


RETHINKING THE GAME PLAN

THE PATHOLOGY OF PITCHING

Researchers at the American Sports Medicine Institute broke down the fastball pitches of healthy, elite pitchers frame-by-frame to study the effect of pitching on the human arm. Their conclusion: Unless it's done very carefully, a major league fastball will eventually spell major league arm trouble.

#### Critical instant Arm acceleration

As the pitcher "cocks" his arm to throw, his arm is rotating into a position for which it wasn't designed.

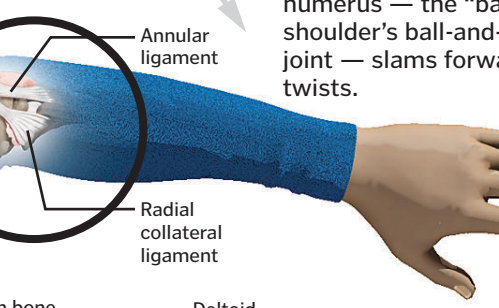


Ulna bone  
Ulnar collateral ligament  
Humerus bone  
Radius bone

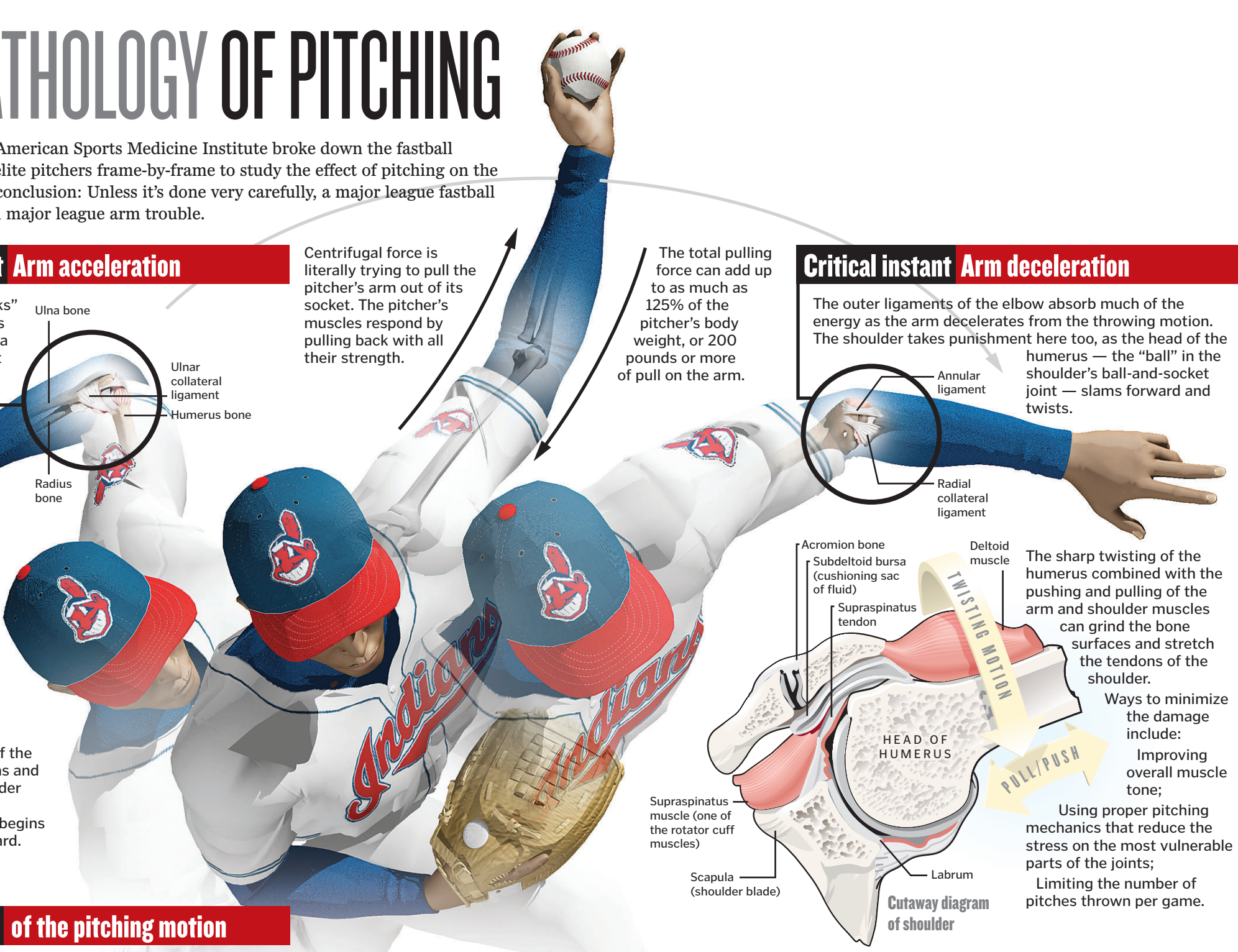
Centrifugal force is literally trying to pull the pitcher's arm out of its socket. The pitcher's muscles respond by pulling back with all their strength.

#### Critical instant Arm deceleration

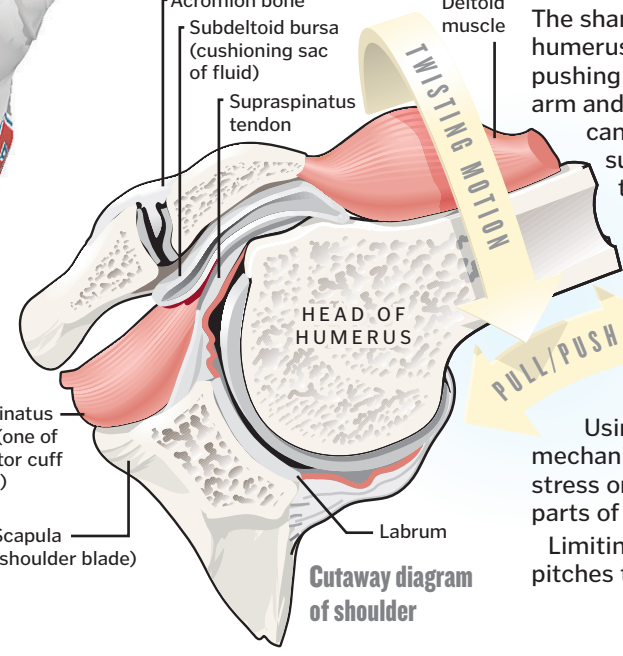
The outer ligaments of the elbow absorb much of the energy as the arm decelerates from the throwing motion. The shoulder takes punishment here too, as the head of the humerus — the "ball" in the shoulder's ball-and-socket joint — slams forward and twists.



Annular ligament  
Radial collateral ligament



The total pulling force can add up to as much as 125% of the pitcher's body weight, or 200 pounds or more of pull on the arm.



Acromion bone  
Subdeltoid bursa (cushioning sac of fluid)  
Deltoid muscle  
Supraspinatus tendon  
HEAD OF HUMERUS  
TWISTING MOTION  
PULL/PUSH  
Supraspinatus muscle (one of the rotator cuff muscles)  
Scapula (shoulder blade)  
Labrum  
Cutaway diagram of shoulder

The sharp twisting of the humerus combined with the pushing and pulling of the arm and shoulder muscles can grind the bone surfaces and stretch the tendons of the shoulder.

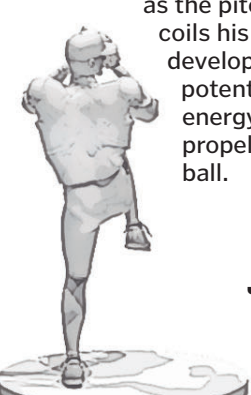
Ways to minimize the damage include:

- Improving overall muscle tone;
- Using proper pitching mechanics that reduce the stress on the most vulnerable parts of the joints;
- Limiting the number of pitches thrown per game.

#### The six stages of the pitching motion

##### The windup

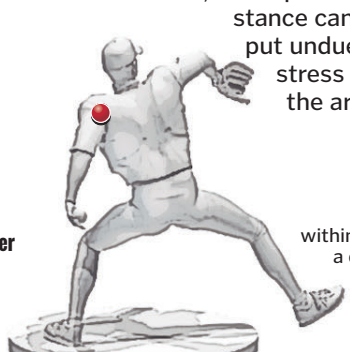
Stress to the body is minimal as the pitcher coils his body, developing potential energy to propel the ball.



LOW STRESS

##### The stride

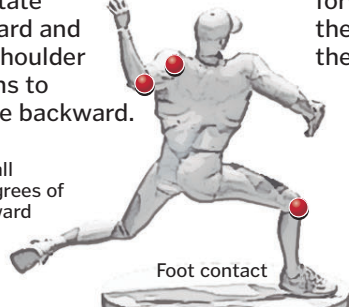
As the legs spread wide, placement and rotation of the feet is critical; too "open" a stance can put undue stress on the arm.



STRESSES BUILDING

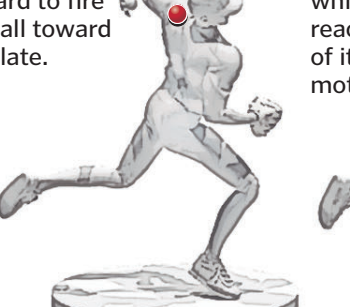
##### Arm cocking

The arm assumes a 90-degree angle from the trunk; the elbow cocks to about 90 degrees as the trunk begins to rotate forward and the shoulder begins to rotate backward.



##### Arm acceleration

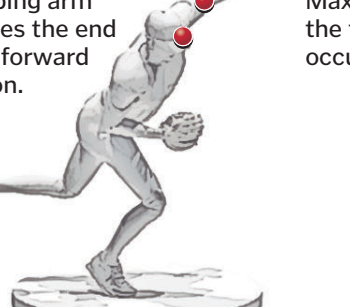
Huge torque forces build up on first the elbow, and then the shoulder as the pitcher whips his arm forward to fire the ball toward the plate.



MAXIMUM STRESS


##### Arm deceleration

Stretching, compression and torque hammer the shoulder and the outer ligament of the elbow as the whipping arm reaches the end of its forward motion.



##### Follow-through

The trunk moves forward and down to help dissipate the tremendous throwing energy.



Maximum inward rotation of the throwing arm occurs here.

Joint under stress

Feet should fall within about 10 degrees of a direct line toward home plate.

Foot contact

SOURCE: American Sports Medicine Institute

WILLIAM NEFF | THE PLAIN DEALER

PITCHERS

FROM A1  
**Indians want relief for pitchers**

The players' scars are roughly V-shaped, but they might as well be dollar signs. Pitching injuries cost Major League Baseball tens of millions a year in disability payments, not to mention the untold price of games not won and seats not filled because a big-name starter is out for a season, if not a career.

Until recently, most teams considered damaged elbows and shoulders part of the cost of business, an inevitable consequence of repeatedly flinging a baseball at speeds that would earn a motorist a hefty ticket. "If you throw baseballs long enough," Andrews says, "sooner or later you're probably going to wind up in somebody's operating room, and maybe more than once."

But the Indians and a few other progressive-minded teams are challenging that notion, aided by Andrews himself, who wouldn't mind losing some of his surgical business if science can help young arms avoid, or at least postpone, the scalpel.

At the American Sports Medicine Institute that Andrews founded in Birmingham, researchers have focused on understanding what happens to shoulders and elbows during the brutality of pitching. Using some unconventional resources — like the computer wizardry behind "The Matrix Reloaded" and dozens of medical specimens better suited to "The Texas Chainsaw Massacre" — ASMI scientists believe they know what separates injury-free pitchers from injury-prone ones.

"We've spent 30 years trying to figure out how to fix injuries," Andrews says in his soft Southern drawl. "We've sort of got the

cart before the horse. What we're trying to do with our research institute is devote more energy and research money to try to figure out how to prevent injuries."

**The cost of injuries**

Let's say you've decided to plunk down \$283,600 for a sleek new Lamborghini Murcielago, one of the fastest sports cars on the planet. It lives up to its 205 mph promise, and for a while, no street racer in the neighborhood can touch you.

But your shifting technique leaves something to be desired; without realizing it, you are riding the clutch. Eventually, your Italian-bred dream machine ends up in the mechanic's bay and you are stuck paying your car note, a whopping insurance premium, and a repair bill that will put your mechanic's kid through college, all with no wheels to show for it.

No one would mistake Bob Wickman for a Lamborghini, but the point is the same. The Indians are paying the beefy 34-year-old right-hander \$16 million over three years to smoke opposing batters. Last December, a year after All-Star Wickman joined the team, the ligament that had stabilized his right elbow during more than 20 years of pitching decided it had had enough, and split.

After surgery and eight months of rehabilitation, Wickman has done some limited throwing with the Indians' minor-league teams. But that does

nothing for the parent club. The disability insurance money the Tribe collects on Wickman — one of just a handful of policies it can afford to maintain on its biggest-name players — probably will end up covering only the cost of the premiums.

Meanwhile, Wickman's replacement as closer, Danys Baez, struggled all season before finally losing the job in August.

When it comes to injuries, the Indians "are one of the worst" compared to the number and severity of other teams', admits General Manager Mark Shapiro. Indians pitchers missed a combined total of 571 days last season because of injuries.

"Right now, it doesn't affect us," Shapiro says. "But if you're trying to be a championship team, every single day one of those players is on the disabled list is impacting your ability. It could be the pennant."

Although injuries are only one factor, no Tribe pitcher has won 20 games or more in a season since Gaylord Perry did it in 1974.

Competition aside, pitching injuries are simply bad for business, and the Indians these days are nothing if not a business-minded team. Here's the seemingly unsolvable equation they and other middle- and small-market ball clubs face:

Team revenues have shrunk. Player salaries have increased. With the impact of 9/11 and the economy in the tank, insurance is much harder and costlier to

get, especially for players with a history of getting hurt. The number of injuries is increasing. The duration of injuries is lengthening. Pitchers get hurt more often than any other players and take longer to recover. Because they tend to be the highest-paid players on a team, pitchers account for an inordinate share of disability payouts. And the talent pool of good pitchers is small, so they're hard to replace.

Whoa. How do you climb out of that quicksand? As the Indians and a couple of other teams have realized, the answer is not to get stuck in the first place. The solution is prevention, or at least postponement. But first, someone had to figure out what exactly to prevent.

**A painful ballet**

Slow a pitcher's motion down to a molasses crawl and you can see elements of a hurdler's high kick, a tightrope walker's balance, a contortionist's freakish bends and a brawler's round-house swing.

Revved back up to real time, it has the sudden, explosive fury of a cobra's strike. The pitcher's shoulder rotates so fast that, if it could move in a full circle like a clock hand, it would complete 21 revolutions in a second. Throwing a baseball is the quickest known motion the human body can make.

Packed into the few seconds it takes to launch the ball toward the plate are a ballet's worth of limb twists, body turns and

weight shifts. Biomechanics specialists call this the "kinetic chain," a fancy phrase that really means the transfer of energy from the pitcher's legs and trunk through the shoulder and arm to accelerate the 5-ounce baseball.

There are six links in the chain, six distinct phases of the pitch — windup, stride, arm cocking, arm acceleration, arm deceleration, and follow-through. Each phase has its own unique set of motions and resulting forces on the body.

To reduce the chance of injury and boost the ball's speed as it leaves his hand, the pitcher must perfectly time this sequence of moves. He also must make sure that legs, pelvis, torso, shoulder, elbow, forearm and wrist are kept properly oriented in space, and in relation to each other.

He can't consciously think about any of this, though. It has to be automatic, instinctive. His focus must be on selecting the right pitch, putting the ball in the right location at the plate, keeping a runner from stealing.

"It's a lot more intricate than a lot of people think," says Jeremy Loftice, a pitcher for Louisiana State University's 2000 national championship team who's now clinical research coordinator at the Alabama sports medicine center.

Even if a pitcher's form is perfect, he can't escape the ferocious toll that throwing dozens of times a day, in dozens of games a year, season after season, exacts on the arm.

"It's the most unnatural thing you can do with your body," says Tallet, the Indians pitcher whose elbow ligament Andrews replaced last month. The lanky left-hander has pitched since the age of 9, and occasionally threw 130 pitches a game in college, although he had a week's rest between games and the season was shorter than in the major leagues.

Like weightlifting, swinging a sledgehammer or any other stressful, repetitive action, pitching causes microscopic tears in muscles, tendons and ligaments. It also bends joints at extreme angles and rubs the surfaces of bones against each other in ways that nature didn't intend. A lot of tugging, a lot of grinding. Load a yard's worth of fertilizer sacks at the garden center or lug your suitcase through a few airports and you'll get the idea.

Given a few days of rest, the body can repair small injuries. But push too hard or too soon and the damage becomes permanent. Over the years, muscle tears accumulate to become cracks, and cracks widen to clefts. Bone-protecting cartilage wears out. Something has to give.

"You're basically breaking yourself down at a faster rate than you're letting yourself heal," explains Glenn Fleisig, the Birmingham center's chairman of research. Fleisig stopped playing baseball in high school but knows more about the pitching motion than most pitchers. Bad pitching mechanics make this breakdown happen much sooner. So does throwing an excessive number of pitches — more than 50 in a game for 9- to 10-year-olds, and generally above 120 for a professional player. Certain kinds of pitches also accelerate the injury process, notably the curveball and slider, which require extra force at the shoulder and elbow to impart the proper spin to the ball.

SEE BASEBALL | A11

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Dr. James Andrews, orthopedic surgeon and founder of the American Sports Medicine Institute

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