided. Failure to remain below the pain threshold could cause further tissue damage and could delay healing.

So Here's The Plan

In essence, **arms made sore from throwing should be taken through pain-free throwing movements.** Pain -free functional movement will promote task-specific blood flow, delivering UMCs directly to the areas of need, and it will send the exact mechanical signals for cell differentiation and deposit.

When you're done with your outing, go down to the bullpen and do some arm care exercises like our scapular enhancers, and thoracic and hip mobility exercises. The next day, engage in a thorough dynamic warm-up, and then do some 7-ounce weighted ball Training Sock throws. I recommend anywhere from 10-30 reps of the following drills: Reverse Pronations With A Switch, Marshalls With A Switch, Impulse, Impulse Step Downs, and any other drills you want to work on. Low intensity sock throws after pitching will be non-taxing and will provide a functional stimulus for blood flow directly to where it is needed.

The throws will move the arm in the exact pattern it uses when pitching, and it will send specific mechanical signals for UMC differentiation, deposit and orderly organization. This will begin the process of tissue healing. I think you'll find this practice will allow you to recover more quickly and you'll be able to answer the bell with your best stuff every time the coach calls your number.

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Here is a suggested schedule for a 7 Day Starter



Here is a suggested schedule for a long reliever

Pre-Season/In-Season Long Reliever



Assumes 2 Appearances Per Week

Here is a suggested schedule for a short reliever



Pre-Season/In-Season Short Reliever

Assumes 3 Appearances Per Week

"Connection day" refers to a throwing session emphasizing any training blend you may have been working on in the off-season or pre season. For example, if you were working on arm action or pelvic controp, perform the drills you were doing in the offseason to "polish the rock" and keep your movement patterns sharp. On "Recovery Day", we ask our athletes to perform 30-40 sock throws according to their individualized drill prescription. Don't get distracted by the word "modified" on "Modified Rest Day". That simply implies an active rest day. On this day, we allow our pitchers the freedom to do whatever it might take to get them to optimal readiness. Some guys do nothing. Others have a catch or a light long toss. It really is up the player to decide through experimentation and selfdiscovery the approach that works best for him.

In addition to delivering and organizing the UMCs, there are other modalities we use at The Florida Baseball ARMory to facilitate recovery Robert Oates at Oatesspecialties.com has created a product we call "Rocket Wrap". It's a neoprene compressive wrap that is kind of like another product on the market, "Voo Doo Floss", except that it is wider and stronger. Cellular waste is cleaned up by the lymphatic system. Lymphatic absorption is a passive process that is more effective when assisted by compression or muscular activity. We use Rocket Wrap to create a pressure gradient in hopes of driving some of the tissue debris into the lymphatic system for uptake and disposal.



We also utilize our Marc Pro stimulator to perfuse the tissue with blood and stimulate mechanic restoration of damaged tissue. The gradually ramping waveform of the Marc Pro provides a painless muscle contraction that facilitates the evacuation of microscopically damaged tissue. The electrical stimulation also excites arterial dilation, which enhances blood flow. One thing I really like about the Marc Pro is it's rugged durability and the simplicity of operation.



The Essence Of Recovery:

- 1) Get the bad/dead guys out.
- 2) Get the good guys in (they're in the blood).
- 3) Tell them where to stand

Randy Sullivan MPT, The Florida Baseball ARMory

Now that we've discussed post game recovery, we should probably address the offseason recovery process. Keep throwing, or shut it down ... What should a player do? The answer (not-unexpected, I'm sure) is... it depends.

When the season ends, pitchers and position players alike are faced with tough decisions about their training for the fall/winter. The "shut it down" police and the "just keep throwing" crowd are usually out in full force and the debate is rages.

One side demands absolute avoidance of all throwing for 2-3 months to allow the UCL, the anterior shoulder capsule and other connective tissue to tighten down and regain passive stiffness after being stressed and stretched throughout the season. Supporters of "keep throwing" approach argue that "rest is rust" and that a complete shutdown will lead to atrophy and loss of mechanical efficiency. This group contends that you can't improve or maintain your ability without throwing, so you cannot afford to shut it down for too long.

If you're a stud who is throwing 3-5 mph harder than your competitive peer group, your command of all your pitches is 15% better than your competitive peer group, your secondary stuff is 15% better than your competitive peer group, and you've already thrown a ton of innings this year, then shutting down probably seems like a good idea. By the way... We're not talking about the group of peers in your local American Legion program, I am talking your competitive peer group world-wide! Are you better than all the other guys around your age on the entire planet? If so, then go ahead and consider a shutdown.

But what if you're not that guy? What if you're at a point in your career where if you don't improve in one or more of those areas you might be done? If you're behind schedule and approaching the finish line, when are you supposed to get better? If you shut it down all winter and stay the same as you are, you could be shutdown for the rest of your life!

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In October, of 2015, I was visited on separate days by 3 different major league organizations, the Tampa Bay Rays, The Pittsburgh Pirates, and The New York Yankees, and I asked them 2 questions. "How many pitchers do you have in your entire organization?" The Rays and Pirates said "200" and the Yankees said "250". I then asked, "Of those 200/250, how many of them, if they don't improve this off-season with regard to velocity, command, secondary stuff, or arm health will you release next spring training?" They all had the same answer, "50". "Send me those 50 guys this off-season." I said. "I'll send you back at least 30 of them better than they were." After a moment of silence, each group had basically the same response… "Well, that sounds good but we have to shut them down for 3 months."

"Wait... What? You just told me you were going to cut them, effectively ending their careers, if they don't get better this off-season, but you want them to go home this winter, sit for 3 months, and do nothing about it? That just doesn't make sense."

So you see, the answer to the shutdown question isn't always clear. Every pitcher must consider his options on a case-by-case, year-by year basis.

What if you *are* already above your competitive peer group? Should you shut it down and avoid throwing for 3 months? Shut down or keep throwing ...Those seem to be the only options.

But, what if there was an alternative, a compromise between full-on continuance of throwing and complete cessation?

Typically, in the shutdown approach, a pitcher fires his last pitch in the final game of the season, says goodbye to all his teammates, cleans out his locker and packs it in, not touching a baseball for the next 2-3 months. The guy has spent the last 7-8 months micro and macroscopically traumatizing all the connective tissue in his arm. Then he simply stops throwing completely. Meanwhile, his body begins the healing process.

So how does the body repair itself?

Recall that floating in the platelets of the blood, along with other healing agents are specialized cells called undifferentiated mesenchymal cells (UMCs). These cells have no form or function until they sense cell damage. These were the cells responsible for tissue repair after an acute episode of throwing, but they're also constantly at work in longterm repair. When the season ends and you stop throwing as much your UMCs get to work making all the necessary repairs. Shutting down allows them more time to replace every damaged cell. But there's a slight problem. Remember that UMCs need a mechanical signal to tell them where to stand.

When UMCs first lay down to form the foundations of new tissue, they do so in a chaotic or disorganized pattern, like a plate of cooked spaghetti noodles you left in the sink all night. But connective tissue has a grain or a pattern to it, and its cells always align themselves along the lines of stress to which they are exposed.





Newly forming replacement cells must have a mechanical signal to guide their alignment. It's Davis's Law at work.

So, if you totally shut it down — with no stress at all for 2-3 months — when you start throwing again, your disorganized connective tissue is the most vulnerable to compromise. Combining disorganized connective tissue, unaddressed physical constraints, biomechanical inefficiencies, and poor preparation/ramp-up could create the perfect storm for tissue failure. This would explain the rash of injuries we see early in spring training as guys are starting to get it going.

Wouldn't it be a better idea to implement an off-ramping/cool down period including a tapered cessation of pitching? Then you could continue with low intensity "throwing like" movements throughout the off-season to keep your connective tissue organized all winter. If you're about to shut it down for the fall/winter, here's an idea...

This off-season instead of stopping cold turkey, gradually wean from your typical intensity and workload. Continue to throw light bullpens and easy long toss for a few weeks. This will allow your new scar tissue to start forming along functional lines. Then you can implement a low intensity off-season maintenance plan including sub-maximal throwing using tools like the Training Sock, weighted balls or bell clubs. When you're ready to start ramping it up, your connective tissue will be better organized. Instead of beginning from scratch with disorganized tissue, you'll have a rolling start into your ramp up which could allow you to progress faster, while reducing your risk of injury.

If you're planning on shutting it down this off-season, that's fine. But before you stop completely, get to The Florida Baseball ARMory and receive a full head-to-toe physical assessment to identify all the physical constraints that most assuredly have crept in over the long season.

Randy Sullivan MPT, The Florida Baseball ARMory

Let us do a video analysis of your throwing pattern, and we'll design an active rest program that will include customized corrective exercises and sub-maximal throwing drills you can perform in the Training Sock all winter long to keep your soft tissue organized and ready for action. You'll have a head start to your normal pre-season throwing plan and you'll be far ahead of where you have been in previous years – far ahead your peers and competitors. If you have any questions, please call me at 1-866-STRIKE3 or email me at

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