

Original article

Citation analysis of the 100 most common articles regarding distal radius fractures

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ABSTRACT

Purpose: Bibliometric studies are increasingly being utilized as a tool for gauging the impact of different literature within a given field. The purpose of this study was to identify the most cited articles related to the management of distal radius fractures to better understand how the evidence of this topic has been shaped and changed over time.

Methods: We utilized the ISI web of science database to conduct a search for the term “distal radius fracture” under the “orthopaedics” research area heading, and sorted the results by number of times cited. The 100 most cited articles published in orthopedic journals were then analyzed for number of citations, source journal, year of publication, number of authors, study type, level of evidence, and clinical outcomes utilized.

Results: The 100 most cited articles identified were published between 1951 and 2009. Total number of citations ranged between 525 and 67, and came from ten different orthopedic journals. The largest number of articles came from J Hand Surg Am and J Bone Joint Surg Am, each with 32. Consistent with previous analyses of orthopedic literature, the articles were primarily clinical, and of these, 53/76 were case series. The vast majority were evidence level IV. Only a small percentage of articles utilized patient reported outcome measures.

Conclusions: These data show that despite distal radius fractures being a common fracture encountered by physicians, very few of the articles were high quality studies, and only a low proportion of the studies include patient reported outcome measures. Surgeons should take this lack of high-level evidence into consideration when referencing classic papers in this field.

Clinical relevance: Analysis of the 100 most cited distal radius fracture articles allows for delineation of which articles are most common in the field and if a higher level of evidence correlates positively with citation quantity.

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1. Introduction

Citation based studies increasingly are being utilized as a way to gauge the impact of an article on a given field or topic. Although many factors contribute to the number of citations an article may receive, citation numbers demonstrate an articles utilization within the literature. Citation analysis offers a quick measure of the most historically significant articles or ‘classics’ within a field and has been compared to current reading curriculums with a large degree of overlap.¹ A better understanding of the characteristics of

the most cited articles gives insight into the research that currently guides clinical decision making and management.

Bibliometric studies in the field of orthopedics have previously explored citation rank lists for numerous topics.^{1–6} Articles presenting a novel criterion or outcome measure were also found to be highly cited.^{2,4} The goal of the present study was to analyze the top cited articles regarding distal radius fractures.

2. Materials and methods

Similar to Lefavre et al., we utilized the ISI Web of Science database to conduct a search for the term “distal radius fracture”.⁷ We then limited the results to include only articles from the “orthopedics” research area heading, which includes articles from 71 of the most relevant journals in orthopedic surgery. The

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categorical list of the articles was then sorted in descending order by total number of citations. As all articles were from source journals that were previously determined to be relevant to the field, no article was excluded from this study.

The top 100 articles in terms of citations were then reviewed for extraction of the following objective parameters: title, source journal, year published, number of authors, study type (e.g., case series, prospective RCT, or basic science), and whether outcome measures were used. The studies were also reviewed for determination of level of evidence based on the rubric provided by Journal of Bone and Joint Surgery. This was assumed to be a subjective determination, so two reviewers (TH and KL) independently analyzed each article. A third reviewer (GD) was available to resolve any disparities in which a consensus could not be reached, but was never utilized. For articles published prior to being assigned a clinical level of evidence, the authors used the rubric provided by J Bone Joint Surg Am to assign an appropriate level.⁸

Citation density was also calculated for each article for analysis of the above parameters. Citation density has previously been used in bibliometric studies and is defined as total number of citations divided by the number of years a work has been published.^{2–6} This parameter is used to highlight more recent articles that have been receiving high numbers of citations.

No external funding was received in support of this study.

3. Results

The 100 most cited articles identified were published between 1951 and 2009, with the two most recent decades accounting for the largest majority of articles (72 articles from 1990 to 2010). The total number of citations ranged between 525 and 67, with an average of 121 citations. Citation density varied greatly from 1.2 citations per year to more than 42 citations per year, mean of 7.3 citations per year. A strong correlation was seen as citation density increased in recent decades ($R^2 = 0.93$). No correlation was seen between decade of publication and total number of citations.

All of the articles in this study came from ten orthopedic journals. The largest number of articles came from The Journal of Hand Surgery American (32) and the Journal of Bone and Joint Surgery (32), which together accounted for more than two-thirds of the articles (Fig. 1). All articles were published in English. The vast majority, 82%, of the source journals were published in the United States. The number of authors ranged from one to eleven, with a mean of 3.5 authors. No relationship was seen between number of authors and total number of citations or citation density ($R^2 = 0.009$ and 0.02 , respectively). There was no correlation with decade and number of listed authors.

The articles were primarily clinical as opposed to basic science (76 clinical, 34 basic science). The articles reviewed included uncontrolled case series, prospective RCTs, review articles, case

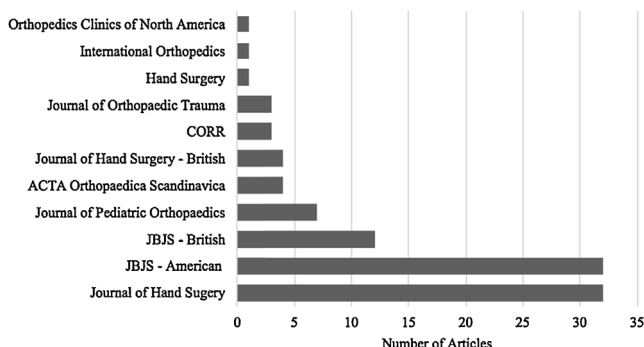


Fig. 1. Number of articles in the top 100 most cited by journal.

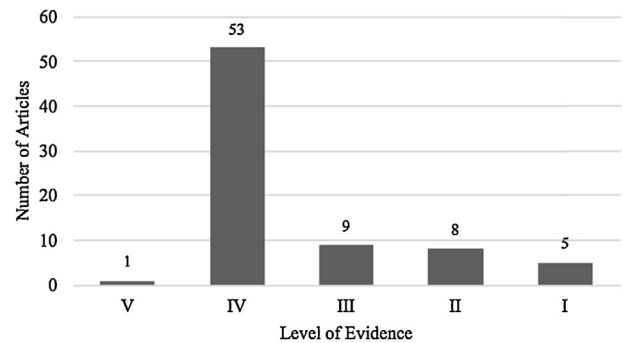


Fig. 2. The number of articles in each level of evidence category. Seventy-six of the 100 studies could be ranked.

control studies, retrospective cohort studies, and reviews. The largest proportion of clinical articles were uncontrolled case series (53).

Of the clinical articles, only five clinical papers were deemed to be Level I evidence, with the majority representing Level IV evidence (53) (Fig. 2). No correlation was seen between level of evidence and decade ($R^2 = 0.0004$), nor between level of evidence and number of citations ($R^2 = 0.002$). No statistically significant differences were seen between clinical and basic science articles when comparing citations. The same goes for patient reported outcome measures (PROMs): there was no correlation between either citation number or decade of publication and PROMs ($R^2 = 0.003$ and 0.002 , respectively). Thirty-nine percent of the clinical studies utilized PROMs. Of these studies, 47% of those utilized the Gartland and Werley score as one of these measures.⁹

4. Discussion

There are inherent limitations to citation analyses in general that apply to our investigation.^{2–6} As previously discussed in other works, these studies cannot analyze the quality or importance of an article. As pointed out by Ahmad et al., the act of criticizing a paper requires citing it, so a confrontational paper that several authors felt the need to publicly disagree with can queue it in the list of most cited references and indicate that it has importance in clinical decision making, when in fact it does not.¹

The number one cited article in this study was referenced 525 times, or 237 times more than the second most cited article. The article from Knirk and Jupiter “Intra-articular fractures of the distal end of the radius in young adults” was published in 1986.¹⁰ It ranks among the most commonly cited articles in the orthopedic literature. This article introduced the idea that anatomic reduction of the articular surface was correlated with development of post-traumatic arthritis in young adults and has been utilized for validation for the use of operative fixation of distal radius fractures as well as the basis for intervention in any articular fracture with displacement.

That articles introduction of >2 mm of articular displacement as indication for operative intervention continues in the most recent AAOS guideline on distal radius fractures.⁹ However, there are numerous significant issues with both the design and production of this article. As described by Drs. Haus and Jupiter, X-rays cannot reliably detect displacement of 1 mm versus 3 mm.¹¹ This is particularly vital to consider because the importance of >2 mm displacement has extrapolated to other fracture sites, including pediatric lateral condylar fractures.¹² Knirk and Jupiter’s study also did not include 23° tilt lateral projections, which provide a better visualization of fracture displacement at the distal radius. Additionally, no kappa value was utilized to help determine reviewer error. More recent studies

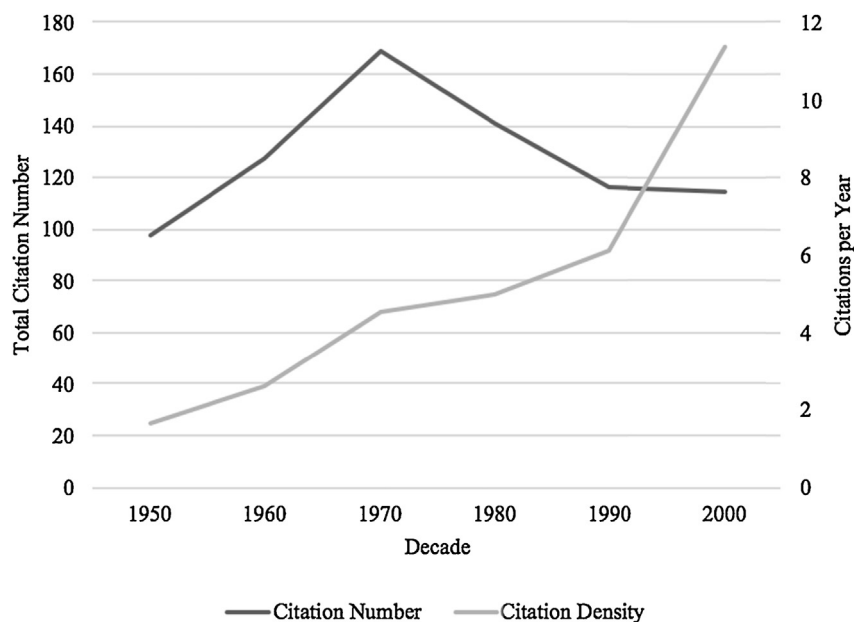


Fig. 3. Average number of total citations and citation density by decade.

have shown that radiographic signs of osteoarthritis do not strongly correlate with poor patient reported outcomes, and unfortunately results of this paper have also been erroneously extrapolated to older patients, instead of just young adults for which it was originally described.¹¹

When comparing macro-trends, the most commonly cited articles concerning distal radius fractures included the same top three criteria: English language, clinically based studies, and Level IV evidence as similar bibliometric studies in the orthopedic literature have demonstrated.^{1–7} Neither the citation density nor the gross citation amount were strongly correlated with number of authors. When looking at level of evidence, there was no statistically significant difference over time. The number of level 1 evidence has not changed over time as well, nor has the use of patient reported outcome measures. English is the most commonly shared language between scientific researchers world-wide, so it is no surprise that it is the language most commonly cited in literature.

The two journals with the largest number of articles in our study were The Journal of Hand Surgery American and the Journal of Bone and Joint Surgery, both of which are published monthly. This increases the accessibility of publication versus other journals which publish less frequently, which may contribute to their higher number of frequently cited articles.

Interestingly, 40 of the top-100 most cited articles are from the 1990s. This could be due to a range of factors. Some older classics may have become general knowledge without requiring reference, which would create a disparity in that article's relative importance in the field versus its number of times referenced. Obviously newer articles may not have had sufficient time to be incorporated into new studies that require months to years to prepare for, complete, and publish (Fig. 3).

These data show that despite distal radius fractures being a common fracture encountered by physicians, there remains a dearth of well-designed comparative studies and a persistent abundance of retrospective case series. And despite an increasing emphasis in the medical field on patient reported outcome measures, the literature does not positively correlate with PROM inclusion, by either year of publication or citation number. When combined, this information shows that there is a need for better comparative studies and awareness of the lack of high quality information regarding a common topic in orthopedics. This is

evidenced by the fact that the AAOS Guideline on The Treatment of Distal Radius Fractures has three consensus (i.e., there is no supporting evidence, so the guideline work group finds a common opinion for the recommendation) clinical practice guidelines: (1) patients treated non-operatively should be re-evaluated radiographically, (2) patients with unremitting pain should be re-evaluated, and (3) patients should begin finger movement exercises after diagnosis of distal radius fracture.⁹ There are five 'moderate' recommendations and no 'strong' recommendations, both of which require objective evidence instead of just group member opinions. This reiterates our conclusion that the lack of quality literature and studies limits the quality of clinical recommendations for care.

Conflicts of interest

The authors have none to declare.

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