Tim Ryan – The Optimal Window for Time Under Load and Time To Concentric Failure

Lawrence: Lawrence Neal here. Welcome back to highintensitybusiness.com. The podcast where we discuss high intensity strength training and provide you with the tools, tactics, and strategies to help you grow your strength training business.

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This is episode 360. Today's topic is Part 4 of the High Intensity Training Fundamental Series with Tim Ryan. Tim is a Master Super Slow instructor and owner of Strong Life Personal Training in Barrington, Illinois. You can contact Tim to learn all about his services that help studio owners and personal trainers including workshops, mentoring, and seminars by going to his website which is stronglifetraining.com. Or emailing Tim directly to info@stronglifetraining.com.

Tim, welcome to the podcast.

Tim: Hey, Lawrence. How are you doing?

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Lawrence: I am very good. It's good to see you. I'm excited to resume the series with you. You wanted to just wrap up a few points on movement speed before we went into some of the other topics, so take it away.

Tim: In our last podcast, we did spend a lot of time talking about the speed of movement and the rationale behind it, the pros and some of the cons and so forth. I just wanted to finish up a thought and that's going to lead us also into our discussion for today where we're going to get into talking about time under load and time to concentric failure, and determining the proper weight load when you train, and those types of things.

With regard to this movement speed, we have already established obviously the positive benefits and the reasons why we should be training in a slow and controlled fashion. But the point that I wanted to make today as we start our discussion is a concept that I've struggled to put a good name to but basically a concept that I call training slow unavoidably versus training slow intentionally. What I mean by that is, first off, consider that everything we do through exercise is a volitional or voluntary or volitional type of experience. In other words, we can talk all about the physics behind slow movement and how it reduces the force and makes it safer, and reduces the momentum and more evenly applies the load to the muscles, and all of these good things. But sort of the fly in the ointment so to speak or the potential problem or limitation with that is the fact that we're dealing with human beings with a certain level of skills and ability, certain level of motivation, certain level of

tolerance for exercise and for the discomfort that's associated with exercise. You've got all these things going on, and at the root of it, you've got an individual that has to intentionally perform in such a way and they have to be able to control their muscles and they have to be able to put forth a certain amount of effort. And everybody's got varying degrees of ability in those areas.

One of the problems that I did highlight in our last discussion was this idea that when you give somebody instructions to move slowly, particularly to barely move, just barely start the movement and the motion. Now try to keep that just barely moving. Those types of instructions with a lot of people that will cost them to be passive. In other words, the way that they think that they barely move is to not produce a lot of effort or not produce a lot of internal muscle force or output of muscle force. In other words, they try to control their speed by being very passive and not really pushing hard. That leads to basically not being able to move a meaningful load and they end up having to give them a very light load in order to match their passivity and their low level of effort. When you give them a heavier load, then all of a sudden they either act like they can't move it or it creates a lot of discrepancies where they push for a second or two and stop and then push for a second or two or stop and you have this sort of disjointed or segmented movement, and this sort of off/on-ing that we call. Turning the muscle on and off rather than sustaining a good deep contraction.

When I talk about this concept of moving slow unavoidably versus moving slow intentionally, here's what I'm talking about. Let's consider the fact that whatever weight load you're lifting, in order to move that load, you need to produce a level of force or apply a level of force that's higher than the load. Just a simple discussion, if you're trying to move a 100lbs load, you have to apply more than 100lbs of force against that in order to get it to move. Now, let's just say it takes at least 101lbs of force to move 100lbs; ignoring the fact that maybe there's some friction there which you have to make a little more force than that. But theoretically, to move that 100lbs you need to produce at least a 101lbs of force to set it into motion. Now, when you do that, if you apply something like 101lbs of force against 100, that load is going to barely move. It's going to just creep along at a snail's pace. And if you continue to just keep that same level of force applied to it and you do it consistently, then you're going to have a very slow moving, smooth, consistent movement of that load.

But let's consider another scenario. In order to move that load faster, you have to provide a higher level of force. Let's say, instead of a 101lbs of force, you applied 150lbs of force. Now, that 100lbs load is going to accelerate. It's going to move at a faster rate. You're going to have a faster speed of movement. As we follow up this progression, the more force you apply to it, all of that force above and beyond what's necessarily to move the load, so in this case, all of the force above 100lbs, the higher the force that's applied

the faster that load is going to move. The greater the rate of acceleration is going to be.

Let's consider the implications to this. When you see somebody doing very fast reps, you go to a typical gym and most people are probably lifting the weight in 1 second and lowering it back down in 1 second. Sometimes even faster with some of these people. But to move a load through a range of motion in 1 second, that takes a lot of force above and beyond the load that you're lifting in order to cause that level of acceleration. We talked a little bit last time about this force plate experiment with what happens with that and so forth. Somebody that's lifting, let's say, 100lbs pound load in 1 second, they may be applying 200, 250, 300lbs of force. At least generating that much force initially to set that weight into motion and accelerate. Consider this, if somebody is generating that much force and moving that load that quickly, that means that they are able to produce quite a bit more force than the load that they are lifting. I'm going to come back to that in a second.

Now, on the flipside, somebody that is moving the load very slowly is applying a level of force just barely above the level of the load. Obviously, from the safety standpoint that we talked about last time, that's a safer thing because we're just applying enough force to move the load. We're not generating any excessive level of force. We're not exposing our bodies to any more force than necessary to move that load, so that's a good thing. But when we start to get into this discussion here of time underload and

determining the proper weight load that you should be training with, this concept that I've just introduced is very important. Because we want to be training at a load that challenges our muscles to a very high level. We want to be able to train with a load that is meaningful enough that it induces fatigue and ultimately muscle failure within a determined amount of time, within a reasonable amount of time. Keep this in mind now as I start to discuss these concepts of time under load and ultimately determine the proper weight load.

Let's just define our terms first. Time under load would be a description of the entire amount of time that the muscle is exposed to the load or ultimately to the exercise. This can be characterized by placing tension on the muscle. Some people refer to this concept as time under tension. Time under load is the same thing, just a different term. But the idea here is from the moment you begin to apply that load or tension against the muscle, that clock starts running. You perform your exercise and that time under load clock is running until which time you complete the exercise, set the load down, release the tension from the muscle. That entire time period is called time under load.

Now, there is a different concept that we call time to failure or more specifically time to concentric failure. Because obviously what we are doing when we are contracting the muscles, shortening the muscle and lifting the load, is concentric muscle contraction. The eccentricity is when you are lowering the load back down. Nautilus used to call this positive work and

negative work. Positive work is when you are lifting the load and contracting the muscle. Negative work is when you are lengthening the muscle back and lowering the load.

Specifically, time to concentric failure would be from the moment you start the exercise until you hit that point of that momentary muscle failure where that rep fails or where you get halfway through the rep let's say, and you can no longer complete the repetition. That would be concentric failure. Notice that the time under load is greater than the time to concentric failure. Because you may train to concentric failure and then you are still under load. Maybe you are halfway up with the rep and you are still applying force. You are still attempting to contract that muscle and lift the load. You may be pushing against that immovable load for several seconds. And then after that, you are going to lower the load back down to the point where you end the exercise. Even after you reach concentric failure, that time under load clock is still running.

Lawrence: Can I ask a question on that quickly?

Tim: Sure.

Lawrence: I don't know whether we are going to get into tracking later in this series. Would you track both of those? Do you have two stop watches and you would be tracking time under load and time to concentric failure.

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Tim: Well, I used to do that. I used to do three things. The time to concentric failure, the total time under load, and the reps.

Lawrence: Okay, wow!

Tim: I no longer do all that because it is kind of burdensome. Some of that stuff maybe isn't as critical to have all three of those. I like to have all three of those because, number one, knowing with the load you're lifting, how long did it take you to reach that concentric failure. That's really probably the most important thing particularly for measuring your progress. If you lifted 100lbs today and you failed to 90 seconds, and then next workout you lifted 100lbs and it took you 105 seconds to reach failure then that's an indication of progress. Or vice versa. If you add a couple of pounds and you still get 90 seconds out of it or something. That's one of the key indicators of measuring your progress.

For a while, and I no longer do this. One of the Super Slow techniques was something called thorough inroad technique. Ken Hutchins used to say that exercise begins at failure. The concept there was that you train to failure but then once you hit that failure wall, you would continue to exert force and keep pushing, pushing, and pushing for maybe 10 or 15 seconds. You would come back down to the start and attempt another repetition. Get it as far as you could and push for another 10 or 15 seconds. You would proceed to do this until you couldn't even budge the weight off the bottom. There may be

in that case 30 or 45 seconds of continuous work and time under load after the point of failure.

In those days, that's why I was recording both of those times because I wanted to know how long did it take for them to hit failure. But how long were they in total working that muscle for. Today is not the discussion for this but I no longer believe that that thorough inroad technique is either necessary or even advantageous in any way. It probably is a decrement. Anyway, that explains why I was doing those things. And then the idea of knowing how many reps they did, that kind of gave me the idea of what their pace was. How many reps did they do within a given amount of time? That would give you an indication of how long each rep took.

Lawrence: Hard to know that there, right? Depending on how long turnarounds took and if there were pauses at max contraction. That could vary each rep, right?

Tim: You got those kinds of things and then you've also got situations where people can milk the clock.

Lawrence: I used to be so guilty of that.

Tim: What they do is they maybe lift the concentric or the positive lifting phase too quickly. They spend a little time pausing or doing an excessively slow turnaround, then they really milk the clock on the negative. You have sort of

an uneven balance between the positive and the negative. According to the clock, they maybe took a good length of time to perform each repetition but it wasn't very uniform. It wasn't consistent and you get all kinds of funny business going on.

At any rate, we know those two concepts of time to concentric failure, time under load. But here is an important point. I'm going to bring all these concepts together as we move forward. But let's talk about what is the ideal time for specifically that time to concentric failure.

Lawrence: Just before you get there can I just say one thing?

Tim: Yeah, for sure. Just to clarify because I love that we're keeping this really basic. We're almost keeping it to a level where if someone was just tuning in who had no idea what high intensity training is so that they could follow along which I think we should definitely continue at that level. But just to clarify, do you say if time to concentric failure, is that the same as muscular failure and the same as momentary muscular failure?

Tim: Yeah. I would say it is. Basically, just this term failure, some people associate that with a negative connotation that, "Oh, you failed." Clients sometimes take it that way too like, "Oh gosh." They'll hit failure and go, "I'm sorry, Tim, I just didn't have it today." "What are you sorry about? That's exactly what is supposed to happen." You should only be sorry if you didn't

give it your maximal effort. If you gave up and quit, then you should be sorry. But if you train to failure and you give a 100% effort and so forth, that's what is supposed to happen.

All we're really describing is as you perform each repetition, your muscle strength is diminishing. Fatigue is setting in and little by little your ability to produce force is diminishing. At some point the output of force from that muscle reaches a level that it's no longer sufficient to move the load. Despite the fact that internally you may give a maximal effort, that muscle strength has diminished or fatigued to a level that it doesn't have enough force to produce movement. You hit that wall. You hit that point where you can no longer move it. Although you can sustain that contraction and maybe keep the load in place for a period of time still pushing on it. Eventually if you continue to push and push and push, that muscle strength will fatigue to a deeper level and now you won't even be able to stop the weight from coming down. That negative will ensue and you won't be able to stop it. That's what we are talking about. Whether you call time to failure, time to concentric failure, momentary muscular failure, that all describes the same event.

Now, this idea of what sort of time frame should be occurring because in years past everything was defined by repetition count. You have these exercise prescriptions where somebody says, "Okay, you should do 3 sets of 10 reps each." Or Nautilus used to say, "Pick a weight that you can lift 8-12 times." With the idea there that the load you are lifting you should at least

get 8 reps out of it before that failure occurs. But you should not be able to do more than 12 reps before failure occurs. Somewhere in between 8-12 reps that failure will occur. Obviously, there's all sorts of recommendations where somebody says, "Oh, do 4-6 rep range, or 8-12, or 12-15." You probably have these recommendations. It is used to be defined by those repetition counts. But now, I'd like to think a little more sophisticated in the sense that we are using a stopwatch. We are recording the time. We are looking at that time to concentric failure. What is the best time to failure? What is the best time frame that this failure should occur?

Here we do have a little bit of science or we have a little bit of physiology which is going to help us determine this. I know there's been these conversations, these discussions of whether it's the rep range, or whether it's the time under load, time to concentric failure, what is that ideal time frame? There's even been some studies recently that have come to the conclusion that at least in terms of repetition ranges it doesn't really matter what repetition range you use as long as you reach failure. I would agree with that to a point. As far as it goes, that may be true. The first thing I would say is that, well, if you don't train with a heavy enough load you are not going to reach failure. This doesn't give you license to just lift any load you want and then just keep going, going, going, going until you reach failure. Because if the weight is not heavy enough there is not going to be failure. You are going to turn it into an aerobic exercise where you are just going to keep

going, going, going as If you were jogging or something like that. The load does matter.

The other problem with some of that research is that they do things and they say, "Okay, we have one group do 6-8 reps to failure. We have 1 group doing 8-12. One group does 12-15, and 1 group does 15-20." All those groups, as long as they train to failure, they got about the same results from the training. Therefore, it doesn't matter.

One thing I think you need to look at the details a little closer because you have to pay attention to what the speed of movement was. Ultimately with those rep ranges what time to concentric failure resulted from those rep ranges. If they were doing relatively conventional movement speeds, maybe lifting the weight in one second and lowering it in one second, or even do the Nautilus type of 2-4 protocol. All those rep ranges result in a fairly low level of time to concentric failure.

Just to set some examples, in a typical gym and a typical person exercising, they are probably lifting the weight in one second and lowering it in one second. Think about this, if they did 10 reps – one second up, one second down. That's only 20 seconds to do 10 reps. Now let's say they did 20 reps – one second up, one second down. That's only 40 seconds. Now, if they reach failure in 20 seconds or whether they reach failure in 40 seconds, or conversely whether they did 10 reps or 20 reps, that research study might

show that 10 and 20 reps produce the same result. But you are only comparing 20 seconds time to failure versus 40 seconds.

Lawrence: You are making a good point. I can't remember seeing in the design methods of a lot of studies the cadences, the movement speeds, so not often even mentioned. This is what I know a lot of our community has a real issue with a lot of the research out there on resistance training.

Tim: Yeah, exactly. I think talking about rep ranges and saying what rep ranges work or don't work is meaningless without defining what their movement speed or their rep cadence was, and ultimately what the time to concentric failure was. But even just moving on with this concept. Okay, let's say, you are doing a 2-4 protocol and you are lifting it in 2 and you are lowering it in 4, so that's taking about 6 seconds per rep. Well, the Nautilus recommendation was to do 8-12 reps. 8x6 is 48. If you did 8 reps to failure that took 48 seconds. If you did 12 reps to failure, that took a minute and 12 or 72 seconds. Even in that, you are talking about 48 to 72 seconds of time to failure. Still a relatively reasonable amount of time. Even if you do a higher rep range, 12-15 or something, you are still going to reach failure, maybe somewhere between a minute or a minute and 30 or so. You could say whether you train to failure in 20 seconds, or 40 seconds, or 60, or 72, or 90, that all works about the same.

Where I have a problem though is that, again, going back to this idea of not defining what the cadence was or not measuring what the time to failure was. Let's say somebody is doing Super Slow, and they are doing 10 seconds up and 10 seconds down – 20 seconds per rep. 5 Super Slow reps is going to take a minute and 40. 10 Super Slow reps is going to take 3 minutes and 30 seconds. 20 Super Slow reps is going to take 6 minutes and 30 seconds. Now, you are going to tell me that it doesn't matter whether you do 5 reps or whether you do 20 reps? You are talking about a difference of a minute and 40 and 6.5 minutes. That's crazy. Now you are talking about a huge difference in the time underload, time to failure.

But compare that to conventional training, you got one guy doing 10 reps in 20 seconds, you got a Super Slow guy doing 10 reps in 3.5 minutes. Are you going to tell me that there is no difference between 20 seconds and 3 minutes and 30 seconds? I mean, you could be all over the map. I think what happens with some of these studies is that they are pretty much generally comparing the more conventional movement speeds. With the rep ranges that they are comparing, they are probably ending up with time to concentric failure of anywhere from 20 or 30 seconds on the low end to maybe 1.5 minute on the high end. They are arriving at a conclusion that anywhere in that range doesn't really make too much difference. That doesn't translate to mean that if you were doing Super Slow and you did 20 Super Slow reps that's the same as 20 – one second up, one second down reps.

I think you really have to look at more of the details. If those details weren't studied for or controlled for, you kind of arrive at conclusions that aren't necessarily valid. This brings us to this idea of, okay, with all these possible ranges of time, and reps, and rep counts, and different speed or cadence of reps, where should we be in terms of this time to concentric failure? This is where you have to bring the science or the physiology in and consider what we are dealing with.

The way muscles work is that they obviously need energy to produce muscle contraction and produce force. That energy is governed by a couple of different energy systems. We've probably all heard these terms anaerobic and aerobic. What the terms mean is aerobic means with oxygen and anaerobic means without oxygen. What these terms are referring to is not the exercise itself, like the body is not consuming oxygen when you exercise or it is. What it's referring to is the energy system, the energy pathway that is delivering energy to the muscles. How is that energy being produced? Whether it is relying upon oxygen to produce the energy or whether it's relying not on oxygen to produce the energy. What you have is this aerobic and anaerobic referring to how the muscle is getting its energy to produce that muscle contraction and to perform the exercise.

We've all said and we understand that strength training, weight training is anaerobic exercise. Because what's taking place there is that the length of time that it takes to perform a set of an exercise and train to failure, that is

relying upon the anaerobic energy system to fuel the work versus when you are doing a very long duration, particularly steady state like you are going for a jog and jogging five miles. That becomes more of an aerobic exercise because it's relying upon the aerobic energy system to deliver that energy to the muscles. At the root of it, here is how this works. The anaerobic energy system is capable of producing energy very quickly and providing that quick energy for intense exercise and for high level effort exercise.

The advantage of the anaerobic energy system is you can access it instantaneously and deliver that energy to the muscles very quickly to fuel that high intensity muscular work. On the down side, there is a limit to how much energy that system can provide. In other words, it runs out of fuel quickly. Essentially, within about 90 seconds you are exhausting the anaerobic energy system which means if you are performing intense exercise and you are using up fuel, you are using up that energy at such a quick phase, that you will run out of energy within roughly 90 seconds.

Lawrence: How did you land on 90 seconds?

Tim: If you have the physiology textbooks and you look at the capacities of this anaerobic energy system, that's how much capacity it has before it runs out.

Lawrence: Did they use an example? Did they use sprinters? I think sprinters… I don't know. Can you sprint for 90 seconds? That's probably actually not possible.

I don't know. I think sprinters sprint for like 10-15 seconds. Don't they? I'm just curious because if the weight is too light, like you were saying, it just seems a little bit arbitrary to me. I'm trying to understand how they landed on that.

Tim: Well, first off, keep in mind that there is a mixture of stuff going on here. Again, we are trying to keep this relatively simple. At the base level, you've got the ATP system that is delivering this energy to the muscles. Then you've got the ATP, Lactic acid, and mixture of things coming in. And then, ultimately you've got the aerobic energy system. It is never like a clearly defined point. If you do something like an all-out sprint, let's say 100-m dash, that's going to be pretty much just a pure anaerobic burst of energy. But there is a continuum here where depending on the intensity of the exercise and the level of effort, you may initially use that ATP pure anaerobic system but then you start to bring in a mixture of the aerobic system and there is a combination of the two going on. This is one of the things now that I'm building to when we look at the aerobic energy system. That machinery, that aerobic system can't supply energy instantaneously or very quickly. It takes a little bit of time for that machinery to get up and running and to start to process energy. What happens is during the initial minute to 90 seconds worth of exercise, your body is primarily relying on that anaerobic system. But then if you are working at such a level, intensity level, that you could get to 90 seconds and sustain that work, the aerobic energy system starts to come online, starts to produce energy, and starts to supply energy.

Lawrence: That 90 seconds then… I know it differs. Probably there is some nuance to that and it differs depending on individuals. But you could define it by saying that as long as there is a force that is a relatively high intensity, or that could be a moderate or heavy load, or an all-out sprint, that's what that 90-seconds is based on basically. That's going to signal to use the energy stored locally in the muscle and utilize the anaerobic pathway maximally and therefore that's going to last 90 seconds. Is that kind of what we are saying?

Tim: Yeah. I guess what I'm trying to describe is the fact that there is a continuum to this whole process. The more intense the exercise is, the higher the level of effort, the more demanding the exercise is, then the faster rate of energy expenditure there is. But there is a whole continuum between different levels of intensity, different levels of effort, and different levels of demand from the activity or the exercise that you're doing, that determines how quickly and how much energy your body needs. The body is going to deliver that energy if it needs it extremely quickly, if there is this really high burst of high intensity effort like in a sprint -100m dash - where you are literally going all out. That's going to be relying on that anaerobic energy system to deliver that energy as fast as possible to those muscles to fuel that intensity.

But then as we go lower down the continuum to something that's not quite as intense then it will start to bring in a mixture of some of the anaerobic energy system, some of the aerobic system kind of thing. And then, if we go to even a lower level, or maybe we're just a slow jog, or we are walking, then

it is not as intense. The body doesn't need the energy as quickly so it can allow the aerobic system to kick in and deliver that long slow energy to the muscles. It all depends on the demands of the activity. How quickly the body needs the energy and it's going to involve those different systems. There is always going to be a mixture depending on that whole continuum and what level you are working at.

The key point we need to focus on is that let's apply this now to sort of the way the muscles work and the contraction of the muscles. When you go to perform any movement, any activity, your body is going to recruit the level of muscle fibers that it needs to perform that task. If I'm going to reach my desk and pick up a pencil, I don't need very much muscle. I don't need to produce very much force in order to lift that pencil. I'm barely going to engage my muscles. But then, as you lift heavier objects, your body needs to recruit more muscle fibers to overcome that and produce a level of force that can lift that heavier object. Again, we have a continuum here that the heavier the load is, the more muscle fibers you have to activate in order to lift that load.

As we perform an exercise, as we get into an exercise machine, as we pick up a weight, a barbell, whatever, your body is going to sense that load and it's going to activate a level of muscle fibers necessary to lift that object. Whatever that happens to be, as you perform repetitions of an exercise, if the load is sufficient enough you are going to start to fatigue the muscles.

That level of force, those activated muscle fibers, those muscle fibers that are being used to lift that load, some of those fibers are going to start to fatigue. As they fatigue, your body is going to recruit more muscle fibers into action. It's going to call in for extra help because due to that fatigue, your ability to produce force is diminishing. Now you need a little more help. More muscle fibers are going to come online to start to help you to continue to produce enough force to lift that load. There is going to be this progressive recruitment. As muscle fibers fatigue, then some of the fresh, rested, unused fibers are going to activate, kick into action and start to assist you. You are going to progressively tap in deeper and deeper to use those muscle fibers, activating those muscle fibers and using them.

Ultimately, as you continue those repetitions and as that fatigue continues to build, more and more of these muscle fibers come online until which time you have no more left to recruit. And then you are going to be able to sustain the exercise until which point that all of those working fibers fatigue to a level that there is not enough production left to overcome the load and then you hit failure. What we are dealing with here is strength training and with what we are intending to do through the exercise that we do, we want to activate all of those muscle fibers that we possibly can. We want to use that entire muscle as deeply as possible. We would ideally like to recruit 100% of our muscle fibers and we want to bring that level of fatigue to such that we reach muscle failure.

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The idea of training to failure is that by training to failure you are optimally recruiting and engaging all of your available muscle fibers and bringing them to a point of fatigue to stimulate the improvements that we are after. We need to have that occur. We don't want to just use half of our muscle fibers. The theory being that, well, you are only going to stimulate and benefit the muscle fibers that are being used. If you are doing an exercise where you are only using half of your muscle fiber capacity, then you are really only getting half of your muscle fibers stimulated for improvement. If you are involving a higher level, you are getting deeper into that muscle and you are getting more stimulation at a deeper level. Ideally, we would desire to activate and stimulate 100% of our available muscle fibers. To do that it requires, as we've been discussing, training to failure.

Tying this back into the time under load we need to work within the anaerobic energy system and we need to hit failure before that aerobic energy system kicks in. Here is the reason why. We talked about the capacity of the anaerobic energy system to supply energy to the muscles. When there is that intense effort and where there is a high rate of fatigue, you are using and completely exhausting that anaerobic energy system bringing all of those muscle fibers into action and exhausting them or hitting failure before the aerobic system is allowed to kick in. Because here is what happens when the aerobic system kicks in. If you are working at an intensity level or the load you are lifting, the effort required, and the force required if you are just

using a moderate load to the point that you can sustain that longer than 90 seconds, that aerobic system starts kicking in and supplying energy.

Now, you are not going to fatigue those muscles very efficiently because as we know that aerobic energy systems can provide real long term energy. Those muscles can keep contracting over and over again because the level of intensity is not high enough to fatigue them very quickly and that aerobic system can keep up with that rate of work and continually keep supplying those muscle fibers energy to keep going, going, and going. That's why somebody can run a marathon because those muscle fibers are not hitting failure. You are not fatiguing. I mean, you are fatiguing to some degree obviously but you are not utilizing 100% capacity of your muscle fibers. You are not bringing those muscle fibers to failure because you are working at a more moderate effort and that aerobic system is continually supplying those muscle fibers with energy to keep going. But here is a key point, if that is happening… In other words, you are utilizing that aerobic energy system to keep supplying that energy to the muscles. Those muscle fibers are not fatiguing and you are not being forced to recruit deeper into the muscle fiber pool to keep recruiting more and more muscle fibers into action. You are just using a very low level of your capacity and you are repeating and reusing those same muscle fibers over and over again. In other words, there is a regeneration of the energy and a regeneration of the same muscle fibers over and over again rather than this previous scenario where you are

progressively recruiting deeper, and deeper, and deeper into the muscle fiber pool.

To make a long story short, if we don't hit failure within about 90 seconds, then we are losing the efficiency of recruiting muscle fibers in bringing them to failure to a deep level of fatigue. We are allowing that aerobic energy system to kick in and start to regenerate these muscle fibers over and over again rather than doing the deep fiber recruitment that we are after. It matters how long your set takes. It matters how long it takes you to reach concentric failure. The bottom line is that if you are using a weight load that you can lift for 3 minutes, which a lot of Super Slow people do. You are using such a lightweight load that you can sustain that work for 3 minutes, you are getting into the aerobic energy system. It's becoming a quasi-aerobic exercise. Not totally but you are kicking in that aerobic energy system and you are regenerating those muscle fibers, and you are just reusing the same muscle fibers without tapping deeper and deeper into that muscle fiber.

Lawrence: If you think they are going for 3 minutes they are just not just getting at the highest order motor unit muscle fiber, and then ultimately stimulating best results. That's the issue there.

Tim: Right. What you've got is… I mean, consider a set, if you are going to go for 3.5 minutes or something, that means those initial reps are fairly easy. If you're lifting a weight that you can lift for 3.5 minutes then that first minute

or two of that exercise is not very demanding. Proof positive is you're not fatiguing very quickly. You are going on and on and on and you can last 3.5 minutes. You are starting to kick in this aerobic energy system, you are regenerating the fibers, and you're not continually progressively recruiting. You are just going on and on. We need to lift a load that is going to fatigue us quick enough that we recruit through those muscle fibers and bring all of those muscle fibers into action and we reach that state of failure before that aerobic system is allowed to kick into action and then keep supplying that long term energy.

In other words, long story short, we need to work within the anaerobic energy system because that is where your muscles are going to fatigue and force your body to recruit into those deeper level muscle fibers to continue to produce force as that fatigue occurs. Whatever your repetition cadence is, whatever the speed of movement is you are using, whatever the rep range you are using, I believe you need to be hitting failure within 90 seconds or else you are losing a lot of efficiency and you are not as effectively stimulating the muscles as you could. These ideas of these 2, 3, 4-minute sets that a lot of Super Slow instructors have their clients doing is just not very productive. You have to get the loads heavier and you have to work at a higher level of effort, a higher level of intensity that's going to fatigue you quicker, and fatigue you within that anaerobic energy system and force that full recruitment of all those available muscle fibers.

This brings us back to my original concept of this training slow unavoidably versus training slow intentionally. Here is what I mean by that. If you're going to train slow intentionally, in other words, somebody told you to move slow and now you are going to just be very gentle, and passive, and train in a slow fashion, you are not going to be essentially lifting a heavy enough weight that is really going to challenge you. Because of that passivity, because of that modest effort, because of that intentional desire to move slow you are not putting up a high level of force. And you are essentially holding back and lifting a lighter load than you otherwise could handle, and you are intentionally moving it slow but you are capable of much more. Which means that the intensity is going to be lower, the rate of fatigue is going to be lower, and you are going to get into this problem where you are doing a 3 or 4-minute set of an exercise.

In contrast, if you lift a heavier load, obviously it's going to be a higher level of effort. It's going to require the recruitment of a higher level of muscle fibers. It's going to be a higher intensity, a higher rate of fatigue. It's going to fatigue you quicker. You are going to hit failure sooner. Remember that concept I started with originally where if you are lifting 100lbs load and you apply 101lbs of force against it, it's barely going to move. If you apply 200lbs or 300lbs of force against that load, it's going to move very quickly. All that extra force is going to accelerate the load. Let's consider something, if your muscles are capable of putting out 300lbs of force and you are choosing to only lift 100lbs, and you are moving slow intentionally which means you are

voluntarily just putting out slightly more than 100lbs of force, you are going to move very slowly. It's going to look nice and pretty. You are going to do a nice, slow, smooth rep. Your instructor is going to think it's great. But here is the problem, if your muscles have the ability to put out 300lbs of force and you are only choosing to put out 100lbs, there is a big discrepancy between what you are capable of and what you are actually voluntarily doing. In that case, you are just simply not using your full capacity of your muscles, you are not going to be working at a high enough level that you are going to fatigue in a sufficient rate of time and reach failure within that anaerobic energy system and tap through those muscle fibers and recruit all of those.

In contrast, this idea of moving slow unavoidably. What I mean by that is you should be lifting a load that challenges you at a very high level of your ability. I'm just plugging numbers in here to illustrate. But if you are capable of producing 300lbs of force with your muscle, you don't want to be lifting 100lbs. You want to be lifting much closer to 300lbs. If you choose to, again, capable of 300lbs of force output of the muscle, you want to be lifting 200lbs so that you have to recruit a very high level of your muscle fibers. And then, that load is going to be heavy enough that it challenges you in a rate of fatigue that's great enough that it forces your body to recruit through those muscle fibers that are remaining and bring everything on the line and bring you to failure within this optimal time range that we are describing.

What I mean by moving slow unavoidably is that if you choose a weight load that's closer to your true capacity, then you don't have enough force capability to accelerate that load. That load is going to move slow unavoidably because you don't have the ability to produce enough force above and beyond that load you are using to cause acceleration. See where I'm getting there?

Lawrence: Yup. Absolutely. Makes a lot of sense.

Tim: I think what happens too many times with people is that they choose too light of a weight load. They intentionally move slow which is great and safe and all that. But because they are choosing too light of a weight load, they are able to go on and on and on and on. Their sets go on too long. The aerobic energy system kicks in. They keep regenerating and reusing the same fibers. They are not efficiently tapping in and recruiting all of these muscle fibers into action. It just loses its efficiency and effectiveness.

I understand why people choose lighter weight loads. One of them I keep going back to this point is that if somebody has been told to intentionally move slow, and they become passive as a result of that, and they become not willing to put forth a lot of effort, they simply don't think they have the ability to move a heavier load because they are really not using all of their available muscle. They are not producing that effort at a high enough level to lift the heavier load. They are just intentionally holding back, moving slow

and picture perfect. But internally, physiologically, they are not really doing intense work and really activating those muscles at a high level.

On the flip side, when you give a person a heavier load, if they are in this idea that they should be intentionally moving slow and they are not putting forth a great effort, they are not going to be able to lift a heavier load. It's not because they don't have the ability to lift the heavier load. It's just because they are not tapping in and using that ability because they are passive.

The other problem that arises is that when you lift a meaningful load that's closer to your true capacity, you feel that load. I mean, it is hard work. It's hard work to move that load. You are activating that muscle at a higher level. You are feeling a much higher level of tension, or load, or strain upon that. It's uncomfortable. It's hard work. Consequently, many people struggle with trying to maintain that high enough level of effort and to endure that very high level of tension or strain and they start misbehaving. They start to push for a second or two and they back off. They jerk at the weight, or they twist and they squirm, and they do this segmenting, and this off/on-ing. They do all this.

Lawrence: It's like this fight or flight response kicks in or stimulus.

Tim: Right, fight or flight response.

Lawrence: Just trying to obtain that and coach it out of them.

Tim: It's very difficult for most people to sustain a very high level, intense, high tension, high strain repetition continuously without letting that muscle relax. Everybody wants to push for a second or two and then relax, and then push for a second or two and relax. You get this disjointed, uneven movement. It takes a skilled person and a motivated person to train with a meaningful load, sustain that long-term muscle contraction, and perform those repetitions without letting that tension release from the muscles. I think what happens a lot of times is instructors witness all of these bad behaviors, witness all of these form discrepancies. And in order to clean up the form discrepancies, they lighten the load so the person will behave. They get the behavior modification that they are after, but now they have given the person a load that's not meaningful enough to challenge them and bring them to failure within the requisite time under load or time to failure.

Lawrence: How would you overcome that then? Just curious, if someone, would it be about getting the load just right, not reducing it too much, or would you keep the load the same? It varies massively depending on the individual and just coach them through the form. I agree with you. If you reduce it too much, it might not be that effective.

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Tim: Well, this is an age-old problem. I don't have all the answers to this. It's extremely hard work with some people. This is where it comes down to the art of exercise instruction. You can have all the head knowledge in the world and you can know all the physiology and the physics. You could know exactly how an exercise should be performed and what you would like to see. But the question is, how do you get the client to conform to that and do the things that you ideally want them to do, and to have their behavior and their performance match what we want to see.

This is hard. You deal with these issues of people that… There are a whole range of limitations here. You've got what we call this motor control issue. That's just the ability for their mind and their nervous system to activate and control the muscle contraction. Some of that is sort of a genetic thing. Some people just have better control, better activation of these things than other people. Some if it is a skill acquisition. That overtime somebody has more experience, somebody that's been an athlete, somebody that's lifted weights throughout the course of their lifetime is going to have had a better development of their skills, a better development of their motor control. Some of it comes down to just plain and simple how focused, how motivated, that client is, how willing to perform that client is, their tolerance for putting up with the discomfort of exercise, putting up with that feeling of straining upon their body that high level of tension applied to their muscles. There's all these different factors. It's very difficult to control all of this.

I think the greatest limitation on an individual's results is themselves. Many people don't have very much willingness to work extremely hard. They don't have a willingness to endure the discomfort. They don't have a willingness to really deeply contract those muscles at a high level and sustain that contraction, and sustain that load and that tension, and concentrate, put their mind into it, pay attention to what they are doing, give their 100% best effort. You've got such a range of variables and just most people are not willing to go there and do that.

Consequently, the limitation is how much is the client willing to do? How good are their skills? How good is their motor control? What level of motivation do they have? And all of this type of thing. This leads to who you are dealing with and where all those variables lay within that person. But then as an instructor, how do you get that out of them or how do you teach them and convince them and motivate them to get to these higher levels? Some people will be easier to do than others. Some people just won't care. Some people are just apathetic. They just want to go through the motions. They are not interested in learning. They don't have the ability to concentrate. You just got a whole mess of variables. Maybe that's something we can get into in later sessions.

Lawrence: Yeah, I know we are going a little bit off bullet on this one. But I just want to reiterate what you said there towards the end. I think there is a massive

amount of earnest on the trainer to have patience. The attitude we are trying to instill is 1%. It's like when you get someone in who is really challenging to work with, it always feels like two steps forward, two steps back. You get them to master a certain aspect or form and then two sessions later they are making the same mistake. But the way I look at it with some of those clients is that if during a workout nothing changed, nothing changed, but let's say they didn't jerk the last 5% of the seated row at the end when they got into full contraction. Or they kept their shoulders down on the chest press and everything else is the same, I see that as a huge win. I'll give them great feedback following that workout because that is an improvement. I think as a trainer… This is just my own opinion. I think if you want to be motivated longer term, you gotta have that mindset of embracing the process and understanding that you're not going to get people to your level ever in many cases. It's just trying to get them a little bit better each time. I think that is key. Otherwise, it's hard to sustain the motivation as a trainer, right?

Tim: Yeah. I think as we start to wrap some of this stuff up and tie it all together, certainly I am not recommending that the first day you bring a client in you give them such a heavy load that they can barely budge it. All of that kind of thing. You are obviously starting them at a lower level. The first step is you need to teach them the fundamentals of what you are asking them to do and what their performance should be. You need to establish the proper habits and develop the skills with a level of weight that's much more modest and be able to allow them the opportunity to develop. Just like anything else. If

you are learning to play the piano or something like that, you have to start at the fundamentals and you don't start playing Beethoven on the first day. You are going to start a person at a lighter level. You are going to establish the ground rules. You are going to teach them the fundamentals. You are going to describe things to them, have them start to perform, give them that feedback, and those corrections.

Those early stages are going to be getting them to behave in the proper way, getting them to perform in the proper way and do things, slow, smooth, controlled, keep your shoulders down, keep your posture set, hold your head and neck still, breathe properly. All of these types of things. And then you are going to establish those patterns and then gradually start to progress them. As you progress them, the weight is getting a little bit heavier. Things are getting a little more challenging. But you are ramping it up slowly so that you are not going to suddenly make them break form and start to behave badly. But as you progress along, and things get progressively harder, and more intense, and higher levels of tension on the muscle, higher levels of discomfort from muscle fatigue, and higher rates of breathing and effort, and all of these stuff going on. This is where things start to break down and where the form starts to degenerate typically and you start to develop these problems. Part of being an instructor is being able to nip those in the bud right away and continue to teach the person and get them to understand that no matter what, don't change your form, don't change your technique. And you continue to progress through that process.

Again, I want to reiterate that the problem that I see is that a lot of trainers become too fixated on having this picture perfect repetition. And going slow and having everything perfect and not doing anything wrong and just having it look picture perfect. In order to get that behavior, they put the weight too light and they keep the weight too light and they consequently are not getting the person to reach failure within a proper amount of time, and they are not getting the intensity. They are not getting that higher rate of muscle fiber recruitment and ultimately fatigue and stimulation. You have something that looks pretty but is not productive.

At some point there is a balance. I've witnessed trainers, trainees, or witnessed people in the gym, or think of bodybuilders or something like that. You witness one of their workouts, their form by our standards is completely sloppy. They are jerking the weights up and down. They are doing partial ranges of motion. They are twisting, and squirming, and yelling, and all these theatrics and doing sloppy form. We would say that that's horrendous. But somehow they get results from all that. Part of it might just be the sheer volume doing so many sets and reps and exercises and things like that that they eventually get around to causing enough stimulation and whatnot.

Part of the reason they are getting results is that somewhere in all of that they are lifting heavy loads. They are working hard. They are pushing themselves. They are working at very high levels of effort with a significant

load and creating enough muscle tension and stress. Ultimately, that intensity, effort, and those heavier loads is what's getting it done even though their form, their technique would not be to our standards.

Lawrence: They are just getting to the same place just inefficiently and dangerously.

Tim: Right. We could say they are doing it dangerously. They are more likely to get injured. They are not doing it as efficiently. They could get a lot more out of it in less time with less volume. And all those things are true. I'm just pointing out that ultimately somewhere in that mix they are stimulating gains and they are getting results. I think to some degree this can be applied to our concept that ultimately we need to get results for clients. The clients need to get benefits. They need to achieve their goals and so forth. You could have somebody that's picture perfect repetition doing everything right but they are training with such a light load in order to gain that behavior. They are training with such a light load that they are not really working very intensely and they are not getting extremely fatigued from that. They are not getting as high a level of stress on the muscle that they could. Again, the workout looks pretty but it's not very productive.

On the other hand, somebody that's maybe not doing everything perfect, maybe a little sloppy at certain points, maybe moving a little bit faster than you would like, but they are working hard and they are training with a more meaningful load, then that's going to be a more productive work out if not our absolute ideal.

You have to find this balance and ultimately what it comes down to is there needs to be hard work. There needs to be intense effort. There needs to be a meaningful load being used. There needs to be a high level of muscle fiber recruitment and ultimately a high level of fatigue that occurs. If you don't get that, it doesn't matter how pretty the workout was. Ideally we want both. We want proper form and behavior. We want slow controlled speed of movement. We want good form and technique. But we want that heavy load that's going to render failure within 90 seconds.

Lawrence: Just bringing it back to that 90 seconds. What do you think is the optimal time window then? Is it 60 to 90? Is it 40 to 90? We actually do 2-4 as one of our protocols. We do lots of different protocols. But we do 2-4 and we'll do 8-12 reps. It is interesting what you said about how 8 reps works out to be 48 seconds but it is obviously usually more than that when you include things like pauses and turnarounds, right?

Tim: Right, right, yeah.

Lawrence: And so it probably needs to be over 60. Anyway, I'm just curious, what is that actual window of time then in your opinion?

Tim: Well, usually, as I define it and based on the physiology and this energy system stuff, I'll usually define it somewhere let's say 45-90 seconds. You

also have to consider that on the low end you need to have enough work. You need to have enough sustained work at a minimal level to get that stimulation. In other words, you just try to pick up an insurmountable load and you push on it for 5 seconds and stop. You could say, "Well, I hit failure and I sort of activated all my muscle fibers." But you really didn't do enough work and induce enough fatigue to cause much of a stimulation. On the low end, there is sort of a minimum. On the high end, we've already discussed. I'd usually say 45-90 seconds. But in practice, I would say for most people, I'm aiming for about 60-90 seconds. I want them to be able to do enough repetitions. I want them to sustain that work long enough that they get a good level of stimulation and good level of fatigue and so forth but I don't want to go too long. I'll usually say 60-90 seconds.

Again, you are trying to temper that with some people. Maybe allow them to go a bit longer because they are not behaving properly and we've got to make some adjustments. I'm very cautious to not go too long with the time underload. I'll just manipulate that weight until it's within range. Clients that maybe aren't as skilled, I'll let them go slightly longer. But the clients that are doing what I want them to do and are willing and motivated and have the ability, they are going to be more in the 60 to 90-second range.

Lawrence: Probably we don't have enough time to get into this and maybe we can discuss this on another podcast. Where someone falls in that range is largely going to be determined by their particular genotype and what

composition they have in terms of muscle fiber and how quickly they fatigue. I find for me I will almost always fatigue, as long as the weight is heavy enough, I'd like the 70-second mark in so many exercises. Doesn't matter even if I creep the weight up like 2lbs each time. It's always at that point. Is that directly linked to my genotype? Again, we can put this off. It's a big topic.

Tim: This reminds me of one of Doug McGuff's earlier books. He taught a lot about signature time under load. That this time under load will sort of find you. Then based on what you are saying whether it's your genotype or just your personal physiology or muscle fiber type that you will naturally fall into this certain time to concentric failure, time under load type of thing. There is some truth to that. Although, I think this is a scenario that's not really well understood. Even back in the day right before Arthur Jones sold Nautilus. He was doing a lot of research with some things and did recognize whether it was fiber type or whatever it was going on that there were certain individuals that did better on higher rep ranges or higher time underloads, and some people less. He believed that the ideal inroad was about 20%. In order to inroad your muscles by 20% some people who fatigued slower required a longer time under load to fatigue to that level. And then other people that fatigued very quickly didn't require as many reps or as much time under load to get that level of inroad.

These are all interesting concepts. They are not well understood. I think there is something going on there but I don't know that anybody really knows exactly what it is. Anyway, I think these all get stuffed and it brings me to the end of my discussion on this today.

Lawrence: Yeah, Tim, I'm really impressed. I think we've covered 3.5 bullets today which is a new record.

Tim: Yeah, it is.

Lawrence: We covered repetition ranges and how they correspond with TUL and TCF. We've done that today. I don't think there is more to say on that. We'll probably start off talking about determination of optimal weight load and resistance level. I think we'll go so much into that.

Tim: Yup. That would probably be the next step.

Lawrence: Fantastic.

Tim: Okay.

Lawrence: I know you've got another appointment so just very quickly. Do you want to just tell the listeners how to find out more about you and your services that you might be able to help them with as well?

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Tim: I think they can reach me through my website stronglifetraining.com. There's links to contact me. There is the email address – info@stronglifetraining.com. If they want to go through one of those ropes, any questions, any desire to learn more about some of my services to teach workshops, seminars, that kind of thing, we can discuss all of that.

Lawrence: Awesome. If you were based over in the EU or even in the same country, Tim, I would be over there in a heartbeat to learn more from you. I think it's a great opportunity for all of us. I really enjoyed this. I learned so much just listening to you talk about this stuff. I'm really going back to the fundamentals. Thank you again.

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