High-Intensity Training: How-To Program for Best Results and Avoid Overtraining

Recorded October 23, 2019

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PhysicalTherapy.com Course #3587

- [Fawn] Our course title for today is High Intensity Training: How-To Program for Best Results and Avoid Overtraining. Our presenter today is Doctor Amy Ashmore. She holds a PhD in Kinesiology from the University of Texas at Austin. She's the author of dozens of articles, blogs, and continuing education programs recognized by many associations. She is a former sports science faculty-- I'm sorry. Amy is former sports science faculty at Florida State University and the former program director for sports sciences at the American Military University. Welcome, Doctor Ashmore, and you can go ahead and get started.

- [Amy] Hi-- can everyone hear me, first of all? Like, if Kathleen would let me know if I can be heard. Okay, thank you. I would hate to continue talking and learn here in a second that no one can hear me, which, yes, does happen sometimes online. So, yes, I am Doctor Amy, and it is a pleasure to be here. I really enjoy doing these webinars, physicaltherapy.com and all you guys out there. I'm excited to see how many of you there are here today, and I even see some familiar names, I think, so, welcome and welcome back. So, Von did go over our title, so I will go ahead and start here with our learner outcomes.

So, after this course, you should be able to develop high-intensity strength training sessions and programs, modify high-intensity strength workouts and programs based on individual response to activity, identify at least three symptoms of overtraining, identify at least two common high-intensity training methods that can cause rhabdomyolysis, incorporate current rest and recovery guidelines into high-intensity strength programming for improved results and decreased overtraining, define rhabdomyolysis and recognize common high-intensity training methods that can cause it, and finally, incorporate current rest and recovery guidelines into high-intensity programming for optimal results and overtraining. So, we will have two hours allocated

to our time together and to this particular topic, so in a nutshell, this is how I outlined it to prepare it and then to present it to you. First of all, we'll go over periodization training and the associated programming variables. Those are fairly common. You will be familiar with them, but I do like to make sure that we're all on the same page as to how we operationally define those and use them. We'll second, go into high-intensity training, to define it first of all, and you've noticed here, right off the job, I wanna point out that I did leave out the interval components. That's one method of high-intensity training, of course, and we'll go over that a little bit more, but here we're talking specifically about high-intensity in general, and as we move through this presentation, I want you to think about what we call training load, which I'll define later, so don't worry about understanding exactly what that is up front, but to think in terms not only of intensity as an outburst of activity, high intensity intervals, but also as, say, higher volume.

I don't think any of us would consider marathon training to be low-intensity, so we'll be looking at different methods of high-intensity training, not just the common interval. We'll be looking at some really popular high-intensity training programming methods as well. My hope, of course, is that you will be able to take these methods and improve your own programs for your own benefit and also for the people that you work with. So, the more fun stuff is gonna be heavily weighted at the end, where we actually get into the what does it look like in the gym, which is why most of my audience typically shows up, is that's what I'm known for, so, we'll look at that at the end, so just bear with me to lay our foundation first. We'll look at circuits, supersets, combined training, and complex training. Don't worry if you don't know what those are right off the bat. We're gonna go over them. Training loads, we're also going to define those, and how we use them and how we manipulate them for different populations. When we get to overtraining, we're gonna look, of course, at what is long-term overtraining, but we're also gonna look at acute overtraining, which is rhabdomyolysis. And finally, we'll look at how do we prevent overtraining through sound programming. Finally, we'll look at

programming with rest and recovery, and we'll look at some fun and exciting new ways to program particularly strength methods or strength training utilizing new research on rest and recovery. Now, another thing I want to say is if you guys have questions during the presentation as we go through the content, just put them in the question and answer box, and I will see them and get to them, hopefully as they come in. Occasionally every now and then, I might not see one, but I'll keep my eyes open. All right, so periodization.

Most of us know what that is. And of course, the picture here-- let me go back-- had an athlete because periodization, of course, comes out of the original 1950s Soviet periodization training research who they essentially followed during that period of time for the Olympic team. They followed athletes, and they monitored or measured the training variables associated with performance like intensity, volume, rest, et cetera, and figured that the persons who were the most successful were peak, or successful in the Olympics, were peaking at the right time based on the strategic manipulation of these training variables. Now, although periodization is typically associated with athletics and is typically associated with a year, so a programming or programming or taking these variables and manipulating them over a year to peak at the right time, in fitness and rehabilitation, we utilize the very same variables as the original periodization training.

The way to think about the periodization method is that 1950s research was essentially the foundation for what would become all exercise science. However, the way that we use them now is different, like, mainly we're dealing with much shorter timeframes, and we're dealing with very different goals and outcomes. Our outcomes are typically related in fitness to physical appearance. They're related to quality of life and rehabilitation, of course. They're related to returning to what was the normal or pre-incident movement behavior and functionality, pain reduction, these types of things that obviously are not the intended outcomes or goals for athletics. Like I said, these

are going to be familiar to you. I do, however, cover them in all of my presentations based within this type of work simply because I want all of us to be on, to have the same operational definition. So, when I talk about mode throughout our presentation, I'm typically talking, or I am talking about the type of training. When we talk about high-intensity training, we're normally talking about strength and/or cardio training. Of course, another mode of exercise is flexibility training, but that's not typically something that, of course, you want to do at a, quote, high intensity. Frequency is the recurrence of sessions, so how many days per week are you doing these exercise sessions? And those will account for your recovery length, whether you're resting one day, two days, whatever that model may be. Duration is the length of your total program, and remember that periodization model with athletes, we're looking typically at a year, and again, we're not-- I know in fitness, we're typically around eight weeks. Sometimes shorter, sometimes a little longer.

Each session total, so the length of that session, which becomes really important in high-intensity training, and of course session components, and that just means when we get to combine training, are we doing cardio and strength in a combined session, so, 20 minutes each, something along those lines. The volume of training is again very important here as we talk about intensity. It's gonna be how much, so if you're doing strength and conditioning type work, you're looking at your sets and your reps. If you're looking at cardio, you're typically measuring distance run, time on the treadmill, that type of thing, and then finally, your intensity is how hard you work, and there's normally gonna be an external or internal correlate of how hard you're working. It might be your heart rate in a cardio mode or your muscle force generation capacity, or the force that the muscle is outputting in a strength workout. Oops, you went quick. So, just to cover really quick because the muscle force generation capacity will pop up again when we talk about the strength studies or when we look at these strength studies. This is going to be a direct measurement of muscular strength, so of course, that's very important when we're looking at outcomes associated with different

programming models. We wanna know how much is this taxing the muscle? Now, although the measurements themselves, what we get is gonna be different for, say, a 19-year-old collegiate athlete versus a 55-year-old person seeking general health and fitness. The measurement itself is similar across all populations. It's just the outcome is different. So, we're gonna start now to look directly at high-intensity training. So, remember, I'm delineating that word interval here in parentheses, so, high-intensity interval training, HIT, what we're most commonly associating with high-intensity training, is the number one exercise trend worldwide for 2018 according to the American College of Sports Medicine. Now, the reason for that, of course, there's really two reasons.

One's gonna come from athletics, fitness enthusiasts, real performance-type persons that, when you exercise at a higher intensity, you'll increase your total oxygen intake. You also increase how hard you push your heart, and of course, the harder you push the system, the greater the response, positive response is going to be, of course, so long as that person is healthy. So, where oxygen consumption is the really important factor here, one thing I wanna point out 'cause it just went through my head, is there's recent data that shows-- it was published, I wanna say, about six months ago, and a lot of you may have seen it. It circulated popular, in a lot of popular culture, that showed if you're doing cardiovascular exercise, your best time of day to do that is late morning.

Now, we kind of knew this. I think we might have been guessing a little, but what happened was this data showed us why and had a definite physiological correlate. What happens is your oxygen intake and use, your body's ability to utilize that extra oxygen in tissues for performance-related outcomes and health-related outcomes appears to be the greatest around 10 or 11 o'clock in the morning. So, that's a little timing trick or a little timing tidbit there, but that interval training is gonna be a little bit different in the way we'll talk generally about high-intensity training because we're

gonna, the intervals, of course, are going to imply a burst and a rest, a burst and a rest, et cetera. Also, oh, that other reason it's popular just crossed my mind is time. Of course, there's this, you know, this connotation that the higher you get your heart rate even for a shorter period of time is of greater value, so, so caloric expenditure, health outcomes, et cetera. So, what is HIT? The way that I look at it, it's gonna be cardiovascular exercise, resistance exercise, or in some programming methods, we can do a combination of both. There are three key variables that are associated with HIT, going back to our periodization verbals. Intensity, so how hard, of course. Volume, how much or how long. These are going to be inversely related, intensity and volume, and they're also related to the third parameter, which is rest periods. So, you wanna make absolutely certain that you're taking into account how hard someone's working, which is typically the harder they work, the less time they do it, and the greater the rest interval.

So, those are the really, the key variables that we think about when we're doing HIT programming, aside from mode, of course. Probably one of the most important relationships to HIT training is the intensity-volume dynamic. So, intensity and volume are inversely related. The healthier the person, the greater the capacity to push that 90 and 95% max heart rate or strength output potential. Clearly, 90 to 95% is not going to be maintained for a significant period of time. When you're doing cardio, you're probably looking at like that 20 to 30-second all out type recommendation. When you're looking at strength outputs, you're thinking more in terms of power lifting paradigms where people are going to be doing one repetition, taking a long rest period. They may be doing 85, 90% max, 1RM max. They may be doing paradigm two, three, maybe even four repetitions, but that's always the dynamic to keep in the back of your head. I kind of just defined it, but I wanna make sure we're all, you know, see it, that high-intensity training is defined as exercise, and this, of course, would be cardio, at higher than 85% max heart rate for 60 seconds to four minutes. And of course, that's gonna be population-dependent, how physically fit that person is. I think even 60

seconds is a little long to shoot for, but remember, my last example, I was, like, 90, 95%, and I said oh, let's do 20 or 30, but that is-- I know on the quiz, that is the definition that you guys want to star or mark. It's this underlined higher than 85% max heart rate for 60 seconds to four minutes. When you're talking about strength work, it's the same number at 85, but again, it's above that one repetition maximum. In athletics, you'll typically know what that is, but that one repetition maximum in the real world, we kind of guess, but there are resources that are out there. If you Google 1RM or estimating 1RM, measurements for estimating 1RM, a lot of resources'll show up that help you figure out that, say with a more fitness or rehabilitation population, where doing a 1RM is not recommended, and it's not safe. I would say that's typically in athletics.

So, we talked about that very intricate relationship between volume and intensity. Remember, those rest periods are going to be proportional to how hard the person worked and how long. Rest is a key factor to safe and effective HITs. There's a couple of reasons beyond the recuperative value to both the heart rate coming down and stabilizing and of course the muscle having that minimal recovery time. When you talk about strength training, one thing in strength training above all else is mechanics of exercise, and especially where loads are concerned. I'm sure we've all been in gyms and seen people lifting weights that are too heavy, and the mechanics are compromised.

They may be swinging weights, dropping them, just doing mechanics that you see. The joints are out of alignment. The back is swayed. Just any number of mechanics that, errors that can lead to disaster, so we know that, and we'll get into this research a little later, but we know that when we give muscles adequate rest, they have a minimal time to recover during that rest period, and this would be especially critical, like I said, in high-intensity strength training paradigms. And what happens is of course, then, we know that the form is maintained during that period of time, so we want to make sure

that we're given adequate rest, especially where, where strength, where strength training is concerned and load is concerned. Rest is a programming variable, and it's accounted for in HIT programming, and there's a lot of different ways we can do it, and we'll look at a little bit more of those down the road. So, the way that we defined rest does vary based on the intensity of exercise, typically in the mode, so where we don't have a super-high-intensity paradigm, we might use less intense exercise for the rest period. For example, low-intensity resistance set, so if you have someone doing a weighted squat under a bar, but it's not prohibitively heavy, it's 65% estimated 1RM, you can have them do wall squats with a ball, for example, that aren't weighted. A set of those, superset those, for example, and that's a way you can technically rest but not cease activity. We might have entire days of active recovery that would include, say, you trained hard on Monday, so on Tuesday, you include modes of dynamic stretching, swimming, or other low-impact and low-intensity cardiovascular exercise like the elliptical trainer. So again, rest periods don't necessarily mean no activity. So, when we talk about HIT programming, what are some of the methods, and then, what does it look like?

To manipulate your intensity, and these are strength examples, you can either increase your load or increase your speed of contraction, and if any of you've ever worked with battle ropes, they look so easy at first. In about 20 seconds in, you notice yourself getting the rope going less high, and you're getting lower to the ground. It's very difficult. It's not a huge load, but that speeded, semi-weighted contraction is hard to sustain for a long period of time. So, some of the common methods that we utilize to increase exercise intensity are circuits. We utilize supersets, going way back in strength, the strength-training world. They can be either strength only supersets, and that was the example I just gave a minute ago, where I utilized the weighted squat with the ball squat, or they can be cardio and strength superset. We'll talk specifically about combined training. That's a popular topic now, especially in fitness because combined training is probably the most effective method for weight management and weight loss,

however, all indicators according, at a molecular level indicate it's, it's a really bad thing for athletic training where you have real performance outcomes. Then we'll look at complex training, which is an advanced method of strength training, strength and plyometric training coming out mainly of athletic training settings. So, circuits, this is a fun way to increase exercise intensity, where you can utilize a variety of exercise, a variety of muscles, so you can keep someone working, but where, say, in particular, you wouldn't have them wanting to focus on, say, just the quadriceps, like in my squat example, and that's simply because this is a really good method for beginning exercises-- exercisers, excuse me.

You don't want them to overload in particular any one muscle or muscle group, which is fine, so it is good for beginning exercisers. Circuits are simply a series of exercises in succession. So, an example is a dumbbell squat, which is gonna be a much less weighted squat than a barbell squat just 'cause holding them adds a parameter or a limit. Followed by a balls crunch, as the person in the example is doing. Followed by a standing overhead press. So, basically what you see there in that three little exercise circuit is that we've increased the intensity of this exercise session by doing a series of exercises that covers lower body, core, and upper body.

Now, you can add more exercises if you want, which is typically recommended if the exerciser is good at the mechanics and good at shifting attention from one exercise to another and so on, but the other thing, of course, here is I just have this written once. As we get into showing some programming methods in actual chart form, you'll see that you would wanna do this succession of exercises for three to four sets or series. Another thing that this is really good for, if you work with people in group settings. Circuits are really well, or work very well, to move people effectively from one exercise to the next to keep them busy. Now, rest here, I didn't mention because it is gonna be so variable based on the size of the exercise group and the fitness level. Typically in a circuit like this, we'll move quickly from one exercise to the next without a break simply

because we go back if we consider that we're utilizing different muscles, and we're not going at a super-high intensity. It's that active recovery model. But again, you can work in as long as you need to rest periods in between each set or exercise. Here I said it basically, three to four sets of 12 to 18 repetitions each exercise. Now, 18 may look like a lot to you, and it used to look like a lot to me, but what happened over the past couple of years, and this data we'll look at later shows, or the data on rest within sets, which we'll get to later, utilizes a 36 repetition set paradigm, all right? So, I don't wanna get into this a lot right now, 'cause then I'll get sidetracked, 'cause I like this data a lot, but what I did is I cut it in half in a lot of my own sessions to take lower-intensity paradigms to a little bit higher volume, up to 18 repetitions, and I found that to be exceptionally effective where applicable.

So, that's where I get the 18 from if you guys are looking at that and thinking wow, you know what, that looks a little high, but we'll talk about that a little more, or in a lot more detail later. To increase intensity, you can, of course, you'd increase the weight used during each set and/or decrease your rest intervals. Circuits were really good for beginning exercisers, general fitness, group fitness, that type of things. Supersets are definitely getting into more high-intensity programming. They're getting into a more advanced exerciser model, so I want you to keep that in mind just by default. If you read the definition, supersets are doing two exercises back to back, and then they're alternated.

So, right there, I want you to, to focus and say, "All right, well, what she's saying then, "there's no rest here, basically." No, the rest is an active rest/recovery, but it's a thing most of these modes don't even really, because they'll utilize the same muscle group, account for rest. But of course, you can add that. We'll look at that in a second. Supersets are a fantastic way to keep people moving and focus on specific muscles. Specificity of exercise, of course, dictates that if I wanna see an improvement in the composition of a particular muscle, I want to build my bicep muscle larger, I must train

my bicep muscle, preferably using isolation exercises or single-joint exercises that focus specifically on that muscle. Supersets are time-efficient, especially if you have a client who is fit enough to super-size compound or multijoint exercises. So, having said that, supersets are best suited to intermediate to advanced exercisers. However, you can utilize them with beginning exercisers where you manipulate your methods to utilize different muscles or muscle groups during a superset and incorporate some degree of rest. Now, there's a couple of ways that we do this. The programming itself is pretty neat because just the exercises that you select dictate the intensity level, or can. It doesn't necessarily-- it's not the only factor, but it's obviously gonna play a significant role, so if I choose to superset leg extension with bar-loaded squats, I'm gonna be focusing on the quadricep muscle, and I'm gonna work it pretty hard, and that's a superset that is best suited to an advanced exerciser. Now, if I wanted to do that same superset, and I said, "You know what, I wanna do this, "and I wanna do it with a beginning exerciser."

One way I could do that is have that same beginning exerciser do that same leg extension exercise, probably at a different weight, and then superset that instead of a bar-loaded cage squat, which is very advanced, with a wall squat utilizing a physio ball or a non-weighted body weight only squat. So, there's a lot of ways to play around with supersets, hence why they been around for so long and why, and they are effective. I mean, that would be why, and they're fun too. So, in the examples, I have a synergist superset. So, synergist muscles, of course, work together. One of the most popular training modalities is to use back-- is to train back and biceps on the same day because a bicep is gonna help. It's an assister or synergist during a back exercise. So, I would do a bicep curl with a lat pull-down, for example. Another way to train supersets are to utilize agonist/antagonist muscles. So, front/back, lateral/medial, that type of thing. So, a tricep exercise followed by a biceps. So, in that, in an agonist/antagonist, you'll see your advantage is you can increase your intensity of each exercise because although the antagonist is working, it's lengthening, so it is getting a

rest during that particular or subsequent exercise. Same muscle group supersets are used, and I talked a little bit about them in a second ago, but they're best, again, for intermediate to advanced exercisers with very specific goals or outcomes in mind. And these can be, because isolation exercises-- excuse me, I don't know what happened there. Isolation exercises are the most effective for body composition changes, all right. We have research data that supports that. So, if you're have a client with a specific goal to improve the way a muscle works-- I mean, excuse me, looks, you're going to want to include isolation exercises like tricep push-downs, bicep curls, leg extensions, leg curls, those types of exercises. Here's couple of examples in pictures, kind of bring it home.

As you can see, let me get this little arrow, when you have here, the bicep, of course aids in the lat pull-down. And this is a little bit different. This might even, the way she's doing it, it might be more of, like, a rhomboid exercise. But either way, the bicep is going to help or assist in that pulling motion. Then over here, you specifically tax the bicep in that superset. So, that's a synergist superset. All right, this would be an example of an agonist/antagonist superset. Let me take that green arrow off. That's not pointing to the right place. So, here, if we're working in elbow flexion and extension, in the same direction or relationship to gravity, we have the bicep exercise followed by a common triceps exercise.

Here, we have same muscle superset, which, of course, both of these exercises, the tricep push-down and the overhead extension, work primarily the triceps but in a different way in relationship to gravity. This would be a way to increase the intensity of exercise utilizing mode or focused muscle work. This would be a very intense triceps training day, if you supersetted these two exercises, say three to four sets each, 12 to 18 reps. Depending on your weight, you would see over time a significant improvement in the appearance of the tricep muscle. Now, of course, another tidbit. I know all these tidbits. The triceps muscle loses strength and tone in women faster than any other

muscle in our body. So, if this is something that you are struggling with or know somebody that is, these are the types of exercise, exercises that you want them doing, I would say two times a week, three or four sets, 12 to 18 reps, and it will help significantly. Now whenever you go down, like this, you're gonna be able to utilize more weight than when you go push up against gravity. Also, I do caution on a single, or utilizing one weight, with the hand here, a lot of times, the hand that's on the bottom, I think, will become the dominant arm, so make sure you don't, you don't let 'em always have to have the right hand on the bottom, or the left hand. And I prefer to do these with two weights versus one so that I don't let the dominant arm take over the work, which is a significant problem, especially in small muscles like the triceps, the biceps. If you don't separate the weight, those, the dominant arm loves to just take over and do the lion's share of the work. Okay, let me take that arrow off. Cardio-strength supersets.

These date back to kind of the origins probably of combined training. Wouldn't work well in athletic training sessions. I think we'll see why, I just, I would consider this to be a more fitness-appropriate modality of training. It's great, has the same benefits of other supersets. It's time-efficient, keeps people moving, great way to increase the intensity without increasing the volume necessarily. So, you're gonna alternate cardiovascular training with resistance training. So, what it would look like in a gym is you're gonna walk or jog on the incline on a treadmill for one to five minutes. That could also be an elliptical. Followed by a set of 10 to 18 lunges for each leg. So, in my example here, I'm utilizing compound exercises with cardiovascular exercises or exercise that utilizes the same muscles. So, if you were to use a paradigm like this for a beginning exerciser, it's pretty easy to manipulate the treadmill. You manipulate the speed, you manipulate the incline, the length. I would suggest lunges as not a starting place for beginning exercisers. The mechanics are tough, and whenever you throw in your lateral exercises into the mix, you increase your volume, but also, it's an advanced exercise, a lunge, to get mechanically correct. So, you might wanna utilize a squat. And

if you have access, you know, you can also get the person on a machine so long as their heart rate's not prohibitively high. You don't want them sitting down immediately if their heart rate's high. But there are other exercises that can be done in the place of a lunge. You're gonna repeat that. Rest as necessary. And of course, modulate your intensity to avoid long rests. 'Cause one thing, when you are trying to include a cardio parameter into a strength set, you don't want to take the intensity down to a level utilizing long rests that you don't benefit from the cardiovascular exercise. And of course, part of that's keeping that heart rate up and sustained for at least 20 minutes. So, this would be just an example. This would obviously be an advanced program because you have a person jumping rope, which, of course, is an advanced exercise utilizing squats.

Now, in this case, whenever you're utilizing a dumbbell, your weight's typically gonna be lower just because what your upper body can hold limits the weight. So, to change the intensity, so, to make this a higher intensity, you're gonna increase, or if you wanna decrease, the incline on the treadmill or other mode of cardiovascular exercise. For me, I've always found incline to be a really good way to modulate intensity before I had to significantly increase the speed, which, of course, is probably what most people think of immediately. But when you do increase your incline, you do change the muscles that are working.

You shift back to the posterior muscles, which, whenever you increase the involvement of the gluteals, which is your largest muscle in the body, your single muscle, you're gonna increase your blood's demand. You're gonna increase your heart rate. So, there's always ways of increasing intensity that go beyond just thinking about speed. I mean, for me, increasing speed, I've seen too many accidents in gyms. I've actually seen someone increase their speed to a point that he could not control it, flew off the back of a treadmill and slammed into a window that was facing onto a sidewalk, which was a super-bad design by that particular facility, but the point being he flew off the

treadmill. And that's not the only time I've seen that. I also saw a video recently at a gym here in Las Vegas, where a guy, it wasn't like something that was supposed to be funny. It was actually a serious video where it was shown to me where the person was on a treadmill that was too fast for him. He fell, fell completely on his shoulder, onto the side, and then rolled off the back, seriously injured. So, speed, gotta be careful. The other place I see problems with speed is on big step mills. Remember, once you set a speed on a treadmill or a step mill, you have to keep up with it, or else disaster happens. Of course, ellipticals are safer in that regard. You don't necessarily have to keep up with it. Let me see, Erin, hold on. Okay, Erin, I'm seeing your question now. Let me just get through this amount of weight, and then I'm gonna pop back over to you. So, increase or decrease your weight. Of course, always your intensity of a strength set is the most popular way to change the intensity. Be wary of speeded modalities of exercise where weight is involved always. All right, I always wanna caution people about speed during weight training.

So, Erin asks, "When documenting circuit training, "do you just state utilize circuit training, "or you need to list out each exercise "and state that"-- I don't, I can't get all the way down, but I can get to "list out each exercise and state that." Erin, I would always, if I were designing a circuit training program, I would document at least which exercises you're using and the major muscles involved. 'Cause that in your head gives you an idea of the intensity of that session or that circuit and what its appropriateness is going to be for different populations. So, if you're utilizing an exercise that has a large gluteal involvement, you know, or quadricep involvement, that that intensity's gonna be pretty high. It's gonna get the heart rate up. It could affect, it's definitely gonna affect fatigue for later exercises that might involve those large muscles. I would also wanna look at and make sure that I was conscientious about incorporating as many novel muscles as I could into that circuit. That's always really important to me when designing a total body circuit is am I utilizing as many muscles as I can during this hour? 'Cause that's what's going to help the general population the most. So, I

hope I answered that. If I didn't, go back and ask me again a little bit later, and I will see it. So, to change your volume, of course, all you've got to do is change your time or change number of reps and sets. And again, remember, intensity and volume inversely related, and the rest periods are going to be related directly to the intensity more than anything 'cause if I'm doing a 45% intensity on the elliptical for half an hour, although that's probably great, I believe the research is showing now, for estrogen levels, so if you have those perimenopausal/postmenopausal clients, there's some exciting new data that's showing longer periods of low volume exercise is effective for estrogen levels. That's, when I get off, I'm not gonna need, obviously, a tremendous rest at 45% to 65%.

So, this would be just a chart you can utilize if you want to. Just change it. Your exercise, your time. Here, we'll go through this. Let me do it it this way. So, your exercise, your mode. Your time and your reps. So, your volume. Your intensity. And go ahead and get your rest in. Now, notice here, I do have zero because on supersets, I will go to zero simply because if the intensity's low enough, volume's high enough, I don't think we need these super-long or any rest. But again, that's gonna, that's-- you need to determine that. So, you choose your cardio mode of choice. Treadmills, ellipticals, step mills, all your lateral trainers, whatever it may be.

Choose how long you're gonna go on there. So, choose your time. Your speed or resistance, of course, is gonna be determined by the individual person. And then, your rest, again determined by these two variables. You have a dumbbell squat here. I just chose it, no real reason. You'll do 10 to eight repetitions, dependent again on the intensity, the exercise, or him or herself. Then, of course, how much resistance. As a general rule, the way that I usually choose resistance is, especially with fitness, is-- and beginning in particular, and it's a, it is. It's a trial and error process. You're in a gym. You have this new client, this new exerciser. Maybe yourself even. You choose a weight looks realistic. All right, if the person can easily, cannot, all right. So, back up, you

choose the weight. If they cannot get to, first of all, if they have trouble just executing initially the one to two, you drop it, obviously. But, as long as they can get to eight or 10 in solid mechanics, you're okay. If they can do 12, 15, 18 super-easy, you have to increase that weight. That's simply just not tough enough. The last two to three repetitions in a strength training environment should always be tough to hammer out, but they should be doable. And that's the real world way of determining weight. And again, you see how, in these charts, I superset three. You can do four. You can do however many you want, but just make sure you're supersetting 'em, and you're, I would say, at least three. So, plyometric supersets are an alternate on, excuse me, you alternate a traditional strength exercise with a plyometric exercise. So, that's, like, a traditional squat with a jump squat. So, plyometric just means something that includes jumping, basically, or explosion in the upper body. You'll see tossing a medicine ball would be considered an upper body plyometric exercise.

Or, like, if you've ever seen somebody doing, if they're laying on a Smith machine and they're gonna do bench press utilizing a Smith machine, they'll pop that Smith machine up. They'll literally push it, let it go, catch it. All right, don't ever do that or suggest to do that with a regular barbell, all right. And you gotta have a spot on that. But that's a plyometric bench press, I think, is what they call it, but that's what that is. So, this would be, of course, an example of-- This is, hold on, let me get the screen thing. This is the traditional exercise. This is the much advanced plyometric version. This is what, this would be a sample plyometric superset workout. Now, if you notice here on these rests, I took the rest period up significantly so whenever plyometrics come into play, you are gonna wanna rest. And you're probably gonna wanna rest even if you don't feel fatigue, necessarily, to require a 30-second rest after the traditional back squat, remember that for the jump squat, for example, you are throwing in an advanced exercise, which, if the mechanics are not executed well, the risk for injury is greater, so, I would caution against in plyometric supersets not including some kind of at least moderate recovery so that muscle can minimally recover, especially in an example like I

have here, this lower body and this upper body. And both these examples, you're utilizing the same muscle, so you do want a minimal recovery. So, here's our reps. See, I took 'em down. Here's our sets, took 'em down too. And again, that's discretionary. So, combined training is doing cardiovascular and resistance training within the same session, all right. So, that's when somebody goes to the gym. You see this probably every day. They do 20 minutes on a treadmill walking, jogging, interval treadmill training, and then they do 20 minutes at resistance training and 20 minutes of flexibility work. That's a really common fitness session.

That's combined training. And it's arguably the most effective training method for weight loss and general fitness. Wendy, "What are the names of those exercises "in the picture?" You're talking here, right? This would be a TRX type. I don't know if it's the same thing, but pushup. And this would be a plyometric pushup. But this is just a traditional. I think it's, if it's not the TRX equipment, it's something similar. Does that answer your questions? Okay, great. All right, so let's keep going. Now, without getting into extraordinary detail into molecular mechanisms of muscle action, the reason combined training is not recommended for athletics is what we know about competing mechanisms at a molecular level, related to muscle performance and outcomes.

The bottom line is strength outcomes, muscle strength and muscle endurance outcomes are different. Muscles know it, and they get confused when you do two competing modes of exercise in a very short time, timeframe. So, what we know is when I do, when I jog on a treadmill for 20 minutes and then run over and do some leg presses, what happens is my muscles don't know which outcome I want. Do I want to get stronger from doing the leg press, or do I want to increase endurance from running? Well, probably has an evolutionary significance. Endurance wins, and strength mechanisms are compromised. So, this is not recommended for athletics. John, you know, when you talk about-- this is John's question. "How much does the energy system used "play into the needed recovery time?" The bottom line is if it's an

anaerobic system, so, a fast or a high-intensity, high-weight, gets that heart rate up really fast, and you only do it for a split second, and that's the anaerobic system, you're gonna need to rest longer. Aerobic systems like I was talking about, like, say, you're doing 45%, 65% on the elliptical, long-term anaerobic activity, you're gonna, probably don't even really need rest unless somebody, that would be somebody that was new to fitness. So, I hope that answered your question. Now, let's just talk about this really quick. You see where I say it's the arguably most effective training method for weight loss and general fitness. That is because the assumption is weight loss and general fitness. The goals are not strength and power. If your goals are strength and power-related, this method, combined training, is a no-no. So, Patricia asks, "So for athletes, you should do cardio "and strength on opposite days?" Yes, absolutely, Patricia, you are on track, and you're a little bit ahead of me.

So, but absolutely, Patricia asks, "So for athletes, "you should do cardio and strength on opposite days?" Absolutely, and actually, the data shows that the absolute minimum time between cardio and resistance training for strength and power is six hours, because we do have a lot of athletes that train two-a-days, so we gotta give 'em six hours, or else the body's just like, well what do you want? I can't figure out what you want. You know, you're doing all these different competing modes of exercise. Muscles are smart enough to know the different modalities. There's a molecular difference, and they just say hey, you know what, I'm going with endurance because I've been exercising for a long time, I guess.

I don't know how they choose endurance, but they do. So, the key difference is that cardiovascular and strength exercises are not done as supersets or circuits as described earlier, but in succession. Like I said, 20 minutes walk dog, 20 minutes resistance, and this is typically a total body method, or paradigm. So, you know, this is really common method to see personal trainers doing with clients, and it's 100% fine. This is a 100% fine method and proven effective for weight loss, general body

composition changes, and, and maintenance, flexibility, functional outcomes. This is a great method so long as power and strength are not what you're looking for. So again, you're gonna see that person jogging on that treadmill, doing these. For more advanced fitness exercisers, doing 20 minutes of total body exercises, functional exercises, that type of thing. Cardio, okay, this is what Victor asks, "So, cardio or weight training first "for weight loss and general fitness "if doing combined training?" Okay, that's a great question, and it's gonna boil down to the person. Most times we do cardio first as a warmup because it's not so prohibitively high-intensity that it negatively affects the mechanics of your strength training. Now, having said that, if your client needs extra attention to form, mechanics, they need to be strong for strength training, it's new to them, or you're going to have them strength train a little bit higher intensity than normal or with new exercises, I recommend doing strength training first.

But for weight loss and general fitness, the old school paradigm of cardio first is fine. And again, that's assuming that you're maintaining a moderate intensity. And it can also be a personal preference. I always wanna throw in a little bit of fitness psychology that personal preferences play a huge role in adherence, they play a huge role in enjoyment, and we only get people to adhere to something they enjoy and that they feel empowered by.

So, when Victor asked, which may be better for weight loss or general fitness, we have some research that we'll follow to make those guidelines, but if you have someone who really enjoys doing one mode of exercise first, or you yourself enjoy doing one mode first, go ahead and do it. The molecular outcomes aren't gonna be so great that it negates the value of that fitness session in general. So, we've talked about general fitness. Complex training, all right. This is an advanced form of strength and conditioning that pairs two biomechanically similar lifts, all right. This original research came out of the Texas A and M football training room, so it is not intended for

beginning or intermediate fitness persons. This is intended for persons who have a strong background, especially in strength and conditioning, who are not in any way recovering from injury or anything to that effect or even overtraining, so you wanna make sure that you understand this is for advanced fitness persons who are in good health at the time of implementing the method. Now, what differentiates this method from other training is that one exercise is a moderate to heavy weight conditioning lift. Think of it as a preparatory lift. It's a moderate to high-intensity, while the other exercise is a plyometric drill. What is differentiating from what my supersets were doing is this. In a football training room, this is normally a heavy-weighted squat deadlift or some other all-body power exercise.

So again, this is great for athletics, and this is great for those advanced fitness clients, fitness enthusiasts, recreational athletes, but we wanna make sure we're being smart about how we apply it. So, here is your conditioning lift. The squat, of course, always going to be your king of exercises simply because it's going to release human growth hormone and testosterone into the system before the remainder of the strength and conditioning session is implemented. So, you have that free-floating hGH and testosterone to help you get those strength and power outcomes. Again, these were our examples of a conditioning lift. Squat, deadlift, bench press.

Little less likely, but it is considered a power lift. And you can also be in with very advanced persons using Olympic lifts, like a press pull, clean and jerk, that kind of stuff. So, explosive lifts. What are examples of explosive lifts? We had this earlier. We had the guy doing the plyometric pushup. This word depth is where they do 'em downwards, so his feet would actually be up here. Cycled split jumps, that's just like jump lunges, but changing feet. Remember that Smith machine explosive press I talked about? That's doing a bench press with a little pop. And of course, proverbial jump squat. This style of training is designed to improve muscle strength and muscle power. So again, this is an advanced method with persons with specific muscle

performance outcomes. Here would be an example of a complex training spot. So, the conditioning lift is the squat paired with tuck jumps, and that's just where you're doing a jump squat, and then you tuck your knees, and touch your knees, bring your knees up, tuck. You're gonna repeat this three to four times. And again, you see this called plyometric drill, and you see it called explosive lift. It just kind of depends on the form. That's the same thing. But what's happening is the back squat, the dead lift, the bench press is priming muscles for the explosiveness. That's why this paradigm is called a conditioning lift. Here is that example. Now, this is obviously a very heavy squat. It is typical to this type of training. And in her example, she's doing a single-leg vertical jump. Again, an advanced exercise combined with another advanced exercise, so that's just, you wanna definitely keep that in mind.

The other thing to remember is, I've already gone over this, but then, you have to have mastered exercise mechanics. So, even, let's say the person believes that they're an advanced exerciser, but they wanna use a deadlift, and their deadlift mechanics are off. This is just not gonna work. So, make absolutely certain that you put your foot down and, and choose your exercises carefully. So, establishing readiness, I won't go over this word for word, but it is there for you. You do want to establish readiness before the person actually engages.

So again, this is not a general fitness where we're just kind of, we can go in there and have it, play around to get our weight right. We wanna make sure before we even suggest that that we have measured upper body readiness, or the strength readiness, excuse me, so, you have lower body strength and upper body strength readiness. Speed readiness, that goes into the explosiveness. So, you have your lower body and your upper body. When you choose your resistance, and this is where you would use a medicine ball because what happens is a lot of times, when you delve into these training methods, you'll see resistance ball presses and passes and that type of thing. You wanna make sure in general that the ball is heavy enough to slow the exercise but

not so heavy to reduce the range of motion to something that's not representative of a full range of motion or near that. And the ball must not be so heavy that it makes it difficult for the client to control the ball for at least five reps. So, that's your key there. Let me see. If you don't have-- okay, this is from John Jordan. "If you don't have access to Olympic weight equipment, "would a single-leg squat, possibly weighted, "be sufficiently in-- would be sufficient intensity?" And I guess you're saying for the conditioning lift. I can't see the bottom. You know, right off the bat, John, my thought on a single-leg squat, boy, 'cause I guess you're talking about a pistol squat, that's a tough exercise.

Now, if you can execute that with full range of motion with right, correct mechanics and weighted, yeah, you're like a superhero, so that might be enough for a conditioning lift, but I would really rather you think, in terms of a conditioning lift, bilateral versus unilateral. If you were really to delve into the research, and the lead author on that is Carter, and he-- Carter and Greenwood. And they're at Texas A and M. I believe they're still there. And you, they have in their paradigms, exercises listed, I don't believe I've ever seen a single-legged exercise, just because it's not gonna ever yield the same intensity as a bilateral exercise.

So, that's just my thoughts right off the bat, and I hope that helps even though I couldn't see the full question, but pose it again if you need some additional help. All right, yeah, this is just those upper body plyometrics, where I was talking about the kneel, with the use of the medicine balls. You have a kneeling ball pass, medicine ball pass, and these are really good starter plyometric drills. The intensity's relatively low. The risk of injury, of course, is lower wherever you see something where you're kneeling, where it's just an upper body, you're gonna be better off. Once you've established that lower body strength, it balances, and it is you always want your balance with plyometrics 'cause you got a landing force. You know, you're getting off feet. Jump squat and jump to reach drills are good starting places. So, a sample

routine would look something like this. I've got an upper body one here, with the medicine ball chest pass alternated with dumbbell chest press or fly. This might not necessarily quantify as the conditioning lift as I defined it earlier. So, I would probably change that to just traditional bench press, no dumbbell, although this would be a good starting place. And then, a simple progression strategy is after two weeks, add the fourth set of 10 to 18 reps.

So, you're gonna do three, then add that fourth. Training load, all right. Bottom line, your load is your frequency volume, so how many days a week, how long, and how hard over time. And always remember when working with athletes and general fitness enthusiasts, this includes time in competition, and this includes time also in the gym that they're not with you. So, your external training load measures the amount of work done during training and competition. It's quantified by those variables we've been talking about: mode, frequency, volume, and intensity. They're indicators of how hard you're working. On a more specific level, they're indicators of strength, power, speed, and acceleration. All right, internal describes your body's response to what you were doing back here.

When you measure, it's gonna look like things like heart rate, blood lactate levels, oxygen consumption, and that very subjective rate of perceived exertion, but rate of perceived exertion is important, especially when it comes into overtraining, or rhabdomyolysis, and it varies day to day and over time, so, how somebody feels today is gonna affect how they feel training, and they're gonna feel different tomorrow. Stress, lifestyle factors, et cetera. Overtraining, so what happens? Breaks down the body's natural defenses over time. This is a chronic event. This is not something that happens in a week. It affects the mind and body. It is highly counterproductive to general fitness outcomes and of course athletic outcomes. It can be dangerous and lead to injury, even death. So, here is your symptoms of overtraining. I won't go through each of them individually, but what it just does show you is it affects almost

every aspect of your body, your mind, and your quality of life. Unfortunately, the only solution is rest. And yes, I've researched this, and yes, I've tried to come up with another solution that doesn't require rest because that was not what I wanted to hear. Rest required for full recovery can vary from days to months, and it depends on the severity of overtraining and its symptoms and then the disappearance of those symptoms, so if you've gotten to the point where you've pulled an ACL, you're clearly gonna have a very long recuperative period. If you're just oh gosh, I just feel tired and sluggish today, you might be okay with taking a week off. So, it just really depends, I think, on how long it goes on. And of course, then if it goes on long enough, would you get that injury?

And it wasn't one of the, the symptoms I personally find the most disturbing, if we were to go back and look at those, that nobody really wants to talk about, especially in athletic environments, is depression and a loss of interest. People can't talk about, if I'm on a scholarship, I've lost interest in playing volleyball, if I'm on a volleyball scholarship. So, just keep those things in mind if you start to see them. Know this, you know, of course affects school performance, that type of thing. So, overtraining is chronic. It takes a long time to get there, typically. Rhabdomyolysis can happen this afternoon to you if you were to do something really crazy.

So, rhabdomyolysis is characterized by the breakdown of muscle tissue that causes the release of muscle fiber contents into the blood. This is a test question, so make sure you get that. It causes the release of muscle fiber contents into the blood. Obviously that sounds, doesn't sound good, and it's truly not. It can be catastrophic. The difference between overtraining and rhabdomyolysis, of course, is although it's acute, it's easily avoidable. When it has been brought to my attention, in particular in a collegiate training environment, I, like most people, are disgusted because this could have been easily avoidable, or was easily avoidable. There's really no excuse for it. So, who is at risk? And again, I know this is a test question. People new to exercise.

Detrained and deconditioned persons. And highly trained persons. Because the key here is this, excessive. Different levels, different people define excessive differently, but if you exercise to excess, you are at the risk for rhabdo. A training example is 100 repetitions of lunges, followed by 100 pushups and 100 squats. And yes, that sounds preposterous, but people do this craziness, and then they'll do it a few times, and that leads to rhabdomyolysis. That is how you get it, and that is a test question. Now, I mean, think about rhabdo, is it likely to be too much or too hard? Rhabdo is typically just too much. If you look at this, you're not gonna obviously be doing heavy weighted 100 reps. It's typically, it's just too much.

It's just overdoing it, excess, poor decisions. When we talk about rest periods, it is an active programming variable. It takes on many forms, including within sets, between sets. Within sets means between repetitions. So, between sets, hours, and days. It can be active, and it can be relatively passive. However, in either case, it's the mechanism of recovery and muscle growth and performance gains. So, rest is a real important variable that is active in the mechanism associated with muscle growth. If you don't give 'em enough rest, they can't grow 'cause remember, by default, to get 'em to kick in those growth processes, you gotta break 'em down, but you then gotta give 'em a little bit of chance to rebuild. You can't just keep breaking 'em down and expect them to miraculously rebuild in timeframe that they just can't do it.

So, programming rest. We're looking at 24-hour cycles. Intermittent rest, which is just the use of 24, or look at, I would say this. Looking at every single day in the 24-hour cycle, and when you utilize intermittent rests, utilize every other day rest. Don't-- so that way, you stay on the 24-hour cycle versus getting into a 48 and beyond cycle. Rest while training includes inter-sets, so that would be those between sets, or intra-set, which is within sets, and that's, again, that can be as little as between reps. And we're gonna talk a little bit about those lower and upper rest limits as well. So, why 24 hours? This is really important. All of your body systems are on a 24-hour cycle

governed by the master clock in the brain. Muscles are on a 24-hour cycle as governed by the master clock and what we now know are their internal muscle clocks. So, this is the first time today that I've mentioned muscle clocks. Muscle clocks, I'll see if I've got it here. Ah, perfect. Well, let me, let me tell you this really quick just why I'm interested in this and why I'm bringing this up. I did recently release a book on this topic called "Timing Resistance Training: "Programming the Muscle Clock for Optimal Performance." So, muscle clocks are relatively new to us in athletics and fitness and rehabilitation. In Europe, they're, well, a little less new. Let me see, Allison, I'm gonna answer this for you. Allison has a really good question. "How do you differentiate between 100 lunges, "all done together, "and 10 to 18 lunges times two to four sets, "times three sets?" Hold on. Is that an extra set in there? "When looking at loads related to overtraining," Allison, typically, okay, so, there was, I'm gonna address this in a little bit different way because I know what you're getting at. It's more, so I'm gonna address this with a recent tragedy.

The University of Oregon was recently sued by a few football players who were subjected to very, very, very high volume training programs that resulted in them, on the spot, urinating blood, which is a cardinal sign of rhabdo, and then led to some more significant health problems. During that particular training session that they believe led to the significant health issue of urinating blood, the athletes were doing situps for, like, an hour, or something. It was something so ludicrous that you and I would find it hard to believe except for some people who've been in that culture who just, people get outta control, and they just keep going on and on and on, but that wouldn't get you out of the consequences, so in that case, it was this extreme volume, like situps, pushups for an hour, something really outrageous like that. That example is rhabdo. I see Allison, that you answered that's related to alternating between strengthening exercises. In the rhabdo example, they'll do 100, 100, 100, and go back and do 100, 100, 100 and a different exercises over and over for maybe like 45 minutes, 'cause I don't think just 100, 100, 100's gonna lead to rhabdo. This typically is

something that's executed for around 45 minutes, whereas a typical training paradigm of 10 to 18 reps over four sets, is not gonna equal that. So, I think, Allison, I see you got it. Thank you, yeah, sure. Glad to help. So, going back to muscle clocks, so, timing's a big thing. Now, when we talk about anything in the strength training world, we like timing now, and we know now because muscle clocks exist, and University of Florida myology lab does most of the work, I think, in the US, on muscle clocks, so what is a muscle clock? It's an internal clock inside each of your over 600 skeletal muscles. Wow, so each muscle has its own clock made up of proteins. They regulate muscle action according to environmental changes, yeah, so muscles are pretty smart. We now know that. They can figure out the time of day. That's the big thing when it comes to timing.

They can figure out the time of day. And they can figure out exercise training and programming cues. Bottom line is they're looking for cues, and if they're made up of proteins, you better believe they're playing a huge role in muscle performance 'cause protein, of course, is what we need to build them. So, muscle clocks keep time for your muscles, telling them what to expect and when. That's the key, all right. They're gonna figure this out, all right. They're gonna figure out what time it is, and this is the clencher, muscles can figure out what you want them to do and when if you provide them with consistent cues.

They let your muscles know when to expect to train versus rest and recovery, so muscles are smart, and if you work with them and you give 'em the right cues, you best believe that's how you're gonna get the most out of 'em. So, how do they work exactly? They keep track of 24-hour cycles, just like that master clock. They monitor specific cues that they get from your environment and your body throughout the day to optimize muscle performance. What are some of these cues that a muscle clock is looking for that you can give 'em to help 'em perform? Light-night, all right? Just like that master clock in your brain that's responsible for biological clock, your circadian

rhythm, causes jet lag, they'll figure out light and night cycles with the help of the master clock, so they'll figure out what time of day it is and when to click on associated actions associated with training or muscle performance in accordance with that cycle of light-night. They are looking for hormone levels, all right. So, testosterone, 8:00 in the morning, it's the highest it's gonna be. Levels off, all right-- no, maybe it's not the highest it's gonna be. I don't know, it might be. But at any rate, at eight in the morning, testosterone is pretty high. Remains that way throughout the day. By about four to six, it levels off. It's not gonna rise anymore. In fact, it's gonna start dropping in preparation for sleep. So what muscles figure out are those changes in hormones on a daily cycle. Same with hGH and cortisol.

They're watching those hormone levels and getting ready to work in response. But of course, hGH and testosterone, you want high. Cortisol, you want low. They're watching your activity-rest patterns. That's why you gotta exercise at the same time of day every day. They're watching your eating habits. They wanna know, in accordance with the nutrition that they're getting, when am I supposed to click on these mechanisms? They're watching muscle pliability that's the highest between four and six p.m. Pliability's flexibility, the ability to stretch. They're looking at exercise programming cues, so, like, the type of training you're doing, they know, and like we said earlier, they know between running and strength training.

They know the difference. And actually, those two types of exercise need to be done at different times. Like you're gonna run, do it about 10, 11. You gonna strength train, you wanna get stronger and faster, four to six p.m. Timing of training. So, "muscles use cues to learn to anticipate "what happens when, like resistance training," 'cause that's my big thing. So, it's always gonna-- if I'm gonna say something, it's probably going to be resistance, right? "And in response turn on the molecular events "associated with muscle performance outcomes ahead of scheduled training." So, how do we know this happens, and I'm not just inventing this? I just haven't decided I believe this happens,

no. You know how we theorize this happens in humans is because data collected on elite racehorses showed that when they were monitored over a certain period of time. I wanna guess around six. That's pretty standard, six weeks. Muscles, okay, so, the racehorses always trained at four, all right, four p.m. What they found is muscles turned on the molecular actions associated with muscle performance outcomes like size, strength, and power at 3:30 in the afternoon. So, with the right consistent timing cues and consistent mode of exercise at that time, muscles will click on 30 minutes ahead of time the molecular events associated with muscle performance, and that's huge. It's probably one of the most significant things we have ever seen in regard to sports performance.

So, what that means to you is you've got these muscle clocks. You've gotta give 'em the right timing cues, and if you do, they'll learn to click on in advance the molecular actions associated with muscle performance, but you gotta work with 'em. You gotta give 'em those cues. So, how do they communicate? I mean, how would we know that they're working and then communicate within the muscle and between muscles even between systems? So, when a muscle contracts, myokines are released. These are little chemicals.

When these are released, and this is consistent muscle contraction, not just one or two. It relays the cues about timing of exercise to the muscles and other structures like ligaments, tendons, bones, who also have their own clocks to anticipate upcoming workout sessions and improve muscle performance, okay? So, the myokines are telling everybody, "This is what time of day this is gonna happen, you guys." And over time, by utilizing the clocks and the cues, muscles will learn to anticipate time of day of exercise. The time of day of training should be goal-dependent, type of training dependent, lifestyle dependent, and consistent. All right, so what I'm saying to you here is that although athletics would be the most obvious application here, individual goals play a role, but lifestyle plays a role as well. So, if you can only train every day at

11, just be consistent that you're training at 11. Don't bounce around. Nancy, I don't know. This is Nancy's question, "Were the horses trained "at four p.m. time for study? "Racehorses typically train between six and 10 a.m., "however, race in the afternoon." I don't know that much about racehorses and what I would guess is what you're saying, the rest of your question is they typically race in the afternoon, and maybe that was why they looked at the four p.m. The data was probably, the four p.m. was probably to best correlate with humans who have greatest muscle pliability between four and six p.m. as to why you see most people do strength training paradigm activities at that time. Most collegiate level athletes train, do strength work also around that time. Probably to correlate with that, first of all. It's probably what I'm thinking. Even if they did manipulate the training schedules, and they could've been retired, I don't know. I can't remember, I-- right off the top of my head, those particular methods. How has-- Victor says, "How has CrossFit "not come up yet?" Because legally, we cannot mention specific franchises.

So, Victor asks, "How has CrossFit not come up yet?" And the simple question is to avoid liability, we cannot discuss, positively or negatively, CrossFit. All right, let me... Oh, Steve asks-- this is a good question. "What is concurrent training?" Concurrent training, concurrent training is combined training. It's another word for combined training. So, concurrent training is when I do strength and cardio training in the same session. Industry interchangeably uses those. Cathy asks, "What are other symptoms of rhabdo?" The main one, Cathy, once it's developed, is that blood in the urine. I mean, that's the most tell-tale sign. Off the top of my head, other than what a lot of times, I believe will look like heat stroke. The stop sweating, the whiteness, paleness to the face. I believe a drop in blood pressure, possibly. That's what I can think of off the top of my head. As those acute signs, of course, you're gonna have muscle fatigue and those types of things, but if you are more interested in rhabdo, there are some great resources out there. I can't remember if I actually put some of 'em in your handout, but if you Google rhabdomyolysis and look at, you know, primary journal articles, there's

gonna be a lot that comes up that will help you on those. Timothy ask... The way that I see these questions, unfortunately, is they'll bounce around. But let me get Steve's question deleted, so I... So this is Timothy. "So, should more emphasis be placed on when the client "is typically more active? "Sometimes scheduling is difficult to me." Okay, so, Timothy, yes. I would agree that scheduling is tough, especially with people in the real world, to always get them on a schedule, but I would, so you should-- "So, should more emphasis be placed on when the client "is typically more active?" Yes, if your client has a fairly established active-rest pattern. So, for example, I'm typically up seven. I'm pretty active throughout the day.

I don't like to train in the evenings because I like to start to wind down six p.m., and I just don't really like evening training. So, I've always been one of those people that trains around 11 a.m. Might not be the absolute ideal, but I've always enjoyed it, and I've done it for 30 years. So, if you have a client with general fitness needs, I think first look at their activity, natural activity-rest cycle or period, personal preference, and willingness to be consistent. You just have to be consistent, I think is the number one question, or number one thing that you have to do. Stacy asks, "What nutrition recommendations do you have "in terms of grams of protein per day, "recovery drinks, et cetera?" Okay, Stacy, I will say this, I defer, and this isn't, it just isn't here for physicaltherapy.com, just anywhere, I do defer all nutrition questions to persons who are experts in that area.

So, I-- I can't answer those questions simply because it's outside of the scope of my practice. And I'm sorry. I feel bad. Alexander, the intent of an intra-set rest period is to provide minimal recovery to a muscle. All right, Wendy, yes, we went over complex training. That was a little bit earlier, with the programming methods. Time of day recommendations, these are kind of fun and specific. Cardio in the morning, sport specific or mind-body work midday, and strength and power training, four to six p.m. These are our testosterone levels. This is simply why we see that four to six p.m.

recommendation on power and strength training. Muscle pliability is strongest four to six, or is greatest between four and six, meaning they're the most flexible, which means they can exert the more, most force because a slightly stretched muscle beyond its resting length is going to produce the most force. And Ulysses asked, "Does the clock signal DOMs "if you don't exercise the next day with the same time?" I don't necessarily know if the clock will signal DOMs because it's not a regular signal, hopefully. If you don't exercise the next day with it at the same time, just in general, you can take that day off. You might want to do an active recovery, something along those lines, but DOMs would not be a regular cue, so it wouldn't be established as something the clock is looking for. It's not a clock regulator.

So, intermittent rest is something I just strongly recommend two days per week on non-consecutive days to stay on a 24-hour cycle. One thing that I've always cautioned against and now with the clocks better understand why is staying on a week-on, weekend-off. Once you get into taking two days off, your clock's getting off and also, we're getting into those upper rest limits. So, this is just a sample routine you can utilize. Day, time, resistance training, utilizing intermittent rest. So, we've talked a lot about 24 hours. We wanna talk a little bit about rest while training. So, we have between set and within set.

The question is, if you rest a little bit between the set, is it gonna have a greater yield than, say, if you do 10 or 15 reps consecutively and then rest? Let me see what I wanna go through here. Here's that question I was asked earlier. "Intra-set rests provide the muscle with minimal "recovery within a set." Okay, so if you can recover within a set, this should result in greater strength and power improvements, and it allows for greater focus on mechanics and range of motion. So, when you look at cluster sets, so that's like doing eight sets of five repetitions each versus traditional sets, which are like four sets of ten, so in this case, a cluster set is, think of it this way. This might be a little bit easier than the way I have it here. If you have a set of 10, in a

traditional way, you do four block sets of 10. In a cluster set, you would do three set, three reps, three reps, four reps. So, they're gonna measure output on a bench press to see which one works better. The bottom line is, because I've looked at this data a lot, is that the intra-set rest breaks, so, doing, like three, three, and four, versus 10, resulted in greater strength gains and power output than longer rest breaks and more repetitions. So, what that just says is if you do give that muscle minimal recovery within a set, it performs better. You get stronger and, if you're looking for power or mass, they're gonna be greater.

So, that would be-- this is just an example of a block training cluster set. Reps, sets. With this next one, we talk about redistributed rest. This is how I train now, and I think it's one of the most interesting things going, which is just basically, what you're gonna do in redistributed rest, is you take equal rests between each rep, and this is where it got up to 36 reps that I was talking about earlier. I'm not gonna go into all these methods. You guys can look at those individually. But the bottom line is when you do a set of, like, a longer, a greater number of reps, like, up to 36, the research'll use. the muscle performance is superior.

So, what you would do is do 36, and I know that sounds huge. I'll take it down to 15. I mean, excuse me, to 18. I'll split it in half. But what they'll do is take a six-second, up to six-second break in between each repetition. And all that does really is it gives that time for that muscle to recuperate, maintains your mechanics, and it really mimics on some level, powerlifting. So, the bottom line is is that redistributed rest indicates that when total rest time is redistributed over each repetition versus between sets, the kinetics and kinematics of each exercise repetition is more constant, which improves your muscle strength and power results. Those are your definitions in case you need to review those. Here's a sample RRT. Up to 32, I mean, 36, big. 80% and again, rest between each rep is dependent on the intensity. Rest and lower/upper limits. Forty-eight hours after high-intensity exercise particular strength to return to baseline

levels of strength, okay? That's really important, but remember, so, if we did a really heavy leg day, and the muscles are sore, we need 48 hours, but we can also do active recovery like swimming, or some very, like, upper body, low intensity exercise, something, or even train upper body. This is important. Length of recovery should not exceed 96 hours. After 96 hours, detraining occurs, so all those hard-fought gains, all those molecular mechanisms began to essentially fall apart. Hold on, Lisa, "Are you doing 36 reps with rest between, "and that is the only set you are doing?" Okay, so, Lisa, yes, in the resource, they use 36 reps, and I do that with leg presses, squats. I mean, it's a killer. You rest as necessary between, and equally between, each rep. Now, I will time myself between four and six seconds, typically, because I'm not lifting extremely heavy.

This can go up to 10, even 60 seconds. Yes, that is the only set of that particular exercise that I will do if I'm doing 36 to avoid overtraining. Now, I will, however, do other exercises in succession for this same muscle or muscle group. So, I might do 36 leg presses and an icarian, a piece of equipment, which is an advanced leg press, and then go and do 36 reps in a seated machine leg extension, which is a much easier exercise, or do that same leg press, and then go to hip abduction.

So, there's a lot of ways to do it. So, Lisa did ask me, "What did you say "the name of your book was?" I believe I listed it in our references, but it's "Timing Resistance Training," so it talks more in detail about all these timing things that we're talking about. So, Paul asks, "Do you let go of the weights completely?" Okay, this is a good question, Paul, 'cause this is time and tension. So, Paul says, "Do you let go of the weights completely, "or hold it in the start or end position?" Well, you're not gonna, you-- say if you're doing that 36 paradigm, 36 set repetitions, and you're doing something with free weights. You have a choice. You can hold onto those free weights. Say they're bicep curls, not as high intensity. And just be in a rest position. But, if it is a higher intensity, then you're gonna want to put the weights down and reconvene, but

it's gonna be quick. So, kind of, I think it's a specific exercise related, and an intensity question. When I do it under a rack, I stay in tension. When I do it in leg press, I stay in tension. When I do it on a leg extension, just by default, I can release tension at the bottom. So, I hope that helps. Joanna, that's an excellent question. Joanna asked, "How do professional athletes "deal with muscle clocks and different game times?" That's a huge question athletic training in general, is how do we deal with performance at different times and we haven't, we can only control the practice at this point. Jet lag will always be a factor on different time zones for athletes, so at this point, we're focusing on training times and muscle clocks, and then it would be determined down the road how we could deal with modulating competition times.

Hugo, yes, concurrent training is the same as combined training. Those are the same mechanism, or the same types. You know what, you guys? I have had so much fun. As you can tell, I love what I do. I absolutely enjoy more than anything doing these webinars, talking to you guys about strength training, but we're running out of time here. I've got, I know, a lot of programs for you guys in terms of strength training program. I just wanna-- we have a routine for bilateral, lower-body exercises, look at that. Look at the routine for lower-body exercises with upper-body exercises, agonist/antagonist paradigm, the pair training method, pairing biomechanically similar exercises, so two exercises that similar or same joint action or similar or same muscle action, or they-- that would be the same. You can't have, you can't have similar joint action and not have similar muscle action. This helps us with overtraining because it plays on volume, okay? Instead of just doing more, we get a little bit smarter and overload you in a shorter amount of time. Here's a paired routine for upper body exercises. Mixed-intensity training, I've thrown in here for you guys as well, which just basically means that you use different-- let me just really quick, let's see where it's at. That you do a single high-load set at 80% and then progressively drop the weight down to 30. If any of you are familiar with the gym culture, that is just a fancy way of saying drop set. And Laura, and mixed-intensity sessions are really effective simply

because you overload that muscle on the front end and then just work it through endurance on the tail end. Might not be your best for strength and power. Definitely a good endurance. Look through this about your strength games are negatively impacted. So, if you're doing your cardiovascular programming, you've got some methods here to include. Sorry I didn't get a chance to go into this. And Rebecca, "How do we determine the 80 or 85%?" That is typically-- it's either done through a 1RM max test, or if you Google how to determine 1RM or estimate 1RM, some sub-maximal measurements will come up. And because if you're gonna do it the real way, you do it to failure, like under a bench press, which is not-- you can't do that with normal people. So, here are our wrap-ups. Here are the references that I provided for you guys if you need any more. But again, I thank you for your time and attention here and your commitment to the profession and to the content, and hope to see you again in another event, so thank you very much. Oh, thank you, Lisa!

- [Fawn] Thank you, Doctor Ashmore, for such a great talk. Many people are logging in, saying-- or actually, commenting they learned a lot, and thank you so much. I hope everyone learned a lot today and you join us again on physicaltherapy.com and continued, and I hope everyone has a great rest of the day. Thank you very much.

- [Amy] Bye bye, everybody.