

What effect does sticky stuff have on baseball?

During the All star break of the 2021 season, Major League Baseball (MLB) introduced a new rule requiring regular umpire checks on pitchers for any possible foreign substance. But what is “sticky stuff” as pitchers are calling it? Basically, it is some sort of sticky foreign substance (sunscreen, rosin or spider tack) that pitchers use to get a better grip on the ball and apply more force on the ball resulting in higher spin rates which cause breaking balls to move much more in the air.

Sticky stuff has always been illegal, but MLB never enforced the rules until June of 2021; it had an instant effect for some pitchers.

According to Justin Dunlap, who has a PhD from Portland State University in applied physics has studied the physics behind throwing a baseball, the reason why breaking balls move so much is because of a force called the “Magnus effect.” What the Magnus effect does is move the ball in the air, the higher the spin rate of the ball the more Magnus force is applied to the ball resulting in greater movement. Dunlap explained the Magnus effect as, “Interplay of the ball’s motion...the velocity of the air is gonna be faster on one side than it is on the other. It actually changes the direction of the ball.”

For example, when a right-handed pitcher throws a slider, he grips the ball in a way that will cause the ball to spin left when thrown, and if that pitcher added sticky stuff, it would create more friction on the ball, and the ball would stay on the pitcher's fingers longer, which lets them apply more force to the ball, resulting in a sharper movement on the slider making it more difficult to hit.

Another major player in the physics of baseball is the “drag force.” “As anything travels through air, it is slowing down because it has this drag effect and it is pushing on the air,” said Dunlap.

San Francisco Giants’ director of pitching, Brian Bannister explained more about the impact of sticky stuff on pitches and how his organization navigated the rule enforcement. Bannister talked about “spin efficiency,” which explains how spin can change the direction of a ball, and active spin which he explained as “percentage of the spin rate that is actually impacting the movement...If the pitcher has 100% spin efficiency that would be like a ball coming out of a pitching machine. Then if you add spin rate then the ball is gonna move a lot more. Now if you throw a slider which spins the same way as a football or a bullet, and you add more spin rate, it’s not gonna move anymore.”

What this means is that with some pitches, faster spin rate doesn’t always mean more break on the pitch. Because if you multiply the spin by 0, it’s always going to be 0.

Most pitchers throw at a 50% spin efficiency, so that means the ball comes at a 45 degree angle. (resulting in the pitch traveling slightly downward).

“Some pitches benefit from more spin, and some pitches actually benefit from less spin,” explained Bannister. “The change up or split finger pitch, those actually draw more if there is less spin. The irony with what has happened in Major League Baseball this year is that some pitchers that were using sticky substances have realized once they stopped using them that some of their pitches actually got better, and some of them are better pitchers now.”

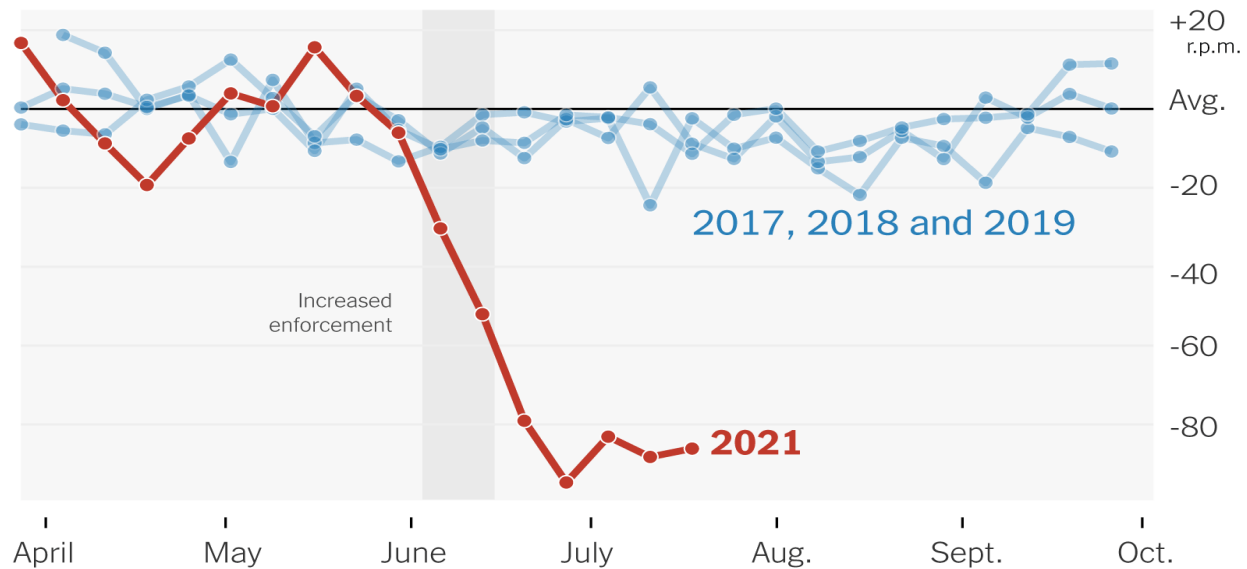
“We knew that Major League Baseball was going to step in this year and start enforcing the foreign substance rule that has always been in the rule book... we wanted to have a pitching staff that wasn't impacted by a change in the rules enforcement. We wanted to avoid pitchers (who relied on sticky stuff to be successful), we didn't want to have pitchers that turned into bad pitchers.” Said Bannister.

“If you look at our pitching staff; Kevin Gausman, Logan Webb, Alex Wood, Tony Descalfina, Johnny Cueto,” continued Bannister, “they all have really good changeups or splitters, those are the two pitches that actually really benefit from less spin. They were not impacted much or at all, compared to a lot of pitchers around the league that relied on sticky stuff to help their pitches move more.”

Bannister's assertion is supported by data, such as Bannister's example of James Karinchack, the Cleveland Indians closer. According to Baseball Reference, prior to the All Star Break (when the rule was enforced) Karinchak's earned runs allowed (ERA) was 2.52, after the rule enforcement, that ERA rose to 8.75. In 2020 Karinchak averaged 17.7 strikeouts per nine innings and just .3 Home Runs per nine innings, in 2021 his strikeouts per nine fell (to 13.7) and his home run per nine rose (to 1.5).

Another pitcher who has been affected by the foreign substance check is the New York Yankees pitcher, Gerrit Cole. The first half of the season he had an ERA of 2.69. After the foreign substance enforcement, his ERA rose to 5.25. Cole's home run per nine and strikeout per nine stayed relatively the same from the 2020, but Cole's first half of the season was potentially Cy Young level.

Yet another pitcher affected by foreign substance check is the Oakland A's pitcher, James Kaprielian. Before the rule change, Kaprielian had an ERA of 3.87. After the rule change, Kaprielian had an ERA of 4.55. Since he's a rookie, we have no previous seasons to compare to, but the rule change still had a noticeable and instant effect on him.



(Picture showing the drop in spin rate after enforcement)

There are some unique outliers when it comes to use of foreign substances. Former Mariners relief pitcher, Tom Wilhelmson, said he never used sticky stuff, and actually didn't use it because "the batter would be uncomfortable." If a batter knows the pitcher is using sticky stuff, the batter gets more comfortable and is less afraid of getting hit.

I found this to be very interesting, because this backs up the claim that sticky stuff does give you better control over the ball. Wilhelmson also agreed, saying that sticky stuff does give you an advantage. He said "It can help with control with all of your pitches. I knew guys that threw hard that used it, I knew guys who threw a lot of sliders and curves and used it."

He also mentioned that some of his teammates used it and they all made their own personal recipe to fit what they like. He mentioned them using a mixture between rosin and sweat. Rosin is legal and provided by the MLB and what they do is get some rosin and run their fingers through their sweat to get moisture on the ball. This raises another question. What is considered an illegal substance? Rosin is legal, and they can't just make sweat illegal. Tom Wilhelmson said, "You can't tell a pitcher they can't wear sunscreen, so that was a pretty common thing, but I saw pitchers bring in their own homemade stuff." We will have to see if the Umpire's think this is illegal in their regular checks.



(image of Trevor Bauer using rosin and sunscreen)

From all my interviews and research, I come to the conclusion that sticky stuff does in fact have an effect on baseball, and can enhance a pitcher's ability to throw a breaking ball. This is also backed by MLB statistics. Some pitchers have been affected by this more than others like Gerrit Cole and Trevor Baurer.

With claims from experts and statistics backing this up, we can conclude that sticky stuff does in fact improve the pitcher's ability. Now will this change pitching drastically, or just be an inconvenience to MLB pitcher's? We must wait and see to find that out.