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UPPER EXTREMITY PLYOMETRICS FOR THE EVERYDAY PATIENT

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We are skilled at restoring strength in our upper extremity patients. But strength alone does not protect patients in real life. Most upper extremity injuries do not occur during slow, controlled loading but rather during rapid, reactive events such as:

- Bracing during a stumble
- Catching a falling object
- Absorbing an unexpected load
- Controlling arm momentum at end range

These examples are rate-limited tasks rather than strength-limited tasks.

Power Declines Before Strength — And Function Declines with It

With aging, muscle power declines earlier and more dramatically than maximal strength. (Skelton et al., 1994; Reid & Fielding, 2012) Power depends on velocity and velocity is what disappears first. Loss of Type II muscle fibers (Lexell et al., 1988), slower motor unit recruitment, and reduced firing frequency diminish rapid force production capacity — even when strength appears acceptable. Importantly, muscle power correlates more strongly with functional performance in older adults than strength alone (Reid & Fielding, 2012). In practical terms, this means that the ability to generate force quickly is more predictive of real-world task performance than maximal force production.

This relationship is supported experimentally. In a randomized controlled trial, van Roie and colleagues (2020) examined the effects of a 12-week age-adapted lower extremity plyometric program in older men. The program incorporated progressive stretch/shortening cycle exercises tailored for safety and feasibility in an older population. Compared with the walking and traditional resistance training group, the plyometric group demonstrated improvements in dynamic strength, jump performance, and functional measures such as stair climbing — without compromising gains in maximal strength.

The key takeaway is that velocity-based training can meaningfully improve functional capacity. For the everyday patient, this reinforces an important principle: They may still be strong enough, but they are simply not fast enough. Restoring rapid force production is not about performance but it is about protection.

Rate of Force Development is a Distinct Adaptation

Rate of Force Development (RFD) describes how quickly force can be generated. RDF does not normalize simply because strength improves. High-velocity and plyometric training improve RFD more effectively than slow resistance training (Cormie et al., 2011), largely through neural adaptations of:

- Faster motor unit recruitment
- Improved synchronization
- Reduced electromechanical delay

In the upper extremity, adding plyometric training to strength training has been shown to improve the speed of transition from force absorption to force production and alter glenohumeral and scapular mechanics during dynamic tasks. (Swanik et al., 2016) That improvement reflects faster eccentric-to-concentric transitions which is a key feature of reactive stabilization.

For the everyday patient, this translates to:

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- Faster protective bracing
- Better dynamic joint control
- Reduced reliance on passive structures

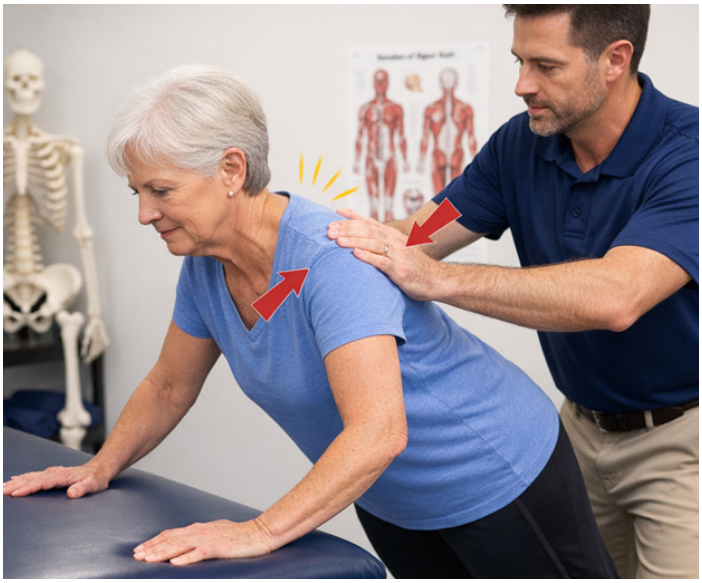
Reactive Capacity Protects During Falls

Many wrist and shoulder injuries occur during attempts to brace a fall. Since protective responses require rapid force production, age-related deficits in rapid force generation and tendon stiffness are associated with impaired dynamic stability (Karamanidis et al., 2008). If rehabilitation restores strength but not rapid activation capacity, the body's protective system remains incomplete.

Clinical Picture

For the non-athlete, plyometrics are not maximal-effort drills but are graded exposures to velocity and unpredictability.

EXAMPLE 1: Controlled Perturbation in Weight Bearing



Goal: Restore feed-forward stabilization and rapid co-contraction.

Set-Up:

- Modified quadruped on table or incline plank at countertop
- Neutral wrist position
- Elbows extended but not locked
- Scapula positioned naturally — not rigidly braced

Execution:

- Therapist applies light, brief, unpredictable perturbations at shoulders, trunk, or forearms
- Patient resists collapse by rapidly stabilizing
- Emphasis is responsiveness, not rigidity

What It Trains:

- Feed-forward rotator cuff activation
- Timing of scapular stabilization
- Reflexive wrist and elbow co-contraction
- Dynamic joint stiffness modulation

Progression:

- Stable surface to foam pad
- Predictable to unpredictable direction
- Bilateral to alternating unilateral load
- 10-second exposure to 20–30 second exposure

This drill mirrors the neuromuscular demand of bracing during a stumble. Slow strengthening does not train that timing, but reactive perturbation does.

EXAMPLE 2: Drop-and-Stabilize Deceleration Drill



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Goal: Improve rapid eccentric absorption and deceleration control. Many upper extremity injuries occur during deceleration, not force production.

Set-Up:

- Seated or standing
- Use light ball (0.5–2 lbs)
- Drop height initially 6–12 inches

Execution:

- Ball is dropped toward patient's open hands
- Patient catches and "sticks" the catch — no rebound
- Emphasis is immediate stabilization

Coaching Cues:

- "Absorb and stop"
- "Stabilize before moving"
- Avoid shoulder elevation or wrist collapse

What It Trains:

- Rapid eccentric rotator cuff activation
- Elbow deceleration control
- Wrist stabilization under speed
- Eccentric-to-isometric transition timing

Progression:

- Increase drop height
- Add unpredictability
- Progress to unilateral catches
- Introduce mild trunk rotation before drop

Following a distal radius fracture, this exercise restores the patient's rapid wrist stabilization. Following rotator cuff repair (once cleared), it retrains deceleration capacity that resistive exercise band work alone cannot replicate.

Key Principles

- Introduce only when foundational strength and pain control are established
- Keep loads light; speed is the stimulus
- Monitor 24-hour symptom response
- Progress unpredictability before increasing load
- Respect surgical healing timelines
- Remember these are protection drills and not performance drills

Clinical Takeaway

Neuromuscular decline does not begin at age 65, and protective reactions are not exclusive to sport. Much of the research on plyometric training focuses on older adults because they exhibit the most measurable loss in rapid force production, but the physiological trajectory begins decades earlier. The everyday patient, whether 45 or 75 years of age, lives in a world that demands rapid stabilization and deceleration control. If rehabilitation restores only strength, we restore capacity. If we incorporate appropriately dosed plyometric training, we restore protection. And for most patients, protection — not performance, is the real goal.

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