A CASE STUDY TO EXAMINE THE RELATIONSHIP BETWEEN ELBOW VALGUS TORQUE IN FOOTBALL THROWING AND BASEBALL PITCHING

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INTRODUCTION

Monitoring workload in athletes is on the rise due to the increased prevalence of throwing related injuries.[1] However, most workload monitors are applied on a gross scale or measure whole body workload.[2] Gross workload based on full body movement can provide significant information, but there is a direct need for a joint specific workload measures in overarm throwing athletes.

The motusBASEBALL sensor is cutting edge technology that monitors stress on the Ulnar Collateral Ligament (UCL) of the elbow through a measure of valgus torque. As prevalence of UCL tears in pitchers has skyrocketed in the last decade[3], monitoring joint specific workloads for pitchers has become a necessity. The importance of measuring these workloads is further supported as this sensor is the first wearable technology to be approved by MLB for in game use for pitchers.

However, football quarterback throwing can also use joint specific workloads to monitor performance and reduce injury risk. Football quarterbacks exhibit overarm throwing injuries due to overuse [4] and often have to rehab from throwing arm injuries caused by contact. This technology would prove invaluable to football QBs to monitor their workloads for performance, injury prevention, and rehabilitation purposes.

METHODS

A high school male baseball pitcher (age 15.0; 72 kg; and 180 cm) reported to the Motus Biomechanics lab for testing. The subject was instrumented with 46 reflective markers on anatomical land markers. Kinematic data were collected at 480 Hz using a twelve-camera 3D motion capture system (Motion Analysis Corp., Santa Rosa, CA, USA). The subject was also instrumented with a motusBASEBALL sensor on the inside of the forearm placed approximately 3 cm distal to the medial elbow epicondyle. The subject was allowed unlimited time to warm-up and then threw ten fast balls down the middle, with game effort. The subject pitched off a mound into a net at a distance of approximately 5 m away from the pitching rubber. Following this, the subject was allowed to take as many warmup throws as desired with a football. Once ready, 7 throws were made in a shotgun stance with no drop prior to throwing the ball.

All marker motion data were filtered through a low-pass 14 Hz Butterworth filter. Full body kinematics were calculated and used to calculate elbow valgus torque. The model utilized to calculate elbow valgus torque has been accepted for presentation in the American Society of Biomechanics 2016 annual conference.[5] The motusBASEBALL sensor also was used to collect elbow valgus torque for all trials. The physics of the sensor that calculate elbow valgus torque were adjusted to account for the different weights of a regulation baseball (6 oz.) and a regulation football (15 oz.).

Condition (Mocap vs Sensor) averages were calculated, but as this is a case study no additional statistics were run.

RESULTS AND DISCUSSION

The elbow valgus torque profiles for baseball pitching and quarterback throwing are presented in Figure 2. Peak torque in both throwing motions occur slightly prior to maximum external rotation or when the throwing arm is fully cocked back.

Average Peak Valgus Torque				
	Baseball		Football	
	MoCap	Sensor	MoCap	Sensor
Mean	45.7	47.0	25.3	24.1
SD	4.2	2.7	1.5	3.7

Table 1. Peak valgus torques for each throwing motions using motion capture (MoCap) and motusBASEBALL (Sensor)

Average peak elbow valgus torques and standard deviations for baseball pitching and quarterback throwing are reported in Table 1 and Figure 1. The motusBASEBALL sensor read slightly higher peak elbow valgus torque for baseball pitching (3%) and slightly lower in football throwing (5%).

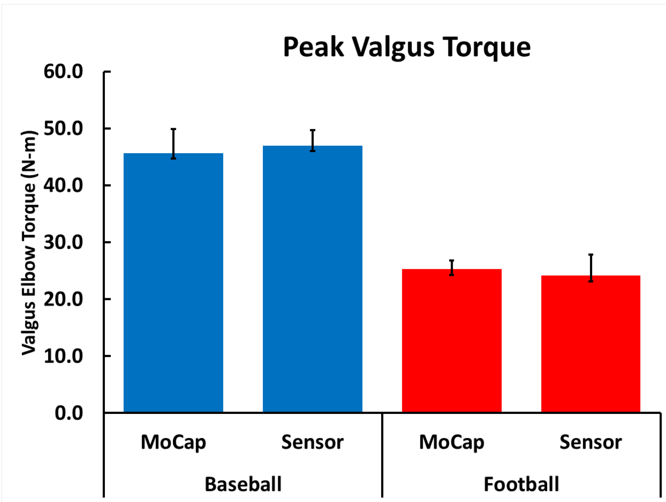

Figure 1. Average peak valgus torque

These results found that the motusBASEBALL sensor was successful in calculating maximum elbow valgus torque in both throwing conditions. The differences that exist between the mocap calculations of torque and sensor calculations of torque are minor.

Monitoring workload in baseball pitching and football pitching will be a tool that trainers, coaches, and athletes can use to ensure maximal performance and reduce risk of injury.

The motusBASEBALL sensor can accurately measure torque for both baseball pitching and football throwing to within a 5% error of torques measured by motion capture.

CONCLUSION

This case study shows that the motusBASEBALL sensor provides an accurate measure of elbow valgus torque for both baseball pitching and football throwing. This allows Motus to utilize the torque readings from the sensor to create measures of acute and chronic workloads that are joint specific to the throwing arm. This Information will prove to be an invaluable tool for preventing throwing arm injury, maximizing throwing performance, and rehabbing from injury to the throwing arm with maximal efficiency.

REFERENCES

1. Black GM, at al. *Sports Medicine. 2016: 1-14.*
2. Hulin BT, et al. *Br J Sport Med. 2016*
3. Conte SA, et al. *Am J Sport Med* **43**(7), 1764-1769, 2015
4. Kelly BT, et al. *Am J Sport Med,* **32**(2), 328-331, 2004.
5. Pearl C, et al. *American Society of Biomechanics. 2016.*

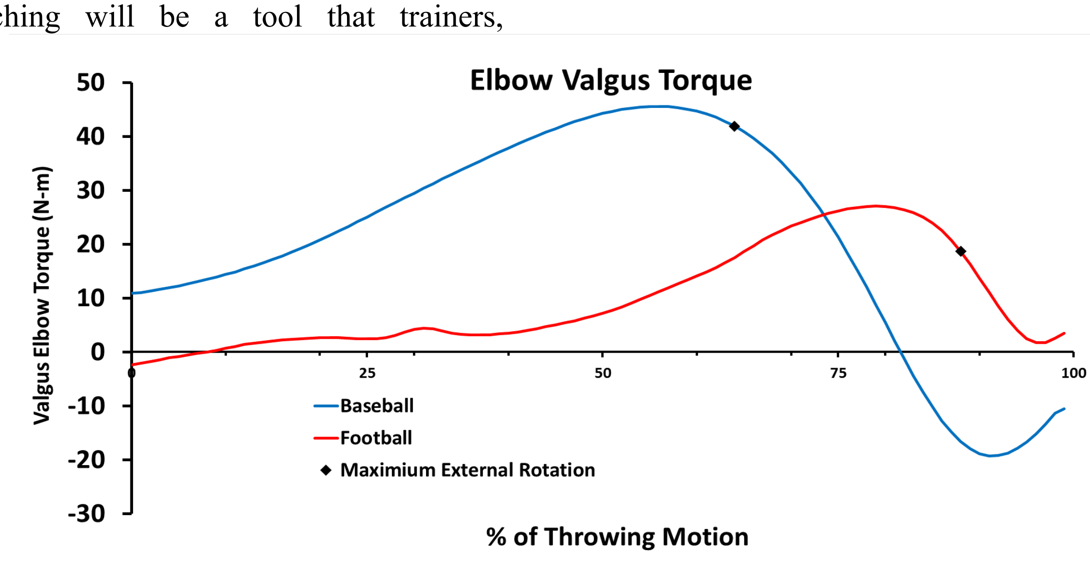

Figure 2. Average valgus torque on the elbow for baseball pitching and football throwing between foot contact and maximum internal rotation.