

HIP TO SHOULDER SEPARATION

Means, Not *Score*

Separation is the most chased number in pitching and one of the least supported. It is a mechanism for loading the trunk, not a measure of how well someone throws, and the same figure can mean two opposite things depending on which segment produced it.

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Separation is a **difference between two segments**. You can raise it by holding the chest back, or by letting the hips fly open early. Same number. Opposite deliveries.

That is the whole problem with treating it as a score. A pitcher can improve his separation figure by getting worse, and a pitcher can throw very hard with a modest one because he is generating rotational speed some other way. The number describes a relationship at one instant. It does not tell you whether the relationship was useful.

What the evidence actually says

Worth stating plainly, because the coaching consensus and the published findings have drifted a long way apart.

THREE FINDINGS THAT COMPLICATE THE USUAL STORY

FINDING	WHAT IT MEANS
No direct link to velocity	One analysis found no significant relationship between separation and fastball velocity at any point in the delivery . Not a weak relationship. None that reached significance.
More separation came with more elbow load	A Wake Forest analysis of 298 pitchers found separation at foot strike was <i>positively</i> associated with elbow varus torque. More of it cost more, rather than less.

FINDING	WHAT IT MEANS
Elite figures are descriptive	Driveline reports roughly 48 degrees in elite throwers. That describes what good pitchers happen to have. It does not establish that adding degrees to a given athlete makes him better.
It shrinks with fatigue	Across a simulated game, separation decreased as the outing went on while elbow torque climbed after the third inning. The number moves for reasons that have nothing to do with skill.

What none of this says

It does not say separation is useless, and it does not say a pitcher with none of it is fine. The mechanism is real: stretching the trunk is how the chest gets accelerated. What the evidence undercuts is the **inference from the number to the intervention** — that a low figure means you should go add degrees to it.

What separation is actually for

One job, and understanding it explains why the number can lie.

Put the trunk on stretch so it can be accelerated

When the hips turn ahead of the chest, the muscles that connect them are lengthened under load: the side abs working diagonally, the lat, the deep spinal rotators. Those tissues then shorten to rotate the chest. That is the entire purpose. Separation is the loading phase of the trunk, in the same way that a shift over the back leg is the loading phase of the hip.

Which gives you the test. **Did the stretch actually happen?** If the ribs are flared and the chest is disconnected from the pelvis, the segments can be far apart on a report and nothing was ever put on stretch. If the pelvis opened early because the front hip could not hold, the gap exists but it opened at the wrong moment and against nothing.

A number produced by loading is worth having. A number produced by leaking is worth removing.

The same figure, three different deliveries



EARNED The chest waited The pelvis rotated on schedule and the chest held its position against it. The tissue between them is genuinely loaded and about to return that energy. This is what the number is supposed to represent.	LEAKED The hips left early The pelvis opened before foot contact, often because the front hip has no rotational range to turn over. The gap is real and the stretch is not, because the chest never had anything to resist.	BORROWED The low back supplied it Ribs flared, pelvis tipped, and the difference between segments is being produced by the lumbar spine rather than by the hips and mid back. This version reads well and shows up later as an oblique strain.
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How to tell which one you have

Look at **when the pelvis peaks** and **what the chest does next**. Earned separation is followed by a sharp rise in chest rotation speed, because the stretch is returning. Leaked separation is followed by nothing much, because there was no stretch to return. And borrowed separation comes with a visibly flared rib cage and a pitcher who is sore in the side rather than the hip.

Timing beats magnitude

If you are going to chase one number in this neighbourhood, chase this one instead.

CLEANER MECHANISM

When the hips peak

Peak pelvis rotation velocity trends toward a lower elbow bill when it happens earlier. Be honest about the strength of it: that parameter did not separate high and low torque groups significantly in the 523 pitcher study, so it is a weaker finding than the arm positions in the same analysis.

It also has a clean mechanical story. The hips are supposed to peak and get out of the way so the chest can be accelerated against them. Late means no handoff, and the arm makes up the difference.

WEAKLY SUPPORTED

How far apart they got

The magnitude of separation has no established velocity relationship and at least one published association in the wrong direction on elbow load.

It is also the number most easily inflated by faults. Which is exactly what you would expect from a figure that measures a gap rather than a movement.

Some pitchers are built to run less of it

One piece turners are not underperforming

Motor preference frameworks distinguish athletes who rotate as a unit from those who rotate as a spiral. The unit type carries **smaller chest rotation and closes the hips more** to compensate for having less twist available. That is not a deficiency being expressed. It is a different organisation of the same task.

Coaching a unit type toward a spiral type's separation figure is asking him to find range his body does not organise around. The usual outcome is that the low back supplies it, which is the borrowed version above.

Treat the motor preference material as a reason to be cautious rather than as a diagnosis. It is a coaching framework, not settled science. But its caution applies here more than almost anywhere: this is the number most likely to be chased across an athlete's natural organisation.

Where separation actually comes from

It is an output. If you want more, you change these, not the gap itself.

INPUT 01 Back hip rotational range To rotate the pelvis around a loaded femur you need range at that hip. Without it the pelvis turns the whole leg instead and opens early, which produces the leaked version.	INPUT 02 Mid back rotation The thoracic spine supplies most of the chest's usable rotation. Stiff there and the chest turns the instant the hips do, so the gap never opens at all.	INPUT 03 Rib cage over pelvis Flared ribs disconnect the two segments, so the side abs never go on stretch. The gap can exist while the loading does not.
INPUT 04 Front hip range A front hip that cannot rotate forces the pelvis open early. Separation faults very often live at the other end of the body from where they are measured.	INPUT 05 Front leg block Braking the pelvis is what converts the stretch into chest speed. Without it the loading has nowhere to go and the separation was academic.	INPUT 06 Anterior core capacity The stretch has to be resisted before it can be returned. Weak here and the athlete either leaks or borrows from the low back.

When to chase it, and when to leave it

CHASE IT

Only when the chest is genuinely slow

The condition that justifies working on separation is not a low separation figure. It is a **flat chest rotation velocity** with a low figure alongside it. That combination says the loading mechanism is not working.

- Chest rotation speed low on the report
- Separation figure low *and* one of the six inputs above screening badly
- Velocity below what his arm speed and block quality suggest it should be

LEAVE IT

When he is producing rotation another way

Plenty of pitchers throw hard with modest separation because the speed is coming from elsewhere: a violent block, high arm speed, or simply a body that organises as a unit.

- Velocity is where it should be and elbow load is normal
- Chest rotation speed is high despite a modest gap
- He is a unit type and the figure has been stable his whole career
- Adding separation would mean adding it at the low back, which is the only place left

REMOVE IT

When the number is being produced by a fault

The case nobody expects: sometimes the right intervention **lowers** the separation figure, because the gap was being manufactured by early hips or a flared rib cage.

- Restore front hip range so the pelvis stops opening early
- Get the ribs back over the pelvis with full exhale work
- Expect the number to fall and the chest rotation speed to rise. That trade is a win, and it will look like a regression on the report

Where this sits in the library

Most separation problems are documented elsewhere

Four of the six inputs above have their own document. A back hip that never loaded is *False Load*. A front hip with no rotational range is *Swing or Rotate*. A front hip that lands turned out and blocks late is *The Long Way Back*. A chest that opens before the arm is ready is *Nothing Left to Turn*.

Which is the practical summary of this whole document: **separation is where you notice the problem, not where the problem is.**

Sources

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

- [The Effect of Trunk and Lower Body Mechanics on Fastball Velocity, SportRxiv](#)
- [Wake Forest — Association between pitching velocity and elbow varus torque, 298 pitchers](#)
- [Fleisig et al. — Kinematic Parameters Associated With Elbow Varus Torque in Elite Adult Baseball Pitchers](#)
- [Driveline — Biomechanics Rewind: A Look at the Numbers](#)
- [Driveline — How We Interpret Biomechanics Reports](#)
- [Manifestations of muscle fatigue in baseball pitchers: a systematic review](#)
- [Decreased Hip Internal Rotation Increases the Risk of Back and Abdominal Muscle Injuries, 258 player seasons](#)
- [ASMI — The Clinician's Guide to Baseball Pitching Biomechanics](#)
- [ActionTypes — Motor preferences in baseball](#)

The number measures a gap. Ask which segment produced it before you decide whether the gap is worth having.