Rest and Recovery

Best practices to maximize muscle strength

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Learning Outcomes

After this course, participants will be able to:

- Identify intra-set versus inter-set rest periods.
- Develop strength training sessions and programs using intra-set and inter-set rest periods.
- Define intermittent rest.
- Design an effective strength training program using intermittent rest principles.
- Develop programs using effective recovery periods to avoid overtraining and detraining.

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Course Outline

- Rest while training.
  - Intra-set versus inter-set rest breaks.
  - Research on different training methods.
  - Sample workouts for strength outcomes.
- Prevention of Overtraining.
- Rest after training.
  - Sleep.
  - Intermittent rest.
  - 24-hour cycles.
  - Recovery period maximum.

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Key Concepts

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Types of Rest During Training

- Intra-set: within sets
- Inter-set: between sets

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Intra-set Rest Periods

- Within sets.
- Breaks range from ten to 60 seconds between repetitions.
- Allow for **minimal muscle rest** during the set.

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Inter-set Rest Periods

- Between sets.
- Breaks range from 30 seconds to four minutes.

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Recovery

After a strength training session.

- Between sessions.
- Hours or days.

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Training Methods

- Used to study the effects of different within set rest periods on muscle strength outcomes.
- Two most common training methods are:
  - Cluster Set Training (CST).
  - Redistributed Rest Training (RRT).
- In contrast to traditional set training (for example, four sets of eight repetitions).

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Cluster Set Training (CST)

- A set might be 24 – 36 repetitions.
- Equal rest after each four to six repetitions, for example.
- Number of repetitions prior to rest within a set varies.

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Redistributed Rest Training (RRT)

- Set repetition range is anywhere from 6 to 36, for example.
- Equal rest between **each repetition** within a set.
- Treats each repetition as an independent event.
- Very effective to control mechanics.

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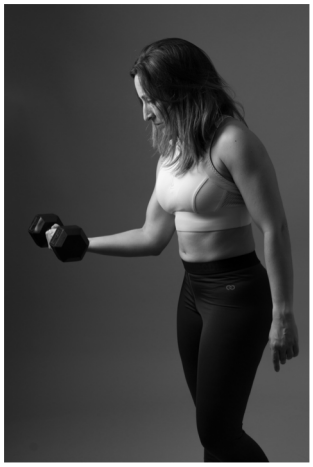
Discrete movements

- Clear start and finish point.
- Most weight lifting exercises are discrete movements.
- Work well with an intra-rest training method.



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Measuring Muscle Force

- Muscle force generation capacity (MFGC).
- A direct measurement of muscular strength.

Research

The Question

Do rest intervals within sets yield greater muscle strength and power improvements than two minute traditional between-set rest periods?

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Study #1

Researchers set out to determine if intra-set rest intervals are better for muscle strength and power improvements than traditional between-set rest periods (Oliver, 2013).

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Rationale

- With minimal rest during a set, the goal is to coax the muscle to produce greater force within a shorter time period.
- This should result in greater strength and power improvements.

*Note: it should also allow for greater focus on mechanics and full ROM.

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The Methods

- Intra-set rest periods ranged from ten to 60 seconds.
- Between set rest breaks were two minutes each.

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Measurements

1RM on the bench press and squat were measured along with power output (60% one repetition maximum)

- before the study began.
- after four weeks.
- at eight weeks.
- at 12 weeks.

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The Results

60-second intra-set rest breaks resulted in statistically significant greater strength gains and power output in the bench press than traditional between set rest breaks.

*Indicating that for upper body strength gains, intra-set rest periods were more effective.

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The Question

"How effective is RRT for strength development versus cluster sets which are similar to traditional set training?"

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Study #2

Compared the efficacy of redistributed rest training to cluster sets on measures of muscle velocity and power output in squats (Tufano 2017).

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Methods

The three different training groups are shown here and on the next slide:

- Group #1: Athletes did four cluster sets (CS4) that included 30 seconds of rest after the 4th, 8th, 16th, 20th, 28th, and 32nd exercise repetition in addition to 120 seconds of rest after the 12th and 24th repetitions.

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Methods

- Group #2: For these athletes, the total 420 seconds of rest given to the CS4 group was redistributed to include nine sets of four repetitions each with 52.5 seconds of rest after every fourth repetition (RR4).
- Group #3: The final group used a unique protocol where the total 420 seconds of rest was evenly distributed after each of the 36 single repetitions resulting in 12 seconds of rest after each repetition (RR1).

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Results

#1: With redistributed rest over each repetition (RR1) mean and peak muscle velocity along with **mean and peak muscle power remained the same**; however, they all decreased every four repetitions during cluster and RR4 training.

#2: **Peak muscle force was maintained during redistributed rest over each repetition** (RR1), but was less for cluster and RR4 for subsequent repetitions.

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Conclusion

These data indicate that when total rest time is redistributed over each repetition, the kinetics and kinematics of each exercise repetition is more constant improving muscle strength and power performance results.

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Interpretation

- Kinetics: rate of change in movement. Velocity.
- Kinematics: joint motion like flexion/extension, etc. Mechanics.

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The Question

Does varying the load (intensity) used during a session and even during a set impact muscle performance outcomes?

Note: volume will play a role here since intensity and volume are inversely related.

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Rationale

- Rest the muscle while working.
- Or complete a set without rest using a lower load.
- Manipulate the volume of training.

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Study #3

Study examined the difference between high-load (80% of one repetition maximum [1RM]), low-load (30% 1RM), set, and single high-load set with additional drop sets descending to a low load without rest on muscle hypertrophy and strength (Ozaki, 2018).

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Methods

Three different training load groups:

- Three high-intensity (80% 1RM) sets.
- Three low-intensity (30% 1RM) sets.
- A single high-load set (80%) with an additional drop set without recovery progressively reducing weight to 30% 1 RM
  - Defined as mixed-intensity training
  - It is a mixed-intensity set.

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Volume

It is important to note that the training volume was about 2/3rds of the three set high and low-intensity in the mixed-intensity set.

*Mixed-intensity set – which was 80% initially with a drop-set was lower volume training. *This is very important to reducing risks of overtraining.*

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Conclusion

Lower volume mixed-intensity training can simultaneously increase muscle hypertrophy and strength when compared to traditional three set high-intensity or low-intensity training models.

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Real world applicability

Mixed-intensity training saves time when compared to the traditional three sets training programs. *It reduces total volume which can mitigate overtraining risks.*

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Sample Workouts

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Sample Traditional Set Workout for Strength

Exercise	Reps	Resistance	Between-set rest break
Back squat	6-10	65-85% 1RM	30 seconds-4 minutes
Seated knee extension	6-10	65-85% 1RM	30 seconds-4 minutes
Back squat	6-10	65-85% 1RM	30 seconds-4 minutes
Seated knee extension	6-10	65-85% 1RM	30 seconds-4 minutes
Back squat	6-10	65-85% 1RM	30 seconds-4 minutes
Seated knee extension	6-10	65-85% 1RM	30 seconds-4 minutes

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Sample RRT Workout for Strength

Exercise	Reps	Resistance	Within-set rest break (each rep)
Back squat	6-10	65-85% 1RM	10 - 120 seconds
Seated knee extension	6-10	65-85% 1RM	10 - 120 seconds
Back squat	6-10	65-85% 1RM	10 - 120 seconds
Seated knee extension	6-10	65-85% 1RM	10 - 120 seconds
Back squat	6-10	65-85% 1RM	10 - 120 seconds
Seated knee extension	6-10	65-85% 1RM	10 - 120 seconds

Sample CST Workout for Strength

Exercise	Reps	Resistance	Within-set rest break
Back squat	6-12	65-85% 1RM	10 - 120 seconds after 4th, 8th, and 12th
Seated knee extension	6-12	65-85% 1RM	10 - 120 seconds after 4th, 8th, and 12th
Back squat	6-12	65-85% 1RM	10 - 120 seconds after 4th, 8th, and 12th
Seated knee extension	6-12	65-85% 1RM	10 - 120 seconds after 4th, 8th, and 12th
Back squat	6-12	65-85% 1RM	10 - 120 seconds after 4th, 8th, and 12th
Seated knee extension	6-12	65-85% 1RM	10 - 120 seconds after 4th, 8th, and 12th

Best Practices

- Try CST and RRT where feasible.
- The higher the weight lifted, the greater the rest period between reps.
- Mechanics are #1!

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Prevention of Overtraining

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Training Load

- Total volume and intensity of training over a week or month for example.
- It is the #1 correlate to overtraining.

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Programming Variables

1. Mode (type of training)
2. Frequency (recurrence of sessions; recovery lengths)
3. Duration (length of program, each session total, and session components)

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Programming Variables

4. Volume (how much; sets and reps; distance and time)
5. Intensity (how hard; heart rate; MFGC or output)

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Overtraining

- The training variable most associated with overtraining is too much volume.
- For example, 10 sets of 10 repetitions (German Volume Training) over many consecutive sessions.
  - or an hour of sit-ups!
- Leads to acute and long-term performance decrements.

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Symptoms of Overtraining

- Fatigue.
- Depression.
- Loss of motivation.
- Anxiety.
- Decreased ability to concentrate.
- Increased blood pressure.
- Increased heart rate.
- Increased rate of injury.
- Chronic muscle soreness.
- Delayed Recovery.
- Poor sleep.
- Insomnia.

Rest After Training

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Sleep and Athletes

- Sleep and recovery are vital to performance.
- However, athletes and anyone that regularly exercises at a high-intensity are vulnerable to poor sleep.

Sleep Disturbances

When over 1600 studies were analyzed (Gupta, 2017) to determine the quality of sleep among athletes, athletes were shown to have:

- Longer sleep latencies (longer to fall asleep).
- Increased sleep fragmentation (waking up).
- Non-restorative sleep.
- Excessive daytime fatigue.

Sleep Solutions

Strategic programming can help to resolve issues related to poor sleep in athletes. Suggestions:

- Provide clear activity-rest cycles.
- Use methods like mixed-intensity training.
- Use lower volume paradigms.
- Include adequate rest and recovery periods.

Working With Patterns

- Intermittent rest.
  - Alternate day rest.
- Muscle clocks and strategic timing of resistance training (Ashmore, 2019).
  - Programming, training, and mechanics.

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Intermittent Rest

- Resting two days per week on **alternate days**.
- Modeled after intermittent fasting.
- Keeps your body on a 24-hour cycle.

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Why? Biological Clocks

- Master Clock
  - Located in the brain.
  - Keeps us on a 24 – hour cycle.
  - Influences all other clocks in the body.
- Other types of clocks include muscle, bone, tendon, and central organs.

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Muscle Clocks

- Inside each of your over 600 skeletal muscles there is an internal time piece.
- Monitoring 24-hour cycles according to these cues:
  - Light/night.
  - Local tissue changes.
  - Activity/rest patterns.
  - Exercise training and programming cycles.
  - Exercise mechanics.

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Maintenance of Strength

Muscles need to rest for **at least 48 hours** after high-intensity exercise (greater than 85% maximum capacity) to return to baseline strength levels (Carter and Greenwood, 2014).

❖*Note: rest can be an active like swimming or walking. The key is to keep the intensity low.*

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Recovery period upper limits

- Length of recovery periods should not exceed **96 hours.**
- After 96 hours detraining occurs (Carter and Greenwood, 2014).

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Thank you!
~ Dr. Amy

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