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Short Communication

Effects of a Sticky Substance on Torque at the Medial Elbow During Pitching: A Pilot Study

SA Cage[1]*, BJ Warner[2], AP Jacobsen[3] and LE Trail[4]

[1]The University of Texas at Tyler, USA

[2]Grand Canyon University, USA

[3]The University of Texas Health Science Center at Tyler, UT Health East Texas, USA

[4]The University of Texas at Tyler, UT Health East Texas, USA

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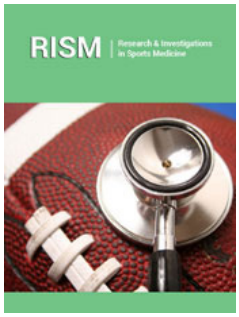

***Corresponding authors:** SA Cage, The University of Texas at Tyler, USA

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Abstract

Ulnar Collateral Ligament (UCL) sprains are considered one of the most detrimental musculoskeletal injuries that can be sustained at the elbow. When pitching, as with other sport related activities, injuries to the UCL can occur because of cumulative structural insult over time, or from singular traumatic events. If a UCL injury occurs, patients are likely to experience a significant loss of time from participation in sport and other physical activities involving the injured limb. Therefore, the purpose of this pilot study was to assess the impact of a grip enhancing substance on torque at the medial elbow during baseball pitching. Five healthy collegiate baseball pitchers consented to participate in this pilot study as a convenience sample. All subjects were instructed to perform their normal warm up routines prior to throwing a bullpen. Subjects were then fitted with a strap that housed an inertial measurement unit (PULSE Throw Workload Monitor, Driveline Baseball Enterprises, Kent, WA). When a subject had thrown half of the pitches for their bullpen, they took a break and had a sticky substance (Spider Tack, Spider Strength LLC, Raleigh, NC) applied to the fingers they used to grip the baseball. After the sticky substance was applied, subjects would then complete the remaining pitches of their bullpen. Independent samples t-tests were performed to assess differences in force at the medial elbow during pitching with and without Spider Tack. Overall, pitchers experienced a 10.3% decrease in torque at the medial elbow when pitching with Spider Tack ($p<.001$). When comparing throwing fastballs only, pitchers using Spider Tack experienced a 7.0% decrease in torque at the medial elbow ($p=.039$). When comparing breaking balls and off-speed pitches only, pitchers experienced a 16.4% decrease in torque at the medial elbow ($p<.001$). The findings of this pilot study suggest that sticky substances for enhancing grip while pitching may decrease the forces experienced at the medial elbow during pitching. While this pilot study was conducted on a small scale, the findings warrant further investigation into the use of sticky substances during pitching as an injury risk reduction measure.

Introduction

Pitching a baseball generates large forces on the humeroulnar joint due to the biomechanics of overhead throwing [1]. When pitching with maximum intent, forces at the humeroulnar joint can exceed 150% of the pitcher's body weight [2]. Pitching is by nature an aggressive motion, leading to, shoulder, elbow and forearm muscle activation that often surpasses maximum the body's ability to initiate maximal voluntary isometric contractions at the competitive and elite levels [3]. Due the high volume of throwing the baseball pitchers partake in, these forces have led to medial elbow injuries becoming a concern for baseball pitchers.

Previous studies have shown that this concern regarding elbow injuries in baseball pitchers is warranted [4]. Among collegiate baseball players, elbow injuries make up 15.5% of all musculoskeletal injuries [5]. At the professional baseball level this percentage

increases, with elbow injuries resulting in 27.8% of all days spent on the disabled list from the 1990 to 2001 seasons [6]. While this information is dated, it is some of the only data on the topic in the literature. Earlier studies have reported that professional pitchers are disproportionately impacted by upper extremity injuries when compared to professional position players [7]. Recently, sports broadcasting companies have increasingly reported on the growing number of arm injuries among baseball pitchers [8-10].

Ulnar Collateral Ligament (UCL) sprains are considered one of the most detrimental musculoskeletal injuries that can be sustained at the elbow [8-10]. The UCL acts as the primary ligamentous support against valgus forces at the humeroulnar joint [11]. When pitching, as with other sport related activities, injuries to the UCL can occur as a result of cumulative structural insult over time, or from singular traumatic events [11]. If a UCL injury occurs, patients are likely to experience a significant loss of time from participation in sport and other physical activities involving the injured limb [11]. If a UCL sprain can be managed with conservative care, patients have to complete an average of three to four months of rest, treatment and rehabilitation before returning to sport [11]. If a UCL sprain is severe enough to require surgical reconstruction, often referred to as Tommy John surgery, the timeframe for returning to sport extends to an average of 12 to 15 months [11]. Despite surgical intervention and subsequent rehabilitation, patients often require an additional three to six months before being able to play at their previous level of competition [11]. Time lost from sport is worrisome for patients, coaches and clinicians, but there are other concerns related to UCL surgical reconstruction. In collegiate and professional baseball, pitchers who have UCL reconstruction may suffer immediate and future financial losses as a result of this lost time [12]. In professional baseball, the economic impact of UCL reconstruction is experienced by more stakeholders than just the pitcher. Under MLB contract rules, if a player is injured and unable to participate in practices or competitions, they are still owed the entirety of their salary. One study found that over the course of 10 seasons, the cost of rehabilitating an MLB pitcher who had undergone UCL reconstruction was $1.9 million based off 2017 United State currency exchange rates [13]. At the MLB and Minor League Baseball levels, 97% of pitchers have been reported to return to participation [14-17]. However, this return to play rate decreases to 75%-87% when looking only at MLB pitchers [14-17]. With MLB contracts being fully guaranteed, MLB organizations may suffer significant economic losses if a contracted pitcher missed substantial playing time due to UCL injuries [18].

The detrimental nature of UCL injuries in baseball pitchers has led to a number of efforts to decrease the prevalence of these injuries. Risk reduction measures such as pitch counts, age-based pitch type limitations, and mandated rest days have been implemented by a number of baseball organizations in the United States [19-27]. Unfortunately, even with these measures being implemented, the rate of UCL injuries among baseball pitchers at all levels has continued to rise [19-27]. This lack of effectiveness is further confounded by the fact that these preventative measures are neither standardized nor universally implemented. While the efficacy of current risk reduction efforts is questionable, there may be other risk reduction measures that warrant consideration. In June of 2021, the MLB and other organizations began stricter implementation of rules prohibiting pitchers from using sticky substances to enhance their grip when pitching [8]. This change in rule implementation led to some pitchers reporting that they were having to grip the ball harder when pitching and were taking longer to recover after outings [8]. To date, there do not appear to be any studies that have assessed the effects of using sticky substances to improve grip when pitching on torque at the medial elbow. This information may prove useful when informing the implementation of risk reduction strategies for baseball pitchers. Therefore, the purpose of this pilot study was to assess the impact of a grip enhancing substance on torque at the medial elbow during baseball pitching.

Methods

Participants

Five healthy collegiate baseball pitchers who were currently not on their team's travel roster (Age=21±2 years, Height=72.6±2.9 inches, Weight=199.2±2.1lbs) consented to participate in this pilot study as a convenience sample. All subjects were informed of the study's purpose, and consent was obtained.

Warmup and pitching

All subjects were instructed to perform their normal warm up routines prior to throwing a bullpen. Each subject was allowed as much time and exercise as they needed to warmup properly. Warmup exercises generally consisted of a dynamic warmup, elastic tubing exercises for the shoulder, elbow and forearm, hip mobility exercises and flat ground throwing at gradually increasing distance and intensity. Subjects were then fitted with a strap that housed an inertial measurement unit (PULSE Throw Workload Monitor, Driveline Baseball Enterprises, Kent, WA) two finger widths below the medial humeral epicondyle. Subjects then stated the number of pitches they intended to throw during their bullpen. When a subject had thrown half of the pitches for their bullpen, they took a break and had a sticky substance (Spider Tack, Spider Strength LLC, Raleigh, NC) applied to the fingers they used to grip the baseball. After the sticky substance was applied, subjects would then complete the remaining pitches of their bullpen.

Inertial measurement unit measurements

Subjects were fitted with a fabric strap housing an inertial measurement unit two finger widths below the medial humeral epicondyle. During each mitch, the inertial measurement unit record the amount of force placed on the medial elbow in Newton meters (Nm). Time between pitches was limited to a maximum of 15-20 seconds to approximately simulate the current pitch clock rules in NCAA Baseball. Data was captured using a smartphone application created by the manufacturer that produced the inertial measurement unit (Pulse Throw, Driveline Baseball Enterprises, Kent, WA).

Statistical analysis

Relevant data from the application was transferred to and analysed using, a commercially available statistics software package (SPSS Version 28, IBM, Armonk, NY). A total of 129 pitches were recorded and included in data analysis. Pitchers threw 63 pitches without Spider Tack (Fastball=36, Breaking Ball/Off Speed=27) and 66 pitches with Spider Tack (Fastball=37, Breaking Ball/Off Speed=29). Independent samples t-tests were performed to assess differences in force at the medial elbow during pitching with and without Spider Tack. Significance was set at $p < 0.05$ a priori.

Result

Means, standard deviations, and differences in terms of percentage between conditions is presented in Table 1. Overall, pitchers experienced a 10.3% decrease in torque at the medial elbow when pitching with Spider Tack (p<.001). When comparing throwing fastballs only, pitchers using Spider Tack experienced a 7.0% decrease in torque at the medial elbow (p=.039). When comparing breaking balls and off-speed pitches only, pitchers experienced a 16.4% decrease in torque at the medial elbow (p<.001).

Table 1: Torque at the medial elbow with and without spider tack.

Pitch Type	With	Without	% Difference	Significance
All Pitches	45.26±8.84Nm	50.48±7.60Nm	10.30%	p<.001
Fastballs	47.51±7.23Nm	51.08±7.27Nm	7.00%	p=.039
Breaking Balls/Off Speed	42.38±9.95Nm	50.67±7.40Nm	16.40%	p<.001

Discussion

The purpose of this pilot study was to assess the impact of a grip enhancing substance on torque at the medial elbow during baseball pitching. In recent years, sports news outlets have expressed concerns over the number of medial elbow injuries sustained by pitchers in the MLB [8-10]. Despite efforts to implement risk reduction measures within some organizations, the incidence of medial elbow injuries among pitchers has remained consistent or increased at different competitive levels of baseball [19-27]. The findings of this pilot study suggest that sticky substances for enhancing grip while pitching may decrease the forces experienced at the medial elbow during pitching. This study showed that there was a particularly large decrease in torque at the medial elbow when pitchers used a sticky substance to throw breaking balls and off-speed pitches. Within college baseball, elbow injuries make up 15.5% of all musculoskeletal injuries experienced by participating athletes [5]. In professional baseball, elbow injuries accounted for 27.8% of all days spent on the injury list from the 1990 to 2001 seasons [6]. This information combined with the fact that in 2017UCL injuries cost an average of $1.9 million in salary and medical expenses, serves to highlight the detrimental nature of medial elbow injuries among baseball pitchers [13]. Given the prevalence and impact of medial elbow injuries to pitchers, consideration should be given to using a sticky substance to enhance a pitcher's grip while pitching.

There have been arguments made anecdotally that using sticky substances to enhance grip while pitching provides a competitive advantage [8]. There is some evidence to suggest that sticky substances increase spin rate as well as vertical and horizontal movement of pitches [28,29]. However, since the MLB began stricter enforcement of rules banning sticky substances there has been little fluctuation in offensive statistics across the league. In fact, between the 2021 and 2024 seasons, league wide batting average has decrease by 0.1% [30]. Runs scored per game has also decreased by 0.14 runs per game [30]. This seems to suggest that decreasing the use of grip enhancing substances has not provided batters with any more ability to produce offense. As such, it may be worth reconsidering the decreased ability to use sticky substances to enhance grip while pitching. A possible limitation of this pilot study was that data was collected provides a small sample size of both pitchers and pitches. Future studies should examine a larger number of pitchers and pitches to attempt to gain a better understanding of the impact sticky substances have on torque at the medial elbow during pitching. Examining this data would provide information about a possible risk reduction strategy for reducing injuries to the medial elbow among baseball pitchers. This risk reduction could have a positive impact on the financial health of both individual pitchers and baseball organizations if pitchers are sustaining fewer injuries to the medial elbow. Another limitation of this study was that data was collected in a bullpen practice setting as opposed to a competition setting. Given the current rules in organized baseball, it would be difficult to gather data on the effects of sticky substances on torque at the medial elbow during pitching in competition. In the absence of a competitive baseball organization permitting the use of sticky substances during competition, inferences must be made off of data collecting during practices.

Conclusion

To the authors' knowledge, this is the first study examining the effect of sticky substances on torque at the medial elbow during baseball pitching. While this pilot study was conducted on a small scale, the findings warrant further investigation into the use of sticky substances during pitching as an injury risk reduction measure. The findings of this study suggest that the use of a sticky substance to enhance grip while pitching may reduce torque at the medial elbow when the ball is thrown. Future research should incorporate larger sample sizes, in terms of both pitchers and number of pitchers thrown. Future research should also examine the impact of sticky substances on elbow and forearm muscle fatigue during pitching. These findings could provide valuable insights when determining the best methods for reducing the risk of medial elbow injuries during pitching.

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