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New Resistance Training Guidelines for Women Over 40

Amy Ashmore, PhD

Learning Outcomes

After this course, participants will be able to:

- Apply resistance training methods that account for the newly discovered role of estrogen-dependent satellite cells to muscle recovery and its novel role in muscle performance in women over 40.
- Define at least two new training load guidelines for women over 40.
- Identify at least two common resistance training methods to avoid for women over 40.
- Design a plan of care with single session workouts, weekly, and long-term programming routines utilizing specific exercises and workouts designed to stimulate muscle growth and fat loss in the absence of estrogen.
- Suggest at least three modified resistance training sessions for individual variability.

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Course Outline

- I. The Unique Role of Estrogen to Women's Health.
- II. Estrogen, Satellite Cells, and Muscle Growth.
- III. The New Training Load Guidelines for Women over 40.
 - i. Defined.
 - ii. Internal.
 - iii. External.
- IV. Resistance Training Programming.
 - a. Research.
 - b. Programming Methods and Sample Routines.

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The Unique Role of Estrogen

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Estrogen

- One of the primary reasons that a woman's body changes with age is because estrogen levels decrease.
- Estrogen is vital to women's health and was recently determined to be the key factor in muscle health in women over 40.

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The Dilemma

- Estrogen rich cells are critically important to preserve muscle function.
- Loss of estrogen negatively affects muscle maintenance and self-renewal directly impacting muscle tone, strength, and appearance.

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Estrogen, Satellite Cells, and Muscle Growth

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Emerging Role of Satellite Cells

- Estrogen rich cells are critically important to the preservation of muscle function.
- However, estrogen works with muscle satellite cells to maintain, repair, and build healthy muscles (Collins, 2019).

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The Role of Satellite Cells

Muscle satellite cells play a critical role to sustain and regenerate muscle fibers.

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Value of Satellite Cells

- When estrogen is depleted it severely limits the capability of muscle satellite cells to maintain, repair, and regenerate muscle fibers.
- This leads to muscle loss and strength over time along with an increase in body fat.

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What are Muscle Satellite Cells?

- Precursors to muscle cells located inside muscles.
- Can give rise to new muscle cells under the right conditions.
- Play a key role in skeletal muscle repair and adaptations in response to exercise, including resistance training.
- But they need estrogen to do their job.

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Exercise Programming

Although estrogen and body composition changes after 40 affect most women, research has shown that specific methods of resistance training can help to preserve muscle mass and strength and positively impact body composition.

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Training Load

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Training Load

The first consideration for resistance training for women over 40 is the training load or the amount of work that is done.



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Defined

Training load is the cumulative effect of training frequency (how often), volume (how much), and intensity (how hard).

*It is very different for different groups of people and individuals.

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Applying Training Load

Developing an understanding of training load and how to best use it is the key to make calculated and desired body composition changes in women over 40.

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Defining Training Load

Training loads are defined by:

1. Type of exercise a client/patient does like machine-based resistance training, free weight exercises, band or ball exercises, or body weight training.
2. Amount of exercise or resistance applied over time.
3. Responses to the exercises or resistance.

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Two Types of Training Loads

- External.
- Internal.

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External Training Load

- Measures the amount of work done during training.
- Easily quantifiable.
- It is what the muscle is subjected to over time.

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External Training Load

- Defined by the frequency of exercise sessions, the number of sets and repetitions per session, and exercise intensity.
- It is an indicator of expected changes to the muscle as a direct response like growth, strength, and appearance improvements.

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Internal Training Load

- Describes how the body responds to the external training load.
- Includes things like muscle force generated or output, heart rate, blood lactate levels, oxygen consumption, and rate of perceived exertion (RPE).
- Varies day to day and over time.

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Differentiating Training Loads

- External training load reflects the type and amount of exercise a client or patient does.
- Internal training load characterizes the exerciser's physiological and psychological responses to exercise during and after training.

Programming Variables

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Programming Variables

1. Mode (type of training).
2. Frequency (recurrence of sessions; accounts for rest and 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 repetitions; distance and time).
5. Intensity (how hard; heart rate; muscle force generated or the output).

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Research

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The Big Difference

The most notable difference in the updated training load recommendations for women over 40 is that the **prescribed volume is higher**.

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The Research

One study showed that women over 40 benefited significantly from higher volume training programs versus lower volume, high-intensity programs (Burrup, 2018).

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Summary

When the resistance training habits of 109 women over 40 were examined, the results showed that for each day per week of resistance training, body fat was reduced by 1.3 percentage points and muscle mass was increased by 656 grams.

*Volume here is frequency.

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The Argument for Volume

- The results of this study indicate that the more days women devote to resistance training the lower their body fat and the higher their fat-free mass tend to be.
- This is true even when the differences in age, energy, and protein consumption were accounted for.

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Inclusion for Women Over 60

- In a similar study (Cuhna, 2019), researchers compared the effects of two different whole-body resistance training programs on body fat and blood biomarkers in 65 untrained women over 60.
- Both training groups performed resistance training for 12 weeks, using eight different exercises and performing 10 - 15 repetitions each exercise.

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Training Volume Difference

The difference between the training programs:

- The low-volume group performed **one** set per exercise.
- The high-volume group performed **three** sets.

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Results

The results showed that the high-volume (3 sets) group had greater improvements in:

- Blood biomarkers.
- Percent body fat.
- Trunk fat.

....when compared to the low-volume group.

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Programming

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Exercise Selection

- In general, multi-joint exercises tend to be favored over single-joint exercises to save time and increase performance factors like total muscles used, heart rate, and total oxygen consumption.
- However, single-joint exercises have been shown to be effective to induce positive body composition changes as well as multi-joint exercises.

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Supporting Research

- In one study (Paoli, 2015), researchers examined the effects of single-joint exercises versus multi-joint exercises on body fat and muscle mass.
- The results showed that both multi-joint and single-joint exercises decreased body fat and increased fat-free mass with no significant difference between them.

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Importance

- Volume is tricky – relying on multi-joint exercises can lead to fatigue, injury, and overtraining.
- Therefore, when increasing the training load, thus volume, consider the value of isolation exercises.

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Suggested Exercises

- Leg extension.
- Leg curl.
- Leg abduction/adduction.
- Hip bridges.
- Prone back extension.
- Biceps curls (any variation).
- Front shoulder raises.
- Posterior shoulder raises.
- Lateral shoulder raises.
- Triceps extensions (any variation).

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Spinal Flexion



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**Programming
Guidelines**

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Time in Tension

- Total time muscle produces a force.
- The goal is to increase the time a muscle spends in *concentric* contraction.

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Risks

High volume programs, either increasing frequency or the amount of exercise per session, comes with the inherent long term risk of overtraining.

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Volume and Intensity

- There is an inverse relationship between volume and intensity.
- With an increase in volume, intensity must decrease.
- Recommended intensity is 45 – 65 % 1 RM or estimated.

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Training Methods

- Cluster Set Training.
- Redistributed Rest Training.

Cluster Set Training

Cluster set training is a method of resistance training that uses short rest periods within sets versus longer rest periods between traditional sets.

The Difference

- A traditional set is three block sets of 15 repetitions with a 30-second rest in between each set.
- A cluster set is a set of 15, but with rest between every 3rd or 5th repetitions, for example, repeated three or five times. Rest intervals between sets are shorter.

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The Study

One study (Oliver, 2013) compared the effectiveness of traditional sets to cluster sets on developing muscle strength.

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The Results

Cluster sets were shown to improve muscle strength more than traditional sets.

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Why?

Most likely this is because the muscles are allowed minimal recovery during the set. The total time in *increased* tension is increased, and thus the total improvement in strength over time is better.

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Cluster Sets

- Cluster sets are good to use for clients and patients new to resistance training because the short breaks within sets allow the muscle minimal recovery during the set.
- This helps to avoid fatigue and the associated form errors, and reduced strength gains.

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Conclusion

Cluster sets are an effective way to change up workouts, and use rest periods in new ways to safely increase resistance training volume.

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Cluster Training Workout

Exercise	Repetitions	Sets	Resistance	Intra-set Rest Periods
Strength Exercise #1	Total 3 x 5	3 - 4	45% to 65% of 1RM or estimated	10 - 60 seconds within set; same between set
Strength Exercise #2	Total 3 x 5	3 - 4	45% to 65% of 1RM or estimated	5 - 60 seconds within set; same between set

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Redistributed Rest Training

- In another study (Tufano, 2017), researchers suggested an entirely new way to train – equal rest between each repetition.
- This method of training is termed redistributed rest training (RRT).
- Participants did one set of 36 repetitions of a single exercise.

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The Difference

When compared to traditional set and cluster training, redistributed rest training provides **equal rest between each repetition.**

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The Results

- The results showed that when total rest time is redistributed over each repetition, muscle force output and mechanics of each exercise repetition is more constant.
- Therefore, the quality of time spent in tension is better and muscle performance outcomes are improved.

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Practical Use

This data also suggests that redistributing rest is a creative programming tool that can improve muscle performance while safely increasing volume.

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Volume-Intensity Balance

When volume is increased during a set, the intensity of the load or weight should be reduced.

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Caution

- Although the principle of cluster set and redistributed rest training is to allow the muscle to minimally recover between each repetition and thus during the set, it does not off-set that up to 36 repetitions are performed in quick succession.
- High volume can cause fatigue, mechanics errors, and over time, lead to overtraining.

Sample RRT Routine

Exercise	Repetitions	Intensity	Sets	Rest Between Repetitions
Dumbbell lunge (each leg)	18 - 36	45 – 65% estimated 1RM	1 - 2	5 - 12 seconds
Leg extension	18 - 36	45 – 65% estimated 1RM	1 - 2	5 - 12 seconds
Seated row	18 - 36	45 – 65% estimated 1RM	1 - 2	5 - 12 seconds
Lateral shoulder raises	18 - 36	45 – 65% estimated 1 RM	1 - 2	5 - 12 seconds
Triceps extensions	18 - 36	45 – 65% estimated 1 RM	1 - 2	5 - 12 seconds

Routine Notes

- 36 continuous repetitions were used in the research; however, two sets of 18 can be substituted.
- Note rest between repetitions.
- Intensity will vary dependent upon client/patient fitness level and resistance training experience.

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Notes, continued

- 45% 1RM is the recommended starting place for exercisers new to resistance training.
- With an increase in frequency, suggested total training time per session is 45 minutes.
- Vary exercises for muscle groups each session.

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Notes, continued

- Whole body training routines have been used in the research; however, splitting the routine in to lower and upper is an alternative.
- When increasing training frequency, be sure that 48-hour rest periods are followed per muscle group.

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Sample RRT Routine (LB)

Exercise	Reps	Resistance	Intra-set rest breaks after each repetition
Modified Romanian Deadlift	Up to 36	45% to 65% of 1RM or estimated	10 - 60 seconds
Back squat	Up to 36	45% to 65% of 1RM or estimated	10 - 60 seconds

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Timing

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Muscle Clocks

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“Muscle clocks keep time for your muscles, telling them what to expect and when. They let your muscles know when to expect to train versus rest and recover.”

(Ashmore, 2020)

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What are Muscle Clocks?

- Internal clocks inside each of your over 600 skeletal muscles.
- Made up of proteins.
- Play a significant role in muscle growth, strength, tone, and appearance.

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How Muscle Clocks Work

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How Muscle Clocks Work

- They keep track of 24-hour cycles.

- They monitor specific cues they get from the environment and your body throughout the day to optimize muscle performance (and overall health).

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How Muscle Clocks Work

The regulate muscle behavior according to cues they get from:

1. Environmental changes.
 1. Inside the muscle and body.
 2. Outside the body.

2. Exercise training and programming.

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“Muscles use cues to learn to anticipate what happens and when. With resistance training, muscles learn when to expect it and in response turn on the molecular events associated with muscle performance ahead of scheduled training. This maximizes results.”

(Ashmore, 2020)

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How Clocks Communicate



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- Myokines are released from muscles during exercise – via sustained muscle contraction.
- Myokines relay cues about the timing of exercise, allowing muscles and other structures to anticipate upcoming workout sessions and improve muscle performance.

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Cues

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Cues

- Light–night (24)
- Hormone levels
 - Testosterone
 - HGH
 - Cortisol
- Eating habits
- Muscle pliability
- Exercise programming
 - type of training
 - timing of training

Activity–rest patterns



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Using Muscle Clocks to Program

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Time of Day Recommendations

- Cardiovascular exercise in the mid morning.
- Sport specific or mind-body work midday.
- Strength and power training 4 – 6 pm.

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Time of Day of Training

- Goal dependent.
- Type of training dependent.
- Lifestyle dependent.
- Consistency is the key.

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Muscle Pliability

Muscles are most pliable around 4 pm to 6 pm.



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Paired Training Method

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Paired Training Method

- Uses biomechanically-similar paired exercises to relay cues to muscle clocks.
- Two exercises are biomechanically similar if they share:
 - Similar or same joint action.
 - Similar or same muscle action.

(Ashmore, 2020)

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Why Paired Exercises?

Play on volume –

- Because one of the biggest dilemmas facing high volume training is overtraining.
- Pairing biomechanically similar exercises allows us to stress maximally the target muscles while varying mechanics enough to change how we work muscles.
- Increases focused time in tension.

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Paired Exercise Programming

- Paired exercises are doing two exercises back to back. Alternated or block method.
- They are a great way to keep people moving and focus on specific muscles.
- Time efficient.

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Paired Exercises Programming

Typically, the muscle groups used complement one another –

- For example, synergist (work together).
 - Paired exercises like a back exercise followed by a biceps exercise.
- Or, agonist-antagonist (functional opposite muscles).
 - Paired exercises like a triceps exercise followed by a biceps exercise.

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Synergist Paired Exercise Programming



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Agonist-Antagonist Paired Exercise Programming



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Compound Paired Exercise Programming

- Same muscle or muscle groups paired exercises can be used.
- Best for intermediate to advanced exercisers with specific goals.

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Compound Paired Exercise Programming



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Building Workouts

- Total body.
- Upper or lower body exercises.
- Agonist-antagonist exercises.
- Same joint(s) or action(s).
- Bilateral or unilateral exercises.
- Use of specific equipment.
- Desired functional outcome.

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Paired Exercise Routine for Bilateral Lower-Body

Exercise	Reps	Resistance	Between-set rest break
Back squat	Up to 18	45-65% 1RM	5 seconds-1 minute
Seated knee extension	Up to 18	45-65% 1RM	5 seconds-1 minute
Back squat	Up to 18	45-65% 1RM	5 seconds-1 minute
Seated knee extension	Up to 18	45-65% 1RM	5 seconds-1 minute
Back squat	Up to 18	45-65% 1RM	5 seconds-1 minute
Seated knee extension	Up to 18	45-65% 1RM	5 seconds-1 minute

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Paired Exercise Routine for Lower and Upper Body

Exercise	Reps	Resistance	Between-set rest break
Back squat	Up to 18	45-65% 1RM	5 seconds-1 minute
Lateral dumbbell raise	Up to 18	45-65% 1RM	5 seconds-1 minute
Back squat	Up to 18	45-65% 1RM	5 seconds-1 minute
Lateral dumbbell raise	Up to 18	45-65% 1RM	5 seconds-1 minute
Back squat	Up to 18	45-65% 1RM	5 seconds-1 minute
Lateral dumbbell raise	Up to 18	45-65% 1RM	5 seconds-1 minute

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Paired Exercise Routine for Agonist–Antagonist Muscles

Exercise	Reps	Resistance	Between-set rest break
Hip abduction	Up to 18	45-65% 1RM	5 seconds-1 minute
Hip adduction	Up to 18	45-65% 1RM	5 seconds-1 minute
Hip abduction	Up to 18	45-65% 1RM	5 seconds-1 minute
Hip adduction	Up to 18	45-65% 1RM	5 seconds-1 minute
Hip abduction	Up to 18	45-65% 1RM	5 seconds-1 minute
Hip adduction	Up to 18	45-65% 1RM	5 seconds-1 minute

Suggested Modifications

- Substitute isolation exercises for multi-joint exercises where appropriate.
- Use partial range of motion (ROM).
- Play on common exercises. For example, use traditional barbell and dumbbell squats but don't forget about wall squats, unilateral squats, physioball squats, etc.

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Squat



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Squat Variation



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Lunge



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Peak Contraction

To increase time in tension, stop mid point at an exercise and engage the muscle using isometric contraction. Hold for a count of five to ten and continue the exercise.

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What to Avoid

- Women over 40 experience decreased estrogen levels and compromised satellite cell activity.
- Satellite cells repair and regenerate muscle cells.
- Avoid exercise methods that *increase* muscle cell breakdown.

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What to Avoid

- Prolonged eccentric or negative contractions.
- Why? Cause an increased number of microscopic tears of the muscle that need to be repaired.
- Overuse of eccentric exercises (stiff-legged deadlifts for example).

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Training Tip

Strategic use of co-contraction

- Two opposing muscles are activated at the same time.
- Protects the joint.
- Reduces degree of eccentric loading.

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Recovery

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Intermittent Rest

Rest two days per week on non-consecutive days to stay on a 24-hour cycle (Ashmore, 2020).

Note: Schedule is consistent with the cues muscle clocks are looking for.

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Sample Routine

Day	Time	Resistance Training
Monday	4 pm	Resistance Training
Tuesday	REST	REST
Wednesday	4 pm	Resistance Training
Thursday	REST	REST
Friday	4 pm	Resistance Training
Saturday	REST	REST
Sunday	4 pm	Resistance Training

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Redefining Rest

- Rest does not necessarily mean no activity.
- Active recovery that doesn't include strength training.
- Other modes of exercise.

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Recovery Upper Limit

Recovery periods should not exceed **96 hours**. After 96 hours detraining occurs.

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Wrap-up

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Key Messages

- Familiarize yourself with the relationship between estrogen, muscle satellite cells, and women's muscle health and performance.

- Understand the suggested training loads.

- Develop resistance training sessions and programs that are higher in volume using:
 - Increased frequency.
 - Paired exercise models.

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