Resistance Training Program Design

Readings:
- NSCA text: Chapter 15 pp 347 – 385

General Training Principles

- Specificity
  - **Anatomical**: If you want better shoulder muscle function, use must train THOSE muscles
  - **Functional**: If you want better muscle size/strength/power/endurance in the shoulders, you must design a program for muscle size/strength/power/endurance, respectively

- Overload
  - You must **stress** your neuromuscular system greater than what it is used to
    - Load (i.e. lbs lifted), speed, # sets, frequency/wk, rest (min between sets, days between work outs)
  - Progression in overload
    - Appropriate increases (frequency and size) in training stress as the body adapts
Program Design Variables (NSCA text)

1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
8. Variation
9. Progression

Program Design Variables

1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
8. Variation
9. Progression

Initial consultation and fitness evaluation

- Initial consultation
  - Goals?
  - Exercise history?
    - Experience with resistance training?
  - Injuries?
  - Illnesses?
    - (diabetes?, high BP? etc.)
**Initial consultation and fitness evaluation**

- **Initial consultation: resistance training status**

  **TABLE 11.1**

  | Experience | Frequency | How many times per week is your resistance training program scheduled? | How many resistance exercises do you perform per session? | How often do you perform the same exercises? | How difficult is it to perform each exercise? | How much weight can you lift in one repetition? | How many months have you been performing resistance training? | Progressed
  |------------|-----------|-----------------------------------------------------------------|-------------------------------------------------|--------------------------------------|--------------------------------------|-----------------------|-----------------------------------------------|--------
  | No         | No        | Very low to low                                                  | Low to moderate                                 | Low to moderate                      | Low to moderate                      | Low to moderate         | Very low to low                                | No     
  | Yes        | No        | Very low to moderate                                             | Low to moderate                                 | Low to moderate                      | Low to moderate                      | Low to moderate         | Very low to moderate                            | No     
  | Yes        | 1 to 4 months | Very low to moderate                                             | Low to moderate                                 | Low to moderate                      | Low to moderate                      | Low to moderate         | Very low to moderate                            | Moderate

- **Fitness Evaluation**

  - **resistance training specific (for this 416 unit)**
    - 1-RM strength assessment for a variety of resistance exercises is standard
      - Two 1-RM techniques covered in KIN 306
      - Compare to norms or criterion standards (KIN 306)
    - Assessment of other muscular function (power & endurance), &/or “functional movement screen” not typically done outside of athlete assessment (& not done in KIN 416)

- **Set goals**

  - **Muscular Endurance**
    - Performance of many reps at submaximal loads
  - **Muscular Hypertrophy**
    - Muscle size
  - **Muscular Strength**
    - Ability to lift heavy loads
  - **Muscular Power**
    - Ability to move moderate to heavy loads at high speeds
    - not mentioned as training goal in NSCA chpt 15
    - discussed in KIN 410

**Table 11.1**

- **Muscular Strength**
  - Example: World’s strongest man competition
  - Duration to exhaustion: One to few seconds duration
  - Muscle contraction level: Max contraction - speed is not important & likely slow

- **Muscular Power**
  - Example: Shotput (1-2sec), jump up (1sec), 100 m sprint (10 sec)
  - Duration to exhaustion: One to few seconds duration
  - Muscle contraction level: Max contraction - As fast as possible

- **Muscular Endurance**
  - Example: Ski Giant Slalom race (1min 30 sec)
  - Duration to exhaustion: > 30 secs, up to few minutes
  - Muscle contraction level: Sub max contraction

- **Cardiorespiratory Endurance**
  - Example: Marathon (2hr 15min)
  - Duration to exhaustion: > 5 min
  - Muscle contraction level: VERY low level contraction
Initial consultation and fitness evaluation

- Set goals
  - Do not use the term "TONE".
  - *e.g.* "He is really well toned"
  - "toned" is a nonspecific, misused term.
  - The accurate physiological use of the term "Muscle Tone" refers to a basal level of muscle activation, even when relaxation is attempted

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Resistance Training Program Design

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Program Design Variables

1. Initial consultation and fitness evaluation
2. **Choice of exercises**
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
8. Variation
9. Progression

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Choice of exercises

- **Overwhelming number of choices**

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Resistance Training Program Design

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Initial consultation and fitness evaluation

- Set goals
  - Many people refer to lifting weights as "Strength Training" (even though they are not really doing a program designed to effectively develop "strength")
  - Use the term "RESISTANCE TRAINING", encompasses:
    - Different training goals (strength, size, endurance, power)
    - Different loading modalities (free or machine weights, body weight, medicine balls, etc.)
Choice of exercises

Select based on:
- Equipment available
- Time available (# exercises possible, time to learn new exercises)
- Client’s experience (no to high skill) to do exercise properly
- Specific body parts to be trained

Choice of exercises - definitions

- “Core” versus “Assistance” exercises
  What does the term “CORE” mean

Choice of exercises - definitions

- Core Exercise: (NSCA text)
  - “typically more effective at helping a client reach their exercise goals”
  - A multijoint exercise (2 or more primary joints move)
  - Recruits one or more large muscle group(s) or area(s)
    - e.g., chest, shoulder, upper back, hip/thighs
  - Involves synergistic help of one or more smaller muscle groups
    - e.g., biceps, triceps, abs, calves, forearms, lower back

Choice of exercises - definitions

- Core exercise examples: (NSCA text)
  - Bench Press
    - Shoulder + elbow joints
    - Pecs
    - Anterior deltid & triceps brachii
    - Squat
      - Hip + knee + ankle joints
      - Gluts + quads
      - plantar flexors
    - Another example?
Choice of exercises - definitions

- **Structural Core Exercise**: (NSCA text)
  - Core exercise that places load on the spine
  - Requires torso muscles to maintain erect or near-erect posture during exercise
    - e.g., Shoulder press, back squat

- Another example?

Choice of exercises - definitions

- **Power (explosive) Structural Exercise**: (NSCA text)
  - Structural core exercise that is performed very quickly
    - e.g., power clean, snatch

- Note: other exercises can be performed powerfully, that are not structural core exercises

Choice of exercises - definitions

- **Assistance Exercise**: (NSCA text)
  - A single primary joint exercise
  - Recruits a small muscle group or only one large muscle group or area
    - e.g., biceps curl, dumbbell fly

Choice of exercises - definitions

- What does the term “CORE” mean
Choice of exercises - definitions

Web site definition

Stecyk definition

McGill definition

What does the term “CORE” mean
What does the term “CORE” mean?
In 416 we use the term “Core Exercise” (& Assistance Exercise) as defined in NSCA text.
We also will have a lab to learn about “Trunk & Pelvis “Core” Exercises”

- Open Kinetic Chain Exercise
  - Distal aspect of the extremity is free in space
    - Straight leg raise, hamstring curl, knee extension, etc.

- Closed Kinetic Chain Exercise
  - Distal aspect of the extremity is fixed to an object that is either stationary or moving
    - Leg press, squat, lunge, step-ups, etc.

- Open & Closed Kinetic Chain Exercise terms are widely & commonly used to define leg exercises, particularly related to knee rehabilitation
Choice of exercises – guidelines “Functional training”??

<table>
<thead>
<tr>
<th>Isolated exercises, free or machine</th>
<th>Biceps curls, triceps extensions, knee extensions, hamstring curls</th>
<th>Very poor training. The body does not work this way in producing real life movements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercises involve ONLY patterns and loads used in performance</td>
<td>Boxing arm thrust, golf swing, soccer kick, swim stroke</td>
<td>Very Poor Training</td>
</tr>
</tbody>
</table>

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

- “...generating twisting torque while twisting away from neutral, appears to be problematic. Now consider the torso twisting machines found in various fitness and training facilities. ... here is a machine that will lead to troubles in many athletes.” (pg 103 3rd ed)
- “...the kinematic act of twisting [against no load = one end of force vs velocity curve] or generating the kinetic variable of twisting torque while not twisting [isometric against load = opposite end of force vs velocity curve] seems less dangerous than epidemiological surveys suggest” (pg 102 3rd ed)

Choice of exercises – guidelines “Functional training”??

Exercise program that involves:
- 90% multijoint
- 90% whole body, hand-to-foot forces
- 90% on your feet
- Movements patterns that are similar to performance

PLUS
- Opposing movements
- Fundamental movement patterns (push, pull, squat)
- Selective isolated muscle exercises for activation and/or rehab

Functional EFFECTIVE Exercise
Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

- Back extension machines that take spine to full flexion (pg 70 3rd ed)

- Low back health requires extensor endurance NOT strength (pg 233 3rd ed)

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

Neutral (=good) versus Flexed (=bad) lumbar spine

(McGill 3rd ed pg 73)

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

"There is a message here for those who have no injury history: the spine must not bend when under load" (pg 301 3rd ed)

Keep your lumbar spine stable (to transfer forces generated; otherwise not generating movement); also are designed to resist movement, not create it… (pg 48)

Develop core stability NOT crunches

Move with your thoracic spine and hips

HOW THE KINETIC CHAIN FUNCTIONS:

- Shoulder
- Hip
- Thigh
- Ankle
- Foot

Develop core stability NOT crunches

Figure 3.4: Neutral depicts the ability of the disc and fibers to maintain their normal length and position. Flexed shows the spine under load with the lumbar vertebrae in flexion. The inability of the spine to maintain its neutral position can lead to injury.
Choice of exercises - definitions

McGill definition

So now we can answer the question of “what is the core?” Proximal stiffness occurs between the ball and socket joints (i.e., the hips and shoulders). It involves all of the muscles in the torso. They function primarily to stop motion and they should be trained this way. The core also involves the muscles that cross the ball and socket joints that have distal connections, such as psoas, the gluteals, latissimus, pectoralis, etc.

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

“... the spine must not bend when under load” (pg 301 3rd ed)

The spine should be held in a neutral position during the lift of the weight, the spine does not flex or extend under the load.

e.g., rowing movements

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

“... the spine must not bend when under load” (pg 301 3rd ed)

The spine should be held in a neutral position during the lift of the weight, the spine does not flex or extend under the load.

e.g., flexion movements

Choice of exercises

To train the core...

- #5. If only I had trained my core for three-dimensional stability...
- Swimming is all about slicing through the water with as little drag as possible. A floppy midsection that snakes from side to side with every stroke not only leaks a ton of energy but also creates serious drag. Unfortunately, ask most swim coaches, and they’ll tell you the way to a strong core is a few hundred crunches, V-ups, and Russian twists daily. These movements are minimally sports-specific, however, as the only time flexion occurs in swimming is during the flip-turn. And even then, several muscles in addition to the abdominals help generate the movement.
- To create the rigid, canoe-like core that’s truly needed for swimming (and all sports, really), core stability work is the key. Anti-extension, anti-rotation, and anti-lateral flexion exercises, plus rotational medicine ball work.

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

“... the spine must not bend when under load” (pg 301 3rd ed)

The spine should be held in a neutral position during the lift of the weight, the spine does not flex or extend under the load.

e.g., flexion movements
Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

‘the spine must not bend when under load’ (pg 301 3rd ed)

* e.g., *squat* = hip flexion/extension NOT lumbar flexion/extension (pg 304 3rd ed)

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

‘the spine must not bend when under load’ (pg 301 3rd ed)

* e.g., *squat* = hip flexion NOT lumbar flexion

Figure 10.6 For people who are not “body aware” and unable to adopt a neutral or a flexed spine on command, we suggest rehearsing the spine-neutral position and hip (not lumbar) flexion while doing *squat* motions before exertion.

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

Athletes should avoid end range of motion during exertion (pg 140 3rd ed)

* e.g., golf swing = “high rotational velocity forces passive tissues to experience impulse loading when they act to create a mechanical stop to motion”*

Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

“This is not justifiable for any patient and is a poor method for athletes as well!” (pg 99 3rd ed)

1000 lbs compression on the spine

1400 lbs compression on the spine

Figure 4.5 Superior exercises for back extensors

Low back health requires extensor endurance NOT strength (pg 233 3rd ed)
Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health

Trunk flexion exercises:

“… hanging with the arms on an overhead bar and flexing the hips to raise the legs…generates well over 100 Nm of abdominal torque to a spine that is often flexed due to faulty technique.” (McGill 3rd ed pg 95)

- Use side bridge for similar muscle activation with lower spine loads.

Sitting:

“There are many other examples of machines that require consideration for optimizing performance and safety: … Any machine that requires a sitting posture.” (McGill 3rd ed pg 43)

- “Certainly, athletes who resistance train in a seated position would be well advised to question their rationale.” (McGill 3rd ed pg 94)

“… the sitting posture required of many machines results in increased bending loading to the back – for example many seated leg press machines force the lumbar spine into flexion with the application of combined shear and compression. … I would very rarely recommend this approach, except in some very particular cases” (McGill 3rd ed pg 42)

“… no single, ideal sitting posture exists; rather they recommend a variable posture to minimize the risk of tissue overload.” (McGill 3rd ed pg 94)
Choice of exercises – McGill’s recommendations of exercises to avoid, for low back health:

Avoid the high shearing forces

good-bye to good-mornings

Program Design Variables

1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
8. Variation
9. Progression

Frequency

# of workouts/week Determined by:
- Client’s training status (1-3 days between training the same muscle group)
- Other exercise & physical activities
- Client’s schedule, health, other life demands, etc.

<table>
<thead>
<tr>
<th>Training status</th>
<th>Frequency guidelines (sessions per week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginner</td>
<td>2-3</td>
</tr>
<tr>
<td>Intermediate</td>
<td>3-4</td>
</tr>
<tr>
<td>Advanced</td>
<td>4-7</td>
</tr>
</tbody>
</table>

Beginning clients can train (2-)3 days/wk
- Whole body workouts
- One Exercise per muscle group
- At least 48 hrs rest/recovery between workouts
- Exercise of a specific body part occurs (2-)3 x/week
Intermediate or advanced clients can train 4+ days/wk AND have rest days between training the same muscle group by:

**Split routines:**
Different muscle groups are trained on different days

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**Frequency**

Split routine examples:
- Upper body Mon & Thurs (More upper body exercises than in beginner whole body workout)
- Lower Body Tues & Fri (More lower body exercises than in beginner whole body workout)
  - At least 72 hrs rest/recovery between same body part
  - Note that exercise of a specific body part only occurs 2x/week

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**Frequency**

**Rest/Recovery days**

To Facilitate Recovery on "Rest Days"

Consider:
- "Active recovery" = low intensity cardiovascular activity

On all days, to support recovery, think about:
- Sleep
- Nutrition
- Hydration
Program Design Variables
1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
8. Variation
9. Progression

Order of exercises
Sequence of exercises within a single workout
Arrange order so that fatigue caused by one exercise has the least possible impact on the capacity to perform the subsequent exercises
Consider and combine the following:
- Core vs. Assistance exercise
- Muscle area in body
- Nature of the movement (push/pull)

Order of exercises
- Core vs. Assistance exercise
  1. Power exercises first
     - These require the greatest motor skill & focus, & are typically core multijoint exercises using large muscles
  2. Core exercises second
     - These are multijoint, large muscles
  3. Assistance exercises third
     - These are small muscles and/or single joint movements

Order of exercises
- Muscle area in body
TRY:
- Alternating upper and lower body
  - e.g, lat pull downs then leg extensions then shoulder press then Lunges, etc....
## Order of exercises

- Muscle area in body
  
  **TRY:**
  
  - Alternating “Push” & “Pull”
    
    - E.g., bench press then seated rows
    
    - But this does not reduce fatigue between exercises as well (as alternating upper & lower) because antagonists are always active as stabilizers. E.g., once you fatigue your pecs & triceps you will not do a rowing pull as strongly.
Load

%1-RM method to set load

1. Determine client’s maximum strength for the exercise
   - = max weight that can be lifted once with proper technique
   - = 1-repetition maximum, (1-RM)
2. Set training load based on training goals as % of 1-RM

Repetition Maximum (RM) method to set load

RM = Most weight client can lift for a specified number of repetitions

e.g., The most weight a client can bicep curl 6x is 35 lbs
the biceps curl 6RM is 35 lbs

Load:

Percent of the 1RM and Repetitions Allowed (%1RM-Repetition Relationship)

<table>
<thead>
<tr>
<th>%1RM</th>
<th>Number of repetitions allowed</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>1</td>
</tr>
<tr>
<td>95</td>
<td>2</td>
</tr>
<tr>
<td>90</td>
<td>3</td>
</tr>
<tr>
<td>87</td>
<td>4</td>
</tr>
<tr>
<td>85</td>
<td>5</td>
</tr>
<tr>
<td>83</td>
<td>6</td>
</tr>
<tr>
<td>80</td>
<td>7</td>
</tr>
<tr>
<td>77</td>
<td>8</td>
</tr>
<tr>
<td>75</td>
<td>9</td>
</tr>
<tr>
<td>70</td>
<td>10</td>
</tr>
<tr>
<td>67</td>
<td>11</td>
</tr>
<tr>
<td>65</td>
<td>12</td>
</tr>
<tr>
<td>60</td>
<td>15</td>
</tr>
</tbody>
</table>

As load decreases you can do more reps

BUT: table is guideline only, not mathematical or physiological rule because many factors affect the relationship

- Training status
  - More trained = more reps possible at given % 1-RM
  - Applies to single set
  - Subsequent sets lower reps due to fatigue

- Table largely based only bench press, back squat, power clean
- Application to other exercises?
  - More reps possible on a machine vs. free weight version of same exercise
  - # reps for assistance exercise may be lower

Load: %1-RM based methods

How to determine client’s 1-RM strength for an exercise?

Method #1: Progressively increase load to find max load client can lift 1x
Load: %1-RM based methods

Method #1: Progressively increase load to find max load client can lift 1x
 Rarely done, particularly in personal training settings, because it is not to be done:
1. If training status or general health is low
2. If technique is low
   - e.g., a well trained person starting a new lift but lacking technique
3. If safety and physical risk of max load is high, even for highly trained person (1-RM load is huge!)
   - e.g. lunge balance safety and spinal compression with extreme load

Continues next slide….

Essentials of Strength Training and Conditioning text (3rd ed, pg 395) states:
• 1RM testing is reserved for resistance trained athletes who are intermediate or advanced, and who have technique experience in the lift being tested
• Is for core exercises
• Is NOT for core exercises that require stabilization by smaller muscle groups (e.g. in test of upper back muscles in bent over row, lower back muscles may fatigue)

Load: %1-RM based methods

Method #2: Use submaximal loads to predict the max load client can lift 1x

How to determine client’s 1-RM strength for the exercise?

Method #2: Use submaximal loads to predict the max load client can lift 1x

Method discussed in Strength Testing Unit of KIN 306
• Determine heaviest load client can lift 10x
• Use chart* to estimate 1-RM load
  - Use <4 trials to avoid fatigue

*Table 15.4 pg 373, NSCA Personal Training text
Assigning Training Load

Based on the client’s training goal

Load and Repetition Assignments Based on the Training Goal

<table>
<thead>
<tr>
<th>Training goal</th>
<th>Load (%1 RM)</th>
<th>Goal repetitions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Strength</strong></td>
<td>≥85</td>
<td>≥6</td>
</tr>
<tr>
<td><strong>Hypertrophy</strong></td>
<td>≥77</td>
<td>0-12</td>
</tr>
<tr>
<td><strong>Muscular endurance</strong></td>
<td>≥57</td>
<td>≥12</td>
</tr>
</tbody>
</table>

*These RM loading assignments for muscular strength training apply only to core exercises; assistance exercises should be limited to loads not heavier than an 85%RM (%).

%1-RM method example

Client wants to increase strength of bench press

Estimated 1-RM for bench press = 40 lbs

Intermediate client will train 85%1RM for strength

Load to train at: = .85(40) = 34 = 35 lbs

%1-RM method example continued

Previously calculated: Intermediate client wants to increase strength of bench press. Load to train at: = 35 lbs

TRY the weight, there should be a limit of ≤ 6 reps (for core exercise), or weight is too light (remember the %1-RM & Reps relationship is approximate)

Load: RM based method (you don’t need to know what the max capacity is)

First: Decide how many reps you want the client to perform when exercising (e.g., 6 reps)

Then: the trainer tries increasing loads to find the maximum load the client can lift the desired # of times
Load: RM based method

Notes for use:
1. Use min # trials (<4) possible to avoid fatigue
2. Assistance exercises should use 8RM loads or lighter (to avoid high load stresses on single joints and small muscle groups) (this means you don’t use heavier loads that can only be lifted 1-7x)
3. Untrained clients should use 8RM loads or lighter (this means you don’t use heavier loads that can only be lifted 1-7x)

Assigning Training Load

RM method example
Client wants to increase strength of bench press
Weight should selected that can be lifted a maximum of 6x (< 4 trials)

<table>
<thead>
<tr>
<th>Trial 1</th>
<th>Trial 2</th>
<th>Trial 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight used</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Max # times lifted</td>
<td>11</td>
<td>8</td>
</tr>
</tbody>
</table>

Load to train at: = 35 lbs

Assigning Training Load: There is a continuum of effects as reps increase and load decreases

Approximate %1RM level to result in desired # reps (from earlier chart):
- Power: 95%
- Strength: 90%
- Muscular endurance: 85%

Assigning Training Load: Further considerations
Two methods to set training load:
1. % of 1-RM
2. Repetition Maximum (RM)

Which is best?
**Assigning Training Load: example...**

In subsequent sets as fatigue occurs you may do fewer reps with same load

You **want** the reps to stay in the appropriate range for your training goal

SO...You **may** need to decrease weight to keep # reps appropriate for your training goal

**Program Design Variables**

1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. **Volume**
7. Rest periods
8. Variation
9. Progression
Volume

- repetition-volume: total # reps in a training session
  - = # reps/set X # sets

- load-volume: total amount of weight lifted in a training session
  - = # reps/set X # sets X weight/rep

Load-Volume depends on # reps, weight lifted, # sets

But # reps & weight lifted, are largely determined by training goal (strength, size, endurance)

So volume is largely determined by # sets

<table>
<thead>
<tr>
<th>Training goal</th>
<th>Goal repetitions</th>
<th>Goal sets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>≤6</td>
<td>2-6</td>
</tr>
<tr>
<td>Hypertrophy</td>
<td>6-12</td>
<td>3-6</td>
</tr>
<tr>
<td>Muscular endurance</td>
<td>≥12</td>
<td>2-3</td>
</tr>
</tbody>
</table>

*These assignments do not include warm-up sets and typically apply to core exercises only (6, 56).

Strength: 3-6 sets, Assistance exercises 1-3 sets

Volume is largely determined by # sets

Beginners: One set is sufficient training stimulus until client is able to perform multiple sets
Program Design Variables

1. Initial consultation and fitness evaluation
2. Choice of exercises
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Rest periods

**Time** between multiple sets of same exercise, or different exercises for the same muscle group, within the same session

<table>
<thead>
<tr>
<th>Training goal*</th>
<th>Rest period length</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strength</td>
<td>2-5 minutes</td>
</tr>
<tr>
<td>Hypertrophy</td>
<td>30 seconds-1.5 minutes</td>
</tr>
<tr>
<td>Muscular endurance</td>
<td>≤30 seconds</td>
</tr>
</tbody>
</table>

Untrained clients need up to 2x amount of rest listed

Types of Sets (affects “Exercise Order”, “Volume” & “Rest” variables)

- **Straight set**
  - Standard set and rest pattern described previously

Techniques for advanced clients

- **Compound set** (NSCA text)
  - 2 exercise sets in a sequence work the same muscle group
    - E.g., bench press & dumbbell flys

- **Super sets** (NSCA text)
  - 2 exercise sets in a sequence stress antagonistic muscle groups
    - E.g., bench press then seated rows

- **Circuit training** (NSCA text)
  - Exercise sets are performed with minimal rest periods
**Types of Sets** (affects “Exercise Order”, “Volume” & “Rest” variables)

**Techniques for advanced clients**
- Drop Sets (Exercise website definition)
  - 3-4 exercise sets of the same exercise, performed in a sequence without rest, using a lighter weight on each set

**Program Design Variables**
1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
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**Variation**

**TO:**
- Lower risk of overtraining
- Lower risk of injuries
- Relieve boredom
- Maintain training intensity
- Stimulate muscle groups in different ways
- KEEP IMPROVEMENT HAPPENING

**BY:**
- Changing program variables discussed above to change the physical (and mental) stimuli
  1. Choice of exercises
  2. Frequency
  3. Order of exercises
  4. Load (weight)
  5. Volume
  6. Rest periods
  - Variety within workout
  - Variety across workouts
Variation

Pyramid Training (within workout variation)

increase load & decrease reps across sets

Set 1: 75% 1RM, 10 reps
Set 2: 80% 1RM, 8 reps
Set 3: 85% 1RM, 6 reps

Variation

Heavy & Light days (across workout variation)

Heavy day: First day in week you do an exercise, use load calculated as shown previously

Light day: Second day in week you do an exercise, use 80% load calculated as shown previously, same # reps

These are not “lazy” or wimp” days, these are critical to program design (see next two examples)

Variation

Heavy & Light days example:


note: “Intensity” = load

Variation

Heavy & Light days example:

Faster, Better, Stronger, Heiden, Testa, Musolf, pgs 3-4, 54

From: 10 rules to follow to get in better shape
Program Design Variables

1. Initial consultation and fitness evaluation
2. Choice of exercises
3. Frequency
4. Order of exercises
5. Load (weight)
6. Volume
7. Rest periods
8. Variation
9. Progression

Progression

- Client will plateau in gains if progression in training stimulus is not provided when needed
- Can increase training stimulus by:
  1. Increasing freq/week
  2. Increasing # exercises
  3. Increasing # sets
  4. Increasing speed of movement
  5. Increasing load
  6. Decrease rest period
  7. More difficult versions of exercise

Progression of load

- 2-for-2 rule:
  - if the client can perform two or more repetitions over his or her assigned repetition goal in the last set in two consecutive workouts for a given exercise, weight should be added to that exercise for the next training session

Progression of load

- How big should the increase be:

<table>
<thead>
<tr>
<th>Resistance training status</th>
<th>Body area</th>
<th>Type of exercise</th>
<th>Absolute increase (add weight)</th>
<th>Relative increase (add a percent of the previous load)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beginner</td>
<td>Upper body</td>
<td>Core</td>
<td>2.5-5 pounds (1.2-2.5 kilograms)</td>
<td>2.5%</td>
</tr>
<tr>
<td></td>
<td>Upper body</td>
<td>Assistance</td>
<td>12.5-25 pounds (5.6-11.3 kilograms)</td>
<td>12.5%</td>
</tr>
<tr>
<td></td>
<td>Lower body</td>
<td>Core</td>
<td>10-15 pounds (4.5-6.8 kilograms)</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Lower body</td>
<td>Assistance</td>
<td>5-10 pounds (2.3-4.5 kilograms)</td>
<td>25%</td>
</tr>
<tr>
<td>Intermediate or advanced</td>
<td>Upper body</td>
<td>Core</td>
<td>5-10 pounds (2.3-4.5 kilograms)</td>
<td>25%</td>
</tr>
<tr>
<td></td>
<td>Upper body</td>
<td>Assistance</td>
<td>15-20 pounds (6.8-9.1 kilograms)</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Lower body</td>
<td>Core</td>
<td>10-15 pounds (4.5-6.8 kilograms)</td>
<td>5%</td>
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<td>Assistance</td>
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<td>25%</td>
</tr>
</tbody>
</table>

*Although these load increases are appropriate for training programs with volumes of approximately three sets with a total of 5 to 10 repetitions, they should be regarded only as guidelines.
Progression of More difficult versions of exercise

- Change your position (to fire different motor units) change hand/foot width & angles, body position/angle
- Change the type of resistance (machine, cable, free)
- Go from bilateral to unilateral
- Add a realistic balance challenge
- Do more compound movements

Progression of More difficult versions of exercise

<table>
<thead>
<tr>
<th>Machine</th>
<th>Progression</th>
<th>Progression</th>
<th>Progression</th>
</tr>
</thead>
<tbody>
<tr>
<td>bench press</td>
<td>?</td>
<td>?</td>
<td>?</td>
</tr>
</tbody>
</table>

Progression

- Progression, and training, will not, and should not be planned or envisioned as a staircase

- Periodization, discussed later in “Athlete Training (but applicable to non-athletes as well) will discuss planned lighter weeks (extensions of the “light days” discussed previously in this unit).
Comparison of NSCA text guidelines to other sources.

HOW TO TRAIN TO PRODUCE HYPERTROPHY?

Current research suggests that maximum gains in muscle hypertrophy are achieved in training regimens that produce significant metabolic stress while maintaining a moderate degree of muscle tension. A hypertrophy-oriented program should employ a repetition range of 8-12 reps per set with rest intervals of 60-90 seconds between sets. Exercises should be varied in a multiple, multistaged fashion to ensure maximal stimulation of all muscle fibers. Multiple sets should be employed in the context of a split training routine to maximize anabolic milieu. At least some of the sets should be carried out to the point of concentric muscular failure, perhaps alternating microsets of sets to failure with those not performed to failure to maximize the potential for overtraining. Consecutive repetitions should be performed at fast to moderate speeds (3-5 seconds) while eccentric repetitions should be performed at slightly slower speeds (5-4 seconds). Training should be periodized so that the hypertrophy phase culminates in a brief period of higher-volume overtraining followed by a taper to allow for optimal supercompensation of muscle tissue.

How does this match with NSCA guidelines for hypertrophy development?

Concepts from Vern Gambetta:
The goal of conditioning is to develop the ability to deliver:
• The right force
• At the right time
• Under control
• Safely

"We want adaptable athletes, not adapted athletes"
Resistance Training Program Design

1. Stay on top of your soft tissue work and mobility drills.
2. Do a small amount of pre-training plyos.
3. Emphasize full-body exercises that teach transfer of force from the lower body to the upper body.
4. Emphasize ground-to-standing transitions.
5. Get strong in single-leg.
6. Use core exercises that force you to resist both extension and rotation.
7. Train outside the sagittal plane.
8. Chuck medicine balls!
9. Be fast on your concentric.
10. Play. Don’t be afraid to have some fun. The longer you’ve been training, the more you realize that your strength and conditioning programs have to be versatile enough to preserve your athleticism and functional capacity while still keeping training fun.

“We want adaptable athletes, not adapted athletes”