Top 50 cited journal articles on overhead throwing athletes: a bibliographic analysis

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Background: The frequency of citations for a journal article is a reflection of its academic impact. The purpose of this study was to identify and characterize the top 50 cited journal articles related to overhead throwing athletes in the published literature.

Methods: The Web of Science database was searched on January 18, 2016, using the terms “throwing athlete,” “baseball,” and “pitcher” to identify the top 50 cited articles related to overhead throwing athletes using the all-database function. The type of study, country of origin, publishing journal, and year published were reviewed for each article.

Results: The top 50 articles identified were cited between 95 and 471 times and were published in 13 journals between 1969 and 2011. Most of the articles were small case series or nonsystematic literature reviews. The shoulder was the most common body region studied in the top 50 articles (33 of 50 [66%]). Among original studies (n = 43), there was a good representation of surgical management of shoulder and elbow pathology in overhead athletes (9 of 43 [20.9%]); however, most of the articles reported on shoulder and elbow kinematics (19 of 43 [44.2%]) and pathoanatomy (15 of 43 [34.9%]).

Conclusion: The greater prevalence of nonsurgical articles may reflect a continued effort to better understand the different pathologies specific to overhead throwing athletes. An understanding of the variable content and quality of frequently cited articles on overhead throwing athletes may serve as a stepping stone for future studies to advance the diagnosis and management of complex elbow and shoulder injuries in these high functional individuals.

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The number of times a journal article is cited serves as a measurement of the influence of that publication in a specific field. In 2002, Paladugu et al. published the “One hundred citation classics in general surgical journals” to identify seminal contributions in general surgery. Inspired by Paladugu et al., multiple specialties have initiated similar publications, including the publications by Lefaivre et al. and Kelly et al. in orthopedic surgery. A number of subspecialties within orthopedics have published similar “top cited” or “classic papers” studies, including pediatrics, hip and knee arthroplasty, arthroscopy, hip arthroscopy, shoulder surgery, elbow surgery, knee research, foot and ankle, spine surgery, sports medicine, fracture surgery, and hand surgery.

Specific journals have also published findings on their own top cited articles. The number of times an article is cited is not the only way to determine its true importance or impact in a field, but it does help identify “classic” articles relevant to orthopedic knowledge and training and may serve as a way to gauge the focus of interest within a given specialty over a period of time.

In sports medicine, particularly in the field of shoulder and elbow surgery, the pathology and treatment associated with overhead throwing athletes is of great interest. Major advances have occurred in the diagnosis and management of shoulder and elbow pathology in throwing athletes in the past decade. This is likely related to a combination of improvement in diagnostic and surgical technology and greater understanding of shoulder and elbow mechanics and pathoanatomy. As the niche for specialized care in high-level overhead throwing athletes continues to expand, identifying the top cited articles in the field provides a concise list of published articles that may serve as a stepping stone for ongoing and future research aimed at improving outcomes in complex pathologies common in overhead throwing athletes. The purpose of this study was to identify and characterize the top 50 cited journal articles related to overhead throwing athletes in the published literature.

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Materials and methods

The Web of Science (formerly Web of Knowledge) database was used to search for all studies of overhead throwing athletes using the search terms “throwing athletes,” “pitchers,” or “baseball.” Between 1945 and 2017, 5538 journal articles from 58 countries and 13,711 authors met the search criteria without restrictions in the type or specialty or journal articles. Previous studies have demonstrated that an all-database search represents a more in-depth methodology of determining the true citation ranking of articles when using this database.

Results were ranked by number of citations and screened for studies related to overhead throwing mechanics, upper extremity anatomy, and injuries and surgical interventions in overhead throwing athletes. Excluded were studies associated with nonoverhead sports (rugby, football [soccer]) or nonthrowing baseball studies (batting mechanics and catching), psychological or cognitive evaluations, economic analysis, and sudden death, among others (Fig. 1).

All selected journal articles were reviewed and analyzed according to the type of article (basic science, clinical, or review), topic (pathology/injury, surgical management, nonsurgical management, or biomechanical/kinetic study), body region (shoulder, elbow, or other), authorship, country of origin, publishing journal, and year of publication. Clinical studies were further analyzed by the level of evidence based on guidelines adapted by The Journal of Bone and Joint Surgery from the Oxford Center for Evidence-Based Medicine 2011 Working Group. Lastly, articles in the top 50 were assessed for citation density, defined as the number of times cited divided by number of years since publication.

Results

The top 50 cited articles in the present study were published between 1969 and 2006 in 13 journals, from 4 countries, and by 142 authors (Table I). The top article, by Fleisig et al., was cited 475 times, and the 50th article, by Reinold et al., was cited 98 times. Taken together, the top 50 articles were cited an average of 170 times and accounted for 8,557 citations in the literature. The oldest article was published in 1969 by King et al. and the most recent article was published in 2011 by Wilk et al. Half of the articles were published on or after 2000 (Table II).

There were 43 original articles, and 7 review papers, and 33 of 50 (66%) focused on the shoulder (Table I). Among 18 clinical studies (36%), the level of evidence ranged from II to IV, and sample size ranged from 23 to 476. The predominant type of study was case series, followed by retrospective case-control studies and no randomized prospective studies. Only 1 study reported on nonbaseball players (ie, handball). When divided by topic, 19 of the original 43 studies (44.2%) reported on shoulder (15 of 19 [78.9%]) and elbow (4 of 19 [21.1%]) biomechanics and kinematics. Interestingly, 3 studies specifically examined scapular kinematic. Studies reporting on pathoanatomy (15 of 43 [34.9%]) were also prevalent, particularly on the shoulder (9 of 15 [60.0%]). Very few publications (9 of 50 [18%]) studied surgical management of a specific shoulder (3 of 50 [6%]) or elbow (6 of 50 [12%]) pathology, and there were no studies regarding nonsurgical or conservative management of injuries.

All review papers were nonsystematic narrative or current concepts reviews. Only 1 review discussed common elbow pathologies and included both surgical and nonsurgical treatment options. The remaining 6 reviews reported on the shoulder, among which 4 focused on the biomechanics, pathoanatomy, and classification of shoulder injuries in throwing athletes. The top cited review, which ranked number 2 in the top 50, focused specifically on the role of scapular kinematics in shoulder pathology. Only 2 reviews highlighted the management of shoulder pathology. The review by Kvitne and Jobe specifically discussed surgical options for anterior shoulder instability in throwing athletes. In contrast, Wilk et al. reported on the evidence of structured rehabilitation for the nonoperative management of several shoulder pathologies.

More than half of the papers (28 of 50 [56%]) were published in The American Journal of Sports Medicine, followed by Journal of Bone and Joint Surgery (4 of 50 [8%]; Table III). All but 3 articles originated from the United States. A total of 142 authors were listed; however, JR Andrews contributed to 19 of the top 50 articles (38%) in these studies.

Citation density ranged from 2.94 to 26.93. The top 3 studies with the highest citation density correlated with the top 3 most cited papers; however, the study with the fourth highest citation density ranked 49th on the total citation list. Among those with citation density greater than 10 (17 of 50 [34.0%]), only 1 discussed...
| Rank | Authors                        | Title                                                                 | Journal       | Year | Citations, No. | Citation density |
|------|-------------------------------|----------------------------------------------------------------------|---------------|------|-----------------|------------------|
| 1    | Fleisig GS, Andrews JR, Dillman CJ | Kinetics of baseball pitching with implications about injury mechanisms | Am J Sports Med | 1995 | 471             | 21.4             |
| 2    | Kibler WB                      | The role of the scapula in athletic shoulder function                | Am J Sports Med | 1998 | 404             | 21.3             |
| 3    | Burkhart SS, Morgan CD          | The Disabled Throwing Shoulder: Spectrum of Pathology Part I: Pathoanatomy and Biomechanics | Arthroscopy | 2003 | 377             | 26.9             |
| 4    | Conway JE, Jobe FW, Glousman RE | Medial Instability of the Elbow in Throwing Athletes: Treatment By Repair or Reconstruction of the Ulnar Collateral Ligament | J Bone Joint Surg Am | 1992 | 265             | 10.6             |
| 5    | Altchek DW, Warren RF, Skyhar MJ | T-plasty modification of the Bankart procedure for multidirectional instability of the anterior and inferior types. | J Bone Joint Surg Am | 1991 | 252             | 9.7              |
| 6    | Crockett HC, Gross LB, Wilk KE, Schwartz ML, Reed J, O'Mara J, Reilly MT, Dugas JR, Meister K, Lyman S, Wilk KE, Meister K | Osseous adaptation and range of motion at the glenohumeral joint in professional baseball pitchers | Am J Sports Med | 2002 | 238             | 15.9             |
| 7    | Townsend H, Jobe FW, Pink M     | Current Concepts in the Rehabilitation of the Overhead Throwing Athlete | Am J Sports Med | 2002 | 233             | 15.5             |
| 8    | Dillman CJ, Fleisig GS, Pappas AM, Zawacki RM, Flesig GS, Andrews JR, Meister K, Yavorovsky P, Jobe FW, Giangarra CE, Kvitne RS | Electromyographic analysis of the glenohumeral muscles during a baseball rehabilitation program | Am J Sports Med | 1991 | 221             | 8.5              |
| 9    | Fleisig GS, Dillman CJ          | Biomechanics of Pitching with Emphasis upon Shoulder Kinematics      | J Orthop Sports Phys Ther | 1993 | 219             | 9.1              |
| 10   | Flesig GS, Barrentine SW, Zheng N, Escamilla RF | Kinematic and kinetic comparison of baseball pitching among various levels of development | J Biomech | 1999 | 216             | 12.0             |
| 11   | Jobe FW, Giangarra CE, Kvitne RS, Meister K, Wilk KE, Andrews JR, Escamilla RF | Anterior capsulolabral reconstruction of the shoulder in athletes in overhead sports | Am J Sports Med | 1991 | 216             | 8.3              |
| 12   | Pappas AM, Zawacki RM, Meister K, Escamilla RF | Biomechanics of baseball pitching. A preliminary report. | Am J Sports Med | 1985 | 209             | 6.5              |
| 13   | Lyman S, Flesig GS, Andrews JR, Meister K, Yavorovsky P, Jobe CM, Kvitne RS, Harrah A, Niehues SL, Kurzweil PR, Schwartzbach CC, Wolfe IN | Effect of pitch type, pitch count, and pitching mechanics on risk of elbow and shoulder pain in youth baseball pitchers | Am J Sports Med | 2002 | 192             | 12.8             |
| 14   | Brown LP, Niehues SL, Harrah A, Yavorovsky P, Jobe CM, Kurzweil PR, Schwartzbach CC, Wolfe IN | Upper extremity range of motion and isokinetic strength of the internal and external shoulder rotators in major league baseball players | Am J Sports Med | 1988 | 190             | 6.6              |
| 15   | Biglani LU, Kurzweil PR, Schwartzbach CC, Wolfe IN | Posterior Superior Glenoid Impingement: Expanded Spectrum | Arthroscopy | 1995 | 188             | 8.5              |
| 16   | Biglani LU, Kurzweil PR, Schwartzbach CC, Wolfe IN | Inferior capsular shift procedure for anterior-inferior shoulder instability in athletes | Am J Sports Med | 1994 | 185             | 8.0              |
| 17   | Myers JB, Laudner KG, Pasquale MR, Bradley JP, Meister K, Levine WN, Wolfe IN, Littlefield MA | Glenohumeral Range of Motion Deficits and Posterior Shoulder Tightness in Throwers With Pathologic Internal Impingement | Am J Sports Med | 2006 | 182             | 16.5             |
| 18   | Biglani LU, Codd TP, Connor PM, Levine WN, Littlefield MA, Flesig GS, Barrentine SW, Escamilla RF | Shoulder motion and laxity in the professional baseball player | Am J Sports Med | 1997 | 179             | 9.0              |
| 19   | Flesig GS, Barrentine SW, Escamilla RF | Biomechanics of overhand throwing with implications for injuries | Sports Med | 1996 | 178             | 8.5              |
| 20   | Reagan KM, Meister K, Horodyski MB, Werner DW, Carruthers C | Humeral retroversion and its relationship to glenohumeral rotation in the shoulder of college baseball players | Am J Sports Med | 2002 | 172             | 11.5             |
| 21   | Werner SL, Fleisig GS, Dillman CJ | Biomechanics of the Elbow During Baseball Pitching | J Orthop Sports Phys Ther | 1993 | 170             | 7.1              |

(continued on next page)
| Rank | Authors | Title | Journal | Year | Citations, No. | Citation density |
|------|---------|-------|---------|------|----------------|-----------------|
| 22   | Lyman S | Longitudinal study of elbow and shoulder pain in youth baseball pitchers | Med Sci Sports Exerc | 2001 | 160 | 10.0 |
| 23   | Feltner M | Dynamics of the Shoulder and Elbow Joints of the Throwing Arm during a Baseball Pitch | Int J Sports Biomechanics | 1986 | 159 | 5.1 |
| 24   | Olsen SJ | Risk factors for shoulder and elbow injuries in adolescent baseball pitchers | Am J Sports Med | 2006 | 150 | 13.6 |
| 25   | Cools AM | Scapular Muscle Recruitment Patterns: Trapezius Muscle Latency with and without Impingement Symptoms | Am J Sports Med | 2003 | 148 | 10.6 |
| 26   | Azar FM | Operative Treatment of Ulnar Collateral Ligament Injuries of the Elbow in Athletes | Am J Sports Med | 2000 | 147 | 8.6 |
| 27   | King JW | Preoperative Evaluation of the Ulnar Collateral Ligament by Magnetic-Resonance-Imaging and Computed-Tomography Arthrography—Evaluation in 25 Baseball Players with Surgical Confirmation | Am J Sports Med | 1994 | 146 | 6.3 |
| 28   | Cain EL | Elbow Injuries in Throwing Athletes: A Current Concepts Review | Am J Sports Med | 2003 | 143 | 10.2 |
| 29   | Osbahr DC | Reteversion of the humerus in the throwing shoulder of college baseball pitchers | Am J Sports Med | 2002 | 142 | 9.5 |
| 30   | Callaway GH | Analysis of the pitching arm of the professional baseball pitcher | Clin Orthop Relat Res | 1969 | 141 | 2.9 |
| 31   | Pieper HG | Biomechanical evaluation of the medial collateral ligament of the elbow | J Bone Joint Surg Am | 1997 | 137 | 6.9 |
| 32   | Rohrbough JT | Injuries to the Shoulder in the Throwing Athlete Part One: Biomechanics/Pathophysiology/Classification of Injury | Am J Sports Med | 2000 | 133 | 7.8 |
| 33   | Hyman J | Medial Collateral Ligament Reconstruction of the Elbow using the Docking Technique | Am J Sports Med | 2002 | 127 | 8.5 |
| 34   | Pieterly HS | Humeral torsion in the throwing arm of handball players | Am J Sports Med | 1998 | 126 | 6.6 |
| 35   | Andrews JR | Outcome of elbow surgery in professional baseball players | Am J Sports Med | 1995 | 122 | 5.5 |
| 36   | Zuel R | Validation of a new model-based tracking technique for measuring three-dimensional, in vivo glenohumeral joint kinematics | J Biomech Eng | 2006 | 119 | 10.8 |
| 37   | Wilke KE | The Strength Characteristics of Internal and External Rotator Muscles in Professional Baseball Pitches | Am J Sports Med | 1993 | 118 | 4.9 |
| 38   | Tirman PJ | MR arthographic depiction of tears of the rotator cuff: benefit of abduction and external rotation of the arm | Radiology | 1994 | 117 | 5.1 |
| 39   | Thompson WH | The diagnosis and treatment of anterior instability in the throwing athlete | Clin Orthop Relat Res | 1993 | 116 | 4.8 |
| 40   | Ellenbecker TS | Glenohumeral joint total rotation range of motion in elite tennis players and baseball pitchers | Med Sci Sports Exerc | 2002 | 112 | 7.5 |
| 41   | Grossman MG | A cadaveric model of the throwing shoulder: a possible etiology of superior labrum anterior-to-posterior lesions | J Bone Joint Surg Am | 2005 | 112 | 9.3 |
| 42   | Thompson WH | Ulnar collateral ligament reconstruction in athletes: muscle-splitting approach without transposition of the ulnar nerve | J Shoulder Elbow Surg | 2001 | 111 | 6.9 |
surgical management, and its focus was ulnar collateral ligament pathology. The remainder of the studies described biomechanics and pathoanatomy of the shoulder and elbow.

Discussion

Overhead throwing athletes exert strong and repetitive forces across the shoulder and elbow joints and subject the arm to range of motion extremes.2,21,89 These highly athletic individuals are susceptible to a wide range of complex injuries to the upper extremity.2,21,89 Although the findings in this study do not provide answers into the improvement of managing different pathologies among overhead throwing athletes, specifically baseball players, our study highlights the different areas of interest published in the literature for new and ongoing research. A greater understanding of shoulder and elbow anatomy and kinetics may identify opportunities for advancement in preventing and treating a number of pathologies.

Baseball has been described as the ninth toughest sport in the world.33 In other words, only 8 sports, most of which are contact sports (ie, boxing, hockey, American football, wrestling, and martial arts), place greater physical demands on the competing athletes. It is not surprising that many of the articles in the top 50 studies focused on the biomechanics of the shoulder girdle and elbow attempting to provide information on the muscle forces and balances at these joints during the overhead throwing motion in high-level athletes. Interestingly, 4 studies discussed scapular kinematics and its role in shoulder function,23,42,49,66 an understanding which is critical in those who care for these athletes. Although the effect of the papers that discussed scapular kinematics on the current understanding of shoulder pathology is difficult to assess, more recent studies have reported on the role of the scapula in shoulder pathology, including rotator cuff disease, glenohumeral internal rotation deficit, subacromial impingement, internal impingement, labral tears, anterior capsule laxity, and shoulder instability.77 As a result, assessment of scapular position, mobility, and strength is a crucial part for successful rehabilitation programs in overhead throwing athletes.104

Only 1 review paper on shoulder pathology represented the outcomes of conservative management of throwers. Results of operative intervention of the shoulder in this population is tempered by a systematic review reporting 63% returning to the same level of play after superior labrum anteroposterior repair.84 Effective nonoperative treatment strategies are of paramount importance to maintain high rates of return to play, but the literature lacks outcomes reporting and evidence-based treatment guidance. Only 9 of the top 50 studies (18%) in this review reported the surgical management of shoulder or elbow injuries.4,6,12,22,45,75,82,95 These studies were all published

| Rank | Authors | Title | Journal | Year | Citations, No. | Citation density |
|------|---------|-------|---------|------|----------------|-----------------|
| 43   | Petty DH, Andrews JR, Fersig GS | Ulnar collateral ligament reconstruction in high school baseball players: clinical results and injury risk factors | *Am J Sports Med* | 2004 | 111 | 8.5 |
| 44   | Myers JR, Laudani KG, Pasquale MR, Bradley JP | Scapular position and orientation in throwing athletes | *Am J Sports Med* | 2005 | 109 | 9.1 |
| 45   | Carson WG | Little League's shoulder—A report of 23 cases | *Am J Sports Med* | 1998 | 107 | 5.6 |
| 46   | Schwartz ML, Al-Zaharni S, Morwessel RM | Ulnar collateral ligament injury in the throwing athlete: evaluation with saline-enhanced MR arthrography | *Radiology* | 1995 | 106 | 4.8 |
| 47   | Paley KJ, Jobe FW, Pink M, Kvitne RS | Arthroscopic findings in the overhead throwing athlete: evidence for posterior internal impingement of the rotator cuff | *Arthroscopy* | 2000 | 105 | 6.2 |
| 48   | Hsu YH, Chen WY, Lin HC, Wang WTJ | The effects of taping on scapular kinematics and muscle performance in baseball players with shoulder impingement syndrome | *J Electromyogr Kinesiol* | 2009 | 103 | 12.9 |
| 49   | Wilk KE, Macrina LC, Fersig GS, Porterfield R, Simpson CD II, Harker P, Paparesta N | Correlation of Glenohumeral Internal Rotation Deficit and Total Rotational Motion to Shoulder Injuries in Professional Baseball Pitchers | *Am J Sports Med* | 2011 | 102 | 17.0 |
| 50   | Reinold MM, Wilk KE, Fersig GS, Zheng N, Barrentine SW, Chmielewski T, Cody RC, Jameson GG | Electromyographic analysis of the rotator cuff and deltoid musculature during common shoulder external rotation exercises | *J Orthop Sports Phys Ther* | 2004 | 98 | 7.5 |

Table II (continued)

List of Journals

| Journals (n = 13) | Citations, No. |
|-------------------|----------------|
| *American Journal of Sports Medicine* | 28 |
| *Journal of Bone and Joint Surgery* | 4 |
| *Arthroscopy* | 3 |
| *Journal of Orthop Sports Physical Therapy* | 3 |
| *Clinical Orthopaedics and Related Research* | 2 |
| *Radiology* | 2 |
| *Medicine and Science in Sports and Exercise* | 2 |
| *International Journal of Sports Biomechanics* | 1 |
| *Journal of Biomechanical Engineering* | 1 |
| *Journal of Biomechanics* | 1 |
| *Journal of Electromyography and Kinesiology* | 1 |
| *Journals of Shoulder and Elbow Surgery* | 1 |
| *Sports Medicine* | 1 |
in the United States, in 3 different journals. All were small case series or retrospective case-control studies, 3 of which did not report outcomes. The outcome studies only reported changes in range of motion or return to play. The highest ranked surgical study (#4) reported outcomes with repair or reconstruction of the medial collateral ligament of the elbow and was published in 1992.

The indication of one technique over another may likely be associated with the type of injury, patient population, and surgeon preference; however, there is currently no consensus on the best treatment option of ulnar collateral ligament injuries.46 These findings highlight that despite significant advances in understanding of elbow pathology and surgical instrumentation, future studies should aim to apply appropriate methodology to answer clinically relevant questions with outcomes data including not only return to play, but time to return to play.48

Although 142 authors contributed to this body of literature, 1 author (JR Andrews) was involved in more than one-third of the studies in the top 50 cited articles. Furthermore, all but 3 papers were published in the United States. This study identifies specific leaders in the field, underlines the importance of baseball within the sporting landscape of the United States, and highlights the need for greater diversity in the field of overhead throwing sports. Baseball is among the top 10 most popular sports in the world. Baseball is the second most popular sport in the United States49 and is the most popular sport in Japan.50 In 2016, Major League Baseball reported $10 billion in revenue,14 and the New York Yankees are tied second for the most valuable sports franchise in the world, at $3.2 billion.94 Clearly, there is great interest and tremendous value in the prevention and management of injuries in athletes at the highest level of competition. The money associated with Major League Baseball and the popularity of the sport in the United States both likely played a role in the greater prevalence of studies in the United States. Perhaps more important, the rise in the epidemic of youth and adolescent throwing arm injuries is cause for concern, with a need for more studies and additional understanding.59

The usefulness or appropriateness of compiling lists of top cited articles has been questioned.51 Some authors contend that simply ranking articles according to the number of times cited does not provide readers with high-quality publications. Our study supports this viewpoint, because the level of evidence for 61% of clinical studies was IV, and all reviews were not performed to systematic review standards. There is consensus regarding the relative weakness in methodological quality of orthopedic literature; however, evidence shows that the quality of orthopedic literature is improving.38,40 Of the publications on this list, 54% (27 of 50) were published in the American Journal of Sports Medicine, one of the highest-rated orthopedic journals in the world, with a 5-year impact factor of 5.501.51 Furthermore, many orthopedic journals have encouraged authors to use reporting guidelines, such as the Consolidated Standards of Reporting Trials (CONSORT),53 Strengthening the Reporting of Observational studies in Epidemiology (STROBE),53 and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA),54 to continue to improve the research quality in orthopedics.

Despite the absence of high-quality clinical studies, this top 50 list provides numerous basic science, biomechanical, and imaging studies that have served as a foundation for the understanding of complex elbow and shoulder pathology in overhead throwing athletes, particularly in baseball players. Although much has been done regarding biomechanics, fatigue, pain, and even injury, the sport still lacks scientifically sound guidelines of safety, including pitch counts and duration. The number of citations can also be influenced by the time since publication, which favors older articles. We corrected for publication duration by calculating the citation density to correct for the years since publication. The top 3 cited articles, however, demonstrated the highest number of citations and highest citation density.

Conclusion

The findings from this study highlight the contributions of investigators who have contributed significantly to the current knowledge of overhead throwing athlete pathologies. Although the list is not meant to be exhaustive, it undoubtedly provides a picture of the direction in which the literature in overhead throwing athletes is headed. Our findings also serve as a primer for the understanding of shoulder and elbow mechanics and pathoanatomy in the overhead throwing athlete and highlights the evolution in management of these complex pathologies in high demand athletes. We additionally highlight that evidence-based medicine for throwing athletes continues to evolve and that the practitioners caring for these athletes continue to make substantial contributions to the field for improved patient care and value. Lastly, this work demonstrates the paucity of high-quality clinical trials among these top cited papers, and understanding the variability in the content and quality of frequently cited articles may help improve the quality of research on overhead throwing athletes.

Disclaimer

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