



Original research

## Fifty top-cited classic papers in orthopedic elbow surgery: A bibliometric analysis



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### HIGHLIGHTS

- All classic elbow papers were written in English and published in nine journals.
- The majority of classic elbow papers originated from United States.
- Fracture was the most discussed topic.
- The majority of classic elbow papers were clinical studies.
- The most common level of evidence was level IV.

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### ABSTRACT

**Objective:** The number of citations that a paper has received reflects the impact of the article within a particular medical area. Citation analysis concerning the most cited articles have been widely reported in orthopedic surgery and its subspecialties. However, which articles are cited most frequently in orthopedic elbow surgery is unknown. This study aimed to identify and analyze the characteristics of the 50 most cited articles in elbow surgery.

**Methods:** Science Citation Index Expanded was used to search for citations in 181 journals chosen according to the relevance for elbow publications. The 50 most cited articles in elbow surgery were identified. The title, authors, year of publications, article type, journal source, country, institution, number of citations, decade published, citation density and level of evidence were recorded and analyzed.

**Results:** The 50 most cited articles were published between 1950 and 2010. The 1980s was the most productive decade. The number of citations ranged from 388 to 124. All the articles were written in English and published in nine journals. The majority of articles originated from United States, followed by Canada and United Kingdom. Fracture was the most discussed topic. The majority of the top cited articles were clinical studies, with the remaining basic research. The most common level of evidence was level IV.

**Conclusions:** Identification of the most cited papers in elbow surgery shows an insight into the historical development of elbow surgery and provides the foundation for further investigations.

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## 1. Introduction

Orthopedic elbow surgery is the special field of medicine

including the prevention, diagnosis, treatment, and rehabilitation of elbow-associated diseases. There has been a large number of elbow articles published in medical journals over the years, while the number is still increasing. Among them, the classic papers have promoted the development of elbow surgery. However, little work has been conducted to identify these important papers.

There are many methods to evaluate the significance of a scientific paper. Citation is the acknowledgment that a previous article has been referenced by the author's article. It indicates the

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contributing effect of a previous work on the current paper. Citation analysis has been widely used to evaluate the academic significance of an article [1–3]. This method is a bibliometric method that examines the frequency and patterns of citations in articles. The number of citations received by an article is an indicator of its scientific impact and provides a reliable approach for ranking articles. The greater the citation history of a paper, the more valuable the paper may be in its field [4,5].

The Institute for Scientific Information (ISI) has been compiling the most relevant bibliometric information from published scientific articles since 1945. Web of science is one of the important database in ISI for collecting citation and other academic impact information. This platform has been increasingly used to identify the most cited articles in various medical fields, including oncology [6], respiratory medicine [7], critical care medicine [8], emergency medicine [9], rehabilitation [10], ophthalmology [11], otolaryngology [12], obstetrics and gynecology [13], anesthesiology [14], dermatology [15], trauma [16], nursing research [17], radiology [18], urology [19], general surgery [20], neurosurgery [21]. Moreover, such articles have been published in orthopedic surgery [5,22] and its subspecialties, including pediatric orthopedics [23], fracture surgery [24], foot and ankle surgery [25], spine surgery [26], hand surgery [27], joint arthroplasty [28], and arthroscopy [29]. This method makes it possible to develop a deeper understanding of the characteristics of the classic papers.

In the field of shoulder and elbow surgery, the most cited shoulder articles have been recently published [30]. As far as we know, there has not been a study to analyze the most cited papers in orthopedic elbow surgery. The objective of the present study is to identify the 50 most cited papers in elbow surgery and to analyze the principal characteristics.

## 2. Material and methods

In September 2014, the citation search was performed using the Science Citation Index Expanded of the ISI Web of Science (Thomson Reuters, Philadelphia, Pennsylvania), which has been conducted in the similar studies [18,26,30]. In Journal Citation Reports (JCR) for the year 2013, there were 67 journals and 81 journals in the subject categories of “Orthopedics” and “Sports medicine” respectively. We also searched the subject category of “surgery” and 46 journals of general surgery were included. After excluding the duplicated journals, a total of 181 journals potentially publishing elbow-related articles were indentified (Supplement 1).

To include all articles published in these 181 journals, journal titles were placed in the search window using the “OR” operator. The 50 most cited elbow-related articles were recorded. Our goal was to include papers that orthopedic elbow surgeons could find absolute relevance to their practice. Following the methods of the previous studies [5,23], the basic information was recorded and analyzed, including the title, authors, year of publications, article type, journal of publication, country, institution, number of citations decade published, citation density and level of evidence. All articles were categorized by the field of research including instability/stability, tennis elbow, fracture, distal biceps brachii tendon, ulnar neuritis, arthroplasty, and others. Citation density was calculated by total number of citations over the number of years since publication [18,24,30]. Based on guidelines from *Journal of Bone and Joint Surgery-American Volume* [31], level of evidence for clinical articles was independently determined by two reviewers. Agreement was excellent for level of evidence, with intraclass correlation coefficient of 0.90 [32]. Disagreements between authors was resolved by consensus. The Spearman's test was used to determined the correlations among variables, and  $p < 0.05$  was considered statistically. Data analysis was performed using

statistical software SPSS version 19.0 (SPSS Inc., Chicago, IL, USA).

## 3. Results

The top 50 articles and the number of citations were shown in Table 1. The number of citations ranged from 388 to 124. The mean number of citations for the 50 most cited papers was 181. The oldest article in the list was ranked in number twenty-two and was published in 1950, while the most recent article in the top 50 was ranked in number forty-two and was published in 2010. The 1980s accounted for the most articles with a number of 19, and followed by 1990s ( $n = 18$ ) and 1950s ( $n = 5$ ) (Fig. 1). The 1970s represented the highest citation density (206) followed by 2000s (195) (Fig. 2).

All articles of the top 50 list were written in English. These articles were published in 9 of the 181 journals (Table 2), with most papers published in *Journal of Bone and Joint Surgery-American Volume* ( $n = 25$ ) followed by *Clinical Orthopaedics and Related Research* ( $n = 7$ ). There was no correlation between the impact factor and the number of citations ( $r = 0.141$ ,  $p = 0.330$ ) or citation density ( $r = 0.159$ ,  $p = 0.271$ ). The top 50 articles originated from five countries (Table 3). The number of articles in terms of country of origin was led by the United States ( $n = 38$ ), followed by Canada ( $n = 5$ ), England ( $n = 5$ ), Germany ( $n = 1$ ), and The Netherlands ( $n = 1$ ). There were thirty institutions responsible for the most cited articles. The institutions with more than one article were Mayo Clinic and Mayo Foundation ( $n = 18$ ), Johns Hopkins University School of Medicine ( $n = 3$ ) and Massachusetts General Hospital ( $n = 2$ ) (Table 4).

A number of first authors were shown multiple times in the top 50 list. The top first author was Morrey ( $n = 9$ ). The next leading author was Regan ( $n = 3$ ), followed by Broberg, Hotchkiss, Nirschl and Odriscoll ( $n = 2$ ) (Table 5). The majority of the top 50 list were clinical articles ( $n = 35$ ), with the remaining basic science ( $n = 15$ ). Of 35 clinical papers, case series ( $n = 20$ ) was the most common type (Table 6). The level of evidence was not strongly correlated with overall number of citations ( $r = 0.234$ ,  $p = 0.176$ ), citation density ( $r = -0.026$ ,  $p = 0.880$ ), or year of publication ( $r = -0.162$ ,  $p = 0.353$ ). According to the classification, the most common topic of the most cited articles was fracture ( $n = 11$ ) (Fig. 3). Level IV was the most popular level of evidence (Fig. 4).

When the selected papers were analyzed by citation density (mean number of citations per year), all the top-three articles discussed tennis elbow. Peerbooms et al. has the leading article (34 citations per year), which was a double-blind randomized controlled trial published in 2010 and investigated the effects of platelet-rich plasma. Mishra and Pavelko's cohort study in 2006 (33 citations per year) was the second and also associated with the platelet-rich plasma. The third was a review article from Kraushaar and Nirschl published in 1999 (14 citations per year).

## 4. Discussion

Orthopedic elbow surgery has been a rapidly developing specialty through recent years. This development could be demonstrated by the large number of papers published in scientific literature. Identifying the classic articles is helpful for understanding the history and development of elbow surgery and designing future research. This citation analysis of the top cited articles has been widespread and reported in other fields of medicine. To our knowledge, this is the first study on the most cited articles in the field of orthopedic elbow surgery. This top 50 list is useful for several reasons. It identifies the milestone articles that have contributed greatly to the field of elbow surgery [22,26]. It allows readers to know institutions and authors that have contributed to these landmark papers and have subsequently led

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