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EFFICACY OF THE ATHLETIC SHOULDER TEST IN COLLEGIATE BASEBALL PLAYERS

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CHAPTER 1

INTRODUCTION

The sport of baseball is known for its unique overhead throwing motion. With the rapid increase in fast ball velocity over recent years, it has become more and more important that athletes utilize proper throwing mechanics and incorporate appropriate resistance training to prevent injury. Shoulder and elbow injuries lead to athletes missing large portions of competitive seasons and in many cases, entire seasons (Dick et al., 2007). In collegiate baseball, athletes practice and condition in the fall to prepare for the spring season. Some of these athletes then continue to play collegiate summer leagues until reporting back to university in the fall. The repetitive nature of throwing a baseball year-round may ultimately lead to injury and thus loss of playing time. Many shoulder and elbow injuries in baseball can be caused by a multitude of variables. Some of which are improper mechanics, muscular imbalances, or long-term fatigue (Thomas, Castillo, Topley, & Paul, 2022; Wang et al., 2016). With these factors in mind, it is important for elite collegiate athletes to possess an objective assessment tool that provides feedback about the physical toll throwing takes on the upper body over time. The use of isometric tests is popular in monitoring the force production in lower body dominant sports such as soccer, American football, and basketball. Isometric tests do not rely on a change in muscle length and can be easily implemented at varying stages of the training calendar without concern for causing overt muscle damage. Although functional isometric evaluations are readily available for the lower body athletes, they are not available for upper body and overhead throwing sports. Isometric tests can be used to monitor functional status and to determine an athlete's readiness to progress to sport-specific activity and return to sport. Objectively determining an athlete's readiness is necessary to prevent re-injury (McCall et al., 2015). The use of isokinetic dynamometry or hand-held dynamometry (HHD) is a useful, objective measurement but is not when used to measure the upper extremity (Johansson et al., 2015). HHD data can be skewed by an administrators' positioning, strength, and experience. Lower body force measurements reduce these errors with fixed force platforms. A rigid, in-ground setup allows the participant to apply as much force as possible without the risk of administrator error. An effective and novel use of a fixed force platform to evaluate upper body strength has been developed by Ashworth et. al (2018) titled The Athletic Shoulder Test (ASH Test). The ASH Test utilizes a fixed force plate to measure upper body isometric strength in three positions. The participant's hand is placed on the force plate, and they apply force through the heel of the palm. This long lever measurement position simulates the position of the shoulder at ball release in a closed kinetic chain method.

During the 2021 collegiate baseball season, the Missouri Valley Conference implemented a four game weekend series for conference play. This was a deviation from the typical three game weekend series plus one midweek game schedule. The four-game series was played as one game on Friday, two on Saturday, and one on Sunday. This schedule allowed limited rest and increased workload over an extended period that could have led to greater muscle fatigue. To track that fatigue, this study measured athletes with the ASH Test prior to the start of the four game weekend series, the midpoint, and the end of the four game weekend series. The purpose of this study was to identify the efficacy of the novel Athletic Shoulder Test in identifying factors that predispose overhead throwing athletes to potential upper body injury.

CHAPTER 2

METHODOLOGY

INTRODUCTION

This section provides the procedures that were used for this study and consists of the following sections: (a) Selection of participants, (b) Data Collection Procedures, (c) Independent Variables, (d) Dependent Variable, (e) Statistical Analysis Procedures.

SELECTION OF PARTICIPANTS

Twenty-three elite collegiate male baseball athletes participated in this study. The athletes were members of the Southern Illinois University (SIU) baseball team. The participants were recruited via email correspondence from their athletic trainer. Athletes interested in participation in the study were then given and signed an informed consent and verbal walk through of the ASH Test procedures. Height, weight, and arm length were measured prior to the first data collection. Arm length was measured to the nearest whole number in inches. This measurement was performed from the posterior angle of the acromion to the wrist joint line (Ashworth, Hogben, Singh, Tulloch, & Cohen, 2018). The participants of the study were composed of athletes from all positions (pitcher, catcher, infielder, outfielder) with different levels of time in-game (starter, second string, bullpen, etc.). Each participant in the study was identified as either a pitcher (P) or non-pitcher (NP).

DATA COLLECTION PROCEDURES

Prior to the start of the first data collection, participants were shown the positions for both arms and how to apply the proper forces. They were instructed to apply force into the force plate as fast and as hard as possible (Ashworth et al., 2018). For each data collection session, participants were given two warm-up rounds to perform at submaximal effort to get a “feel” for body positioning. In all three positions, the palm of the hand is rested entirely on the force plate, forearm pronated, and elbow fully extended. When cued to apply force, the participant lifted their fingers off the force plate and drove down through the heel of the palm only. A usable trial was completed when the isometric contraction was completed without rotating the trunk and lower body to the side being measured. This was cued through instructions to maintain the chest, hips, knees, and feet in contact with the floor. The test was performed in the following order: I, Y, T and each measurement was conducted for three seconds with a twenty second rest in between (Ashworth et al., 2018). Each arm position was measured 3 consecutive times prior to changing to the next position. Body position was checked between each position to prevent compensations. The tests at each arm position took approximately 69 seconds and the entire data collection session took approximately 8 minutes with repositioning.

Once the participant assumed the measurement position, a verbal "ready" cue was given to prepare for collection and to start the force plate's seven second collection period. Once the force plate began to register activity for two seconds, participants were given a verbal "go" cue and began a three second fast and hard push into the force platform. At the end of 3 seconds, a verbal "stop" cue was given to signal the end of the repetition and the start of the twenty second rest period. Each participant was instructed to push down on the force plate as fast and as hard as possible (Ashworth et al., 2018). The Accusplit Pro Survivor A601X Stopwatch was used to time the isometric hold and the twenty second break.

To test the efficacy of the ASH Test in the collegiate baseball population, the testing methods used in the original study were replicated. The ASH Test is comprised of three positions where the body lies prone and forms a I, Y, and T with their arm. The "I" position has the participant with their shoulder abducted above their head 180 degrees, the "Y" position abducted above their head at 135 degrees, and the “T” position abducted at their side 90 degrees. In the “I” position, the opposite arm was at their side, palm up, and forearm supinated. In the “Y” and “T” positions, the opposite arm was rested behind their back, elbow flexed, forearm supinated, and palm upwards. The position of the opposite arm was chosen to prevent contralateral compensations to produce more force (Ashworth et al., 2018). To standardize neck position, a 4 cm bolster was used. Participants rested their forehead on the bolster in each position.

NP participants were measured the day after a four-game series, at the same time of day, and in the same location. Pitcher participants were measured two days after their game performance with the highest pitch count. This was selected to coincide with their scheduled off day from throwing. If a pitcher participant did not throw in-game over the four-game series, they were brought in at the same time as non-pitcher participants.

Repetitions were excluded if the participant performed a contralateral countermovement or a compensation. For example, if the participant lifted one or both feet off the floor during the isometric hold, the repetition did not count.

INDEPENDENT VARIABLES

The independent variable for this study was the participation in collegiate baseball activity and the ensuing throwing volume related to participant’s position. For the non-pitcher group, the throwing volume varied from position to position (catcher, infielder, outfielder) between data collection sessions. For the pitcher group, the throwing volume varied based on number of in-game pitches thrown between sessions.

DEPENDENT VARIABLE

The dependent variable for both groups was the force plate data sets recorded from each ASH Test position.

STATISTICAL ANALYSIS

Each participant was measured three time at each position. The respective three scores for each position were averaged, with the average serving as the participant's score for the respective position. The pitcher group ($N = 15$) and non-pitcher group ($N = 8$) displayed similar reliability scores when compared between data collection session 1 to 2 and 2 to 3.The data were analyzed and presented as means, standard deviations, and reliability scores.

CHAPTER 3

RESULTS

Twenty three male collegiate baseball players participated in this study. Since the focus of the study was baseball players, the data were only collected for each participant's throwing arm only. The mean score of the I position of both groups was the highest throughout the study (I*M* = 113.84 ± 2.38, Y*M* = 91.13 ± 4.42, T*M* = 88.91 ± 2.56). The same observation was noted for both the P group (I*M* = 114.12 ± 4.08, Y*M* = 93.40 ± 3.93, T*M* = 88.80 ± 3.47) and NP group (I*M* = 113.30 ± 3.18, Y*M* = 86.86 ± 5.34, T*M* = 86.98 ± 5.17). The reliability scores for each testing position (I, Y, T) showed a moderate to very high reliability. Pearson's r from sessions 1 to 2 and 2 to 3 was (I = 0.5 and 0.7, Y = 0.7 and 0.6, T = 0.8 to 0.9). The same relationship was noted for the Pitcher (I = 0.4 and 0.8, Y = 0.8 to 0.5, T = 0.8 to 0.9) and Non-Pitcher groups (I = 0.7 to 0.7, Y = 0.7 to 0.9, T = 0.9 to 0.9) individually.

CHAPTER 4

DISCUSSION

The purpose of this study was to identify the efficacy of a novel Athletic Shoulder Test to identify factors that predispose overhead throwing athletes to potential upper body injury. The salient finding of this study was that the ASH Test was efficacious in evaluating throwing arm stress over the course of a NCAA Division 1 collegiate baseball season.

When comparing the reliability of the scores in each testing position (I, Y, T) in the P group, NP group, and all participants, reliability either improved or stayed within the same "strong" or "very strong" relationship range. This indicated that as participants continue to gain familiarity with the ASH Test, the more accurate and reliable their scores become. When comparing the means and standard deviations of each testing position, it was noted that values decreased from the first position (I) to the last (T). Several variables could have caused these differences. The "I" position was the first position measured and possibly susceptible to the least fatigue. The "I" position is an overhead position providing the most stability and large muscle recruitment (latissimus dorsi) compared to the "Y" and "T" positions (pectoral muscles). Finally, the "Y" and "T" positions replicated the participant's throwing slot which could be weakened due to the continued throwing throughout the season (Donohue, Lubitz, & Kremchek, 2017).

All participants displayed some type of variation in their recorded scores across the three data collection sessions. The variation surrounding each participant's data included being a starter vs. bench player, amount of time since their most recent start (starting pitchers), increased or decreased utilization out of the bullpen (pitchers only), and injury.

Further investigation is needed to discover the clinical efficacy of the Novel ASH Test. From this study, it was noted that familiarity and repetition is key to accurate outputs from individual participants. The ASH Test could benefit from an increased rest period between positions to measure the “Y” and “T” positions more accurately. On the other hand, a variation of the ASH test for baseball players might be developed to only test the position most similar to the participant’s arm slot.

CHAPTER 5

CONCLUSION

In conclusion, the purpose of this study was to identify the efficacy of the novel Athletic Shoulder Test to identify factors that predispose overhead throwing athletes to potential upper body injury. When performed over multiple sessions, reliability of the ASH test became stronger. It can be concluded that of all factors, familiarity is most important to this test.

The means and standard deviations within each group and both groups combined suggest that an adjustment could be made to adapt the testing position for baseball. Thus, more research is needed to establish the applicability of the ASH Test to baseball. A longer study will establish the long-term outcomes and benefits of utilizing this test. Clinical implementation of the ASH Test is also needed to create improvements to the test regarding testing positions and length of time to complete the test. Additionally, increased clinical implementation in baseball will establish norms to guide return to sport eligibility and injury prevention.

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