[Editorial]

Play Ball!

It's that wonderful time of year again filled with new beginnings as the snow melts and spring inches toward us. Soon, the green fields of spring will be filled with softball and baseball players getting ready for the season. Most of us enjoyed these spring rituals in our youth and cherish those days gone by. I, for one, have fond memories of spring days in high school where practices and games early in the season were greeted with unseasonably cold temperatures and even snow showers, including special memories of foul tips onto bare hands tingling in the cold.

Most elderly alumni of the games of spring have left the diamond but still relish the opportunity to play catch, swing the bat, or field a few grounders with youngsters. Unfortunately, many of us former enthusiasts can no longer throw a baseball—myself included—because of shoulder injuries that led to osteoarthritis and/or rotator cuff deterioration. Looking back, it's often hard to pinpoint the culprit for loss of shoulder function.

There are no doubt multiple explanations for this loss of shoulder function in former athletes, including the toll of contact sports and their associated posttraumatic osteoarthritis, new trauma, poorly designed training and conditioning programs, and/or genetics. In most cases, the cause is usually complex: a multifactorial evolution that diminishes function. Nevertheless, I marvel at those former athletes in their 50s, 60s, 70s, and beyond who are still able to throw the ball and enjoy the game as seniors.

To make sense of the evolution of these debilitating shoulder pathologies, correct some errors of the past, and improve the prognosis for those now playing these games, it is helpful to review the recent well-done research featured in this issue of *Sports Health*. To start, it is critical to recognize the integral kinematic relationship of the shoulder and elbow in throwing sports. This kinetic chain is fascinating for multiple reasons, not the least of which are the large forces usually tolerated in the act of throwing, let alone pitching fastballs. The ability to throw a baseball at 90 to 100 mph is truly an amazing feat, accomplished by many of today's pitchers. Because of the demands on the upper extremity during these activities, arm pain is generally accepted as part of the price of participating, with as many as 74% of youth baseball players reporting arm pain sometime during play.[5] Overuse has been identified as the culprit for much of this pathology, and multiple attempts have been made to control the number of throws, especially while pitching, with pitch count regulations in youth baseball and softball.[2,3] Clearly, something is wrong with the sport when nearly 33% of Little League baseball players had abnormal preseason magnetic resonance imaging scans of the elbow.[6] The review by Pytiak et al[7] highlights the comparison of elbow pathology between softball and baseball athletes and examines the epidemiologic changes that occurred over a 10-year span (2005-2015) in high school players.

So, why all the upper extremity pathology? Where is the problem in overhead sports? A large part of the problem is pitching and the high demands on the arm necessary to be an effective pitcher. To address this issue, Thompson et al[8] performed a systematic review to provide a better understanding of safe pitching kinetics and kinematics in healthy youth pitchers. The suggested parameters for normal shoulder rotation and elbow valgus are helpful to better understand where problems may arise. Interestingly, it is the pitcher's height and weight that are the major determining factors of how pitchers perform and suggest an evolution that takes place as kids grow.

With the onset of puberty and the acceleration of growth in the extremities, it appears that repetitive, overhead motion leads to bony adaptation, initially. Once skeletal maturity is achieved, the continued repetitive stress in throwing appears to alter soft tissues.[4] This is the focus of the exhaustive systematic review by Keller et al[4] highlighting glenohumeral internal rotation deficit (GIRD). This hypothesis has been accepted by many in clinical practice, with ample evidence for its occurrence at multiple levels of competition. Several years ago, Wilk et al[9] reported that pitchers with GIRD of 20° or more were almost twice as likely to be injured, emphasizing the need to maintain full range of motion to prevent excessive strain in the upper extremity. Demonstrating the need to maintain full range of motion were the data that showed that pitchers with as little as a 5° loss of motion were at greater risk for injury.[9] Even though the systematic review by Keller et al[4] could not confirm the relationship between GIRD and upper extremity injury, the results are certainly suggestive, and the need for more research is clear.

DOI: 10.1177/1941738118756280

It's apparent that the bone and soft tissues of the shoulder joint, and consequently, the elbow, are quite sensitive to the forces applied through growth. Small alterations in shoulder range of motion can have pathologic consequences that can eventually affect the elbow, especially in pitchers. Therefore, as clinicians, there is a need to monitor these shoulder parameters, especially in pitchers, and particularly in those who are still growing. It appears to be a dose-response phenomenon with the break point not clearly defined.

Unfortunately, in baseball, softball, and many other sports, we don't yet know where the tipping point of "too much" training lies. That breakpoint is where the training effects turn negative and damage is done. Not surprisingly, this dose-response phenomenon is also present in other sports such as swimming, as demonstrated by Dischler et al,[1] who used ultrasound imaging in female collegiate swimmers to show the positive correlation between years of participation and supraspinatus tendon thickness. Using shear wave velocity, they also demonstrated the declining mechanical properties that accompanied the increase in tendon thickness. Again, the optimal level of training to generate positive change in mechanical properties is not clear, at least in this group of 18 elite swimmers. Knowing that break point between producing positive, anabolic soft tissue development and negative catabolic soft tissue deterioration appears to be the elusive problem. A more in-depth understanding of how soft tissue responds to mechanical forces would aid in the development of training and conditioning programs, especially for youth. So far, it looks like we've been guessing at these parameters, and too often we've guessed wrong. More training isn't always better.

—Edward M. Wojtys, MD
Editor-in-Chief

REFERENCES

1. Dischler JD, Baumer TG, Finkelstein E, Siegal DS, Bey MJ. Association between years of competition and shoulder function in collegiate swimmers. *Sports Health*. 2017;10:113-118.
2. Ireland ML, Andrews JR, Fleisig GS; American Orthopaedic Society for Sports Medicine. Stop Sports Injuries sports tips: baseball. http://www.sportsmed.org/aossmimis/stop/downloads/baseball.pdf. Accessed January 5, 2017.
3. Ireland ML, Snyder-Mackler L, Ferguson BJ; American Orthopaedic Society for Sports Medicine. Stop Sports Injuries sports tips: softball. http://www.sportsmed.org/aossmimis/stop/downloads/Softball.pdf. Accessed January 5, 2017.
4. Keller RA, De Giacomo AF, Neumann JA, Limpisvasti O, Tibone JE. Glenohumeral internal rotation deficit and risk of upper extremity injury in overhead athletes: a meta-analysis and systematic review. *Sports Health*. 2018;10:125-132.
5. Makhni EC, Morrow ZS, Luchetti TJ, et al. Arm pain in youth baseball players: a survey of healthy players. *Am J Sports Med*. 2015;43:41-46.
6. Pennock AT, Pytiak A, Stearns P, et al. Preseason assessment of radiographic abnormalities in elbows of Little League baseball players. *J Bone Joint Surg Am*. 2016;98:761-767.
7. Pytiak AV, Kraeutler MJ, Currie DW, McCarty EC, Comstock RD. An epidemiological comparison of elbow injuries among United States high school baseball and softball players, 2005-2006 through 2014-2015. *Sports Health*. 2017;10:119-124.
8. Thompson SF, Guess TM, Plackis AC, Sherman SL, Gray AD. Youth baseball pitching mechanics: a systematic review. *Sports Health*. 2017;10:133-140.
9. Wilk KE, Macrina LC, Fleisig GS, et al. Correlation of glenohumeral internal rotation deficit and total rotational motion to shoulder injuries in professional baseball pitchers. *Am J Sports Med*. 2011;39:329-335.