The Top 100 Cited Articles in Clinical Orthopedic Sports Medicine

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Abstract

Orthopedic sports medicine continues to evolve, owing much of its clinical management and practice to rigorous academic research. In this review, we identify and describe the top 100 cited articles in clinical sports medicine and recognize the authors and institutions driving the research.

We collected articles (excluding basic science, animal, and cadaveric studies) from the 25 highest-impact sports medicine journals and analyzed them by number of citations, journal, publication date, institution, country, topic, and author.

Mean number of citations was 408 (range, 229-1629). The articles were published in 7 journals, most in the 1980s to 2000s, and represented 15 countries. Thirty topics were addressed, with a heavy emphasis on anterior cruciate ligament injury and reconstruction, knee rating systems, rotator cuff reconstruction, and chondrocyte transplantation. The 3 most cited articles, by Insall and colleagues, Constant and Murley, and Tegner and Lysholm, addressed a knee, a shoulder, and another knee rating system, respectively. Several authors contributed multiple articles. The Hospital for Special Surgery and the University of Bern contributed the most articles (5 each).

This study provides a comprehensive list of the past century's major academic contributions to sports medicine. Residents and fellows may use this list to guide their scholarly investigations.

Orthopedics and the sports medicine subspecialty are continually evolving fields that depend on research investigation and publication to further knowledge and advance practice. Research has produced new findings that have changed the way we practice sports medicine. In this review, we identify the most widely referenced sports medicine topics and articles, which we believe by their permeative presence in the literature have made lasting contributions to the field.

Many factors can be used to quantify the influence of an academic article on the practice of medicine. Citation analysis is one method that reflects the impact of a publication on the academic medical community.[1-3] Total citations record the number of times a journal article has been credited by another study. Therefore, citation count indirectly highlights the articles that are widespread, relevant, and that form the foundation for other investigations on the topic. Related to the impact of the article is the impact of the journal that published the study. We examined journals by impact factor, a score based on the mean number of citations a published article received during the preceding 2 years.

Similar analyses have been performed of publication history in orthopedics and other medical fields. Investigators have examined which historical articles were the most influential in orthopedics as a whole,[4] pediatric orthopedics,[5,6] shoulder surgery,[7] and arthroscopy.[8] This influence has also been studied in general surgery,[9] otolaryngology,[10] plastic surgery,[11] dermatology,[12] critical care,[13] and other disciplines. To our knowledge, the present study is the first bibliometric analysis of the highest-impact articles in orthopedic sports medicine.

Our goal was to identify the 100 articles that have had the highest impact on the clinical orthopedic sports medicine literature. We hypothesized that the most widely recognized articles would be from the highest-impact journals and may also have earlier publication dates. We describe the topics and objectives of these articles to highlight the sports medicine areas on which most research has focused during the past century.

Materials and Methods

Our bibliometric analysis used the Thomson Reuters Web of Knowledge, which consists of all publications from 1900 to the present. This research modality ranks journal articles by frequency of citation. Similar analyses have identified the most often cited articles in pediatric orthopedics,[5] shoulder surgery,[7] and arthroscopy.[8] In our analysis, we included the top 25 journals by impact factor in the field of sports medicine, as rated by the *Journal Citation Reports* database. Within the highest-impact journals, we sorted all articles by those most often cited, and read them all to identify which ones discuss conditions commonly encountered in the clinical practice of sports medicine. We focused on clinical articles only and therefore excluded related basic science and cadaveric biomechanical studies. The

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100 most cited articles were then further evaluated by primary author, journal of publication, institution, country of origin, year of publication, topic, and total number of citations. One-way analysis of variance (ANOVA) and linear regression analyses were used to determine if publication date correlated with mean number of citations.

Results

Eighty authors wrote the top 100 articles in sports medicine, and each publication garnered several hundred citations, ranging from 229 to 1629 with a mean of 408 (**Table 1**[14-113]). Most of these articles were written in the past 3 decades, with equal distribution from the 1980s, 1990s, and 2000s (**Figure 1A**). We ran a linear regression to determine if publication date correlated with higher number of citations by virtue of longer time available for citation. The analysis poorly modeled the variability ($R^2 = 0.05$), revealing no correlation between number of citations and publication date. Further, 1-way ANOVA found no significant difference between the number of citations per decade, $F(5, 93) = 1.60$, $P = .17$ (**Figure 1B**). Despite this finding, the oldest cited article, written by Fairbank[39] in 1948, ranked high (position 7). Of these top 100 publications, the most recent, written by Knutsen and colleagues[69] in 2007, ranked in the second half at position 66.

Table 1. Ranking of Studies by Number of Citations

Rank	Author(s)	Year	No. of Citations	Title
1	Insall et al[62]	1989	1629	Rationale of the Knee Society clinical rating system
2	Constant & Murley[32]	1987	1567	A clinical method of functional assessment of the shoulder
3	Tegner & Lysholm[113]	1985	1150	Rating systems in the evaluation of knee ligament injuries
4	Neer[81]	1972	1098	Anterior acromioplasty for the chronic impingement syndrome in the shoulder: a preliminary report
5	Outerbridge[96]	1961	1031	The etiology of chondromalacia patellae
6	Lysholm & Gillquist[74]	1982	970	Evaluation of knee ligament surgery results with special emphasis on use of a scoring scale
7	Fairbank[39]	1948	809	Knee joint changes after meniscectomy
8	Ganz et al[42]	2003	700	Femoroacetabular impingement: a cause for osteoarthritis of the hip
9	Peterson et al[99]	2000	697	Two- to 9-year outcome after autologous chondrocyte transplantation of the knee
10	Neer[82]	1983	654	Impingement lesions
11	Arendt & Dick[18]	1995	627	Knee injury patterns among men and women in collegiate basketball and soccer. NCAA data and review of literature
12	Rowe et al[103]	1978	612	The Bankart procedure: a long-term end-result study
13	Daniel et al[36]	1994	589	Fate of the ACL-injured patient. A prospective outcome study
14	Shelbourne & Nitz[107]	1990	542	Accelerated rehabilitation after anterior cruciate ligament reconstruction
15	Harryman et al[50]	1991	533	Repairs of the rotator cuff. Correlation of functional results with integrity of the cuff
16	Hewett et al[52]	1999	519	The effect of neuromuscular training on the incidence of knee injury in female athletes. A prospective study
17	Goutallier et al[47]	1994	505	Fatty muscle degeneration in cuff ruptures. Pre- and postoperative evaluation by CT scan
18	Noyes et al[91]	1983	503	The symptomatic anterior cruciate–deficient knee. Part I: the long-term functional disability in athletically active individuals
19	Hewett et al[53]	2005	498	Biomechanical measures of neuromuscular control and valgus loading of the knee predict anterior cruciate ligament injury risk in female athletes: a prospective study
20	Knutsen et al[70]	2004	491	Autologous chondrocyte implantation compared with microfracture in the knee. A randomized trial
21	Neer & Foster[84]	1980	490	Inferior capsular shift for involuntary inferior and multidirectional instability of the shoulder. A preliminary report
22	Jones et al[67]	1977	467	Humeral hypertrophy in response to exercise
23	Roos et al[101]	1998	464	Knee Injury and Osteoarthritis Outcome Score (KOOS)—development of a self-administered outcome measure
24	Galatz et al[41]	2004	461	The outcome and repair integrity of completely arthroscopically repaired large and massive rotator cuff tears
25	Ellman et al[38]	1986	454	Repair of the rotator cuff. End-result study of factors influencing reconstruction
26	Beck et al[22]	2005	444	Hip morphology influences the pattern of damage to the acetabular cartilage: femoroacetabular impingement as a cause of early osteoarthritis of the hip
27	Bentley et al[24]	2003	425	A prospective, randomised comparison of autologous chondrocyte implantation versus mosaicplasty for osteochondral defects in the knee
28	Solomonow et al[110]	1987	424	The synergistic action of the anterior cruciate ligament and thigh muscles in maintaining joint stability

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Table 1. **Ranking of Studies by Number of Citations** (continued)

Rank	Author(s)	Year	No. of Citations	Title
29	Notzli et al[87]	2002	420	The contour of the femoral head-neck junction as a predictor for the risk of anterior impingement
30	Tapper & Hoover[112]	1969	406	Late results after meniscectomy
31	Daniel et al[35]	1985	399	Instrumented measurement of anterior laxity of the knee
32	Baratta et al[19]	1988	392	Muscular coactivation. The role of the antagonist musculature in maintaining knee stability
33	Peterson et al[97]	2002	391	Autologous chondrocyte transplantation. Biomechanics and long-term durability
34	Berndt & Harty[26]	1959	390	Transchondral fractures (osteochondritis dissecans) of the talus
35	Johnson et al[66]	1974	389	Factors affecting late results after meniscectomy
36	Hewett et al[54]	1996	385	Plyometric training in female athletes. Decreased impact forces and increased hamstring torques
37	Curl et al[34]	1997	378	Cartilage injuries: a review of 31,516 knee arthroscopies
38	Matheson et al[77]	1987	369	Stress fractures in athletes. A study of 320 cases
39	Hawkins & Kennedy[51]	1980	368	Impingement syndrome in athletes
40	Sachs et al[105]	1989	365	Patellofemoral problems after anterior cruciate ligament reconstruction
41	Ludewig & Cook[73]	2000	360	Alterations in shoulder kinematics and associated muscle activity in people with symptoms of shoulder impingement
42	Horas et al[56]	2003	354	Autologous chondrocyte implantation and osteochondral cylinder transplantation in cartilage repair of the knee joint. A prospective, comparative trial
43	Hangody & Fules[49]	2003	354	Autologous osteochondral mosaicplasty for the treatment of full-thickness defects of weight-bearing joints: ten years of experimental and clinical experience
44	Steadman et al[111]	2003	350	Outcomes of microfracture for traumatic chondral defects of the knee: average 11-year follow-up
45	Andrews et al[17]	1985	347	Glenoid labrum tears related to the long head of the biceps
46	Hughston et al[58]	1976	343	Classification of knee ligament instabilities. Part I. The medial compartment and cruciate ligaments
47	Irrgang et al[63]	2001	341	Development and validation of the International Knee Documentation Committee subjective knee form
48	Ito et al[65]	2001	338	Femoroacetabular impingement and the cam-effect. A MRI-based quantitative anatomical study of the femoral head-neck offset
49	Gerber et al[44]	2000	327	The results of repair of massive tears of the rotator cuff
50	Burkhart & De Beer[29]	2000	326	Traumatic glenohumeral bone defects and their relationship to failure of arthroscopic Bankart repairs: significance of the inverted-pear glenoid and the humeral engaging Hill-Sachs lesion
51	Sher et al[108]	1995	325	Abnormal findings on magnetic resonance images of asymptomatic shoulders
52	Aglietti et al[14]	1994	321	Patellar tendon versus doubled semitendinosus and gracilis tendons for anterior cruciate ligament reconstruction
53	Noyes et al[89]	1980	320	Arthroscopy in acute traumatic hemarthrosis of the knee. Incidence of anterior cruciate tears and other injuries
54	Neer et al[83]	1983	318	Cuff-tear arthropathy
55	Beck et al[23]	2004	307	Anterior femoroacetabular impingement: part II. Midterm results of surgical treatment
56	Marder et al[76]	1991	307	Prospective evaluation of arthroscopically assisted anterior cruciate ligament reconstruction. Patellar tendon versus semitendinosus and gracilis tendons
57	Insall et al[61]	1976	305	Chondromalacia patellae. A prospective study
58	Daniel et al[37]	1985	304	Instrumented measurement of anterior knee laxity in patients with acute anterior cruciate ligament disruption
59	Lohmander et al[72]	2007	303	The long-term consequence of anterior cruciate ligament and meniscus injuries: osteoarthritis
60	Potter et al[100]	1998	300	Magnetic resonance imaging of articular cartilage in the knee. An evaluation with use of fast-spin-echo imaging
61	Gerber & Krushell[45]	1991	297	Isolated rupture of the tendon of the subscapularis muscle. Clinical features in 16 cases
62	Clancy et al[30]	1982	292	Anterior cruciate ligament reconstruction using one-third of the patellar ligament, augmented by extra-articular tendon transfers

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Table 1. **Ranking of Studies by Number of Citations** (continued)

Rank	Author(s)	Year	No. of Citations	Title
63	Rowe[102]	1956	284	Prognosis in dislocations of the shoulder
64	Boileau et al[28]	2005	282	Arthroscopic repair of full-thickness tears of the supraspinatus: Does the tendon really heal?
65	Rowe & Zarins[104]	1981	281	Recurrent transient subluxation of the shoulder
66	Knutsen et al[69]	2007	279	A randomized trial comparing autologous chondrocyte implantation with microfracture. Findings at five years
67	Glousman et al[46]	1988	279	Dynamic electromyographic analysis of the throwing shoulder with glenohumeral instability
68	Morgan et al[80]	1998	278	Type II SLAP lesions: three subtypes and their relationships to superior instability and rotator cuff tears
69	O'Brien et al[93]	1991	276	Reconstruction of the chronically insufficient anterior cruciate ligament with the central third of the patellar ligament
70	Barrack et al[20]	1989	273	Proprioception in the anterior cruciate deficient knee
71	Mandelbaum et al[75]	2005	272	Effectiveness of a neuromuscular and proprioceptive training program in preventing anterior cruciate ligament injuries in female athletes: 2-year follow-up
72	Peterson et al[98]	2003	269	Treatment of osteochondritis dissecans of the knee with autologous chondrocyte transplantation: results at two to ten years
73	Noyes & Stabler[92]	1989	269	A system for grading articular cartilage lesions at arthroscopy
74	Olsen et al[95]	2004	267	Injury mechanisms for anterior cruciate ligament injuries in team handball: a systematic video analysis
75	O'Driscoll et al[94]	1991	265	Posterolateral rotatory instability of the elbow
76	Berchuck et al[25]	1990	264	Gait adaptations by patients who have a deficient anterior cruciate ligament
77	Nirschl & Pettrone[85]	1979	262	Tennis elbow. The surgical treatment of lateral epicondylitis
78	Siebenrock et al[109]	2003	258	Anterior femoro-acetabular impingement due to acetabular retroversion. Treatment with periacetabular osteotomy
79	Gazielly et al[43]	1994	258	Functional and anatomical results after rotator cuff repair
80	Nistor[86]	1981	258	Surgical and non-surgical treatment of Achilles tendon rupture
81	Freedman et al[40]	2003	256	Arthroscopic anterior cruciate ligament reconstruction: a metaanalysis comparing patellar tendon and hamstring tendon autografts
82	Noyes et al[90]	1983	255	The symptomatic anterior cruciate-deficient knee. Part II: the results of rehabilitation, activity modification, and counseling on functional disability
83	Noyes et al[88]	1991	251	Abnormal lower limb symmetry determined by function hop tests after anterior cruciate ligament rupture
84	Bartlett et al[21]	2005	250	Autologous chondrocyte implantation versus matrix-induced autologous chondrocyte implantation for osteochondral defects of the knee: a prospective, randomised study
85	Huston & Wojtys[59]	1996	249	Neuromuscular performance characteristics in elite female athletes
86	Iannotti et al[60]	1991	249	Magnetic resonance imaging of the shoulder. Sensitivity, specificity, and predictive value
87	Jones[68]	1963	248	Reconstruction of the anterior cruciate ligament: a technique using the central one-third of the patellar ligament
88	Corry et al[33]	1999	247	Arthroscopic reconstruction of the anterior cruciate ligament. A comparison of patellar tendon autograft and four-strand hamstring tendon autograft
89	Guskiewicz et al[48]	2000	246	Epidemiology of concussion in collegiate and high school football players
90	Irrgang et al[64]	1998	242	Development of a patient-reported measure of function of the knee
91	Matsusue et al[78]	1993	240	Arthroscopic multiple osteochondral transplantation to the chondral defect in the knee associated with anterior cruciate ligament disruption
92	Samilson & Prieto[106]	1983	239	Dislocation arthropathy of the shoulder
93	Kujala et al[71]	1993	238	Scoring of patellofemoral disorders
94	Homminga et al[55]	1990	236	Perichondral grafting for cartilage lesions of the knee
95	Clancy et al[31]	1983	233	Treatment of knee joint instability secondary to rupture of the posterior cruciate ligament. Report of a new procedure
96	Altchek et al[16]	1991	232	T-plasty modification of the Bankart procedure for multidirectional instability of the anterior and inferior types
97	McDaniel & Dameron[79]	1980	231	Untreated ruptures of the anterior cruciate ligament. A follow-up study

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Table 1. **Ranking of Studies by Number of Citations** (continued)

Rank	Author(s)	Year	No. of Citations	Title
98	Hovelius et al[57]	1996	230	Primary anterior dislocation of the shoulder in young patients. A ten-year prospective study
99	Allen et al[15]	1984	230	Late degenerative changes after meniscectomy. Factors affecting the knee after operation
100	Binkley et al[27]	1999	229	The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application

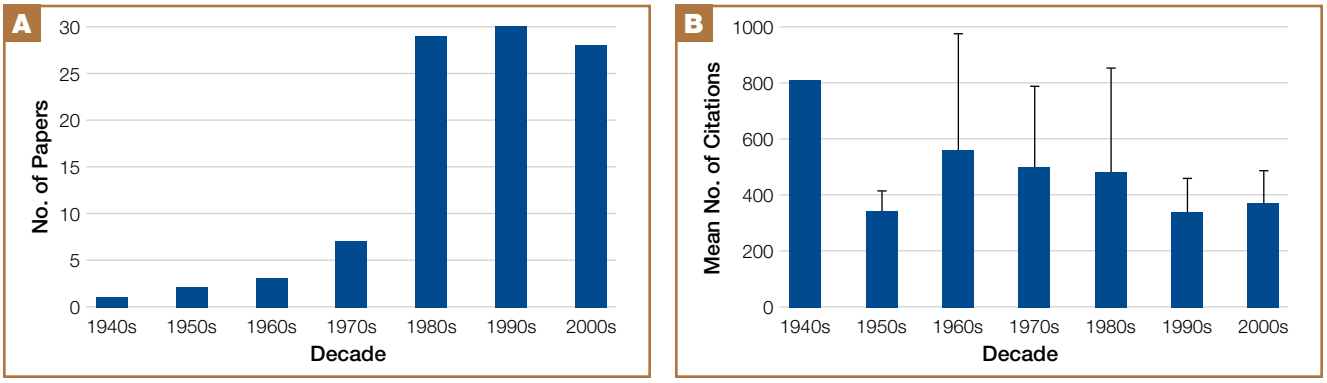

Figure 1. (A) Number of articles by decade. There is equal distribution of articles from the 1980s, 1990s, and 2000s, showing that much of current clinical knowledge and practice in sports medicine is based on findings from the past 4 decades. (B) Mean number of citations by decade. Error bars show standard deviation, with no significant differences between decades, suggesting that older articles did not have increased citation simply because of earlier publication dates.

Seven journals published the top 100 articles, with the American volume of the *Journal of Bone and Joint Surgery* publishing nearly half (44%) (**Table 2**). In second place, with 28 articles, was the *American Journal of Sports Medicine*, followed by the British volume of the *Journal of Bone and Joint Surgery*, with 10 articles.

Thirty different topics were investigated in this collection of articles, encompassing nearly every major research area of sports medicine. There was a heavy emphasis on anterior cruciate ligament (ACL) injury and reconstruction, knee rating systems, rotator cuff reconstruction, and chondrocyte transplantation (**Table 3**).

In several cases, an author contributed more than 1 classic article. In fact, 31 of the top 100 articles were by an individual who had coauthored 2 or more of the publications on this list. The researchers with the largest number of first-authored articles were Noyes[88-92] (5 articles), Neer[81-84] (4 articles), and Rowe,[102-104] Daniel,[35-37] Peterson,[97-99] and Hewett[52-54] (3 articles each) (**Table 4**[17,19,21-24,29-31,35-37,42,44,45,52-54,58,61-65,69,70,72,74,80-84,87-92,97-99,101-105,107,109,110,113]). Articles from authors with multiple publications had a common topic.

Last, these articles originated from a number of different countries and institutions. Of the 15 source countries (**Figure 2**), the United States contributed the most (61 articles). Other countries had prominent representation: Sweden and Switzerland (8 each), United Kingdom (5), and Canada, France, and Norway (3 each). These articles originated from 69 universities, hospitals, and clinics; 21 institutions had 2 or more articles (**Table 5**). The 5 institutions with the highest number of articles were Hospital for Special Surgery, University of Bern, Columbia College of Physicians and Surgeons/Columbia-Presbyterian Medical Center, Cincinnati Sports Medicine and Orthopaedic Center, and Massachusetts General Hospital.

Discussion

Several trends can be ascertained from analyzing the top 100 clinical articles cited in sports medicine. The 5 most frequent topics discussed were ACL injury and reconstruction, knee rating systems for injury and function, rotator cuff reconstruction, chondrocyte transplantation, and femoroacetabular impingement (**Table 3**). Of those 5 topics, only ACL injury

Table 2. **Journals Ranked by Number of Top 100 Articles**

Journal	No. of Cited Articles
Journal of Bone and Joint Surgery, American Volume	44
American Journal of Sports Medicine	28
Journal of Bone and Joint Surgery, British Volume	10
Clinical Orthopaedics and Related Research	9
Arthroscopy: The Journal of Arthroscopic and Related Surgery	6
Physical Therapy	2
Journal of Orthopaedic & Sports Physical Therapy	1

Table 3. **Most Popular Topics Ranked by Number of Articles**

Topic	No. of Articles[a]
Anterior cruciate ligament injury and reconstruction	15
Knee rating system	9
Rotator cuff reconstruction	8
Chondrocyte transplantation	7
Femoroacetabular impingement	6
Injury pattern, knee	6
Shoulder instability	5
Strengthening and conditioning	5
Injury pattern, rotator cuff	4
Meniscectomy	4
Shoulder impingement	4
Bankart procedure	3
Kinesthetics, knee	3
Chondromalacia patellae	2
Knee instability	2
Microfracture	2
Osteochondritis dissecans	2

[a]Thirteen topics—Achilles injury and reconstruction; concussion; elbow instability; gait; injury pattern, glenoid labrum; kinesthetics, shoulder; patellar ligament reconstruction; osteochondral mosaicplasty; mobility rating system; shoulder rating system; perichondral grafting; proprioception; and tennis elbow—were discussed in only 1 article each and are not included here.

and reconstruction falls within the top 10 most common orthopedic surgical procedures performed in the United States reported by one analysis.[114] The most common orthopedic surgical procedure, knee arthroscopy, ranks 10th of all topics covered by the top 100 articles, whereas the second most common procedure, shoulder arthroscopy, was not discussed by any of those 100 articles. Also notable is the high frequency of knee rating system studies, which correlates well with the fact that 4 of the most common orthopedic surgical procedures are knee procedures. The prevalence of rating system articles reflects the importance of and need for accurate methods in the diagnosis of injuries in sports medicine.

The most cited sports medicine article was written by Insall and colleagues[62] in 1989, more than 2 decades ago. In this article, "Rationale of the Knee Society Clinical Rating System," they reported on a rigorous system that rates knee function and ability to walk and climb stairs. The second most cited article, "A Clinical Method of Functional Assessment of the Shoulder," was written in 1987 by Constant and Murley.[32] This article discusses another rating system but offers a functional assessment of the shoulder that is highly reproducible and time-efficient. "Rating Systems in the Evaluation of Knee Ligament Injuries," the third most cited article, was written in 1985 by Tegner and Lysholm.[113] This article details the complexities and variable uses of different knee ligament injury rating systems. These top 3 articles were all published in *Clinical Orthopaedics and Related Research*. In addition, all 3 discussed rating systems, reinforcing the need for accurate scoring systems to standardize the diagnosis of injury across the field of orthopedics and qualify outcomes after injury.

A number of studies have introduced physical examination findings, clinical tests, and rating systems used in the clinical setting of sports medicine (and named after the contributing authors). For example, the Neer sign[82] and the Hawkins-Kennedy test[51] are used to determine shoulder impingement. In knee ligament injuries, the Tegner knee activity score[113] complements other functional scores (eg, Lysholm knee score[74]). For grading joint cartilage breakdown, the Outerbridge classification system[96] is commonly used. The Fairbank test[39] is used to gauge knee instability. In evaluating fatty degeneration of rotator cuff muscles through computed tomography scans, the Goutallier classification[47] is used. Other metrics, such as the Knee Injury and Osteoarthritis Outcome Score, introduced by Roos and colleagues,[101] measure knee injury and osteoarthritis. In other scenarios, studies have improved on surgical techniques—for example, the Neer open modification[84] of the Bankart procedure. Many of these rating systems and named clinical findings are so ingrained in the practice and vernacular of orthopedics that it is possible they are in fact undercited in the literature.

As in other bibliometric analyses, one concession made here was to credit the first author listed for making the primary contribution to an article. As a result of journal variability and inconsistency, we were precluded from analyzing senior authors.

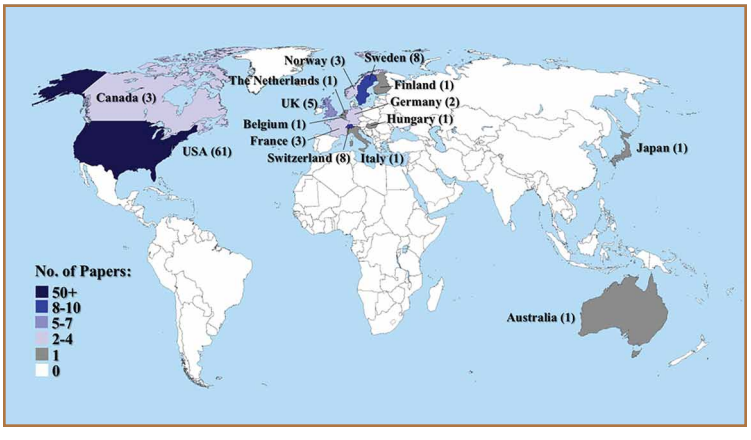

Figure 2. Countries of origin. Number in parentheses is number of articles published from that country.

Table 4. **Top Published First Authors and Topics**[a]

First Author	No. of Articles	Topics
FR Noyes[88-92] ([52,54])	5 (+2)	ACL injury and reconstruction; knee rating system; strengthening and conditioning
CS Neer[81-84]	4	Rotator cuff reconstruction; shoulder impingement; shoulder instability
DM Daniel[35-37] ([105])	3 (+1)	ACL injury and reconstruction; kinesthetics, knee
TE Hewett[52-54]	3	ACL injury and reconstruction; strengthening and conditioning
L Peterson[97-99]	3	Chondrocyte transplantation; osteochondritis dissecans
CR Rowe[102-104]	3	Bankart procedure; shoulder instability
M Beck[22,23] ([42])	2 (+1)	Femoroacetabular impingement
WG Clancy[30,31]	2	ACL injury and reconstruction; knee instability
C Gerber[44,45]	2	Injury pattern, rotator cuff; rotator cuff reconstruction
JN Insall[61,62]	2	Chondromalacia patellae; knee rating system
JJ Irrgang[63,64]	2	Knee rating system
G Knutsen[69,70]	2	Chondrocyte transplantation
R Ganz[42] ([22,23,65,109])	1 (+4)	Femoroacetabular impingement
RA Sachs[105] ([35,37])	1 (+2)	ACL injury and reconstruction (kinesthetics, knee)
JR Andrews[17] ([58])	1 (+1)	Injury pattern, glenoid labrum (knee instability)
R Baratta[19] ([110])	1 (+1)	Kinesthetics, knee
G Bentley[24] ([21])	1 (+1)	Chondrocyte transplantation
SS Burkhart[29] ([80])	1 (+1)	Bankart procedure (injury pattern, rotator cuff)
L Lohmander[72] ([101])	1 (+1)	Injury pattern, knee (knee rating system)
J Lysholm[74] ([113])	1 (+1)	Knee rating system
HP Notzli[87] ([42])	1 (+1)	Femoroacetabular impingement
EM Roos[101] ([72])	1 (+1)	Knee rating system (injury pattern, knee)
KD Shelbourne[107] ([31])	1 (+1)	ACL injury and reconstruction (knee instability)
KA Siebenrock[109] ([42])	1 (+1)	Femoroacetabular impingement
M Solomonow[110] ([19])	1 (+1)	Kinesthetics, knee

Abbreviation: ACL, anterior cruciate ligament.
[a]Entries in parentheses indicate additional articles/topics in which author was not first author. Same topic(s) was/were not repeated.

When analyzed for authorship at any position, 3 of the top authors (**Table 4**) showed contributions to additional articles in the top 100 list. Noyes was listed as last author on 2 other articles,[52,54] raising his total to 7. Daniel was listed as second author on 1 additional article,[105] and Beck was listed as third author on 1 other article,[42] raising their totals to 4 and 3, respectively.

A criticism of bibliometric analysis is its use of number of citations as an accurate measure of academic contribution. However, other methods for measuring the productivity and impact of researchers (eg, the recently developed Hirsch Index) have their own drawbacks,[115,116] including being able to compare authors only at the same point in their careers and self-citation. It is important to note that our analyses focused strictly on publications related to clinical sports medicine, with the exclusion of basic science and cadaveric biomechanical studies.

Through bibliometric citation analysis, we have identified the authors who have made lasting contributions to the field of sports medicine, and we have highlighted the publications that have been cited by hundreds to thousands of authors. This list identifies trends within the articles that have become "classic," by nature of their deep permeation into subsequent sports medicine literature, and offers guidance for trainees interested in studying the most high-yield sports medicine literature. Given that 69 institutions in 15 countries conducted these studies, we have also shown that orthopedic research can be readily disseminated internationally. Last, our study provides a thorough overview of the sports medicine literature over the past century and provides a strong framework for future research in our field.

Table 5. **Top Institutional Origins of Articles**

Institution	No. of Articles[a]
Hospital for Special Surgery	5
University of Bern	5
Columbia College of Physicians and Surgeons	4
Cincinnati Sports Medicine and Orthopaedic Center	3
Massachusetts General Hospital	3
Cincinnati Children's Hospital	2
Kaiser Permanente	2
Louisiana State University	2
Royal National Orthopaedic Hospital	2
Rush Medical College	2
Sahlgrenska University Hospital	2
San Diego Kaiser Medical Center	2
Steadman Hawkins Sports Medicine Foundation	2
University Hospital Tromsø	2
University of Cincinnati	2
University of Giessen	2
University of Minnesota	2
University of Pennsylvania	2
University of Pittsburgh	2
University of Wisconsin	2
University of Zurich	2

[a]The remaining 48 articles were published individually from different institutions.

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