

# STRENGTH / CONDITIONING CLINICAL PRACTICE Chris Kolba, PT, PhD, MHS, CSCS

## Disclaimer

- Strength progression in rehabilitation is time and criterion-based.
- Dependent on tissue healing timeframes, patient demographics, and clinician evaluation.

## Background

- Clinicians in outpatient and sports medicine are responsible for helping patients return to functional activities.
- Lack of knowledge in strength and power progression can hinder optimal recovery.
- Long-term studies show many patients lack strength and power even *1-2 years* post-injury/surgery, preventing a return to previous activity levels.
- Proper strength and power progression reduces the risk of re-injury and boosts patient confidence.
- This document provides a framework for strength progression beyond the subacute phase, aiming to fill gaps in education and clinical practice, significantly impacting patient recovery goals for life, work, or recreation.

## RECOMMENDATIONS

### Precautions / Contraindications

- Avoid stressing unhealed or inflamed tissue.
- Follow post-surgical guidelines for contraindicated movements (e.g., avoid bench pressing after anterior shoulder stabilization).
- Diabetes, heart disease, osteoporosis are not contraindications if stable.
- Avoid lifting/exercising with fever or flu-like symptoms.
- Address postural and technique considerations.
- Avoid heavy weights in skeletally immature individuals.
- Progress plyometric exercises appropriately; not for conditioning and endurance.

- See **Appendix B**.

### Criteria for Progression

- Pain-free range of motion.
- No compensatory motion affecting exercise performance.
- Ability to communicate and follow directions appropriately.
- Successful completion of the previous phase (lightweight before moderate, then heavy weight exercises).
- No reactive pain or effusion.
- See **Appendix A**.

Phase	Description	Intensity	Reps	Sets	Frequency	Rest Between Sets
<b>Hypertrophy</b>	Increase muscle size to prepare for the next phase	50-75% of 1 Rep Max (RM)	6-12	3-5	2-3x/week	30 sec – 1.5 min
<b>Strength</b>	Focus on force production	80-90% of 1 Rep Max	4-8	3-5	2-3x/week	2-5 min
<b>Power</b>	Maximal force generation by the muscle	85-95% of 1 Rep Max	1-4	3-5	2x/week	2-5 min

*\*See Appendix A for linear and undulating models of periodization*

### Plyometric / Power

**Purpose:**

To decrease the amortization phase and increase muscle explosiveness, thereby enhancing the rate of force development.

**Key Points:**

- Involves high eccentric forces.
- Higher risk of injury.
- Not intended for conditioning.
- Typically performed at the beginning of a session.
- Intensity is measured by the number of foot contacts (lower extremity) or hand contacts/throws (upper extremity).

### Plyometric Volumes & Frequency

*(per NSCA, Essentials of Strength Training and Conditioning 3rd Edition, 2008)*

Plyometric Experience	Volume (contacts/session)	Frequency/week	Rest
<b>Beginner (no experience)</b>	<i>80-100</i>	<i>1-3 times/week</i>	<ul style="list-style-type: none"> <li>• Alternate linear &amp; multidirectional days.</li> <li>• 45-60 sec between sets,</li> <li>• 1:5 – 1:10 work/rest ratio</li> </ul>
<b>Intermediate (some experience)</b>	<i>100-120</i>	<i>1-3 times/week</i>	<ul style="list-style-type: none"> <li>• Alternate linear</li> <li>• Multidirectional days</li> </ul>
<b>Advanced (considerable experience)</b>	<i>120-140</i>	<i>1-3 times/week</i>	<ul style="list-style-type: none"> <li>• Alternate linear</li> <li>• Multidirectional days</li> </ul>

*\*See Appendix B for an example of Plyometric Progression.*

## Appendix A

### Linear Model Periodization

*(Essentials of Strength Training and Conditioning, 3rd Edition, 2008)*

- **Purpose:** Applied when there is sufficient training time to complete all phases.
- **Duration:** Multiple weeks are spent on each phase, typically 4-6 weeks. Starting with hypertrophy, then moving to strength, and finally power. This method helps optimize patient progression, preparing them for a safe return to sport and reducing the risk of re-injury.

### Hypertrophy Phase Practical Example - Upper Body Exercises

- **Warm-up:** Superset Y & T with serratus punches, 2-3 sets of 15 reps
  - **Bench Press/Stand Band Press:** 3 sets of 8-10 reps, rest 30 sec – 1.5 min
  - **1 Arm Cable Row (from mid position):** 4 sets of 8-10 reps, rest 30 sec – 1.5 min
  - **Shoulder Overhead Press:** 3 sets of 8-10 reps, rest 30 sec – 1.5 min
  - **B Cable Pull Down:** 4 sets of 8-10 reps, rest 30 sec – 1.5 min

**Clinical Pearl:** Superset Bench Press with Cable Row and Shoulder Press with Cable Pull Down for a push-pull superset.

### Strength Phase Practical Example - Leg Exercises

- **Warm-up:** 2-3 rounds of Bodyweight Lunge Walk superset with band or cable-resisted side stepping
  - **Barbell Squat:** 4 sets of 5 reps, rest 2-5 min
  - **Barbell Deadlift:** 4 sets of 5 reps, rest 2-5 min
  - **Leg Press:** 4 sets of 5 reps, rest 2-5 min
  - **Modified Deadlift:** 4 sets of 5 reps, rest 2-5 min

**Clinical Pearl:** Superset each exercise with a balance or opposite muscle group exercise to maximize efficiency. For example, pair Barbell Squat with feet-on-physio-ball bridge or a balance exercise.

Phase	Intensity	Reps	Sets	Frequency	Duration
Hypertrophy	50-75% of 1RM	10-25	3-5	2-3x/week	4-6 weeks
Strength	80-90% of 1RM	4-8	3-5	2-3x/week	4-6 weeks
Power	85-95% of 1RM	1-4	3-5	2-3x/week	4-6 weeks

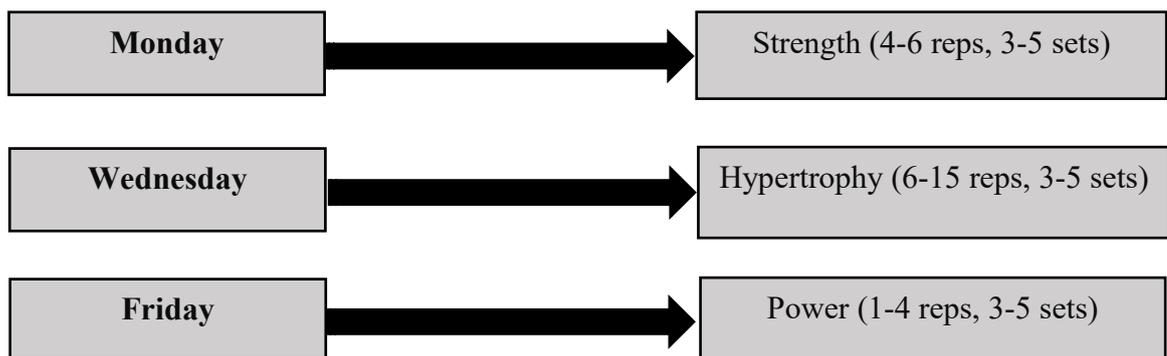
### Undulating Model Periodization (2 Examples)

- **Approach:** Varies intensity in each workout throughout the week.
- **Effectiveness:** Proven to be as effective as the linear model and may be more practical for certain athletes.

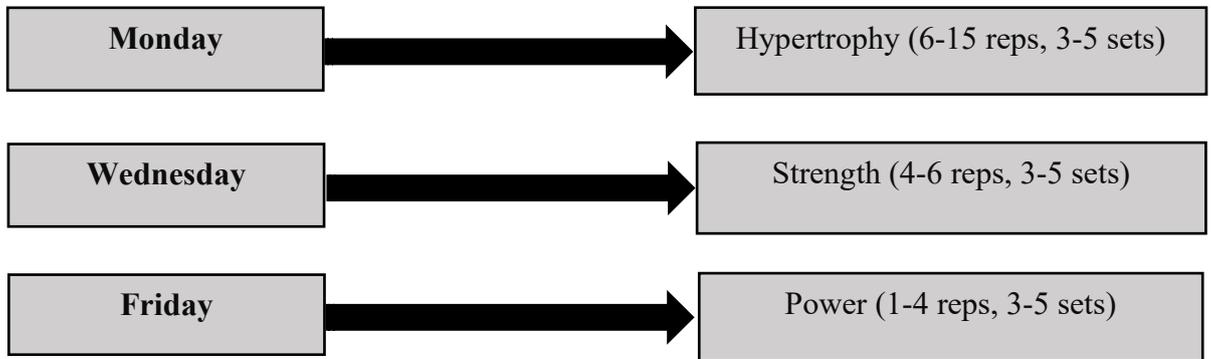
This model is beneficial for athletes training or competing year-round, or multi-sport athletes who cannot adhere to 4-6 week time frames. It may also be more suitable for later phases of rehabilitation.

For instance, a patient in a later phase of ACL rehabilitation attending physical therapy twice a week could perform exercises with 8 reps on one day and 4 reps on the second day. Alternatively, both days could involve 6-8 reps but with different exercises each day.

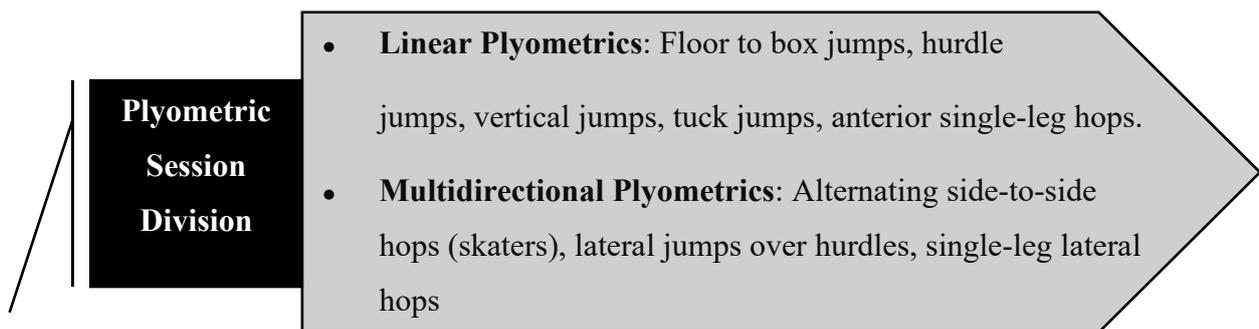
#### Example 1



## Example 2



### Appendix B



### Example of Plyometric Progression

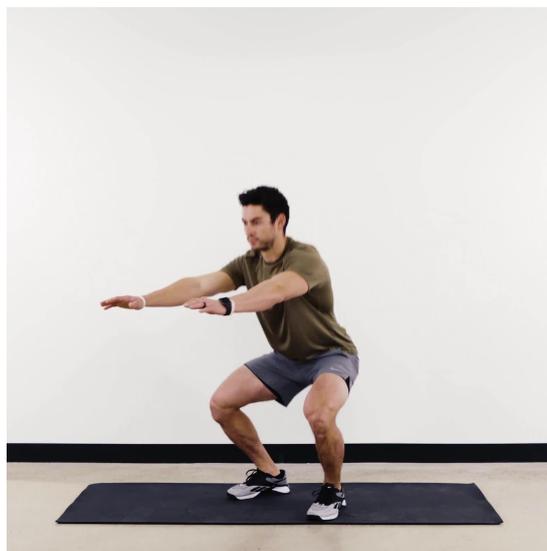
*(New Functional Training for Sports, 2nd Edition, 2016)*

<b>Phase 1</b>	<ul style="list-style-type: none"> <li>• Focus on mechanics with reduced eccentric forces and quiet landings.</li> <li>• <b>Frequency:</b> 2x/week, 5 sets of 5-10 foot contacts per session (50-100 contacts per week).</li> <li>• <b>Exercises:</b> <ol style="list-style-type: none"> <li>1. <b>Jump onto box</b> → Single-leg hop onto box (4-8 inch box): 5x5-10</li> <li>2. <b>Lateral hop onto box / Alternating side-to-side hop with hold (Skater hops):</b> 5x5-10</li> </ol> </li> </ul>
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<b>Phase 2</b>	<ul style="list-style-type: none"> <li>• Continue emphasizing form and technique, increase eccentric forces by removing the box.</li> <li>• <b>Frequency:</b> 2x/week, 5 sets of 5-10 foot contacts per session.</li> <li>• <b>Exercises:</b> <ul style="list-style-type: none"> <li>○ Vertical jump and stick landing.</li> <li>○ Lateral jump over hurdle and stick landing.</li> </ul> </li> </ul>
<b>Phase 3</b>	<ul style="list-style-type: none"> <li>• Introduce elastic response.</li> <li>• <b>Frequency:</b> 2x/week, 5 sets of 5-10 foot contacts per session.</li> <li>• <b>Exercise:</b> <ul style="list-style-type: none"> <li>○ Jump over hurdle to vertical jump and stick landing.</li> </ul> </li> </ul>
<b>Phase 4</b>	<ul style="list-style-type: none"> <li>• Focus on repetitive jumps.</li> <li>• <b>Frequency:</b> 2x/week, 5 sets of 5-10 foot contacts per session.</li> <li>• <b>Exercises:</b> <ul style="list-style-type: none"> <li>○ Multiple jumps over hurdles (anterior and lateral).</li> <li>○ Progress to hops.</li> </ul> </li> </ul>

### Appendix C: Common exercises for muscle strength

#### Squat



## Deadlift



## Sumo Deadlift



## Bench press



## Appendix D: Terminology

<b>Term</b>	<b>Definition</b>
<b>Periodization</b>	The strategic cycling of volume, intensity, and duration to achieve specific goals, reduce injury risk, and prevent plateaus.
<b>Volume</b>	The total amount of weight lifted in a training session, calculated as sets x reps x load.
<b>Intensity/Load</b>	The amount of weight lifted.
<b>Duration/Frequency</b>	The number of repetitions or how often an exercise is performed.
<b>Set</b>	A group of repetitions performed sequentially before resting.
<b>Rep</b>	The number of times a weight is lifted within a set.
<b>Super Set</b>	Performing two or more exercises targeting different muscle groups in succession without resting between them.
<b>Strength</b>	The product of force and distance.
<b>Power</b>	Work divided by time.
<b>Jump</b>	A double-leg takeoff followed by a double-leg landing.
<b>Hop</b>	A single-leg takeoff followed by landing on the same foot.
<b>Bound</b>	A single-leg takeoff followed by landing on the opposite foot.
<b>Skip</b>	A single-leg takeoff with two foot contacts.