

Basics of Periodization For the Physical Therapist

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Goals

- ▶ History of PT's famous 3 sets of 10
- ▶ Learn different periodization models
- ▶ Learn different programming models
- ▶ How to create a training program that can effect strength, hypertrophy, and/or power

Why do we use 3 sets of 10???

- ▶ In **1948** Dr. Thomas DeLorme and Dr. Arthur L. Watkins wrote a paper based on injured WWII vets and patients with polio. Their program is called “Progressive resistance exercise”¹⁻²
 - ▶ It uses 3 x 10 with progressively heavy loads that looks like 50% x 10RM, 75% x 10RM and 100% x 10RM¹⁻²
- ▶ This is what DeLorme & Watkins (1948) had to say:
 - ▶ "In the initial publications concerning progressive resistance exercise, 70 to 100 repetitions were advocated, the repetitions being performed in 7 to 10 sets with 10 repetitions per set. Further experience has shown this figure to be too high and that in most cases a total of 20 to 30 repetitions is far more satisfactory. Fewer repetitions permit exercise with heavier muscle loads, thereby yielding greater and more rapid muscle hypertrophy."³

Periodization

- ▶ Simply: How training is organized.⁴
- ▶ Formally: Planned manipulation of training variables using predetermined training goals, through appropriate sequencing, integration and variation of training factors. To produce specific physiological and performance adaptations and prevent the onset of overtraining syndrome.^{5,6}

Goals of Periodization

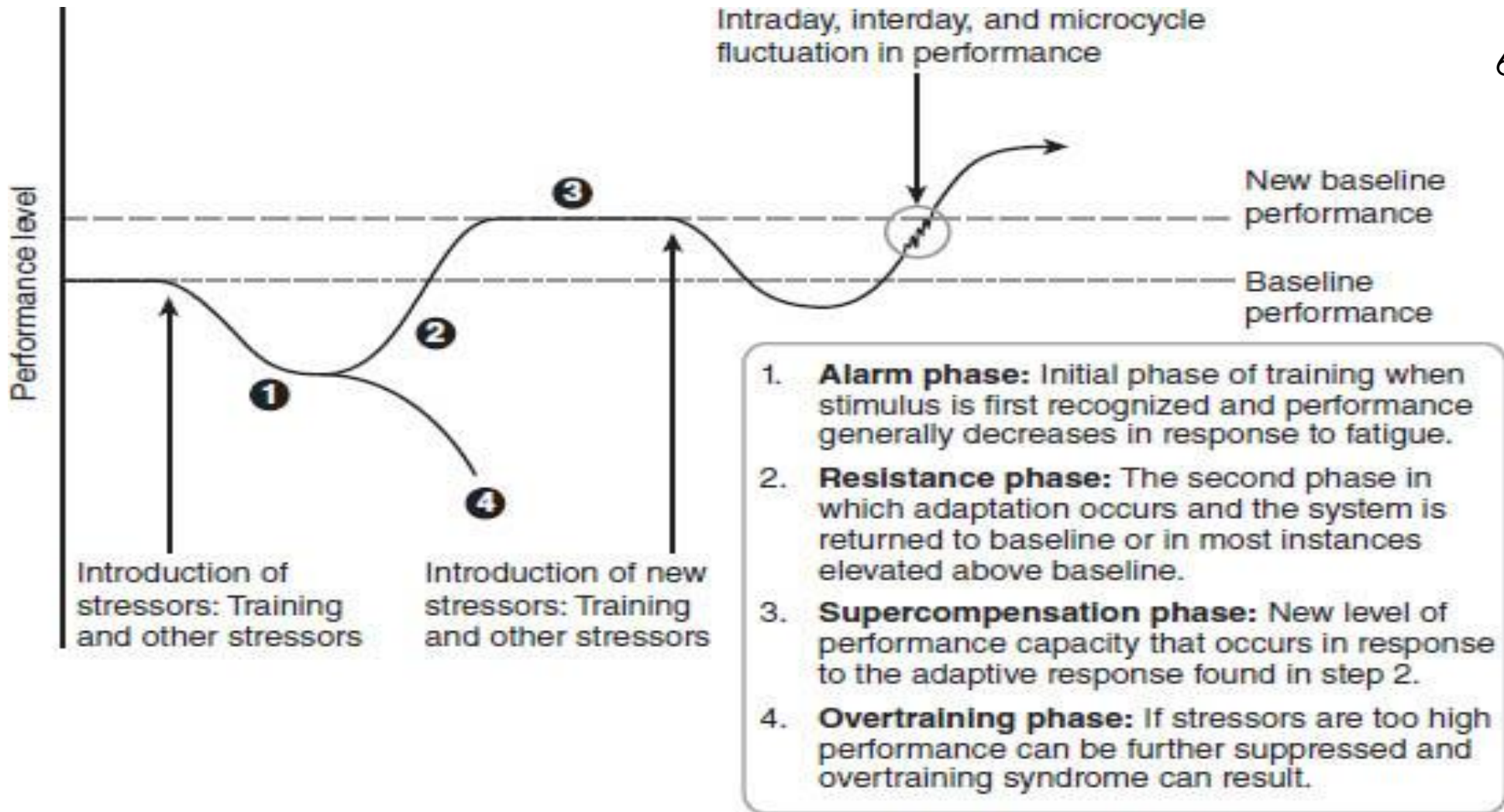
- ▶ Optimization of an athlete's performance at predetermined points^{5,6}
- ▶ Maintaining performance capacity during a specific season^{5,6}
- ▶ Structuring precise training interventions to target the development of specific physiological and performance outcomes⁵⁻⁶
- ▶ Managing training stressors to reduce the potential for overtraining^{5,6}
- ▶ Promoting long-term athletic development⁶
- ▶ For the Physical therapist it allows us to plan a person's rehabilitation around the patient goals, through a more structured method

Concepts of Periodization

- ▶ General Adaptation Syndrome (GAS)
- ▶ Fitness-Fatigue Model
- ▶ Stimulus-Fatigue-Recovery-Adaptation Theory (SFRA)

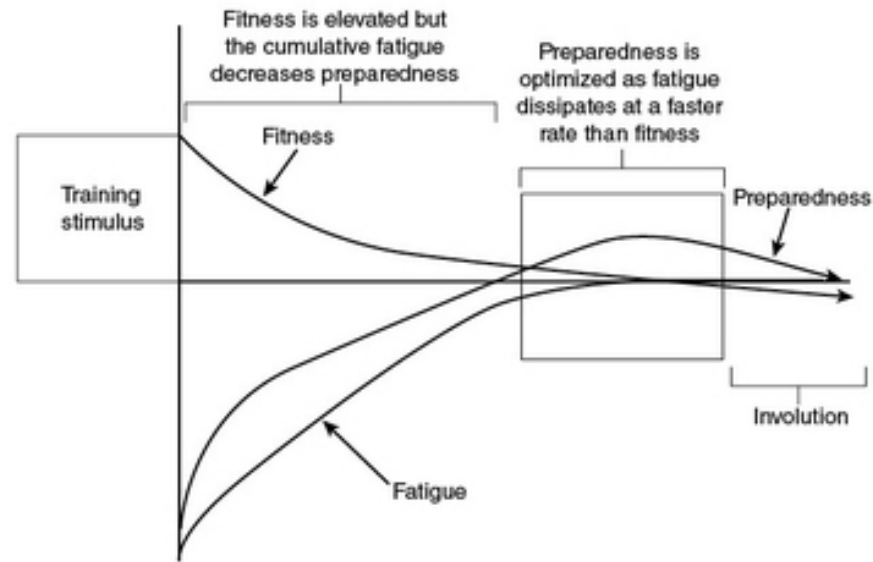
General Adaption Syndrome (GAS)

- ▶ Systems will adapt to any stressors they might experience to meet the demands of these stressors.⁵
- ▶ Alarm/reaction phase:
 - ▶ Initial response to a training stressor
 - ▶ Fatigue, soreness, stiffness, and reduction in energy stores.⁵⁻⁷
- ▶ Resistance Phase: Body responds and adapts to the stressors
 - ▶ Less soreness, stiffness and fatigue
 - ▶ Performance will return to baseline or higher levels⁵⁻⁷
- ▶ Supercompensation: Higher performance capacity due to adaptive responses developed in the resistance phase.⁵⁻⁷
- ▶ Exhaustion: When a stressor goes on longer than the body can adapt for then over-training can occur, or staleness in training



Fitness-Fatigue theory

- ▶ Views periodization as a balancing act between fitness and fatigue. An individual's level of preparedness results from the interaction between the level of fitness and amount of fatigue.⁵
- ▶ Training that maximizes fitness and minimizes fatigue will have the greatest potential to optimize the athlete's preparedness.⁷
- ▶ Suggests that affects of fitness and fatigue are exercise specific. If an athlete is too tired to perform a specific exercise (i.e. squat) with quality; they should be able to perform a different exercise (i.e. lunge)with quality.⁷
- ▶ Increased demands cause the neuromuscular system to adapt by increasing muscular performance. Though there is an increase in physical, mental, and metabolic fatigue in recovery.⁵
 - ▶ If the fatigue is too much due to the load being too high, the athletes physical readiness for training for compromised⁵



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FIGURE 11.4 The fitness-fatigue paradigm.

Adapted from Stone, Stone, and Sands (80) and Zatsiorsky (88).

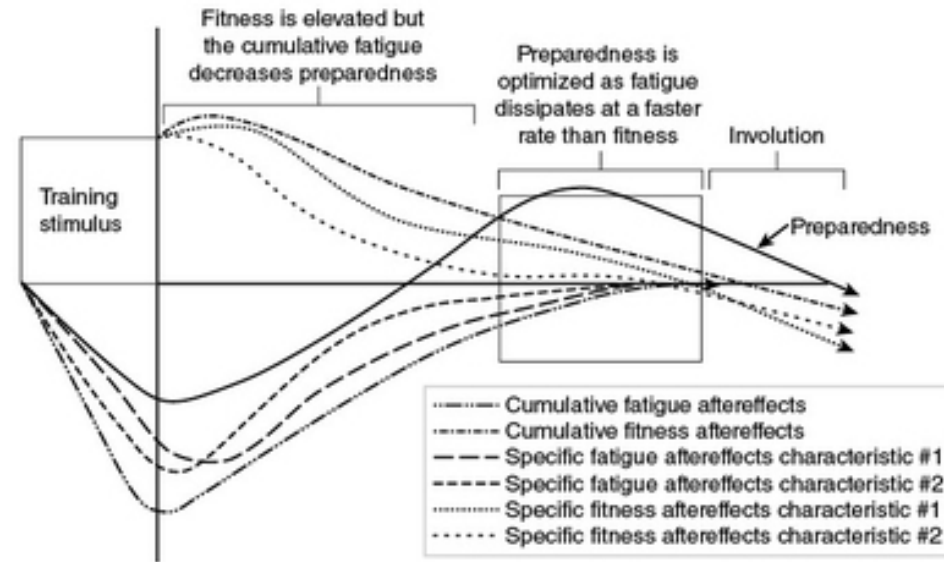
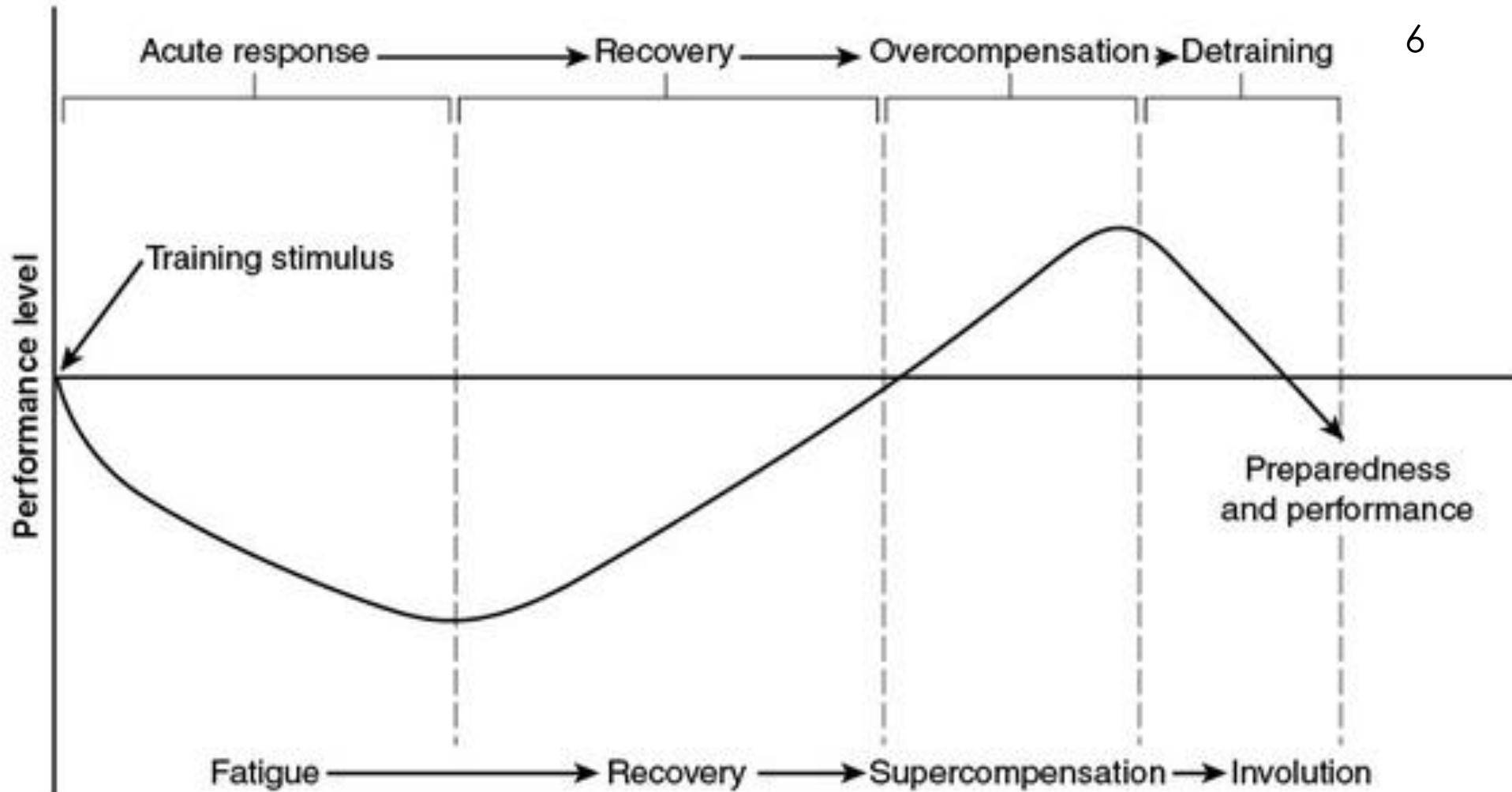


FIGURE 11.5 Modified fitness-fatigue paradigm depicting multiple training aftereffects.

Adapted from Stone, Stone, and Sands (80) and Chiu and Barnes (11).

Stimulus-Fatigue-Recovery-Adaptation theory

- ▶ "Fatigue accumulates in proportion to the strength and duration of a stimulus" ⁷
- ▶ Training causes fatigue, this will decrease both preparedness and performance. As the fatigue dissipates and recovery begins both performance and preparedness will improve. ⁶
- ▶ Delayed training effect: magnitude and duration of loading dictate the length of time needed for recovery and adaptation. ⁶⁻⁷
- ▶ Involution/detraining – a decline in performance and preparedness due to a lack of new training stimulus after recovery and adaptation occurred. ⁶⁻⁷



6

FIGURE 11.2 The stimulus-fatigue-recovery-adaptation theory.

Adapted from Verkhshansky (81), Rowbottom (66), Yakovlev (87), and Stone, Stone, and Sands (80).

Cycle Breakdown

- ▶ Multi-year preparation- 2-4 years long ⁵⁻⁷
 - ▶ i.e. world championships/Olympics
 - ▶ Development of college or high-school athletes
- ▶ Annual training plan: 1 year ⁵⁻⁷
 - ▶ Can involve several macrocycles or be 1 macrocycle
- ▶ Macrocycle – 12 weeks to 1 year ⁵⁻⁷
 - ▶ Training plan that is targeting a specific training or competitive goals
- ▶ Mesocycle – 2-8 weeks ⁵⁻⁷
 - ▶ Focused on training the same skill or physical quality
- ▶ Microcycle – 1 – 2 weeks ⁵⁻⁷
 - ▶ Very specific training goal
- ▶ Training Session: a single day of workout/s ⁵⁻⁷

Methods of periodization

- ▶ Sequential
 - ▶ Linear
 - ▶ Non-linear/undulating
- ▶ Conjugate
- ▶ Block

Sequential Method

- ▶ Using specific time intervals to develop only 1 training goal at a time.
- ▶ Can include:
 - ▶ Linear
 - ▶ Non-linear/undulating⁸

Linear periodization

Traditional/Classic Periodization

- ▶ Most rehab protocols follow this style⁴⁻⁹
 - ▶ I.e work on ROM → Strength → Power → speed → sport-specific training
- ▶ Gradual wavelike increases in workload progressing toward a training goal in a linear fashion.⁴⁻⁹
- ▶ Typically goes from high volume, low intensity to low volume, high intensity ⁴⁻⁹
- ▶ Pros: Good for beginners/novices ⁴⁻⁹
 - ▶ Repetition and loading schemes are predictable based on which phase the person is in.
- ▶ Cons: Not good for intermediate or advanced lifters ⁴⁻⁹
 - ▶ There will be a loss the training benefits from the previous cycle
 - ▶ Not often good for competitive athletes because it can cause a large amount of fatigue, doesn't adapt to weekly competitions well.

Non-linear/Undulating periodization

- ▶ Changing the training volume and/or intensity from one training session to the next ^{4-6,9-11}
- ▶ Allows the neuromuscular system a longer period of recovery, by integrating lighter loads more often ^{4-6,9-11}
- ▶ Pros: Better for intermediate/advanced lifters ^{4-6,9-11}
 - ▶ Better neuromuscular adaptations
 - ▶ Allows for modifications in the training program
 - ▶ More than 1 training parameters can be addressed in the same week
- ▶ Cons: Not great for beginners ^{4-6,9-11}
 - ▶ Doesn't allow optimal development of training characteristics- not enough time spent in one area.
 - ▶ May not develop foundational strength enough.

Conjugate Periodization

- ▶ Famously known as the Westside method ⁴⁻⁷
- ▶ Regularly changing training stressors to address different physical characteristics at the same time ⁴⁻⁷
- ▶ Emphasize 1 ability while maintaining all others with minimal volume ⁴⁻⁷
- ▶ Sequencing of Accumulation, transmutation, and realization: ⁴⁻⁷
 - ▶ Accumulation: Concentrated loading of one major training emphasis with complimentary training with smaller emphasis
 - ▶ Transmutation: Workloads redistributed and emphasis changed
 - ▶ Realization: reduced workloads with another change in emphasis to allow continued dissipation of fatigue.

Block Periodization

- ▶ Highly concentrated specialized workloads. If you don't need an aspect of training (i.e. endurance), you don't do it. ⁵
- ▶ Uses a high volume of exercises focusing on specific training abilities to ensure maximum adaptation. ⁵
- ▶ Long-lasting delayed training effect – retention of changes even after the cessation of training. ⁵
- ▶ 3 phases:
 - ▶ Accumulation: builds work capacity
 - ▶ Transmutation: increased loads of specific exercises
 - ▶ Realization: even more specific movements at higher loads. ⁵

Basic steps for setting up a training program

For The Strength and conditioning Specialist ⁶

1. Determine the long-term goals
2. Prioritize the major objectives, evaluate last year's training plan and performance results. Determine the number and length of Macrocycles.
3. Determine preparatory, competitive and transitional phases or hypertrophy, strength, peaking and schedule testing days.
4. Determine length of mesocycles, establish the focus of each mesocycle and establish loading patterns
5. Construct microcycles: determine training vs. recovery days and what and how training will be that day.
6. Design the training day
7. Implement training plan with constant monitoring and re-assessing.

For the Physical Therapist

1. Determine the long term goals
2. Evaluate the patient, prioritize the patient's primary impairments. Establish the length of Plan of Care (AKA Macrocycle)
3. Determine the phases of rehab: healing/protective, restoration of normal movement patterns, strengthening, sport-specific and maintenance.
4. Determine the length of the mesocycles and focus of those mesocycles
5. Construct the microcycles: how many days a week is the patient training/rehabbing or recovering.
6. Determine the treatment session
7. Implement the plan of care with constant monitoring and re-assessing.

Resistance training program variables

- ▶ Exercise selection⁶
 - ▶ Type of contraction (ECC/CON/ISOM)
 - ▶ Joint involvement: single vs. multi-joint
 - ▶ Type of equipment: what do they have access to?
 - ▶ Open vs. Closed chain
 - ▶ Unilateral vs. Bilateral exercises
- ▶ Exercise order/workout structure: Primary training goals dictate order⁶
 - ▶ 3 basic workout styles
 1. Total Body:
 2. Upper and lower body Splits
 3. Muscle group split routine

Resistance Training program variables:

- ▶ Intensity = Amt of weight lifted ⁶
 - ▶ Untrained athletes need \geq 45-50% of 1RM to build strength
 - ▶ Advanced athletes need \geq 80-85% of 1 RM to increase max strength.
 - ▶ Inverse relationship of amount of weight lifted and # of reps preformed
- ▶ Volume: Total # of sets & reps in a workout
 - ▶ 1-6 sets per exercise: multiple more effective.
 - ▶ 3 ways to structure volume:
 1. Constant load/rep
 2. Light to heavy
 3. Heavy to light⁶
- ▶ Rest: CRUCIAL
 - ▶ This affects metabolic, hormonal and cardiorespiratory responses. ⁶
- ▶ Repetition Velocity: how fast the concentric and eccentric motions, and pauses⁶
- ▶ Frequency: # of times exercises or muscle groups are done in a week. ⁶

Rehab training Variable: Pain/Injury

- ▶ Want to have a program that is easily modifiable based on feedback
- ▶ Autoregulation – modification of Daily adjusted progressive resistive exercise (DARPE) system which allows for a more adjustable application of traditional approaches.
- ▶ Zone-based approach focusing on Strength/power, strength/hypertrophy, hypertrophy
 - ▶ Change the load based on that day's performance
- ▶ RPE: Reliable measure of both session intensity and a specific exercise intensity
 - ▶ This is helpful in Rehab setting when we don't have ability to perform a 1RM

Training hypertrophy

- ▶ Training hypertrophy adds muscle. This translates to more muscle to lift bigger weights. ⁴
- ▶ Hypertrophy can also include endurance training if you are performing the higher end of the volume ranges.⁴
- ▶ Typically a lower load that can allow for form development and can be helpful for people who can not be loaded at 80+% of 1RM because of injury.

Hypertrophy Breakdown

	Reps	Sets	Intensity	Tempo	Rest	Frequency
NASM	6-12	3-5	75-85%	2/0/2/0	0-60s	3-6x
ACSM Novice/intermediate	8-12	1-3	70-85%		1-3 min based on Intensity	2-3x Novice 3x total body, 4x split
Advanced	1-12	3-6	70-100%			4-6 x
NSCA	6-12	3-6	67-85%		30-90s	As above

Training for strength

- ▶ Fundamental to all training and the foundation of the most successful return to play programs ⁵
- ▶ Exercise Intensity/load is considered a critical component for achieving strength adaptations.⁵
- ▶ Heavy strength training enhances the nervous system's ability to use the muscle gained in hypertrophy phase to produce more force. ⁴
- ▶ Multiple sets of > 80% 1RM in trained individuals ⁵
 - ▶ 3-4 sets per exercise and 8 sets per muscle group found to be most effective ⁵

Strength Breakdown

	Reps	Sets	Intensity	Rest	Frequency
NASM	1-5	4-6	85-100%	3-5 min	2-4x/wk
ACSM Beginner	8-12	1-3	60-70%	1-2 min	2-3 x/wk
ACSM Advanced	1-8	2-6	80-100%	2-3 min	4-6x/wk
NSCA	1-6	2-6	85-100%	2-5 min	Novice: 2-3x Intermediate: 3 x total body, 4x split Advanced: 4-6x

Training for power

- ▶ Power = Rate that work is performed and is the product of force and velocity ⁵
- ▶ Important for rehab professionals for everything from fall prevention to return to sport ⁵
- ▶ Can be divided into: ⁵
 - ▶ Muscular strength
 - ▶ Rate of force development
 - ▶ Max force at high velocities.
- ▶ Peak power = 15-60% of 1RM for ballistic exercises ⁶
- ▶ Peak power for Olympic lifts: 70-80% of 1RM ⁶

Power Breakdown

	Reps	Sets	Intensity	Rest	Frequency
NASM	1-5 = Strength 8-10 = Speed Superset	3-5 Super-sets	85-100% strength 30-45% or up to 10% of BW Speed	1-2 min	2-4x/wk
ACSM	3-6	1-3	LE = 0-60% UE = 30-60%	1-3 min Based on Intensity	Novice: 2-3x Intermediate: 3x total 4x split Advanced: 4-6x
NSCA	1-5	3-5	75-95%	2-5 min	As above 12

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