the CrossFit JOURNAL ARTICLES

Why a 10K WOD?

Tony Leyland

I had planned to follow on from my November CrossFit Journal article on spine mechanics for lifters by discussing injury potential due to repetitive loading. In the November article I talked about the dangers of exceeding the shear strength of the spine with poor lifting form. However, injuries often occur in fitness programs due to low-force cyclic loading rather than peak loading. Then, in October, something happened on CrossFit.com that provided the perfect context for my points. On October 16, 2007, the Workout of the Day (WOD) was "Run 10K." The comments contained a few of the usual complaints from folks who dislike running, but nothing unusual for this WOD. Just three days later, on October 19, the WOD was "Run 10K"!

The first five posts to Comments will give you an indication of the general response:

1. Huh? Really? 3,2,1,....
2. Again?
3. Again...seriously? Is there a methodology to this? Is this a mistake?
4. You'd think it was April 1st.
5. Is it Groundhog Day?

Many who posted comments were surprised, as the posts above indicate, and there were a few more complaints than usual, but this post from RoyG caught my interest.

> *How does a 10k run fit in with the CrossFit philosophy?*
>
> *Quotes from the foundations pdf:*
>
> *"Well, at CrossFit we work exclusively with... shorter high intensity cardiovascular sessions."*
>
> *"There is a near universal misconception that long distance athletes are fitter than their short distance counterparts. The triathlete, cyclist, and marathoner are often regarded as among the fittest athletes on earth. Nothing could be farther from the truth. The endurance athlete has trained long past any cardiovascular health benefit..."*
>
> *Isn't 10K a bit too long? I would love to hear from someone regarding the methodology around the frequency of these different WODs. Is it just completely random, or what?*

I think this post asks some really good questions. So this month I will answer them to the best of my ability, which also leads right into my original thoughts on tissue loading.

So why should you run 10K?

If you have adopted the CrossFit philosophy, I imagine you would agree that covering considerable distances is a functional movement. We evolved tracking animals, gathering food, migrating with the seasons, etc., so covering distances like 10K are part of our genetic make-up.

Regarding RoyG's question about randomness, I addressed that in my July CFJ article "The Principles of Physiologic Conditioning," where I stated that the incredible variety of CrossFit programming is sometimes described as "random," but of course it isn't literally

randomly generated. With a truly random program you could theoretically get three CrossFit Totals in a row, or three 10K runs in a row. I argue that the variety in CrossFit helps optimize the overload experienced by the body and forces better adaptation. And as CrossFit is designed to force adaptation in all ten fitness components (physical skills), endurance is fair game.

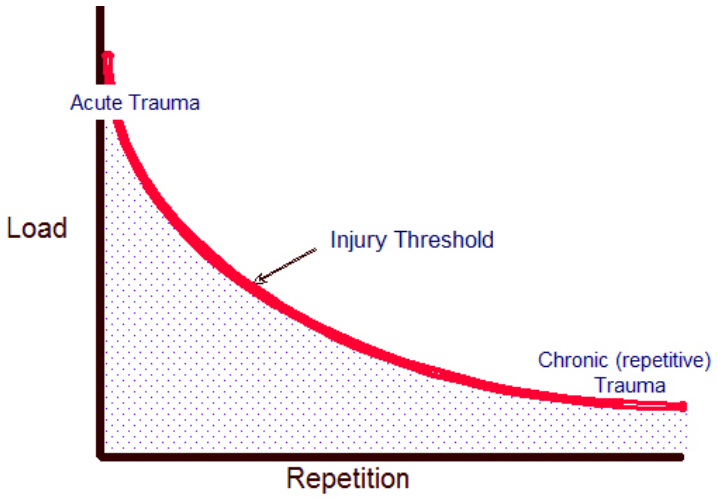

Figure 1: Tissue tolerance and the injury threshold

But the question about whether 10K is too long from the point of view of developing efficient cardiovascular system is a good one. The benefits of running 10K and other distances is well explained by Lon Kilgore in "The Paradox of the Aerobic Fitness Prescription" (*CrossFit Journal* issue 52). He explains that long slow distance (LSD, defined as 60-120 minutes) running at approximately 70 percent of your running VO_2 max does not improve either your cardiovascular efficiency or your running VO_2 max. From a physiological point of view, all it results in is "improvement in stores of oxidative energy substrates and associated enzymes; the athlete can run longer but not faster." But that in itself is not a bad goal, of course—to be able to run longer. And certainly endurance in the muscle groups used in running is improved as well. Of course, you shouldn't train just LSD (as so many supposedly "fit" folks do), but that doesn't mean it is something to be avoided entirely.

One of the reasons CrossFit is so safe is that it doesn't specialize, and, although you may be working hard again the day immediately after a brutal workout, you aren't doing the same thing day after day.

But there is another good reason to occasionally cover long distances and that reason is a mechanical one. In last month's article about spine mechanics and the potential dangers of lifting with a flexed (rounded) back, I presented peak spinal compression and shear values during "good" and "bad" deadlifts. If a tissue's tensile, compressive, or shear strength is exceeded, that tissue will rupture. Figure 1 shows an approximate "tissue tolerance" graph.

Last month I looked primarily at acute injury due to poor form with a heavy load at just one or a few reps (the top left area of the graph). But it is also true that tissues can become damaged due to low forces if those forces are applied repeatedly and without adequate recovery time. Many athletes, especially specialists in certain high-rep, high-distance, long-duration activities, sustain chronic injuries caused by repetitive loading of tissues at low forces (the bottom right area of the graph). These are often runners (recreational or competitive), who commonly experience injury to their knees, iliotibial bands, ankles, etc.; it certainly isn't unusual for swimmers, either, to develop tendonitis and/or small tears in their rotator cuff muscle tendons.

A tissue's response to mechanical loading is complex, but think of breaking a piece of metal by bending it back and forth a number of times. You don't snap it in a single high-force effort but by working it repeatedly. This is not exactly what happens in a human tendon exposed to repeated mechanical stress, but it is pretty close. When repeatedly loaded, the tendon or ligament never quite recovers from the first loading; then it is loaded a second time and recovers slightly less again; then is loaded again and recovers even less, and so on. This lack of full recovery and repair of the tissue

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ultimately lowers its ability to withstand forces and can eventually cause failure at a much lower load than that required to cause failure in a single application.

Running injuries are the most common example of this repetitive stress failure. Each footstrike is a collision with the ground as your body moves down, hits the ground and moves back upward and forward. The number of footstrikes you perform during a 10K run depends on your stride length, but it's probably in the range of approximately 6,000 to 7,000 (around 1,000 per mile). The peak contact force will depend on body weight and running style (see the articles by Collins and MacKenzie in this issue), but for most athletes it is around three times body weight—not an inconsiderable figure even for the lightweight among us. Another factor is the high repeat rate of these impacts—about 180 times per minute for the average runner. The higher the rate, the less time between impacts for the tissue to rebound and recover. So, simply put, thousands upon thousands of footstrikes, each one applying hundreds of pounds of force, executed at a high frequency, take their toll.

I am making the argument that running 10K is tough on your body. In addition to the potential of mechanical injury to the joints, tendons, muscles, and ligaments, the trauma associated with footstrike is the major cause of hemolysis after running. Hemolysis is the breaking open of red blood cells and the release of hemoglobin into the surrounding fluid. Studies have shown that cycling at 75 percent of VO_2 max does not cause the same amount of hemolysis as running at that intensity. The same would be true of rowing, an activity that quite a few CrossFitters seem to post as their substitute for long runs.

So what is my point? Am I saying that you should not run 10K? No. Although CrossFit can effectively build a high level of aerobic running fitness and endurance via interval training and other highintensity anaerobic activity, these do not simulate the mechanical loading of a long run. A split jerk with a heavy load results in very high ground contact forces, but how many would you do per workout? Even in a program based in part on the necessity of variety, the principle of specificity cannot be ignored—and one of the basic tenets of CrossFit is to prepare the athlete for anything life can throw at him or her. The running, box jumps, push jerks, and anything else requiring footstrikes in your general strength and conditioning will certainly help your tissues develop tolerance, but no other CrossFit workout would require 6,000 to 7,000 footstrikes. It's a useful part of the programming, from time to time.

So what about the mechanical injury potential and hemolysis I have described? The point is that with all derangements of our homeostasis there is always an optimum level of stress that the tissue can recover from without injury or sickness. As it recovers, the body is forced to adapt and become stronger and better able to withstand the same physical insult the next time. The metal bending example shouldn't make us forget that human tissue, unlike cold hard metal, can repair itself if given appropriate rest. One of the reasons CrossFit is so safe is that it doesn't specialize, and, although you may be working hard again the day immediately after a brutal workout, you aren't doing the same thing day after day. So although your legs may take a pounding (and the impact and vibration will reach the back as well!), your upper body and shoulders are having a recovery day during that 10K run. This is one of the extremely fascinating things about CrossFit: how it can make you work so hard on a 3:1 work:rest cycle of days and be a very safe, even protective, program (with appropriate scaling for individual athletes, of course).

The graph in Figure 2 shows another relationship between loading and injury. The sedentary in our society risk injury because their tissues are so deconditioned they are hardly able to withstand even moderate loading

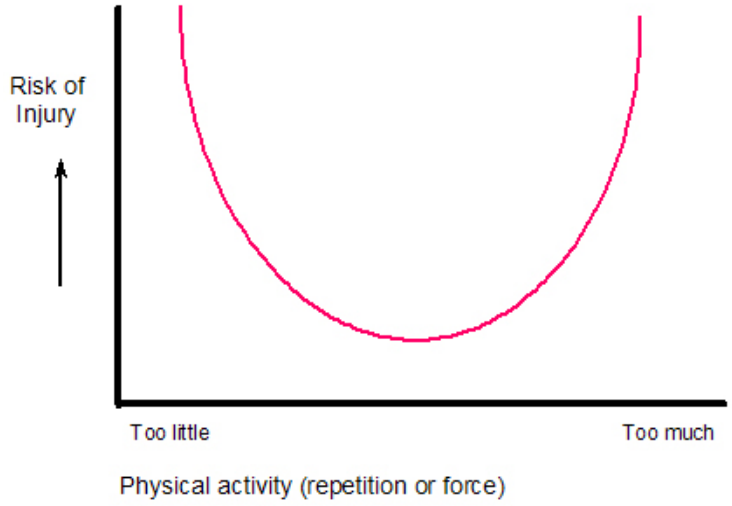

Figure 2: Optimal loading and activity level versus risk of injury

(left of graph) and the specialized athlete is at risk due to excessive repetition (right of graph). CrossFit makes you go hard and that always carries some risk; but intensity is what gets results. The key is to achieve the high work and power outputs while allowing our joints, tendons, muscles and ligaments to recover sufficiently enough to avoid injury. I believe CrossFit does that very well.

So maybe I have convinced you that covering a reasonable distance is a good WOD that has physiological and mechanical benefits. But why twice in four days, as happened in October? Or, maybe we should ask…why not? Although not random, CrossFit does intentionally offer a variety of challenges, physical and mental. Variety forces effective adaptation.

In summary, if you just do short interval work to improve VO_2 max and then have to run (or even hike with heavy gear) quite a distance, your body will hate the pounding it takes. Just as your body adapts to strength training and progressive overload, it also adapts to the mechanical stress of thousands of foot strikes. Trust me: you may be able to easily handle a 200-pound push jerk and, yes, the contact force will be much higher than of any individual footstrike when running, but if you duck all the runs and then have to cover a lot of distance, it'll hurt big time and may even injure you. That's a big chink in your fitness armor.

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