Disuse

Wasting away in *"Margaritaville"*

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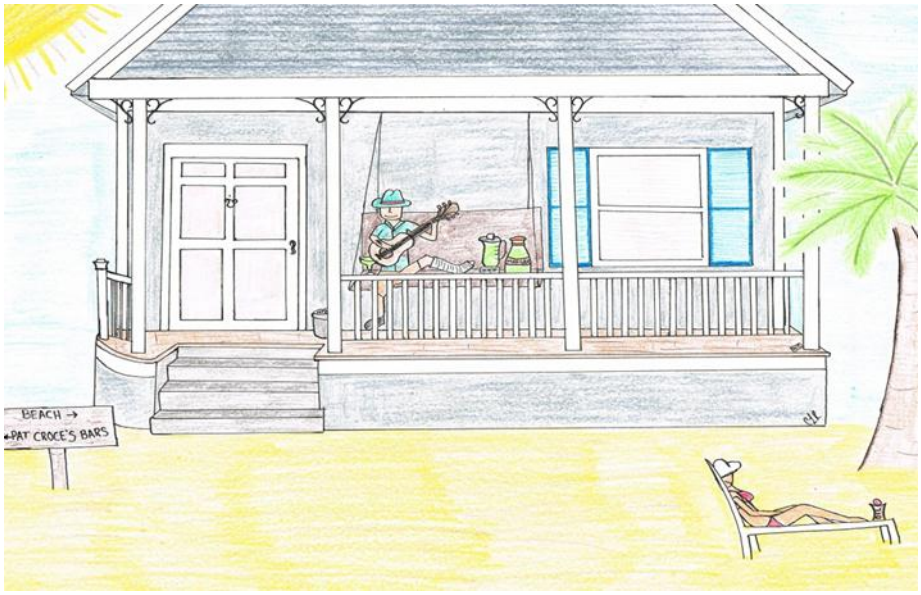

In addition to delaying and disrupting the healing process, disuse leads directly to the destruction (e.g. suffocation and elimination) of otherwise perfectly healthy tissue!

If you have a significant musculoskeletal injury or have recently undergone a related surgery, it is not helpful to just sit around ♫*Watchin' the sun bake all of the tourists covered in oil*♫ and it actually makes matters much worse. Thus, if you're ♫*wasting* away *in Margaritaville,*♫ it's your ♫own damn fault.♫

In regards to wasting away, the reason doing nothing *makes matters much worse* is simple. To prevent further decline, you need to stress, or what the experts call "load," your muscles, not the opposite.

Here's why: your circulatory system cannot adequately move waste from, or nourishment to, the damaged area without the right amount of stress (e.g. ♫strummin' your six-string♫ is likely not enough). ***This results in otherwise perfectly healthy tissue suffocating.*** Furthermore, without this stress, your involved bone, fibrous tissue, and muscle begin to dissolve (or "self-destruct") through a process technically called "disuse atrophy", ***which results in the elimination of otherwise perfectly healthy tissue.***

That said, since most of us spend the first 72 hours (or more) after an injury or surgery all pillowed-up in the corner of our favorite couch in a near-hallucinogenic daze convinced that movement is bad and absolute stillness is our only path to salvation, ***the mindless destruction of otherwise perfectly healthy tissue*** has become the unfortunate norm.

The overall result: you are now weaker, less functional, and more susceptible to needless suffering than before you zoned-out in couch heaven. Talk about needing a ♫frozen concoction that helps you hang on.♫

But you can cancel Happy Hour because the news just got worse! All of that previously otherwise perfectly healthy tissue that was ***"suffocated"*** or ***"eliminated"*** has now been added to the pool of waste that was already obstructing flow to and from the originally damaged area. ♫How we got here I haven't a clue.♫ No worries, "sometimes things need to get worse before they can get better" … right?

A New Direction … So Long Jimmy!

Now that you are headed in the right direction, here's your new "map." First and foremost, you need to think and act like a pro. Next, you need to understand how to prevent tissue death and disuse atrophy. Lastly, you need to create a plan and follow it.

Think and Act Like a Pro!

As a group, physicians, trainers and therapists employed by professional athletic teams and many other individuals with similar qualifications understand that the best, easiest and fastest way to regain full unrestricted function after an injury and/or surgery is to prevent, via low-level muscle stress, the destruction of otherwise perfectly healthy tissue during the healing process.

Speaking frankly, once the principles of progressive loading are correctly administered, regaining function is the easy part (see Healing … A Heavy Load next page). The real challenge is to maintain optimal regional circulation and prevent disuse atrophy throughout the entire healing process.

We say challenge, but that's a misnomer. It really isn't hard to do at all … it's just requires more personal effort on a daily basis than healing. By the way, **there is no pharmacological way to provide the needed stimulus** … you must actually stress the involved muscles to get the desired response; preservation of otherwise perfectly healthy tissue.

How to Prevent Tissue Death and Disuse Atrophy

To prevent the destruction of otherwise perfectly healthy tissue you need a relatively low level of non-fatiguing, comfortable rhythmic stress applied above and below the damaged tissue that, by design, does not directly load the damaged tissue in any meaningful way yet provides the needed stress to prevent disuse atrophy and increase regional circulation to a level sufficient to move the higher than normal amounts of nourishment and waste associated with musculoskeletal healing. You will need several doses a day for 30-60 minutes or more each session until at least several days after the risk of tissue death and disuse atrophy is assuaged.

Sample prevention scenario: you severely sprain a ligament in your knee and the entire area, including your ankle, is very swollen. There is widespread bruising and it hurts from mid-thigh to mid-calf. You can't bend your knee and flexing your foot makes everything feel worse. In response, you stop "loading" the entire leg and foot and instead decide to rest after your doctor advises you to "keep off it" for two or three weeks followed by another week or two of what your doctor called partial weight barring. Ah, stress free; that feels better.

Here's the problem: optimal circulation is contingent upon stress. Without stress, waste builds up (swelling) and blood flow is compromised, thereby immediately commencing the suffocation and killing of otherwise perfectly healthy tissue. And all of the "unloaded" or inadequately loaded tissue will begin to atrophy within a few days.

But everything hurts. You can't walk, bend your knee, lift weights, or anything you would normally do to "load" (stress) the involved muscles. You tried wiggling your toes and basic ankle pumps, but those methods were painful, fatiguing, immediately cramp-inducing, and did not work very well.

You know that you need to adequately stress the involved muscles to prevent tissue death and disuse atrophy, but the point is … you can't.

Here's how the pros do it; ***they use an FDA approved medical device that is cleared to increase circulation and prevent disuse atrophy***. The device that we are most familiar with was introduced in 1981 and today it is used by players and trainers from more than half of all of the teams in the NFL, NBA, MLB and NHL. It's called H-Wave® (Huntington Beach, CA). {1}

The Plan

Specifically, begin with a load that is equal to or less than the stress created when you slightly wiggle your big toe and gradually increase the load until the desired level is reached. The basic rule is "do no harm, never cause pain."

Sound simple? Want a little more information?

Using the "injured knee" scenario to the left, here's what you would do if you wanted to *"be treated like a pro"*; you would, **after your doctor examined you and wrote a related prescription**, stress the muscles, ***via an FDA approved medical device that is cleared to increase circulation and prevent disuse atrophy***, in your foot, lower leg and thigh (do not cause any pain whatsoever). That stress causes all of the involved muscles (which are the muscles that you are otherwise inadequately loading) to contract, which sets in motion a process that increases the flow of nourishment, blood and other supplies in the entire area. Simultaneously, those muscle contractions move the waste (via lymphatic vessels), set in motion a process of post-use enhanced circulation called angiogenesis (new blood vessels) {2} and stimulates the expression of the transcriptional coactivator PGC-1α (peroxisome proliferator-activated receptor γ coactivator 1α) which, among other things, protects skeletal muscle from atrophy by suppressing FoxO3 action and atrophy-specific gene transcription. {3}

The above load induced physiological response is not unique to the "knee" … the same process will occur anywhere in the body that is similarly stressed. Also, once your doctor approves your specific protocol, you do not need to "go anywhere" you can instead, self-treat in the comfort and privacy of your home or other personal space.

Healing: A Heavy Load

The following is the abstract of the article "*Loading of healing bone, fibrous tissue, and muscle: implications for orthopedic practice*" by JA Buckwalter, published in the American Academy of Orthopaedic Surgeons in 1999:

*"**One of the most important concepts in orthopedics in this century is the understanding that loading accelerates healing of bone, fibrous tissue, and skeletal muscle.** Basic scientific and clinical investigations have shown that these tissues respond to certain patterns of loading by increasing matrix synthesis and in many instances by changing the composition, organization, and mechanical properties of their matrices. Although new approaches to facilitate bone and fibrous tissue healing have shown promise (e.g., the use of cytokines, cell transplants, and gene therapy), none has been proved to offer beneficial effects comparable to those produced by loading of healing tissues. For these reasons, patients with musculoskeletal injuries and those who have recently undergone surgery are now being treated with controlled physical activity that loads their healing tissues. Evaluation of new approaches to the promotion of healing of bone, fibrous tissue, and muscle should include consideration of the effects of loading on tissue repair and remodeling."*

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2.) Smith, T. L., Callahan, M. F., Blum, K., Dinubile, N., Chen, T. J., Waite, R. L., *H-Wave® effects on blood flow and angiogenesis in longitudinal studies in rats.* Department of Orthopedic Surgery, Wake Forest University School of Medicine, Winston-Salem, NC, USA. J Surg Orthop Adv. 2011 Winter;20(4):255-9. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/22381420

3.) Sandri, M., Lin, J., Handschin, C., Yang, W., Arany, Z. P., Lecker, S. H., Goldberg, A. L., Spiegelman, B. M.. *PGC-1alpha protects skeletal muscle from atrophy by suppressing FoxO3 action and atrophy-specific gene transcription.* Department of Cell Biology, Harvard Medical School, 240 Longwood Avenue, Boston, MA 02115, USA. Proceedings of the National Academy of Sciences (impact factor: 9.68). 11/2006; 103(44):16260-5. DOI:10.1073/pnas.0607795103. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17053067

Additional Suggested Reading

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Pedersen, B. K., *Muscles and their myokines.* Centre of Inflammation and Metabolism, Rigshospitalet-Section 7641, Blegdamsvej 9, DK-2100, Copenhagen, Denmark. J Exp Biol. 2011 Jan 15;214(Pt 2):337-46. doi: 10.1242/jeb.048074.

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