

The impact of the 30 most cited articles on hip arthroscopy: what is the subject matter?

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ABSTRACT

The purpose of this study was to identify the 30 most cited articles on hip arthroscopy and discuss their influence on recent surgical treatment. Due to advancements in hip arthroscopy, there is a widening spectrum of diagnostic and treatment indications. The purpose of this study was to identify the 30 most cited articles on hip arthroscopy and discuss their influence on contemporary surgical treatment. The Thomson Reuters Web of Science was used to identify the 30 most cited studies on hip arthroscopy between 1900 and 2018. These 30 articles generated 6152 citations with an average of 205.07 citations per item. Number of citations ranged from 146 to 461. Twenty-five out of the 30 papers were clinical cohort studies with a level of evidence between III and IV, encompassing 4348 patients. Four studies were reviewed (one including a technical note) and one a case report. We were able to identify the 30 most cited articles in the field of hip arthroscopy. Most articles were reported in high-impact journals, but reported small sample sizes in a retrospective setting. Prospective multi-arm cohort trials or randomized clinical trials represent opportunities for future studies.

INTRODUCTION

Hip arthroscopy was first described in cadaveric studies in 1931 and applied clinically in 1939 [1, 2]. In 1977, it was introduced as a treatment option for congenital dislocations of the hip [3] and gained more popularity with the description of the lateral approach by Glick *et al.* in 1987 [4, 5]. Initially the main indications for hip arthroscopy were the treatment of labral tears, removal of loose bodies, diagnosis of hip pain of unclear etiology and management of degenerative and/or pyogenic arthritis [6–8]. With the increasing recognition of femoroacetabular impingement (FAI) as a common cause of hip pain, the utilization of hip arthroscopy has increased [9–12]. One report noted an increase of 365% in the rate of hip arthroscopy between 2004 and 2009 in the United States [13]; a separate

cross-sectional study of trends in the United States reported a 250% increase between 2007 and 2011 [14]. In 2011, the annual frequency of hip arthroscopy was four cases per 10 000 orthopedic patients [14]. We performed a bibliographic analysis of the literature to identify the 30 most cited articles in the current literature. These citation reviews have been conducted in various specialties and subspecialties [15–17]. In the current literature, there is one article addressing the most cited articles related to FAI [18]. The goal of this study is to identify the citation patterns and summarize these studies in hip arthroscopy.

MATERIALS AND METHODS

We searched the ‘cited reference search’ through the ISI web of knowledge (Thompson Reuters, New York, NY,

USA) to identify the 30 most cited articles. The search was performed using the term hip arthroscopy in the search bar under the title category or the topic category on 5 February 2019 including all articles from 1900 to 2018. The search has been performed independently by two study authors. We did not specify the journal specialty. Only articles written in English and German were included. The results were sorted in descending order according to the total citation count. We found 2211 articles with a Hirsch index of 102 characterizing the scientific output of this set of papers [19]. The average number of citations per item was 21.96 with 48 548 sum of times cited. Articles not dealing with hip arthroscopy were excluded. The 30 most cited articles were analyzed and integrated into a master sheet. For each, we determined the total number of citations and the average number of citations per year. The following data were then extracted from the 30 articles: article title, source journal, year of publication, authors, country of origin in accordance with the corresponding author's address, study design, number of patients included, total number of citations and average number of citations per year. After reviewing the text of each article, articles were classified according to a general topic and we rated the level of evidence (LoE) [20]. Articles were analyzed for content and further descriptive statistics regarding citation patterns were calculated. This study did not require approval from an institutional review board as it included publicly available data.

RESULTS

We selected 30 papers with the most citations (Table I). The sum of citation was 6152 with average number of citations of 206 per article. All articles in the top 30 list were published between 1994 and 2013, with the most, 16.7%, in 2007 (Fig. 1). The 30 articles appeared in 7 different journals (Table II). The averaged impact factor was 4.250 (min. 3.053, max. 4.433) (Table I). The articles were generated from 5 countries (United States, England, Brazil, Scotland, Switzerland) with 90% (27) written in the United States. Three authors have contributed nearly two-thirds of the articles (Table III). There were 25 clinical studies 4 review papers and 1 case report. A total of 4348 patients were included in the 22 clinical studies and 1 case report. Further 1 systematic review regarding complications and reoperations included 6134 patients [21]. Montgomery *et al.* (3447 cases) and Byrd *et al.* (20 cases) mentioned cases instead of patients [13, 22]. The primary topics covered were labral tears, FAI and complications (Table IV). A total of 22 articles were Level IV evidence (73.3%) (Table I).

DISCUSSION

This article delineates the most cited articles about hip arthroscopy, which may serve as a foundational resource for the orthopedic community.

American authors predominate various medical fields and bibliometric analysis regarding orthopedic surgery confirmed this within classic orthopedic literature [16, 17, 23, 24]. Contrary to this, a recent bibliometric analysis by Cassar Gheiti *et al.* [25] determined the citation frequencies of the 25 most cited arthroscopic surgery-related articles and found 55% of them to originate from Europe. Using the same search terms in 61 orthopedic journals revealing a majority of citations from North America (48%) [25]. Performing an all-database analysis not limited to Orthopedic journals and found 27 (90%) of the top 30 articles from the United States which confirms the finding by Lee *et al.* [18] who found 26 (52%) out of the 50 articles regarding hip arthroscopy and FAI to origin from the United States.

Authors have reported a clear time effect in citation analysis of orthopedic articles with the 1980s having the most articles published [17, 24]. As a consequence, two bibliometric analyses of orthopedic literature barely cover any Arthroscopic topics and no hip arthroscopy [17, 24]. Even when considering arthroscopic surgery-related publications a bibliometric analysis found the knee to be the most common joint cited in orthopedic journals and within this analysis only 3% cited articles regarding hip arthroscopy [25]. The increasing citation counts regarding arthroscopic surgery per year by decade of publication were taken into account. These early publications started in 1980 and saw a rise until they peaked in 2008 [25]. This development was noticeable regarding hip arthroscopy in the early 1990. The rising popularity might be attributable to the description of the lateral approach by Glick *et al.* in 1987 [4, 5]. The increase of citation after some years of stagnation in 2004 is accompanied by a 365% increase in the rate of hip arthroscopy between 2004 and 2009 in the United States [13]. Accordingly, we only found 4 articles published before 2000.

The most cited article was by Philippon *et al.* [26] reporting the outcome of hip arthroscopy for FAI with associated chondrolabral dysfunction. They showed good results at short-term follow-up and were able to define certain factors related to higher satisfaction and better outcomes: preoperative Harris hip score (HHS) [27], repair for labral pathology (rather than debridement) and a preoperative joint space ≥ 2 mm [26]. First described as 'the impingement of the femoral neck on the anterior acetabulum margin' in 1935 by Smith-Peterson, FAI is now a recognized source of hip pain and dysfunction [9]. With

Table I. Top 30 articles

<i>Title</i>	<i>Authors (year)</i>	<i>Level of evidence</i>	<i>Total citations</i>	<i>Average per year</i>	<i>Sample size</i>
Outcomes following hip arthroscopy for femoroacetabular impingement with associated chondrolabral dysfunction	Philippon <i>et al.</i> (2009) [26]	IV	461	49	112
The role of labral lesions to development of early degenerative hip disease	McCarthy <i>et al.</i> (2001) [30]	III	324	17.05	436
Prospective analysis of hip arthroscopy with 2-year follow-up	Byrd and Jones (2000) [27]	IV	317	15.85	35
Femoroacetabular impingement in 45 professional athletes: associated pathologies and return to sport following arthroscopic decompression	Philippon <i>et al.</i> (2007)	IV	272	20.92	45
Arthroscopic labral repair in the hip: surgical technique and review of the literature	Kelly <i>et al.</i> (2005) [31]	V	244	16.27	–
Arthroscopic debridement versus refixation of the acetabular labrum associated with femoroacetabular impingement	Larson <i>et al.</i> (2009) [35]	IV	227	20.64	34
Arthroscopic management of femoroacetabular impingement—osteoplasty technique and literature review	Philippon <i>et al.</i> (2007) [10]	V	227	17.46	–
Hip arthroscopy for acetabular labral tears	Farjo <i>et al.</i> (1999) [33]	IV	219	10.43	28
Revision hip arthroscopy	Philippon <i>et al.</i> (2007)	IV	209	16.08	37
Diagnostic accuracy of clinical assessment, magnetic resonance imaging, magnetic resonance arthrography and intra-articular injection in hip arthroscopy patients	Byrd and Jones (2004)	IV	209	13.06	40
Arthroscopic management of femoroacetabular impingement: early outcomes measures	Larson <i>et al.</i> (2008)	IV	208	17.33	96
Hip arthroscopy: current indications, treatment options, and management issues	Kelly <i>et al.</i> (2003) [29]	IV	203	11.94	–
Clinical presentation of patients with tears of the acetabular labrum	Burnett <i>et al.</i> (2006) [32]	IV	197	14.07	66
Hip arthroscopy: complications in 1054 cases	Clarke <i>et al.</i> (2003) [40]	IV	197	11.59	1054
Hip arthroscopy utilizing the supine position	Byrd (1994) [22]	V	196	7.54	20 cases

(continued)

Table I. (continued)

<i>Title</i>	<i>Authors (year)</i>	<i>Level of evidence</i>	<i>Total citations</i>	<i>Average per year</i>	<i>Sample size</i>
Arthroscopic debridement versus refixation of the acetabular labrum associated with femoroacetabular impingement: mean 3.5-year follow-up	Larson <i>et al.</i> (2012) [34]	III	190	23.75	42
Arthroscopic femoroplasty in the management of cam-type femoroacetabular impingement	Byrd <i>et al.</i> (2009)	IV	185	16.82	200
Radiologic and intra-operative findings in revision hip arthroscopy	Heyworth <i>et al.</i> (2007)	IV	185	14.23	23
Acute iatrogenic dislocation following hip impingement arthroscopic surgery	Matsuda (2009)	V	181	16.45	1
Arthroscopic labral repair and treatment of femoroacetabular impingement in professional hockey players	Philippon <i>et al.</i> (2010)	IV	170	17	28
Clinical presentation of femoroacetabular impingement	Philippon <i>et al.</i> (2007)	IV	166	12.77	301
Open surgical dislocation versus arthroscopy for femoroacetabular impingement: a comparison of clinical outcomes	Botser <i>et al.</i> (2011)	III	157	17.44	–
Trends in hip arthroscopy utilization in the United States	Bozic <i>et al.</i> (2013) [12]	IV	153	21.86	1574
Trends and demographics in hip arthroscopy in the United States	Montgomery <i>et al.</i> (2013) [13]	IV	153	21.86	3447 cases
Hip arthroscopy in the presence of dysplasia	Byrd and Jones (2003) [28]	IV	153	9	48
The acetabular labral tear: an arthroscopic classification	Lage <i>et al.</i> (1996)	IV	153	6.38	37
Complications and reoperations during and after hip arthroscopy: a systematic review of 92 Studies and more than 6,000 Patients	Harris <i>et al.</i> (2013) [21]	II	152	21.71	6134 (systematic review)
Prospective analysis of hip arthroscopy with 10-year follow-up	Byrd <i>et al.</i> (2010)	IV	149	14.9	50
The ligamentum teres of the hip: an arthroscopic classification of its pathology	Gray and Villar (1997)	IV	149	6.48	20
Traumatic rupture of the ligamentum teres as a source of hip pain	Byrd and Jones (2004)	V	146	9.13	41

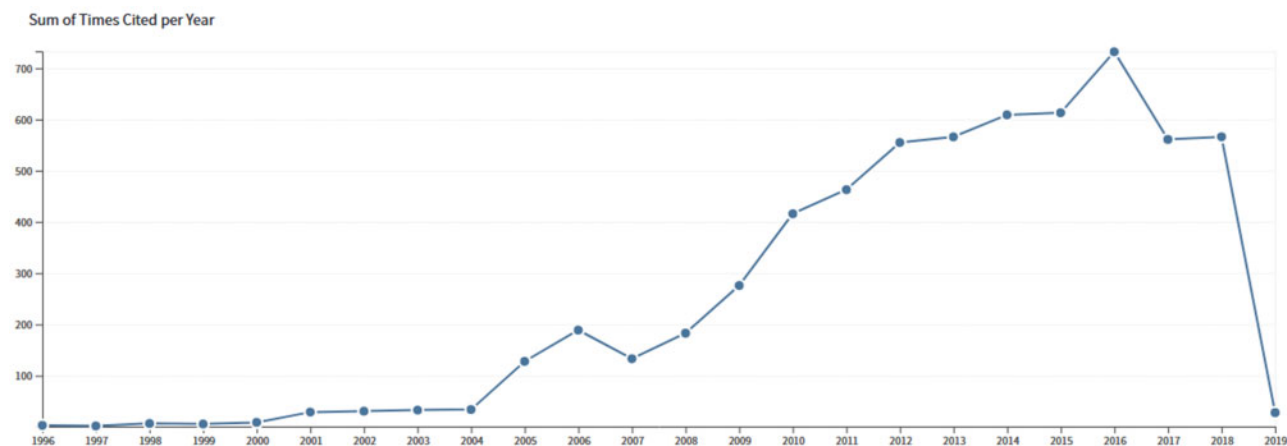


Fig. 1. Citations per year.

Table II. Journals

Journals	Impact factor	Number of articles
<i>Arthroscopy: the Journal of Arthroscopy and Related Surgery</i>	4.433	11
<i>American Journal of Sports Medicine</i>	6.057	7
<i>Clinical Orthopedics and Related Research</i>	4.091	4
<i>Arthroscopy</i>	4.292	4
<i>Knee Surgery, Traumatology and Arthroscopy</i>	3.053	2
<i>Journal of Arthroplasty</i>	3.524	1
<i>Journal of Bone and Joint Surgery British Volume</i>	4.301	1

Table III. Top three authors

Authors	Number of authorships
Byrd and Jones	7
Philippon <i>et al.</i>	7
Jones <i>et al.</i>	6

Table IV. Top three major topics

Topic	No. of papers
Labral repair	10
FAI	9
Complications and revisions	5

improved understanding of FAI as a potential cause of premature osteoarthritis along with evolution in hip arthroscopy equipment and techniques, FAI has become a primary indication for the procedure since the early 2000s [13, 27–29]. This is reflected in FAI being the second most common topic in the 30 papers, and a specific focus. The second most cited paper written by McCarthy *et al.* won the Otto E. Aufranc Award. Using a cadaver and retrospective clinical approach, they related the presence of labral lesions to early degenerative hip disease by noting an association in the location of damage [30]. Labral tears were the most frequent topic in our analysis. Some authors describe labral tears as the leading reason for hip arthroscopy, occurring in 90% of the cases [31]. Burnett *et al.* [32] described groin pain (92%) and activity-related pain (91%) as the main clinical findings associated with intraoperatively confirmed labral tears. In contrast, Farjo *et al.* [33] failed to identify a common clinical presentation to

help in the diagnosis of acetabular labral tears. Furthermore, they described the anterior located radial flap tear type as the most common location for labral damage, leading to their recommendation for a posterior portal in order to visualize the anterior joint [33]. They also confirmed that pre-existing arthritis is associated with less optimal outcomes [33]. Several studies compared the results between re-fixation and debridement of a torn labrum [34, 35]. In a cohort study using HHS, visual analog scale and Short Form 12 as outcome measures, Larson *et al.* [34] reported better results with re-fixation. A finding that was echoed in a 10-year follow-up study by Byrd and Jones [36].

The role of hip arthroscopy in acetabular dysplasia continues to be a topic of controversy [37]. Two studies in this list addressed the topic. In a retrospective study of 48 patients, Byrd *et al.* concluded that dysplasia was not a 'harbinger' for poor results. However, the criteria for dysplasia was based on a single measure: the lateral center-edge angle [38]. Pooling data from two institutions, Parvizi *et al.* retrospectively reviewed the results of hip arthroscopy in patients with dysplasia defined by radiographic parameters that included the acetabular index, Tonnis angle, lateralization index and disruption of Shenton's line. They found patients had significant improvement in functional scores at 6 weeks post-surgery, but scores deteriorated with time, decreasing to 76 points (super simplified hip score) at 2 years. The authors concluded that hip arthroscopy should be reserved for patients with no deformity or in patients where the deformity can be treated with arthroscopy [39]. Two review articles in the top 30 deal with complications of hip arthroscopy. Clarke *et al.* [40] reported an overall complication rate of 1.4% in 1054 cases. Harris *et al.* [21] conducted a systematic review of 92 studies including 6134 patients. They found a 7.5% incidence of minor and 0.58% incidence of major complications, with iatrogenic labral injuries being the most common [21]. One article in the top 30 was a case report of iatrogenic anterior hip dislocation in a female patient who had undergone arthroscopic acetabular rim trim, labral debridement and femoral head-neck osteoplasty for symptomatic cam- and pincer-impingement after hip arthroscopy. A common issue raised by many of the authors in these 30 articles is the need for a validated outcome instrument that is applicable for non-arthroplasty patients. None of the 30 papers specifically addressed functional outcome tools [41].

The most common topic in arthroscopic surgery-related citations was cartilage lesions and its treatment which could be found in both orthopedic literature and in a general database search. All topics covered by the 25 most cited articles in hip arthroscopy were published

orthopedic-related journal [25]. Articles that are related to topics of interest, in our case labral repair, will tend to be cited more frequently than others resulting in higher citations as seen in our study and has been described by other bibliometric analysis [18, 25]. Furthermore, with labral repair being the most frequent topic, 22 articles (80%) were published in only 3 journals are specific for arthroscopic techniques with labral repair as most common and highly specific topic. The top 30 articles are condensed in 7 journals while 22 of them (73%) are published in journals focusing on arthroscopic surgery. Nevertheless and despite a broader inclusion criteria Kelly *et al.* [17] found the most cited 100 articles regarding orthopedic surgery in 7 journals, with 58 (58%) in 1 journal.

While Cassar Gheiti *et al.* did not specify the LoE found in the articles, Lefavre *et al.* described Level IV clinical studies as the most common study regarding orthopedics [24, 25]. Lee *et al.* share similar findings regarding the field of FAI, and we found Level IV studies to be the most frequent one regarding the field of hip arthroscopy [18, 24]. Despite a considerable progression in the quality of research in orthopedics in the last decades there is only one Level 1 study among the most cited works in orthopedics [24]. There was an increasing number of publications as well as citations in the early 2000s. The same increase in term of citations was witnessed in arthroscopy in general and might be attributable to the increase in Internet use over this period as part of this development [25]. Nevertheless, while the most cited articles in general orthopedics originate from the 1980s the most cited articles regarding hip arthroscopy was published in 2009 [26]. In 2013, Montgomery *et al.* reviewed the national database of orthopedic insurance records Harris *et al.* published a Level 2 systematic review implementing the so-called 'Big Data' and higher LoE in the field of hip arthroscopy [13, 21]. Nevertheless, there is a need for higher LoE in future research regarding the field of hip arthroscopy [42]. A more frequent use of larger databases as seen in other medical fields might provide useful insights especially with more detailed coding in form of International Classification of Disease system (ICD-10) [43, 44]. However, we do not conclude that this lower LoE decreases the significance of these articles. We believe that given the relatively early stage and recent widespread of the utilization of hip arthroscopy, such LoE is not surprising.

LIMITATIONS

Citation analysis as a technique has been critiqued in the past as a form of assessing article influence. The most salient point of this critique focuses on whether number of

citations is an accurate correlate of influence especially with regard to self-citations. However, citation analysis is generally considered to be the best analogue for widespread influence [45]. Further limitations are the possible intrinsic bias created by the authors intent to publish a certain journal and therefore cite it. Additionally, most bibliometric analysis is biased by language, many of which only consider English language. Moreover, bibliometric analysis are cross-sectional studies at one point in time. Facing a continuously updated citation count we can exclusively draw conclusions based on the citation counts of these articles at that particular time [16, 17, 24].

CONCLUSION

We identified the 30 most cited articles on hip arthroscopy, which are relatively contemporary compared to other classic orthopedic publications and reflects the recent emergence and rapid growth of the procedure. These articles offer a foundation for clinicians who are seeking resources to expand their knowledge on the topic.

CONFLICT OF INTEREST STATEMENT

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

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