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Evidence-Based In-Season Finger Flexor Tendon Training for Pitchers

Bottom line questions answered:

1. What FPG training should starters and relievers do in season?

Starters:

- 1) 10% Long Holds same day following game or pen
- 2) Two % of 1RM Target training days per 5, 6, or 7 day rotation at either 30% with 8 second holds or 50% with 4 second holds
 - a) If mid-finger flexion is $< 85\%$ of the 1RM Target, perform two “C” days for every one “A” day
 - b) If mid-finger $\geq 85\%$ of fingertip and are both $\geq 85\%$ of the 1RM Target, alternate “A” and “C” days
 - c) If mid-finger $\geq 85\%$ of fingertip and are both $< 85\%$ of the 1RM Target, alternate “A” and “C” days
 - d) Perform a 30% or 50% of 1RM “B” day once every 2-3 weeks

Relievers:

- 1) 10% Long Holds same day following every high intensity throwing session (within 10 mph of max velo)
- 2) One or two 30% of 1RM Target training session per week provided pitcher will not throw high intensity (within 10 mph of max velo) for 48 hours
 - a) If mid-finger flexion is $< 85\%$ of the 1RM Target, perform two “C” days for every one “A” day
 - b) If mid-finger $\geq 85\%$ of fingertip and are both $\geq 85\%$ of the 1RM target, alternate “A” and “C” days
 - c) If mid-finger $\geq 85\%$ of fingertip and are both $< 85\%$ of the 1RM target, alternate “A” and “C” days
 - d) Perform a 30% or 50% of 1RM “B” day once every 2-3 weeks

2. Is it better to do Long Holds on the same day post high intensity throwing and an “A” or C” Day % of 1RM training the following day, or vice versa?

Performing 10% Long Holds immediately after throwing, followed by 30% or 50% 1RM Target training the next day, generally provides a better balance between adaptation and recovery. But as long as there’s at least 48 hours recovery before the next high-intensity throwing day, either option is viable.

3. Is doing Long Holds on the same day post high intensity throwing better than doing nothing?

Post–high-intensity throwing 10% Long Holds is superior to doing nothing, as it enhances tendon recovery signaling, supports remodeling between outings, reduces cumulative fatigue, and improves dynamic elbow stabilization endurance, primarily accelerating tendon recovery for starters and improving fatigue resistance and durability for relievers.

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1) Primary Drivers of Tendon Stiffness

- Peak tendon strain magnitude
- Duration of strain exposure
- Loading frequency
- Controlled loading rate

Tendon adaptation is determined primarily by mechanical strain magnitude and duration, which together can be approximated as force multiplied by time under tension (TUT). Evidence indicates that moderate-intensity shorter-duration loading and lower-intensity longer-duration loading can produce similar mechano-transduction signaling when total tendon stress is comparable (Kongsgaard et al., 2007; Baar, 2017). Adaptation is most robust at higher strain magnitudes (often \geq ~70% MVC), though meaningful adaptation can still occur at moderate intensities (~30–40% MVC) when time under tension and total mechanical exposure are sufficient.

2) Primary Drivers of Muscle Fatigue and DOMS

- Rapid force development
- High peak contraction intensity
- Eccentric loading stress
- Total contraction volume
- Local stress in small muscle groups

3) Two Plausible FlexPro Grip Finger Flexor Tendon Training Protocols

Protocol	Intensity	Ramp Up	Hold Time	Total Time Under Tension	Exercises / Reps	Total Workout Time	Supplement
1	30% of 1RM Target	3 sec	5 sec	8 sec	20 / 4	~7 min	10% Long Holds
2	50% of 1RM Target	1 sec	3 sec	4 sec	20 / 4	~4 min	10% Long Holds

4) Exercises for FlexPro Grip “A” and “C” Day Protocols

1. Four-finger flexion
2. Index finger flexion
3. Middle finger flexion
4. Ring finger flexion
5. Little finger flexion
6. Ulnar deviation

5) Load Equivalency Between the Two Plausible Training Protocols

A 30% 1RM contraction with 8 seconds of total TUT per rep provides similar tendon loading to a 50% 1RM contraction with 4 seconds of TUT when repetition counts are equal (Heinemeier et al., 2007; Enoka & Duchateau, 2008).

6) Comparison of Training Intensities of Two Protocols

A) Low-Load Long-Duration Loading (\approx 30% 1RM with 8 second hold time)

- Produces strong tendon signaling through extended TUT
- Lower neuromuscular fatigue
- Greater total contraction time requirement

B) Moderate-Load Short-Duration Loading (\approx 50% 1RM with 4 second hold time)

- Provides efficient tendon strain magnitude
- Maintains high-threshold motor unit recruitment
- Produces equivalent stiffness stimulus with less total contraction volume

C) Comparative Physiological Effects

When paired with low-load long-duration isometrics (\sim 10% 1RM) to enhance tendon remodeling and recovery, both loading schemes, performed twice weekly, provide a minimum effective mechanical dose to preserve tendon stiffness while limiting fatigue accumulation.

7) Role of 10% of 1RM Target Long Holds

The forearm flexor–pronator muscle group provides dynamic resistance to valgus stress at the elbow. Residual fatigue prior to throwing may reduce joint stabilization and increase UCL loading risk.

- Low-intensity isometric contractions (\sim 10% 1RM) held for \sim 30 seconds enhance collagen synthesis and extracellular matrix remodeling with negligible neuromuscular fatigue.
- Long Holds performed immediately after throwing enhance tendon remodeling without increasing fatigue. Moderate-intensity loading is best scheduled at least 48 hours prior to the next maximal throwing session.

8) Scheduling Relative to High-Intensity Throwing

Pitchers tend to perform two high-intensity throwing sessions within a 5–7 day rotation. Flexor tendon loading must be coordinated with throwing stress to avoid residual fatigue.

9) Optimal FlexPro Grip In-Season Scheduling for Starters

Day	5 day rotation	FPG	6 day rotation	FPG	7 day rotation	FPG
1	Game	LH 10% + (B day every other week)	Game	LH 10% + (B day every other week)	Game	LH 10%
2		C day		C day		C day
3		Optional LH 10%		Optional LH 10%		B day + LH 10%
4	Pen	A or C day (alternate)	Pen	LH 10%		Optional LH 10%
5				A or C day (alternate)	Pen	LH 10%
6	Repeat Day 1					A or C day (alternate)
7			Repeat Day 1			
8					Repeat Day 1	

10) Optimal FlexPro Grip In-Season Scheduling for Relievers

Primary objectives:

- Maintain tendon stiffness and structural integrity
- Preserve rapid neuromuscular force production
- Minimize cumulative fatigue
- Maintain fine motor control

Supplemental forearm flexor training functions primarily as a tendon maintenance and durability strategy rather than a primary adaptation stimulus.

Because AI indicates our 30% of 1RM Target protocol is slightly less fatiguing than our 50% of 1 RM Target – SHORT protocol, we recommend the following:

- 30% 1RM 8-second isometric protocol once weekly
- 10% 1RM Long Holds 3–4 times weekly

This supports tendon durability while minimizing neuromuscular fatigue.

Training Strategy	Tendon Stiffness Outcome	Fatigue Risk	Injury Protection	Performance Stability
30% of 1RM Target weekly + 10% Long Holds	Excellent maintenance	Very Low	Very High	Very High
50% of 1RM Target – SHORT weekly + 10% Long Holds	Slight stiffness improvement	Low	Very High	Slightly Reduced

11) Comparing Post-Throw Flexor Loading Approaches

Tendon stiffness and structural remodeling are influenced by peak strain magnitude, total duration of loading, and consistency. Higher loads generate greater collagen deformation and structural adaptation, while lower loads require longer duration to produce comparable signaling.

- Doing 30% or 50% of 1RM Target training post high-intensity throwing followed by 10% Long Holds delivers a moderate strength stimulus immediately, reinforcing neuromuscular patterns but may increase same-day fatigue and soreness.
- Doing 10% Long Holds post high-intensity throwing followed by 30% or 50% 1RM training the next day prioritizes low-fatigue tendon loading immediately after throwing and places the moderate-strength stimulus when fatigue has dissipated.
- Provided at least 48 hours recovery before the next high-intensity throwing day, either option is viable. That said, in-season, performing 10% Long Holds immediately after throwing followed by 30% or 50% 1RM training the next day generally provides a better balance between adaptation and recovery.

Protocol	Same Day Post Throw	Following Day	Pros	Cons
A	30 or 50% of 1RM Target	10% long hold	Maximizes strength-tendon synergy; neural reinforcement immediate	More muscle fatigue same day; potential DOMS
B	10% Long Holds	30 or 50% of 1RM	Minimizes muscle fatigue same day; tendon loading immediate; gentler	Strength stimulus ~24 hours later; slightly less acute neural reinforcement

12) Post high-intensity throwing 10% Long Holds vs no post-throw 10% Long Holds

A) Starting Pitchers

Post-throw low-load long-duration isometrics are likely:

- Moderately superior to no post-throw flexor training
- Beneficial for tendon remodeling between outings
- Safe for implementation immediately following game performance

B) Relief Pitchers

Post-throw low-load long-duration isometrics are likely:

- Strongly superior to no post-throw flexor training
- Particularly effective for reducing cumulative fatigue
- Highly compatible with next-day availability and performance demands

C) Evidence-Based Summary

10% Long Holds post-throw are likely to provide:

- Enhanced tendon recovery signaling
- Reduced cumulative fatigue accumulation
- Improved endurance of dynamic elbow stabilization
- Minimal risk of performance impairment

For relief pitchers, the primary benefit is fatigue mitigation and durability. For starting pitchers, the primary benefit is tendon remodeling and recovery acceleration.

13) Supporting Scientific Evidence

Kongsgaard et al.

Demonstrated that moderate-to-high intensity isometric loading significantly improves and maintains tendon stiffness and collagen organization with relatively low training volume.

Baar et al.

Showed tendon collagen synthesis is highly responsive to sustained mechanical loading and that low-load, long-duration isometric contractions stimulate extracellular matrix remodeling.

Enoka et al.

Documented that cumulative contraction time is a primary driver of neuromuscular fatigue, particularly in small muscle groups such as forearm flexors.

14) References

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