

DECELERATION AND THE BACK OF THE SHOULDER

Stopping *It*

Acceleration gets all the training and deceleration does all the failing. Over 225 pounds of pull tries to separate the arm from the shoulder on every pitch, and the tissue that resists it is the tissue nobody programs for.

OUTLIER PERFORMANCE LAB COMPANION TO ALLOWED, NOT MADE

Throwing hard is a solved problem for most of the arm. **Stopping** is what it cannot do.

Every pitch, the arm reaches the fastest rotation the human body produces and then has to be brought to zero by a small group of muscles on the back of the shoulder, working while being stretched. Nothing about that is optional and nothing about it is trained by throwing more. The forces are enormous, they are concentrated in a handful of structures, and they arrive at the exact moment the athlete has the least control over what happens next.

What the arm is actually asked to survive

The numbers are worth sitting with, because they explain why this is where things break rather than during acceleration.

THE DECELERATION BILL, PER PITCH		
FORCE	MAGNITUDE	WHAT IT IS DOING
Shoulder distraction	over 1000 N about 225 lb	Pulling the arm bone out of the socket along its length. Roughly the athlete's own bodyweight, applied to a joint held together largely by soft tissue.
Internal rotation torque	about 67 Nm about 50 foot pounds	Twisting the arm inward just before peak layback, which the back of the cuff has to resist while lengthening.
Anterior shear	about 310 N about 70 lb	Pushing the arm bone forward against the front of the joint capsule at the same instant.
Rotation speed being cancelled	roughly 6,000 to 7,000 degrees per second	Somewhere around seventeen to nineteen full turns per second, taken to zero in the time it takes the arm to travel through the follow through. Reported values vary by study.

The physics is the whole story

Peak force depends on how much momentum has to be cancelled and **how long you give yourself to cancel it**. The momentum is set by how hard he throws and is not negotiable. The time is set by mechanics, and it is.

Every fault in this document is a fault that shortens the runway. That is the only lever there is.

Who does the stopping

A short list, doing an enormous amount of work, in the hardest way a muscle can work: producing force while being lengthened.

THE DECELERATION MUSCLES AND WHAT EACH ONE RESISTS		
MUSCLE	WHAT IT RESISTS	WHY IT MATTERS
Teres minor back of the rotator cuff, lower	The arm bone being pulled forward, adducted across the body, and rotated inward, all at once.	Peaks higher than the muscle next to it. This is why post outing soreness localises where it does rather than spreading across the whole back of the shoulder. If a pitcher can point at one sore spot, it is usually this one.
Infraspinatus back of the rotator cuff, upper	Internal rotation and forward translation.	Works alongside teres minor through the whole follow through. Also one of the muscles that produced the layback in the first place, so it is being asked to do both jobs on the same pitch.
Posterior deltoid back of the shoulder	The arm swinging across the body.	The largest contributor by size, and the one most likely to be trained already, since it responds to ordinary pulling work.
Rhomboids and trapezius between the shoulder blades	The shoulder blade being dragged forward around the rib cage.	The arm does not decelerate against the torso directly. It decelerates against the shoulder blade, which has to be held in place while that happens.
Biceps and brachialis front of the upper arm	The elbow snapping into extension.	The elbow has its own deceleration problem. Front of the upper arm soreness late in a season is this, and it is frequently misread as a shoulder issue.
Serratus anterior ribs under the armpit	The shoulder blade lifting off the rib cage.	Working at over 40 percent of a max effort through deceleration. If it fails here the blade wings and the cuff decelerates against an unstable base.

What shortens the runway

Deceleration failures are usually mechanical, not muscular. These are the faults that compress the time available and drive peak force up.

FAULT 01 Fake layback An elbow folded forward instead of a rotated arm bone. The reversal happens over a much shorter arc, so peak force climbs without any velocity being gained. The single clearest example of a shortened runway.	FAULT 02 Glove side blocking Stopping the glove arm abruptly stops the whole torso rotating, which removes the trunk's contribution to slowing the arm down. It also pulls the head off line. The arm ends up doing alone what the body was supposed to help with.	FAULT 03 A stiff or early finishing trunk The follow through is trunk rotation continuing past release. A chest that stops turning at release hands the entire deceleration job to the shoulder in a much shorter window.
FAULT 04 Short stride and upright finish Getting over the front leg lengthens the path the arm travels after release. Finishing tall and short cuts that path down.	FAULT 05 A winging shoulder blade The cuff is decelerating against a base that is itself moving. Force that should have gone into stopping the arm goes into stabilising the platform instead.	FAULT 06 Cutting the follow through short Usually taught, occasionally to field the position better. The follow through is not decoration; it is the deceleration phase, and shortening it is shortening the runway on purpose.

Why late innings are a different exposure

Velocity falls and load rises at the same time

Across a simulated game, pitch velocity dropped roughly **0.28 mph per inning** while medial elbow torque **increased after the third inning**, climbing about 0.84 Nm each inning. Separately, hip to shoulder separation shrank sharply across an outing in adolescent pitchers, and maximum layback fell from about 181° in the first inning to 172° in the last in a small group of major leaguers.

Read that together and it is the deceleration story in miniature. He is throwing softer and paying more, because the mechanics that spread force over time are the ones fatigue takes first. The arm has less help and the same job.

It also explains why pitch count works as a management tool when perceived effort does not. The athlete's sense of how hard he is throwing tracks velocity, which is falling. The load is going the other way.

Training it

Deceleration is an eccentric quality, so it needs eccentric work. High rep light band work builds endurance in these muscles but does not prepare them for the one thing they actually do.

STAGE 1

Build capacity in the tissue that stops the arm

Load the back of the shoulder in the direction it actually resists, with the lengthening phase emphasised rather than rushed.

- **External rotation at 90 degrees with a slow return** — three to four seconds on the lowering phase, which is the part that matters
- **Prone horizontal abduction** and **prone external rotation** for the posterior cuff in its throwing position
- **Slow lowering biceps work** for the elbow's half of the problem
- **Thrower's Ten** as the year round base, with the eccentric emphasis added rather than assumed

STAGE 2

Stabilise the platform

The cuff cannot decelerate the arm against a shoulder blade that is moving. This is the same work that improves layback, which is why the two documents share a protocol.

- **Serratus** — wall slides, bear position reaches, serratus punches
- **Lower and middle trapezius** — prone Y and T raises, face pulls
- **Rhythmic stabilisation** and **bottoms up carries** for reflexive control rather than voluntary strength

STAGE 3

Train catching force, not just producing it

The gap between a strong shoulder and a durable one is the ability to absorb load at speed. That has to be trained at speed.

- **Reverse throws** into a wall or a partner, where the arm has to catch and redirect rather than push
- **Plyo ball catches** at progressively higher intent
- **Drop catches** in the throwing position for the posterior cuff specifically
- Program these as quality work with full rest. Fatigued eccentric work at speed is how you injure the thing you are protecting

STAGE 4

Give the arm its runway back

The mechanical half, and the half with more upside. Every one of these lengthens the time available to stop the arm.

- **Fix fake layback** — release the front side tissue so real rotation is available, rather than drilling the position
- **Stop coaching a firm front side** — let the glove decelerate over the front hip instead of stopping abruptly
- **Let the trunk keep turning** past release rather than finishing square
- **Get over the front leg**, which lengthens the arm's path after the ball is gone
- **Leave the follow through alone.** It is the deceleration phase, not a flourish

What to watch for

SORENESS Back of the shoulder, one spot Expected after high intent outings and not by itself a problem. What matters is whether it clears on schedule and whether it is getting worse across a season.	SORENESS Front of the upper arm The elbow's deceleration bill. Commonly mistaken for a shoulder complaint because of where it radiates.	RANGE External rotation increases after throwing Measured acutely after pitching, external rotation and total motion go up. That is tissue laxity, not improvement, and it is the window where the joint is least protected.
VIDEO The finish gets shorter across an outing A follow through that is full in the first and abbreviated in the sixth is a deceleration system that has run out. Compare the same camera angle across innings.	VIDEO The head gets yanked at release Usually the glove side stopping abruptly. It costs rotation speed on the way out and deceleration help on the way back.	TESTING External rotation strength relative to internal The back of the shoulder should not be dramatically outmatched by the front. Test it fatigued as well as fresh, since that is the state the failures happen in.

Where this sits in the library

Two halves of one motion

Allowed, Not Made covers getting into layback: what drives it, what allows it, and every reason it comes up short. This document covers getting out of it. The two share a training protocol at the shoulder blade, because a stable platform is required in both directions.

The connection worth holding onto: **more real layback lowers elbow load precisely because it lengthens the runway.** Real range and good deceleration are the same argument applied at two moments. Fake layback fails both at once.

Sources

Reference values are population means with real spread. They locate an athlete, they do not grade one.

- Comparison of teres minor and infraspinatus muscle activation, deceleration phase roles
- Jobe, Moynes, Tibone, Perry — An EMG analysis of the shoulder in pitching
- ASMI — The Clinician's Guide to Baseball Pitching Biomechanics, distraction and shear values
- Fleisig et al. — Kinematic Parameters Associated With Elbow Varus Torque in Elite Adult Baseball Pitchers
- Manifestations of muscle fatigue in baseball pitchers: a systematic review
- Rehabilitative and Preventive Effects of the Thrower's Ten Program in Overhead Athletes
- Driveline — Why We Don't Teach Equal and Opposite or Firm Front Side
- Bullock, Nicholson et al. — Baseball pitching biomechanics in relation to pain, injury, and surgery
- Tread Athletics — How to Fix a Pushing Arm Action

The momentum is not negotiable. The time you give yourself to cancel it is the only thing on the table.