

Human shoulders evolved to throw, some better than others

By Natalie Jacewicz

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NFL quarterbacks make it look so easy -- and in an evolutionary sense perhaps it is. Scientists say the human shoulder evolved to throw things, unlike those of our ape cousins, whose anatomy is more adapted to swinging from trees than hurling coconuts.

Even so, some human shoulders may be better adapted to withstand the rigors of constant throwing than others, even among pro athletes. And that's something scientists are studying further in hopes of discerning which athletes may be more prone to injury and which are destined for the Super Bowl.

"There's something about human throwing that's really different from our closest living relatives," said evolutionary biologist Nathan Young of UC San Francisco.

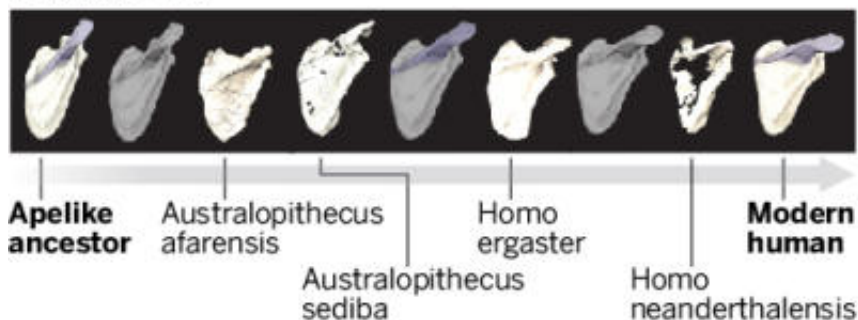
WHY CHIMPANZEES CAN'T THROW

Chimps and humans have differently oriented shoulder blades best suited to different functions. Research suggests that both descended from an apelike ancestor about 6 million years ago, but human shoulders realigned in a touchdown-friendly orientation.



Evolution of the shoulder

Shoulder shape evolution from African apelike ancestor to modern human, including predicted ancestral forms (gray) and hominin fossils:



Consider chimpanzees, humans' stronger, hairier cousins from a shared ancestor six to seven million years ago. Chimps with athletic ambitions may give the occasional rock a fling, but their poor aim and weak thrust would embarrass a Pop Warner quarterback.

By contrast, "humans are really good at throwing with accuracy," Young said.

The secret lies in the shoulder blades. Chimp shoulders tilt upward toward their heads, as though they're perpetually shrugging. This alignment lends itself to hanging off branches, which large apes need to do because they are usually too heavy to rest on a single branch.

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Human shoulder blades, on the other hand, jut outward to either side. In 2015, Young led a team analyzing the evolution of the shoulder blade of apes and humans since their last common ancestor. This ape ancestor, the team suggests, had shoulder blades closer to those of chimps. When humans' ancestors migrated from trees to the ground, their shoulders wiggled down and outward, the better to hold stone tools and launch primitive missiles at potential predators or competitors.

Neil Thomas Roach, a college fellow at Harvard University and a member of the team who conducted the study, explained how human shoulders enable throwing a football as fast as 60 miles per hour.

Muscles, like rubber bands, have tremendous energy storing potential. If someone hangs a brick from his hand by a rubber band and then slowly lifts his hand upward, for example, the brick will initially stay stationary, while the band stretches. But once the hand stops moving, the energy from the rubber band will pull the brick upward.

Human shoulders allow pitchers and quarterbacks to wind their arms backward before throwing, lengthening the shoulder muscles in the process. When these athletes release their throws, they unleash stored muscular energy, which in turn propels the ball forward.

"It creates a sort of slingshot mechanism," Roach said.

But structure is far from infallible.

"The thrower that we're most interested in is the quarterback," said Deborah Faryniarz, an orthopedic surgeon at Arthroscopy and Sports Medicine Clinic in San Jose.

She cited a 2004 study in *The American Journal of Sports Medicine* analyzing quarterback shoulder injuries in the National Football League. These players suffered injuries to the shoulder almost as frequently as those to the head. Fourteen percent of shoulder injuries stemmed from overuse.

Ron Kaminski, president and founder of MORE Physical Therapy, a string of clinics in and around San Jose, counts amateur football players among his clients. He cited shoulder injuries as clients' third most common complaint. Kaminski also sees a lot of overuse cases.