

The Rising Fastball

The Newsletter of SABR's Science and Baseball Research Committee



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Greetings from the Chair

Well, the newsletter is much delayed, and I apologize for this; a variety of circumstances have been contributory. However, I am now out of hibernation and onto SABR business.

In this issue, we have a contribution by Dr. Thomas Mueller who has been working with the Baseball Hall of Fame to incorporate Geographic Information Systems into their geography curriculum. GIS is a popular application of computer technology that is becoming increasingly wide-spread in a variety of research areas. For example, a search on "Geographic Information Systems" in PubMed pulls nearly 400 hits from 1986 to present covering such areas as epidemiology, public health surveillance, eco-system management and population control.

KVH

Baseball and GIS: Helping Students Understand Geography

by Thomas R. Mueller, Ph.D.
California University of Pennsylvania
SABR Member

Recently I have been working with the Baseball Hall of Fame on their geography curriculum. My job is to infuse geographic information systems (GIS) into it. GIS is an electronic map tied to a spatial database. Maps are models of the earth's surface and use three different objects; points, lines and polygons. For example, on a state map you may see state boundaries (polygons), with the interstate systems (lines) and major cities (points). In a GIS, each of set of objects is a layer on to itself which is overlaid to create this map. All of the cities represented by points are one point layer. Each layer is tied to a database that contains information. For example the cities layer may contain the population size of each city, median income of the city, etc. Also within a GIS, you can complete spatial analysis using your computer. It can help finding distances between cities or show you how many cities are within 4 miles of an interstate, etc.

The Baseball Hall of Fame's geography curriculum teaches students some important geography concepts; 1) Cardinal Directions, 2) Location of Cities – Absolute and Relative, and 3)

Distance. These concepts are blended into the historical movement of baseball from the northeast to the south and western parts of our country. Currently, the curriculum has the students examining these concepts using a paper map, however with GIS the students will be able to complete this on a computer. Most people enjoy working on a computer, especially the younger generations. The hope is that with GIS as a tool in this curriculum, students will become more knowledgeable about geography and will see the spatial relationship between baseball history and American history.

Research Briefs

From PsychInfo:

Disability days in Major League Baseball

Conte, Stan; Requa, Ralph-K; Garrick, James G

American-Journal-of-Sports-Medicine. July-August, 2001; 29 (4): 431-436

We have examined the injury experience in Major League Baseball as reflected by the disabled list, based on data presented by American Specialty Companies in their publications, to examine any changes in injury rates over the past 11 years. It is reasonable to expect that improvements in training and conditioning, diagnostic methods, and surgical treatment over the last 11 years would have reduced injuries and resulted in fewer players on the disabled list. Yet, such does not appear to be the case. There is no evidence that the number of injuries in Major League Baseball has declined over the last decade; on the contrary, it appears that both the number of players and player days on the disabled list have increased. Team membership, injury location, and position do not appear to be related to the increase. Nor does it appear that the increase in injuries is a result of more sensitive diagnostic tests allowing the diagnoses of previously

unrecognized injuries. Whatever the reason, it is significant that publicly available data, when viewed over an 11-year period, reveal a gradual and consistent increase in reported injuries—suggesting a problem that deserves attention.

Kinematic comparisons of 1996 Olympic baseball pitchers.

Escamilla, Rafael F; Fleisig, Glenn S; Zheng, Nigel; Barrentine, Steven W; Andrews, James R

Journal-of-Sports-Sciences. September, 2001; 19 (9): 665-676.

The aim of this study was to compare and evaluate the kinematics of baseball pitchers who participated in the 1996 XXVI Centennial Olympic Games. Two synchronized video cameras operating at 120 Hz were used to video 48 pitchers from Australia, Japan, the Netherlands, Cuba, Italy, Korea, Nicaragua and the USA. All pitchers were analysed while throwing the fastball pitch. Twenty-one kinematic parameters were measured at lead foot contact, during the arm cocking and arm acceleration phases, and at the instant of ball release. These parameters included stride length, foot angle and foot placement; shoulder abduction, shoulder horizontal adduction and shoulder external rotation; knee and elbow flexion; upper torso, shoulder internal rotation and elbow extension angular velocities; forward and lateral trunk tilt; and ball speed. A one-way analysis of variance ($P < 0.01$) was used to assess kinematic differences. Shoulder horizontal adduction and shoulder external rotation at lead foot contact and ball speed at the instant of ball release were significantly different among countries. The greater shoulder horizontal abduction observed in Cuban pitchers at lead foot contact is thought to be an important factor in the generation of force throughout the arm cocking and arm acceleration phases, and may in part explain why Cuban pitchers generated the greatest ball release speed. We conclude that pitching kinematics are similar among baseball pitchers

from different countries.

The effects of extended play on professional baseball pitchers.

Murray, Tricia A; Cook, Timothy D; Werner, Sherry L; Schlegel, Theodore F; Hawkins, Richard J

American-Journal-of-Sports-Medicine. March-April, 2001; 29 (2): 137-142.

The purpose of this study was to investigate kinematic and kinetic changes as a result of extended play in baseball pitching. Seven major league baseball pitchers were videotaped with high-speed (120 Hz) cameras during multiple innings of the same game. For each athlete, two fastballs (one thrown during the initial inning of play and one from the final inning) were chosen for analysis. Twenty-one physical landmarks were manually digitized from the video data. Kinematic and kinetic parameters were subsequently calculated relative to four phases of the pitching motion: windup, cocking, acceleration, and follow-through. Paired t-tests revealed that seven parameters changed significantly between early and late innings. These included decreases in maximum external rotation of the shoulder, knee angle at ball release, ball velocity, maximum distraction force at both the shoulder and elbow, and horizontal adduction torque at both release and its maximum value. Ultimately, a decline in performance was evident by a 2 m/s (5 mph) drop in ball speed. It is unclear whether the kinematic and kinetic changes occurred because of fatigue or if protective mechanisms were adopted.

Manual laterality and hitting performance in major league baseball.

Grondin, Simon; Guiard, Yves; Ivry, Richard B; Koren, Stan

Journal-of-Experimental-Psychology-Human-

Perception-and-Performance. June, 1999; 25 (3): 747-754.

Asymmetrical hand function was examined in the context of expert sports performance: hitting in professional baseball. An archival study was conducted to examine the batting performance of all Major League Baseball players from 1871 to 1992, focusing on those who batted left (n = 1,059) to neutralize the game asymmetry. Among them, left-handers (n = 421) were more likely to hit with power and to strike out than right-handers (n = 638). One possible account, based on the idea of hand dominance and an analogy to tennis, is that batting left involves a double-handed forehand for left-handers and a weaker and more reliable double-handed backhand for right-handers. The results are also interpretable in the light of Y. Guiard's (1987) kinematic chain model of a between-hands asymmetrical division of labor, which provides a detailed account of why left batting is optimal for left-handers.

A biomechanical study of fast throwing movements of the shoulder in baseball pitching

Xue, Qingyun

Chinese-Medical-Journal-English-Edition. 1997; 110 (3) 220-224.

Objective: To define the biomechanic function of the shoulder in fast throwing movements in baseball pitching. Methods: Using NAC high-speed video and PIAS LA-555 computer system, overhand pitching movements carried out by 12 healthy Japanese professional baseball pitchers were analyzed in three dimensions. The pitching motion was displayed as stick to stick figures dynamically. Results: Pitching motion was a combination of translational and rotational movements. Acceleration and deceleration, being two typical motion patterns, worked sequentially through the anatomic link system from the pivot leg to the pitching hand. During the acceleration

phase, the shoulder joint acted as a junction point and a fulcrum, supporting the rotational acceleration motion, shoulder forward flexion and elbow extension. According to the changing glenohumeral angles of the pitching shoulder, shearing force turned into tension force which worked on the anterior shoulder structures and then shifted to the posterior part of the joint. Conclusions: In fast throwing motion, the shoulder functions as an important fulcrum to support the pitching arm during the acceleration phase. Avoiding excessive stress and shearing force on the joint components and enhancing coordination of muscle action are important to a successful throwing motion and the prevention of shoulder injury.
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The visual function of professional baseball players.

Laby, Daniel M; Rosenbaum, Arthur L; Kirschen, David G; Davidson, John L; Rosenbaum, Louis J; Strasser, Charles; Mellman, Michael F

American-Journal-of-Ophthalmology. 1996; 122 (4) 476-485.

PURPOSE: To measure the visual acuity, stereoacuity, and contrast sensitivity of professional baseball players. 0 METHODS: Three hundred eighty-seven professional baseball players underwent several tests of visual function including distance visual acuity. Stereoacuity was evaluated at near by the Randot test and at distance by both contour and random dot targets. Distance stereoacuity was also tested under timed and untimed conditions. Contrast sensitivity was evaluated by the Vision Contrast Test System, Contrast Sensitivity Viewer, and Binocular Visual Acuity Tester. 0 RESULTS: Visual acuity (measured with players' regular distance correction) in 774 eyes ranged from 20/8.89 to 20/100. Near stereoacuity ranged from 23 to 37 seconds of arc, mean untimed distance contour stereoacuity from 55 to 35 seconds of arc, and mean untimed distance random dot

stereoacuity from 98 to 76 seconds of arc. The results under timed conditions were 86 to 65 seconds of arc (timed distance contour stereoacuity) and 104 to 83 seconds of arc (timed distance random dot stereoacuity). Statistically significant differences were found between major and minor league players on tests of untimed distance con, tour and random dot stereopsis, and on contrast sensitivity testing with the 3.0- and 6.0-cpd gratings using the Contrast Sensitivity Viewer. 0 CONCLUSIONS: Professional baseball players have excellent visual skills. Mean visual acuity, distance stereoacuity, and contrast sensitivity are significantly better than those of the general population.

Three-dimensional kinematic analysis of baseball pitching in acceleration phase.

Wang, Y Tai; Fordi, H T Ii; Ford, H T Jr; Shin, Dong Min

Perceptual-and-Motor-Skills. 1995; 80 (1) 43-48.

(No abstract available)

Comparative analysis on the physique and batting records of the players in the National Summer High School Baseball Tournaments before and after the adoption of metal bats.

Uchida, Hayato; Mino, Yoshio; Babazono, Akira; Ogawa, Takanori; Aoyama, Hideyasu

Acta-Medica-Okayama. 1994; 48 (4) 217-223.

(No abstract available)

Stereophotometric testing for Pulfrich's phenomenon in professional baseball players.

Hofeldt, Albert, J; Hoefle, Frank B
Perceptual-and-Motor-Skills. 1993; 77 (2) 407-416.

(No abstract available)

Self-esteem and narcissism among the most and least empathetic Finnish baseball players.

Kalliopuska, Mirja

Perceptual-and-Motor-Skills. 1992; 75 (3 PART 1) 945-946.

560 girls and 819 boys, ages 8 to 16 years and actively interested in Finnish baseball, were tested in small groups in three training-camp championship games with the modified Mehrabian and Epstein's Empathy Scale and the Battle Self-esteem Inventory, Form B. Narcissism was estimated on the 1984 Emmons scale. The hypothesis that the most empathetic players compared with the least empathetic players have better self-esteem and less narcissism was confirmed.

From PubMed:

Conservative treatment of isolated posterior cruciate ligament injury in professional baseball players: a report of two cases.

Iwamoto, J; Takeda, T; Suda, Y; Otani, T; Matsumoto, H.

Knee. 2004 Feb;11(1):41-4.

Conservative treatment is currently recommended for most isolated posterior cruciate ligament (PCL) injuries in athletes. However, it is not known whether conservative treatment is applicable even in high performance athletes with isolated PCL injury. The results in two extremely high performance athletes, professional baseball players with isolated acute PCL injury treated conservatively are reported. A catcher and an out fielder, who were regular players, hurt their knees in baseball games. Magnetic resonance images of the knee detected complete PCL rupture. Following a carefully guided physical therapy program, a 3-week

period of immobilization of the knee in full extension was achieved with a knee brace, while performing hard quadriceps muscle strengthening exercise, and then running exercise was started. Six to eight weeks after injury, they were able to return fully to their original sporting activity despite tibial posterior translation on posterior drawer test, and to sustain this activity over 2 years. Switching of weight-bearing to non-weight-bearing in a deep knee flexion is considered to contribute to subjective instability in athletes with PCL-deficiency. Probably because our cases, even though extremely high performance athletes were infrequently subjected to such a situation while playing baseball, they were able to return to their pre-injury level of athletic performance without severe subjective instability through conservative treatment.

Infraspinatus muscle atrophy in professional baseball players.

Cummins, CA; Messer, TM; Schafer, MF.

Am J Sports Med. 2004 Jan-Feb;32(1):116-20.

BACKGROUND: Infraspinatus muscle atrophy has been observed in athletes who stress their upper extremities in an overhead fashion. The majority of such case reports have been in volleyball players, with far fewer cases reported in baseball players. HYPOTHESIS: Infraspinatus muscle atrophy occurs to a notable degree in professional baseball players. STUDY DESIGN: Retrospective cohort study. METHODS: At the end of the 1999 baseball season, data were collected from all Major League Baseball teams in regards to players affected with infraspinatus muscle atrophy. RESULTS: Twelve of the 1491 major league professional baseball players were identified as having appreciable infraspinatus muscle atrophy. There was an increased prevalence of the muscle atrophy in professional pitchers (10 of 494, 4%) compared to position players (2 of 997, 0.2%) (P <0.001). Among affected pitchers, the atrophy was identified

more frequently in starting pitchers (8 of 10) compared to relief pitchers (2 of 10) ($P = 0.036$), pitchers who had played for more years at the major league level (8.7 ± 4.9 versus 5.2 ± 4.0) ($P = 0.017$), and pitchers who had thrown for more innings at the major league level (971.4 ± 784.4 versus 485.0 ± 594.6) ($P < 0.001$).
CONCLUSION: Infraspinatus atrophy was identified in 4.4% of major league starting pitchers and occurred in those pitchers who pitched for more years and innings during their major league career.

Home field advantage: new stadium construction and team performance in professional sports.

Watson, JC 2nd; Krantz, AJ 3rd

Percept Mot Skills. 2003 Dec;97(3 Pt 1):794-6.

To identify the relations between new stadiums and home team performance and attendance for professional baseball (MLB) ($n=14$), basketball (NBA) ($n=13$), and football (NFL) ($n=25$) teams in the USA since 1950 dependent t tests assessed significance of increases in attendance in both MLB and the NBA and a significantly improved home winning percentage in MLB following the building of new stadiums. Implications include a better understanding of the rationales used by owners, fans, and players for building new stadiums.

Training and equipment to prevent athletic head and neck injuries.

Cross, KM; Serenelli, C.

Clin Sports Med. 2003 Jul;22(3):639-67.

Due to the potential for catastrophic neurotraumas and cervical spine injuries in sport, the sports health care professional must take proper measures to prevent such injuries. Strength training of the cervical spine, teaching of proper sporting techniques, and use of protective sports equipment are three primary means of

attempting to prevent neurotraumas and cervical spine injuries in sports. There are other avenues to assist in preventing these injuries, such as flexibility programs. The sports health care professional, therefore, must be knowledgeable of the needs of each individual athlete when developing prevention plans.

SUGGESTED WEBSITES:

Biomechanics of Baseball Pitching

A nice kinematic model by John J. Elias, Ph.D. at Johns Hopkins University Department of Orthopaedic Surgery

<http://www.biomech.jhu.edu/Projects/bball/Default.htm>

Dr. Richard J. Puerzer is Professor of [Industrial Engineering](#) in the Department of Engineering at Hofstra University, and a member of the Science and Baseball Committee.

http://www.hofstra.edu/Academics/HCLAS/Engineering/egg_puerzer.cfm

Quackwatch Guide to Health Fraud, Quackery, and Intelligent Decisions

Operated by Stephen Barrett, M.D, Quackwatch is a useful resource for investigating various medical/health claims, some of which have application to sports medicine, rehabilitation, and performance enhancement.

<http://www.quackwatch.org/>

Batter's Up Baseball

A cute math-skills game for kids in which runners are advanced by scoring "hits" with the right answers to math problems.

<http://www.prongo.com/math/>