HOW TO MANIPULATE REST INTERVALS TO MAXIMIZE STRENGTH TRAINING EFFECTIVENESS

AJ MORTARA, EDD, CSCS,*D

The typical personal training session lasts one hour, including warm-up and cool-down. Some clients have even less training time due to travel, wardrobe changes needed for work, etc. Therefore, personal trainers must be efficient, accomplishing as much work as possible, in a narrow, often sub-optimal time window.

A common strategy is to increase training density (minutes of work divided by total minutes in a session) by decreasing rest intervals between sets. However, this may not always be the best strategy. In fact, numerous articles have been published indicating that longer rest periods between resistance exercise sets may produce better strength and hypertrophy outcomes (3,4,7). This article will review the latest evidence regarding optimal rest intervals, and the science behind them. Alternative time saving strategies will also be examined.

IS 60 SECONDS OR LESS REST BETWEEN SETS GOOD?

Exactly how long a client needs to rest between sets is dependent upon numerous factors. Some of these factors include age, the type and intensity of the exercise performed, the total accumulated fatigue of the client, and a client's training experience.

Perhaps the most crucial factor in determining rest interval length is the type and intensity of the exercise performed. Core movements, which recruit large amounts of muscle mass, such as squats or deadlifts, require longer rest intervals. Research literature suggests a minimum of two minutes or more between sets, with as long as five minutes being acceptable (3,6,7). For accessory, or single joint, movements, such as biceps curls or calf raises, rest periods of 1 – 2 min are likely sufficient for most populations.

HOW SLEEP AND STRESS SHOULD IMPACT REST INTERVALS

The second most critical factor is the total accumulated fatigue of the client. This is a difficult factor to quantify and largely out of the hands as the personal trainer. Factors which contribute to cumulative fatigue are sleep, stress, and diet. It is well known that sleep quality and quantity impact exercise performance (1). Therefore, on days when clients are exhausted from poor sleep quality, an increase in rest interval is warranted; a decrease in training volume and intensity may also be necessary. Stress also plays a major role in exercise performance (9).

Many clients live busy, stressful lives, which is often reflected in the gym. For example, training loads and volumes that were manageable last week, can become exhausting or even impossible this week due to stress from work or home. It is the personal trainer's job to observe and react accordingly by lengthening rest intervals and potentially altering the session plan.

NUTRITION AND REST INTERVALS

The impact of diet on exercise cannot ignored. Most training clients have a weight loss goal and employ calorie restrictions, even on training days. This is an important consideration when determining rest intervals. Diet counseling with clients is beyond the scope of this article; however, if clients are on a steep calorie deficit, they may benefit from longer rest intervals between sets. This is especially true if they are on a low carbohydrate diet, which will impair both performance and recoverability (10).

It is important to note that all of the above factors and their impacts are subjective. Determining how long the rest interval should be for a given session will be a combination of client self-reporting and the personal trainer's observations during the warm-up and initial exercises.

TRAINING AGE AND REST INTERVALS

Another factor, which complicates the discussion, is the experience level of the client, often referred to as "training age." Training age can impact rest intervals in a variety of ways. Clients with a low training age (i.e., beginners) are usually not able to safely sustain high training loads. Therefore, their programs tend to utilize more accessory movements, have fewer multi-joint lifting movements, and are performed at a lower intensity.

These programs can take the form of circuit training and involve very low rest intervals (about 30 s) (6). As a client develops and shifts towards hypertrophy and strength programs, their work capacity increases, as well as their fatigue tolerance. This leads to more multi-joint lifting movements, heavier loads, and longer rest periods (2 – 5 min). A personal trainer will have to use their judgement to determine when these shifts can occur within the greater framework of the clients' program.

ADJUSTING REST INTERVALS EACH SESSION

With so many factors impacting rest interval length, it becomes clear that a client-to-client and session-to-session approach is best. Adjusting programming on a session-to-session basis, based on performance, or perceived capacity is termed "autoregulation" (3). This can be accomplished in a variety of ways, using both quantitative (e.g., monitoring heart rate) and qualitative data, (e.g., using rating of perceived exertion [RPE] or repetitions in reserve scales). The goal is to tailor microcycles and mesocycles to client abilities by balancing fatigue and performance. Autoregulation is a far-reaching concept that applies to training volume, intensity, rest intervals, and exercise selection.

Applying autoregulatory principles to rest interval length involves assessing a client's fatigue level and lengthening or shortening the interval accordingly. There are a few fatigue factors to consider: cardiovascular, local muscle, and mental fatigue. Unless a client has a specific cardiovascular goal that is being met

during resistance training, high heart and breathing rates are not beneficial, and will negatively impact future set performance. Poorly trained clients will likely require additional rest time to allow for cardiovascular recovery. Monitoring heart rate during sessions can help quantify these needs, but subjective report from the client is also satisfactory. Rest intervals greater than three minutes are likely required.

MUSCULAR FATIGUE AND REST INTERVALS

It may seem obvious, but local muscle fatigue can also negatively impact successive set performance. As a result, rest intervals often need to be lengthened on successive sets to ensure full recovery; for example, a two-minute rest after the first set, three minutes after the second and so on. This is not limited to the agonist muscles only, synergists and stabilizing muscles must recover fully prior to successive sets.

In addition to muscular fatigue, mental fatigue will also limit performance. In essence, if a client does not "feel ready," regardless of their physical readiness (e.g., muscle soreness), additional rest is required. Mental preparedness allows for a greater focus on movement technique and muscle contraction; this is referred to as the "mind muscle connection" and has been shown to improve exercise performance and adaptations (8). Therefore, the ideal recovery interval is long enough to substantially decrease heart rate, eliminate local muscle fatigue, and restore mental focus.

HOW TO USE AUTOREGULATION FOR REST INTERVALS

While research on autoregulation does not suggest a specific minimum or maximum rest interval, it is important to balance the need for rest, with training density and client time constraints. A reasonable strategy is to assign rest interval lengths within the 2 – 5 min range established by research, and then autoregulate within that range.

USING SUPERSETS AND DROP SETS

If time constraints still inhibit a client's ability to complete their program, other time saving strategies, such as supersets and drop sets, can be employed to maximize efficiency. Supersetting involves performing two exercises back-to-back with no rest between them (5). A common strategy includes pairing agonist and antagonist movements such as a chest movement followed by an upper back movement or a quadriceps movement followed by a hamstring movement. Table 1 shows a sample total body superset program.

Another common time-saving strategy is drop set training. Drop set training involves performing multiple sets of an exercise, reducing the load on each successive set with no rest interval between them (5). For example, a client may squat 225 lb for their first set, 185 lb for their second, and 135 lb for their final set. Obviously, fatigue will be high, and therefore a long rest interval may be needed upon completion. Load reductions will vary based on client tolerance and total volume per muscle group, however, researchers have recommended 20 – 25% (5).

Evidence suggests that both supersetting and drop setting are effective at developing muscular hypertrophy and strength (5). However, it is unclear if they are as effective as traditional straight sets. Ultimately, it is likely a tradeoff: training more muscle groups with less volume per muscle versus training fewer muscle groups with additional volume per muscle.

TABLE 1. SAMPLE TOTAL BODY SUPER SET PROGRAM

Chest press		Bent-over rows
	Rest	
Shoulder press		Lat pulldown
	Rest	
Biceps curls		Triceps pushdowns
	Rest	
Leg press		Romanian deadlift
	Rest	
Calf raise		Anterior toe raise
	Rest	
Ab curl-up		Back extension

Note: Perform both movements back-to-back, completing an autoregulated rest period between sets

CIRCUIT TRAINING CAN BE AN EXCELLENT ALTERNATIVE

Clients with a low training age often struggle with supersets and drop sets due to their low fatigue thresholds. Furthermore, they may struggle with higher relative loads due to their lack of neural recruitment. Therefore, the use of circuits is an effective time-saving alternative for those not ready for more traditional strength training. Circuit training is the systematic completion of movements with little to no rest between them, which is typically more cardiovascular in nature and not ideal for muscle hypertrophy or strength. However, clients with a low training age are very sensitive to training and will likely show substantial benefits from this form of training. After a base of general physical fitness is established, through circuit training, they can be transitioned to any of the aforementioned strategies. A sample total body circuit program is provided in Table 2.

QUALITY OVER QUANTITY

In summary, longer rest intervals (three minutes or more), are likely superior for strength and hypertrophy, with an autoregulated approach being optimal. Therefore, personal trainers should consider a quality over quantity approach, choosing longer rest intervals, with a lower overall training density per session. Employing techniques such as supersets or drop sets can be appropriate and effective strategies to save time.

REFERENCES

1. Dolezal, B, Neufeld, E, Boland, D, Martin, J, and Cooper, C. Interrelationship between sleep and exercise: A systematic review. *Advances in Preventative Medicine* 1-14, 2017.

2. Greig, L, Hemingway, BH, Aspe, R, Cooper, K, Comfort, P, and Swinton, P. Autoregulation in resistance training: Addressing the inconsistencies. *Sports Medicine* 50: 1873-1887, 2020.

3. Grgic, J, Lazinica, B, Mikulic, P, Krieger, J, and Schoenfeld, B. The effects of short versus long inter-set rest intervals in resistance training on measures of muscle hypertrophy: A systematic review. *European Journal of Sport Science* 17(8): 983-993, 2017.

4. Henselmans, M, and Schoenfeld, B. The effect of inter-set rest intervals on resistance exercise-induced muscle hypertrophy. *Sports Medicine* 44: 1635-1643, 2014.

5. Iversen, V, Norum, M, Schoenfeld, B, and Fimland, M. No time to lift? Designing time-efficient training programs for strength and hypertrophy: a narrative review. *Sports Medicine* 51: 2079-2095, 2021.

6. Ratamess, N, Alvar, B, Evetoch, T, Housh, R, Kibler, B, Kraemer, W, and Triplett, N. Progression models in resistance training for healthy adults. Position statement from the American College of Sports Medicine. Retrieved July 13, 2022 from https://journals.lww.com/acsm-msse/Fulltext/2009/03000/Progression_Models_in_Resistance_Training_for.26.aspx.

7. Schoenfeld, B, Pope, Z, Benik, F, Hester, G, Sellers, J, Nooner, J, et al. Longer interset rest periods enhance muscle strength and hypertrophy in resistance-trained men. *Journal of Strength and Conditioning Research* 30(7): 1805-1812, 2016.

8. Schoenfeld, B, Vigotsky, A, Contreras, B, Golden, S, Alto, A, Larson, R, Winkelman, N, and Paoli, A. Differential effects of attentional focus strategies during long-term resistance training. *European Journal of Sport Science* 18(5): 705-712, 2018.

9. Stults-Kolehmainen, M, and Bartholomew, J. Psychological stress impairs short-term muscular recovery from resistance exercise. *Medicine and Science in Sports and Exercise* 44(11): 2220-2227, 2012.

10. Wroble, K, Trott, M, Schweitzer, G, Rahman, R, Kelly, P, and Weiss, E. Low-carbohydrate, ketogenic diet impairs anaerobic exercise performance in exercise-trained women and men: A randomized-sequence crossover trial. *Journal of Sports Medicine and Physical Fitness* 59(4): 600-607, 2019.

TABLE 2. SAMPLE TOTAL BODY CIRCUIT TRAINING PROGRAM

Squats	20 repetitions
Romanian deadlifts	20 repetitions
Chest press	20 repetitions
Seated horizontal rows	20 repetitions
Seated vertical rows	20 repetitions
Biceps curls	20 repetitions
Triceps extensions	20 repetitions
Planks	(30 – 45 s)

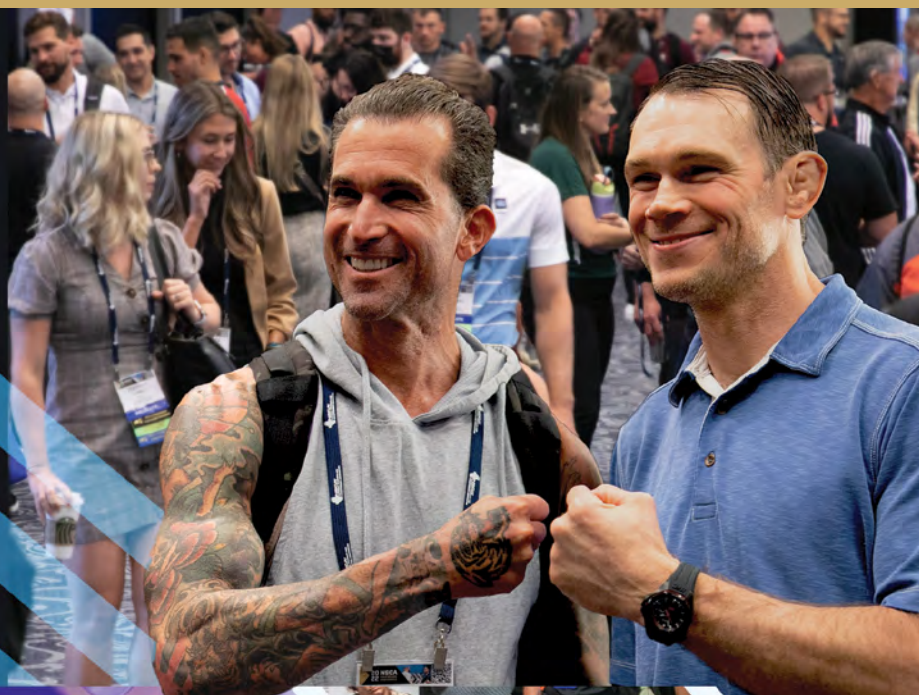
Note: Perform these movements in a series, with as little rest as possible between exercises. Completing as many circuits as appropriate for the client's ability.

**Substitute dumbbells or kettlebells for barbells where needed.*

ABOUT THE AUTHOR

AJ Mortara is an Associate Professor at Berea College, chairs the Health and Human Performance Department, and directs the human performance laboratory. Mortara teaches in the exercise science curriculum, including classes such as sports nutrition, exercise physiology, biomechanics, personal training certification, and others. Mortara's research interests include exercise metabolism and electromyography. Mortara received his Master's degree from Eastern Kentucky University and his Doctorate of Education degree from the University of Kentucky. Prior to working in education, Mortara specialized in work conditioning and work hardening for Toyota Motor Manufacturing.

2023 NSCA NATIONAL CONFERENCE



THE ULTIMATE STRENGTH & CONDITIONING CONFERENCE

Learn from industry leaders at the 2023 NSCA National Conference, the only event that connects the entire strength and conditioning community. Join your peers from every facet of the profession for an outstanding blend of research and application.

Discover diverse sessions on niche interests and industry advancements. Interact with authentic spearkers who hold nothing back. Explore emerging tools and technologies in the Exhibit Hall. Form powerful partnerships at networking receptions.

JULY 12-15
LAS VEGAS & ONLINE
Up to 3.0 CEUs

And now, for the first time ever, earn an **additional 1.0 CEUs** (3.0 total) when you join us in person in Las Vegas.

NSCA®
NATIONAL STRENGTH AND CONDITIONING ASSOCIATION

Reserve your spot now for the most anticipated event of the year!

NSCA.com/NSCACon