

LAYBACK · THE SHOULDER BLADE'S HALF OF IT

Allowed, Not *Made*

Layback isn't something a pitcher does. It's what happens to a relaxed, well positioned arm when a fast trunk rotates underneath it — which means most layback problems are somewhere other than the shoulder joint, and drilling the position is the one thing guaranteed not to work.

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Nobody lays the arm back. The trunk rotates, the arm has mass, and the arm **gets left behind** — layback is the result, not the action.

Which reorganises the whole problem. If layback is passive, then it depends on three separate things: something has to **drive** it, the joint and the shoulder blade have to **allow** it, and the athlete has to not **fight** it. Every reason a pitcher is short on layback lands in one of those three buckets — and only the middle one is about the shoulder. That's why the fix so often lives in the shoulder blade, the rib cage, or the lead leg, and why asking someone to "get more layback" produces a worse arm rather than a longer one.

The number is a composite, not a joint

Maximum external rotation on a report is the humerus measured *relative to the trunk*. Several structures contribute to that figure, and they fail independently.

Glenohumeral joint

THE BALL IN THE SOCKET

The largest single contributor, but nowhere near all of it. True rotation at the joint itself is capped well below the number you see on the report — the rest is supplied by everything underneath. **This is the only layer**

Shoulder blade

POSTERIOR TILT · UPWARD ROTATION · RETRACTION

As the arm lays back, the scapula must **tilt backward and rotate upward** to keep the socket pointed where the arm is going. A blade stuck in anterior tilt runs the humerus into bony and capsular end range early. This is the layer that fails most often and gets diagnosed least often.

Rib cage & thoracic spine

THE SURFACE THE BLADE SLIDES ON

The scapula has no true joint to the axial skeleton — it floats on the rib cage. A flexed or badly positioned thorax means the blade is sitting on a surface angled the wrong way, so it **cannot** tilt back no matter how strong the muscles are.

Trunk

ROTATION AND CONTRALATERAL TILT

Both the engine and a contributor. Trunk rotation is what drives the arm into layback in the first place, and leaning away from the arm adds to the measured angle without any shoulder motion at all.

Elbow

THE IMPOSTOR

Flexing the elbow forward makes the forearm look laid back from the side view while the humerus hasn't rotated. **Contributes to the picture and nothing to the pitch.** See the section on fake layback.

The shoulder blade's half

Serratus and trapezius are a force couple: together they rotate the blade up and tilt it back. Everything in the front row is a brake on that. Short tissue and weak tissue both reduce layback — by opposite routes.

WHO MOVES THE SHOULDER BLADE, AND HOW EACH ONE COSTS YOU RANGE

MUSCLE	WHAT IT DOES	WHEN IT'S SHORT	WHEN IT'S WEAK
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MUSCLE	WHAT IT DOES	WHEN IT'S SHORT	WHEN IT'S WEAK
Serratus anterior fingers of muscle on the ribs, under the armpit	Rotates the blade upward, tilts it backward , and holds the inner border flat against the ribs. Working at over 40% of a max effort through acceleration and deceleration.	Rarely the problem — it's a hard muscle to shorten.	The big one. The blade tips forward and the inner edge lifts off the ribs. The socket ends up facing down and forward, so the arm hits end range early and layback is gone before the tissue is even stretched.
Lower trapezius mid back, below and between the blades	Upward rotation and posterior tilt — serratus's partner in the force couple. Pulls the blade down and back.	Uncommon.	Upward rotation collapses and the upper trap takes over the job. The blade elevates instead of rotating, which does not open the same space.
Middle trapezius & rhomboids between the shoulder blades	Retraction — pulls the blade toward the spine, building the platform the arm loads against.	Rhomboids also rotate the blade <i>downward</i> ; dominant, they actively oppose the motion you need.	No retraction means no scap load, so the arm has no runway and the elbow supplies the speed instead.
Upper trapezius top of the shoulder into the neck	Elevates the collarbone and contributes to upward rotation as part of the couple.	Short and dominant, it shrugs the blade upward rather than rotating it — the classic substitution. Also a Tread release target.	Rarely weak in throwers.
Pectoralis minor small chest muscle under the pec, coracoid to ribs	Pulls the blade forward, down and into anterior tilt — the exact opposite of what layback requires.	The most common mechanical block there is. A short pec minor holds the blade tipped forward, and no amount of shoulder mobility work gets past it.	Not a meaningful problem.
Subclavius collarbone to first rib	Anchors and depresses the collarbone.	Quietly important: the collarbone is the only bony strut connecting the shoulder blade to the rest of the skeleton. Restrict it and the entire girdle can't travel back, whatever the blade muscles do. Tread names it alongside pec minor.	Not relevant.
Latissimus dorsi big back muscle under the armpit	Extends, adducts and internally rotates the arm; also pulls on the lower blade and the low back.	A direct brake. Short lats limit the combination of arm elevation and external rotation, and drag the blade into depression and anterior tilt. On Tread's release list.	Costs acceleration, not range.
Teres major under the armpit, beside the lat	Same actions on the arm as the lat, attaching directly to the blade's outer border.	Blocks external rotation in abduction, and tethers the blade to the arm so they can't move independently.	Minor.

MUSCLE	WHAT IT DOES	WHEN IT'S SHORT	WHEN IT'S WEAK
Triceps, long head back of the upper arm, attaching to the blade	Crosses both the elbow and the shoulder because it originates on the shoulder blade itself.	Restricts arm elevation combined with external rotation — the exact position layback needs. Also on Tread's list, and frequently missed because it's thought of as an elbow muscle.	Costs extension speed, not range.
Pectoralis major chest	Internal rotation, adduction, horizontal adduction.	A straightforward brake on the layback position. Stretched hard at max external rotation, which is also where it stores energy for acceleration.	Costs velocity.
Subscapularis front of the rotator cuff, on the underside of the blade	Internally rotates, and eccentrically brakes external rotation to protect the front of the joint.	Blocks range directly.	Subtler and more important: if the muscle guarding the front of the joint isn't up to the job, the nervous system will cap external rotation on purpose . The range exists; he won't be allowed to use it.
Infraspinatus & teres minor back of the rotator cuff	Produce external rotation, and take the brunt of deceleration afterward.	Rarely limiting.	Can't actively reach the position even when passive range is available — and can't safely slow the arm down from it, which the nervous system knows.

The pattern underneath the table

Almost everything that **shortens** and blocks layback sits on the *front* of the body — pec minor, pec major, subclavius, subscapularis, lat, teres major. Almost everything that **weakens** and fails to produce it sits on the *back* — serratus, lower and middle trap, posterior cuff.

That's why the order matters so much: release the front, then build the back. Strengthening the back against a locked front just teaches a stronger version of the same restriction.

Every reason layback comes up short

Grouped by what's actually responsible, because the group decides the intervention. Two of these groups can't be trained at all, and one of them isn't the shoulder.

A · Tissue length — something is physically blocking it

Release work first. These are the ones that respond fastest.

- 01 **Pectoralis minor short** — holds the shoulder blade in anterior tilt. The single most common block.
- 02 **Subclavius short** — restricts the collarbone, and with it the whole girdle's ability to travel back.
- 03 **Pectoralis major short** — a direct brake on the external rotation position.
- 04 **Latissimus dorsi short** — limits elevation plus rotation together, and drags the blade down and forward.
- 05 **Teres major short** — tethers the arm to the blade so they can't move independently.
- 06 **Triceps long head short** — crosses the shoulder, so it restricts the elevated and rotated position. Routinely missed.
- 07 **Upper trapezius short and dominant** — shrugs the blade instead of rotating it.
- 08 **Subscapularis short or guarded** — the internal rotator on the underside of the blade, blocking from the inside.
- 09 **Posterior capsule tightness** — shifts how the joint centres itself and alters what rotation is available.
- 10 **Anterior capsule stiffness** after injury or surgery.

B · Shoulder blade strength and control — nothing is producing it

The blade has to move for the arm to finish moving. This group is trainable but slow.

- 11 **Serratus anterior weakness** — no posterior tilt, no upward rotation, and the inner border lifts off the ribs.
- 12 **Lower trapezius weakness** — upward rotation collapses and upper trap substitutes.
- 13 **Middle trapezius and rhomboid weakness** — no retraction, so no scap load and no runway.
- 14 **Upper trapezius dominance** — elevation standing in for upward rotation. Looks like effort, opens nothing.
- 15 **Scapular dyskinesis or winging** — the blade doesn't track with the arm at all.
- 16 **Poor scapulohumeral timing** — the blade moves, but late, so the joint runs out of range before the blade contributes.
- 17 **Weak drive side hip** — published work links gluteus medius activation to the shoulder blade force couples. The blade's stability is not purely a shoulder problem.

C · Rotator cuff — it can't get there, or isn't allowed to

The protective mechanism in this group is the one that gets missed most often.

- 18 **Infraspinatus and teres minor weakness** — can't actively produce the rotation even when passive range exists.
- 19 **Subscapularis weakness** — the nervous system caps external rotation because the brake on the front of the joint isn't trustworthy. The range is there and he's not permitted to use it.
- 20 **Cuff fatigue** — layback quietly shrinks across an outing as the deceleration muscles tire.

D · Structure — the range isn't there to find

Not trainable. Screening for these prevents months of work against a ceiling.

- 21 **Low humeral retroversion** — throwers typically develop extra retroversion in the throwing arm, which is a large part of why they have more external rotation than everyone else. An athlete who developed less of it has a lower ceiling, permanently.
- 22 **Glenoid version** — how the socket is oriented on the shoulder blade.
- 23 **Acromial shape and subacromial space** — bone limiting the arc mechanically.
- 24 **Prior labral or capsular injury** that changed the joint's behaviour for good.

E · Rib cage and thoracic spine — the blade's foundation is wrong

Upstream of everything in group B. Strengthening the blade on a bad foundation doesn't work.

- 25 **Limited thoracic extension** — a rounded upper back mechanically prevents the blade from tilting back.
- 26 **Limited thoracic rotation** — the shoulder ends up supplying rotation the trunk failed to deliver.
- 27 **Rib flare and poor rib position** — the blade sits on a badly angled surface, and mobility screens read falsely optimistic.
- 28 **Breathing pattern holding the rib cage in extension** — the same fault, upstream again. Full exhale work is the entry point.

F · Delivery mechanics — nothing is driving it

Layback is passive. If the trunk doesn't produce it, no shoulder is going to. This group is not a shoulder problem at all.

- 29 **Arm not level with the shoulders at foot contact.** Drifting away from about 90° reduces achievable external rotation directly. Reference is $93 \pm 11^\circ$.
- 30 **Low scap load** — elbow at or under about 5° behind the shoulder line, so the arm has no runway before it starts.
- 31 **Flying open** — the trunk rotates before the arm is in position, so the arm is dragged rather than left behind.
- 32 **Arm late at foot contact** — arriving still packed compresses the layback event into a shorter, sharper arc.

33 Poor lead leg block — less trunk rotation speed means less of the force that produces layback in the first place.

34 Substituting lateral trunk tilt — leaning away from the arm inflates the measured number while nothing at the shoulder improved.

G · Protective and neuromuscular — he won't, rather than can't

Forcing range on this group is how the next injury happens.

35 Guarding after an injury — the nervous system restricting range around tissue it doesn't trust yet.

36 Pain, present or anticipated.

37 Low intent — layback is produced by speed. Submaximal throwing genuinely produces less of it, and that's normal rather than a fault.

38 Global tension — an athlete gripping the ball hard and bracing everywhere cannot let an arm be left behind.

H · Training artifacts — something in the program is causing it

Tread's list. All four are self inflicted and all four are quick to reverse.

39 Balls heavier than 1 lb — protective tensioning prevents the arm relaxing into layback and drives a triceps led push instead. Avoid 2 lb entirely for youth.

40 Standing too close on plyo wall work — produces a cutting or pushing finish rather than a rotational one.

41 Overcueing strikes — accuracy pressure produces a linear, trunk flexing finish instead of a rotational one.

42 Drilling the position directly — chasing layback as a shape is what produces the fake version below.

Fake layback

The reason you can't trust the side view, and the reason "more layback" is a dangerous instruction.



REAL

The humerus rotates

The upper arm bone itself turns back in the socket. The chest, lat and front of the shoulder go on stretch, and the arm's momentum is reversed **over a long arc**.

That long arc is why real layback is **protective**: more true external rotation is associated with *less* elbow load, because peak force drops when you spread the same change in momentum over more time.

FAKE

The elbow folds forward

Forcing the elbow into flexion makes the forearm read as laid back from the side, and can look like 180° or more on video. The humerus hasn't rotated and nothing has been stretched.

So he gets the appearance without the arc — **pays the elbow load and doesn't collect the velocity**. More elbow flexion at foot contact is independently associated with more elbow load.

Why this makes layback a bad coaching target

Ask an athlete for more layback and he will produce more of the *picture*, because the picture is all he can see. The cheapest route to that picture is folding the elbow — so the instruction reliably generates the version that costs him.

Treat layback as an outcome you measure, never a position you cue. Change what drives it, what allows it, or what's fighting it, and the number moves on its own.

Screening it

The job is to find which of the eight groups above he's in. Most of that is settled in ten minutes on a table.

WHAT TO TEST AND WHAT IT SEPARATES		
TEST	LOOKING FOR	WHAT IT RULES IN OR OUT
External rotation at 90° abduction, lying face up, blade held down	Pure joint rotation with the shoulder blade stabilised	Separates the joint from the blade. Big difference between held and unheld means the blade is the problem, not the joint.
Total rotational motion, both arms	Internal plus external rotation added together, compared side to side	More informative than either direction alone. Total motion tells you whether the shoulder has adapted normally or lost range overall.

TEST	LOOKING FOR	WHAT IT RULES IN OR OUT
End feel at the limit	Springy and soft, or abrupt and hard	The fastest way to identify group D. A hard, early stop means bone — stop working on it and build around it.
Pec minor length lying face up, arms at sides	Does the front of the shoulder rest down, or sit up off the table?	The single highest yield tissue test on this list.
Lat and teres major length arms overhead with the low back flat	Can he reach overhead without arching to get there?	Separates a genuine tissue restriction from a lumbar cheat.
Wall slide, watching the inner border	Does the blade rotate upward smoothly? Does the inner edge lift off?	Serratus and lower trap. Winging here is group B.
Thoracic extension and rotation	Segmental movement with the pelvis locked and the ribs down	Group E. Test after a full exhale — a flared rib cage makes this look better than it is.
On the report	Arm elevation at foot contact · elbow behind the shoulder line · external rotation at foot contact · max external rotation	Group F. If these are off, the shoulder may be fine and the delivery is what's short.
Where he feels the end of the range	Front of the shoulder, back of the shoulder, or "just stops"	Front of joint apprehension points at group G — guarding — and changes the plan entirely.

Fixing it, in order

Release the front, rebuild the foundation, then train the back. Skipping to the last step is the most common way this gets worked on and the least effective.

STAGE 1

Take the brakes off

Tread's sequence is explicit: release the tissue first, then throw. Strength work against a locked front side just builds a stronger athlete inside the same restriction.

- **Pec minor and subclavius** — manual work, partner release, or self release. Start here; it's the highest yield target
- **Lat, teres major and triceps long head** — the three that block the elevated and rotated position together
- **Upper trapezius** — quiet it down rather than stretching it repeatedly
- Retest range immediately after. If it doesn't move at all, you're in group D or E, not group A

STAGE 2

Fix the surface the blade sits on

Thoracic position gates everything scapular. A rounded upper back or a flared rib cage physically prevents posterior tilt.

- **Full exhale work** — 90/90 breathing, wall press dead bug — to get the ribs back over the pelvis
- **Thoracic extension over a roller**, and **side lying windmills** with a complete exhale
- **Open books and quadruped rotation** for thoracic rotation
- Mobility here regresses fast — load the new range in stage 3 rather than repeating stage 2 forever

STAGE 3

Build the force couple

Now the back can be trained, because the front has let go and the foundation is oriented correctly.

- **Serratus** — wall slides, bear position reaches, serratus punches. This is the priority muscle
- **Lower and middle trapezius** — prone Y and T raises, low trap raises, face pulls
- **Landmine press** — upward rotation under load, which is hard to train any other way
- **Posterior cuff** — external rotation at 90°, with slow lowering for the deceleration side of the job
- **Thrower's Ten** as the year round base — the evidence supports blade stability, range of motion and cuff strength gains
- Add **glute medius** work; the hip to blade relationship is published, not folklore

STAGE 4

Fix what drives it — then leave the position alone

If groups A, B, C and E are clear and layback is still short, the problem is the delivery. That's group F, and it's a lower half and timing conversation.

- **Arm level with the shoulders at foot contact** — pivot pickoff and scap retraction throws, cueing the elbow *back*, not up
- **Scap load** — get the elbow behind the shoulder line so the arm has runway
- **Block quality** — trunk rotation speed is what produces layback; a late or soft block starves it
- **Long toss** to reteach a rotational finish, and back off the plyo wall so the drill stops producing a push
- **Cap the ball weights** — selective above 1 lb, never 2 lb for youth
- **Do not drill layback.** Measure it, change its inputs, and let it appear

When short layback is the right answer

Not every arm should be chasing more range, and for some athletes the pursuit is actively dangerous.

CASE 01 The range isn't there to find Low humeral retroversion or a hard bony end feel means the ceiling is anatomical. Build velocity through the trunk and the block instead, and stop treating a structural limit as a mobility failure.	CASE 02 He's guarding for a reason After an injury, restricted range is the nervous system protecting tissue it doesn't trust. That restriction is doing a job. Forcing it is how you get the next injury.	CASE 03 The compact action is the weapon Short arm deliveries give the hitter less time to see the ball. If he throws hard and commands it with a compact action, adding range may only add load.
CASE 04 He tolerates it and the numbers are fine Genuinely limited external rotation with normal arm load and good velocity is a viable, lower stress build — not a fault waiting to be corrected.		

The one thing worth chasing even here

Whatever the ceiling, the **fake** version is always worth removing. Elbow flexion standing in for rotation costs load without returning velocity, in every athlete, regardless of how much real range he has. If you fix nothing else on this list, fix that.

Where this sits in the library

FOUR FAULTS, FOUR MOMENTS		
DOCUMENT	FAILS AT	THE MECHANISM
False Load	Leg lift and drive	The back hip never gets loaded, because the pelvis was lifted instead of the body being shifted.

DOCUMENT	FAILS AT	THE MECHANISM
Swing or Rotate	Foot contact	The front hip has no rotational range, so the leg swings the pelvis open instead of anchoring it.
The Long Way Back	Contact to release	The front hip lands at the far end of its range and has ground to cover before it can resist. The block is late.
Allowed, Not Made <i>this one</i>	Cocking, into max external rotation	The arm doesn't get left behind — because nothing is driving it, or the blade and rib cage won't allow it, or the athlete is fighting it.

The three lower half documents are upstream of this one

Group F above — nothing driving the layback — is largely produced by the faults in the other three. A hip that never loaded, a pelvis that swung open, or a block that arrived late all mean less trunk rotation speed, and trunk rotation speed is the thing that lays the arm back.

So an athlete short on layback with a clean shoulder screen usually has a lower half problem, not a shoulder problem. **Screen the shoulder to rule it out, then go downstairs.**

Sources

Reference values are population means with real spread. They locate an athlete; they don't grade one.

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- [Effect of Increased Scapular Internal Rotation on Glenohumeral External Rotation and Elbow Valgus Load](#) — the blade's position directly changes available rotation and elbow load
- [Gluteus Medius and Scapula Muscle Activations in Youth Baseball Pitchers, J Strength Cond Res](#)
- Fleisig et al. — [Kinematic Parameters Associated With Elbow Varus Torque in Elite Adult Baseball Pitchers](#) — max external rotation inversely associated with elbow load; elbow flexion at contact positively associated
- ASMI / Diffendaffer, Bagwell, Fleisig et al. — [The Clinician's Guide to Baseball Pitching Biomechanics](#) — arm elevation, external rotation and elbow flexion reference values
- Driveline — [How We Interpret Biomechanics Reports](#) — scap load thresholds, elbow climb, pivot pickoff prescription
- Driveline — [Making Movement Changes in the Weight Room](#) — soft tissue, then range, then strength through range
- [Rehabilitative and Preventive Effects of the Thrower's Ten Program in Overhead Athletes: A Systematic Review](#)
- [Comparison of teres minor and infraspinatus muscle activation — deceleration phase roles](#)
- [Effect of Glenohumeral Internal Rotation Deficit on the Shoulder During Fastball Pitching](#)
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- Bullock, Nicholson et al. — [Baseball pitching biomechanics in relation to pain, injury, and surgery: a systematic review](#)

Companion to *False Load*, *Swing or Rotate*, *The Long Way Back* and *Deficiency or Adaptation*. Layback is measured, never cued —

ask for the picture and you get the elbow flexion version that costs load and returns nothing.
