



Top 50 most impactful publications on massive rotator cuff tears



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Background: Bibliometric analysis is a useful tool for measuring the scholarly impact of a topic and its more and less heavily studied aspects. The purpose of this study is to use bibliometric analysis to comprehensively analyze the 50 articles with the highest citation indices in studies evaluating the treatment and outcomes of massive rotator cuff tears (mRCTs).

Methods: This cross-sectional study identified articles within the Scopus database published through December 2022. Keywords used were “massive rotator cuff tear.” Articles were sorted in chronological order. The year published and number of citations were recorded. A citation index (CI) was calculated for each article by dividing the number of citations by number of years published [1 citation/1 year published (2021) = CI of 1]. Of these, the 50 articles with the highest CIs were carried forward for evaluation. Frequencies and distributions were assessed for data of each variable collected.

Results: These search methods produced 625 articles regarding mRCT research (ranging from January 1986 to December 2022). Four of the top 10 most impactful articles were published in the 2010s. The level of evidence (LOE) published with the greatest frequency was level of evidence 4 (41%). The journal Arthroscopy published the highest number within the top 50 (26%) followed by the Journal of Bone and Joint Surgery and the American Journal of Sports Medicine (20% each). Clinical studies composed 88% of the top 50. Case series (38%) predominated, while systematic reviews (20%) and randomized control trials (8%) were less prevalent. The majority of studies concentrated on the clinical outcomes of certain interventions (62%), mainly comparing multiple interventions.

Conclusion: Despite the relatively high prevalence of mRCTs (40% of all tears), this topic comprises only a small proportion of all rotator cuff research. This analysis has identified gaps within and limitations of the findings concerning mRCTs for researchers to propose research questions targeting understudied topics and influence the future treatment and outcomes of this clinically difficult diagnosis.

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Rotator cuff tears are a common shoulder injury affecting glenohumeral stability, with increased incidence beginning in the third decade.^{12,15,28,29,36,66,68} Surgeries to alleviate rotator cuff pathologies are increasing, with 40,000 procedures conducted in the United States alone.^{14,56,62,66} While there are both nonsurgical, such as physical therapy, and surgical treatments to repair or augment rotator cuff tears, more extensive forms of these tears may only be amenable to surgical intervention. Several factors play into treatment of rotator cuff tears, such as the size of the tear, the number of

tendons involved, duration of symptoms, shoulder dominance, the type of tear (partial vs. full thickness), age, comorbidities, and activity level.^{51,56,62}

The term “massive rotator cuff tear” (mRCTs) is generally used to describe a large tear involving two or more tendons, although there is no consensus in the literature on an exact definition of this injury pattern. *DeOrto* identified mRCTs as >5 cm in either the anterior-posterior or medial-lateral dimension, whereas *Zumstein* defined them as those with complete tears of at least 2 tendons.^{17,30,73} Importantly, while mRCTs may be more difficult to repair and may be associated with a higher risk of retear after surgery, a mRCT is not necessarily synonymous with an irreparable tear.

Like any rotator cuff tear, mRCTs have both nonoperative and surgical treatments. *Bedi* et al sought to outline treatment options for

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mRCTs such as nonoperative, débridement and subacromial decompression, biceps tenotomy, partial repair, complete repair, repair with scaffold or tissue augmentation, tendon transfer, hemiarthroplasty, and reverse total shoulder arthroplasty (rTSA) along with grading of level of evidence (LOE) for the treatment option.³ However, there is heterogeneity amongst clinical presentations, tissue quality, patient-related factors, and the defects within mRCTs that make it difficult to implement treatment guidelines and algorithms, even for the most well-skilled surgeons contributing to the literature on this topic.

Given the complexity of this injury and its unique considerations, the objective of this study is to identify the 50 most impactful literature for mRCTs. It is important for the medical and science communities to evaluate the highly impactful references for mRCTs to understand what literature dictates current criteria for diagnosis and treatment. This paper also strives to acknowledge potential gaps within the top-cited papers on mRCTs.

Methods

Inclusion and data collection

This study describes the characteristics and trends of the most influential articles by the number of citations concerning mRCTs. The SCOPUS database was used to identify the articles published through December 2022. Our search term in the Scopus database was “massive rotator cuff tears” filtered by “search within” set to “source title”. The articles were sorted in descending order chronologically. The data collected were exported to an excel worksheet, and each article was filtered, organized, and analyzed for this review. The number of citations, year of publication, LOE, article type, country of origin, contribution institution, PlumX metrics (number of citations, readers, mention in tweets, etc), and topics of focus were recorded for each article. All included studies were written in English and peer reviewed.

Topics

The LOE was either provided upon evaluation of the abstract or determined by full-text review using the Oxford LOE Guidelines. The author’s article classifications of each study included the following: epidemiology, diagnostic, surgical technique, clinical outcomes, complications, and basic science/anatomy. Articles were placed into only 1 category via reviewer determination, and the single most applicable category for that article was selected. These data were verified by a separate investigator, with discrepancies being reviewed by the lead author.

Statistical analysis

A citation index (CI) was calculated for each article to determine degree of impact by dividing the number of citations by the number of years published [$1 \text{ citation}/1 \text{ year published (2021)} = \text{CI of } 1$]. The 50 articles regarding mRCTs with the highest citation index were carried forward for evaluation and included in the study. Frequencies and distributions were assessed for data of each variable collected. Binary logistic regression analysis evaluated the interventions and outcomes of studies within the top 50. A *P* value lower than .05 denoted statistical significance. All analyses were performed using SPSS (version 28.1.1; IBM Corp., Armonk, NY, USA).

Results

Overall findings

These search methods produced 625 articles regarding mRCT research (ranging from January 1986 to December 2022). The most

influential articles regarding mRCTs were analyzed using citation analysis (Table 1). The article with the highest CI of 76 was “The Outcome and Repair Integrity of Completely Arthroscopically Repaired Large and Massive Rotator Cuff Tears” by Galatz et al, while the lowest CI was 8. Four of the top 10 most impactful articles were published in the 2010s. The average number of citations was 183 ± 238 , with the highest-impact article having 1461 citations. This led to a mean CI value of 14.2 ± 10.9 among the top 50 (Fig. 1). The PlumX metric evaluation demonstrated articles had a mean of 116 reads (max: 264) and 4.8 tweets (max: 41). The LOE published with the greatest frequency was LOE 4 (41%) followed by LOE 3 (17%) (Fig. 2). In terms of productivity by year, 2012 was the most productive year, with 7 publications in the top 50, followed by 2015 with 6 publications (Fig. 3).

Topics of interest

Clinical studies composed 88% of the top 50 relative to 12% being basic science. Case series (38%) predominated the types of studies conducted within the top 50, while systematic reviews (20%) and randomized control trials (8%) were the least prevalent (Fig. 4). When examining the characteristics of mRCT studies, the majority concentrated on the outcomes of certain interventions (62%), followed by surgical techniques (12%) and complications (8%). However, outcomes studies were more likely to have a follow-up of less than 2 years (77%; odds ratio: 3.2, 95% confidence interval: [2.2–24.3]; *P* = .029) and more than two-thirds of these studies focused on elderly populations (mean age greater than 60). Of those examining the outcomes of interventions, 38% were comparison studies of multiple interventions, while tendon transfer (22%), superior capsular reconstruction (14%) and suture anchor/arthroscopic repair (14%) were also studied more frequently.

Journals and settings

Twelve journals published the 50 most cited articles, with the journal *Arthroscopy* publishing the highest number within the top 50 (26%) (Fig. 5). The *Journal of Bone and Joint Surgery* (JBJS) (mean: 392 ± 459 citations) and *Clinical Orthopaedics and Related Research* (CORR) (333 ± 185) had the most frequently published articles. The journals with the highest average citation indices were *Journal of Bone and Joint Surgery* and *Orthopaedic Journal of Sports Medicine* (OJSM) with a mean of 23.8 and 15.0 citations per year, respectively, for articles included within the analysis. Forty-four percent of the studies were conducted in the United States, with 12% produced in Switzerland and South Korea each (Fig. 6).

Discussion

Our bibliometric analysis presented studies comprising the outcomes, treatment methods, and gaps existing within the literature for mRCTs; along with current metrics to assess article impact, such as reads and mentions in tweets from PlumX. We utilized a citation index to measure article impact to guard against the time-sensitive limitations of absolute amount of citations used by many previous studies. In doing so, a total of 625 articles on mRCTs published from 1986 to 2022 were identified and the 50 most impactful articles were identified. *Arthroscopy* published the greatest number of articles included in the study ($n = 13$ [26%]), followed by the *Journal of Bone and Joint Surgery* ($n = 10$ [20%]) and *American Journal of Sports Medicine* (AJSM) ($n = 10$ [20%]) publishing the second most. PlumX metrics indicated publications within the top 50 had an average of 116 reads (range 0–264) and mentioned in 4.8 tweets (range: 0–41). The United States led all countries in the number of articles published ($n = 22$ [44%]),

Table 1
Top 50 most highly impactful studies on massive rotator cuff tears.

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
The Outcome and Repair Integrity of Completely Arthroscopically Repaired Large and Massive Rotator Cuff Tears	Galatz 2004 ²⁵	JBJS	76 [1461]	Case Series	Missouri, USA	Academic Center	18	Arthroscopic Repair
The results of repair of massive tears of the rotator cuff	Gerber 2000 ²⁶	JBJS	41 [943]	Case Series	Switzerland	Academic Center	29	Open Repair
Arthroscopic Superior Capsular Reconstruction With Acellular Dermal Allograft for the Treatment of Massive Irreparable Rotator Cuff Tears: Short-Term Clinical Outcomes and the Radiographic Parameter of Superior Capsular Distance	Pennington 2018 ⁶⁰	Arthroscopy	30 [150]	Retrospective Cohort	Wisconsin, USA	Private Practice	88	SCR
Isolated arthroscopic biceps tenotomy or tenodesis improves symptoms in patients with massive irreparable rotator cuff tears	Boileau 2007 ⁵	JBJS	25 [411]	Retrospective Cohort	France	Academic Center	72	Biceps tenotomy vs. tenodesis
Reverse total shoulder arthroplasty for massive irreparable rotator cuff tears in patients younger than 65 year old: Results after 5 to 15 years	Ek 2013 ¹⁹	JSES	24 [240]	Retrospective Cohort	Switzerland	Academic Center	46	rTSA
The clinical and structural long-term results of open repair of massive tears of the rotator cuff	Zumstein 2008 ⁷³	JBJS	21 [329]	Case Series	Switzerland	Academic Center	23	Open repair
Arthroscopic repair of massive rotator cuff tears: Outcome and analysis of factors associated with healing failure or poor postoperative function	Chung 2013 ¹⁰	AJSM	19 [191]	Case Series	Korea	Academic Center	108	Arthroscopic Repair
Reverse Total Shoulder Arthroplasty for Massive, Irreparable	Ernstbrunner 2017 ²³	JBJS	18 [112]	Case Series	Switzerland	Academic Center	23	rTSA

Table I (continued)

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
Rotator Cuff Tears Before the Age of 60 Years: Long-Term Results								
Massive tears of the rotator cuff	Bedi 2010 ³	JBJS	17 [227]	Review	New York, USA	Academic Center	N/A	N/A
Arthroscopic Replacement of Massive, Irreparable Rotator Cuff Tears Using a GraftJacket Allograft: Technique and Preliminary Results	Bond 2008 ⁶	Arthroscopy	16 [249]	Case Series	Oklahoma, USA	Academic Center	16	Arthroscopic graft placement
When do rotator cuff repairs fail? Serial ultrasound examination after arthroscopic repair of large and massive rotator cuff tears	Miller 2011 ⁵⁴	AJSM	16 [196]	Case Series	Michigan, USA	Academic Center	22	Arthroscopic repair
Roentgenographic findings in massive rotator cuff tears. A long-term observation	Hamada 1990 ³⁴	CORR	15 [521]	Case series	Japan	Academic Center	22	Radiographic technique for diagnosis
Relationship between massive chronic rotator cuff tear pattern and loss of active shoulder range of motion	Collin 2014 ¹³	JSES	16 [196]	Retrospective Cohort	Multicenter	Academic Center	101	Tear Pattern on Range-of-motion
Outcome of lower trapezius transfer to reconstruct massive irreparable posterior-superior rotator cuff tear	Elhassan 2016 ²⁰	JSES	15 [108]	Case Series	Minnesota, USA	Academic Center	33	Lower trapezius transfer
Clinical and structural outcomes of nonoperative management of massive rotator cuff tears	Zingg 2007 ⁷²	JBJS	14 [227]	Case Series	Switzerland	Academic Center	19	Nonoperative
Platelet-rich plasma for arthroscopic repair of large to massive rotator cuff tears: A randomized, single-blind, parallel-group trial	Jo 2013 ⁴²	AJSM	14 [143]	RCT	Korea	Academic Center	48	Repair with PRP augmentation
Arthroscopic Superior Capsular Reconstruction for Treatment of Massive	Hirahara 2015 ³⁹	Arthroscopic Technique	14 [119]	Review	USA	Private Practice	N/a	N/a

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Table I (continued)

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
Irreparable Rotator Cuff Tears								
Arthroscopic Repair of Massive Rotator Cuff Tears With Stage 3 and 4 Fatty Degeneration	Burkhart 2007 ⁷	Arthroscopy	13 [215]	Case Series	Texas, USA	Academic Center	22	Arthroscopic repair
A radiographic classification of massive rotator cuff tear arthritis	Hamada 2011 ³⁵	CORR	12 [152]	Retrospective cohort	Japan	Academic Center	75	Repair
Dermal tissue allograft for the repair of massive irreparable rotator cuff tears	Gupta 2012 ³¹	AJSM	12 [133]	Case Series	North Carolina, USA	Academic Center	24	Open repair
The benefit of synthetic vs. biological patch augmentation in the repair of posterosuperior massive rotator cuff tears: A 3-year follow-up study	Ciampi 2014 ¹¹	AJSM	12 [116]	Retrospective cohort	Italy	Academic Center	152	Variations of open repair
Arthroscopic Subacromial Spacer Implantation in Patients With Massive Irreparable Rotator Cuff Tears: Clinical and Radiographic Results of 39 Retrospectives Cases	Deranlot 2017 ¹⁸	Arthroscopy	12 [75]	Case series	France	Private Practice	39	Arthroscopic balloon spacer
Massive rotator cuff tears: Functional outcome after débridement or arthroscopic partial repair	Berth 2010 ⁴	JOT	11 [143]	RCT	Germany	Academic Center	42	Arthroscopic partial repair vs. débridement
Arthroscopic surgery of irreparable large or massive rotator cuff tears with low-grade fatty degeneration of the infraspinatus: Patch autograft procedure vs. partial repair procedure	Mori 2013 ⁵⁵	Arthroscopy	11 [114]	Retrospective cohort	Japan	Private Hospital	48	Patch graft vs. partial repair
Massive rotator cuff tears: Pathomechanics, current treatment options, and clinical outcomes	Greenspoon 2015 ³⁰	JSES	11 [88]	Review	Colorado, USA	Private Practice	N/a	N/a
Reverse shoulder arthroplasty for massive irreparable	Petrillo 2017 ⁶¹	Musculoskeletal Surgery	11 [68]	Review	Italy	Academic Center	N/a	rTSA

Table I (continued)

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
rotator cuff tears and cuff tear arthropathy: a systematic review								
Clinical and radiographic outcomes after arthroscopic repair of massive rotator cuff tears using a suture bridge technique: Assessment of repair integrity on magnetic resonance imaging	Kim 2012 ⁴³	AJSM	10 [117]	Retrospective Cohort	Korea	Academic Center	66	Arthroscopic repair
Arthroscopic partial repair of irreparable large to massive rotator cuff tears	Kim 2012 ⁴⁵	Arthroscopy	10 [117]	Case Series	Korea	Academic Center	27	Arthroscopic partial repair
Arthroscopic repair for chronic massive rotator cuff tears: A systematic review	Henry 2015 ³⁸	Arthroscopy	10 [85]	Review	Canada	Academic Center	N/a	Arthroscopic repair
The biodegradable spacer as a novel treatment modality for massive rotator cuff tears: a prospective study with 5-year follow-up	Senekovic 2017 ⁶³	Archives of Orthopaedic and Trauma Surgery	10 [64]	Case Series	Multicenter	Academic Center	24	Balloon spacer
Superior Capsular Reconstruction for Massive Rotator Cuff Tear Leads to Significant Improvement in Range of Motion and Clinical Outcomes: A Systematic Review	Sochaki 2019 ⁶⁷	Arthroscopy	10 [41]	Review	Texas, USA	Private Hospital	N/a	SCR
Latissimus dorsi transfer for the treatment of massive tears of the rotator cuff. A preliminary report	Gerber 1988 ²⁷	CORR	9 [327]	Case series	Switzerland	Academic Center	14	Latissimus dorsi transfer
Latissimus dorsi tendon transfer: A comparative analysis of primary and salvage reconstruction of massive, irreparable rotator cuff tears	Warner 2001 ⁷⁰	JSES	9 [201]	Retrospective cohort	Massachusetts, USA	Academic Center	22	Latissimus dorsi transfer vs. repair
Surgically repaired massive rotator cuff tears: MRI of tendon integrity,	Mellado 2005 ⁵²	AJR	9 [165]	Case series	Spain	Academic Center	28	Open complete and partial repairs

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Table I (continued)

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
muscle fatty degeneration, and muscle atrophy correlated with intraoperative and clinical findings								
The association of suprascapular neuropathy with massive rotator cuff tears: A preliminary report	Mallon 2006 ⁵⁰	JSES	9 [153]	Case Series	North Carolina, USA	Private Practice	8	Débridement and partial repair
Reversal of Suprascapular Neuropathy Following Arthroscopic Repair of Massive Supraspinatus and Infraspinatus Rotator Cuff Tears	Costouros 2007 ¹⁵	JSES	9 [150]	Case series	Massachusetts, USA	Academic Center	26	Arthroscopic repair
Comparison of partial vs. complete arthroscopic repair of massive rotator cuff tears	Iagulli 2012 ⁴⁰	AJSM	9 [101]	Retrospective cohort	Texas, USA	Private Practice	97	Arthroscopic partial repair
Clinical and ultrasonographic outcomes of arthroscopic suture bridge repair for massive rotator cuff tear	Park 2013 ⁵⁷	Arthroscopy	9 [99]	Case Series	Korea	Academic Center	36	Arthroscopic repair
Massive or 2-tendon rotator cuff tears in active patients with minimal glenohumeral arthritis: Clinical and radiographic outcomes of reconstruction using dermal tissue matrix xenograft	Gupta 2013 ³²	AJSM	9 [99]	Case Series	Illinois, USA	Academic Center	27	Graft reconstruction
Arthroscopic repair of massive contracted rotator cuff tears: Aggressive release with anterior and posterior interval slides do not improve cuff healing and integrity	Kim 2013 ⁴⁴	JBJS	9 [95]	Retrospective cohort	Korea	Academic Center	41	Arthroscopic complete or partial repair
Clinical and radiographic outcomes of failed repairs of large or massive rotator cuff tears: Minimum 10-year follow-up	Paxton 2013 ⁵⁹	JBJS	9 [92]	Case Series	Missouri, USA	Academic Center	18	Arthroscopic Repair

Table I (continued)

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
Reverse shoulder arthroplasty for massive rotator cuff tear: Risk factors for poor functional improvement	Hartzler 2015 ³⁷	JSES	9 [76]	Retrospective cohort	Florida, USA	Private Practice	74	rTSA
Reverse shoulder arthroplasty for irreparable massive rotator cuff tears: a systematic review with meta-analysis and meta-regression	Sevivas 2017 ⁶⁴	JSES	9 [59]	Review	Portugal	Academic Center	N/a	rTSA
Arthroscopic Superior Capsular Reconstruction for Massive, Irreparable Rotator Cuff Tears: A Systematic Review of Modern Literature	Catapano 2019 ⁹	Arthroscopy	9 [39]	Review	Multicenter	Academic Center	N/a	SCR
Superior Capsular Reconstruction Using Dermal Allograft Is a Safe and Effective Treatment for Massive Irreparable Rotator Cuff Tears: 2-Year Clinical Outcomes	Pashuck 2021 ⁵⁸	Arthroscopy	9 [18]	Case Series	Multicenter	Academic Center	14	SCR
Massive rotator cuff tears: definition and treatment	Lädermann 2015 ⁴⁷	International Orthopaedics	8 [65]	Review	Multicenter	Academic Center	N/a	N/a
Mesenchymal Stem Cell Secretome Improves Tendon Cell Viability In Vitro and Tendon-Bone Healing In Vivo When a Tissue Engineering Strategy Is Used in a Rat Model of Chronic Massive Rotator Cuff Tear	Sevivas 2018 ⁶⁵	AJSM	8 [40]	Animal Study	Portugal	Academic Center	N/a	Tissue Healing via MSCs
Superior Capsular Reconstruction With the Long Head of the Biceps Autograft Prevents Infraspinatus Retear in Massive Posterosuperior Retracted Rotator Cuff Tears	Barth 2020 ²	AJSM	8 [26]	Retrospective cohort	Multicenter	Academic Center	82	Repair vs. SCR
Management of irreparable massive rotator cuff tears: a	Kovacevic 2020 ⁴⁶	JSES	8 [26]	Meta-analysis	Multicenter	Academic Center	N/a	N/a

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Table 1 (continued)

Title	Author year ^{ref}	Journal	Citation index [citation #]	Study type	Country	Setting	Patients in study	Intervention
systematic review and meta-analysis of patient-reported outcomes, reoperation rates, and treatment response								
Superior Capsule Reconstruction for Irreparable Massive Rotator Cuff Tears: Does It Make Sense? A Systematic Review of Early Clinical Evidence	Altintas 2020 ¹	AJSM	8 [24]	Review	Multicenter	Academic Center	N/a	SCR

JBS, Journal of Bone and Joint Surgery; JSES, Journal of Shoulder and Elbow Surgery; AJSM, American Journal of Sports Medicine; CORR, Clinical Orthopaedics and Related Research; JOT, Journal of Orthopaedic Trauma; AJR, American Journal of Roentgenology; SCR, superior capsular reconstruction; rTSA, reverse total shoulder arthroplasty; RCT, Randomized control trial; PRP, Platelet-rich plasma.

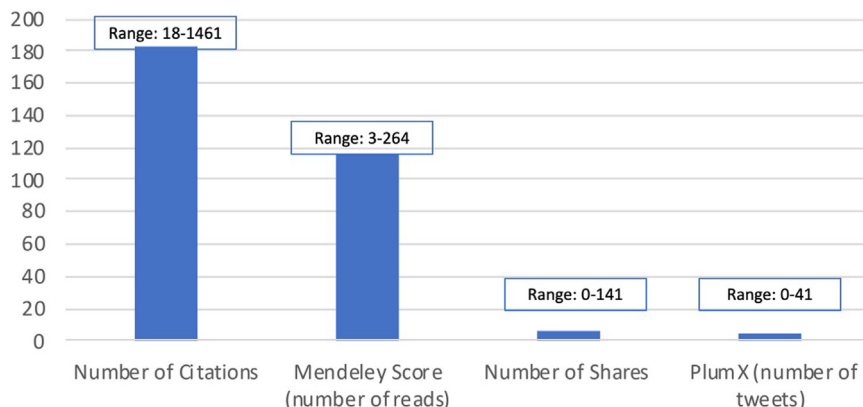


Figure 1 Average “impact” based on citation and sharing on social media.

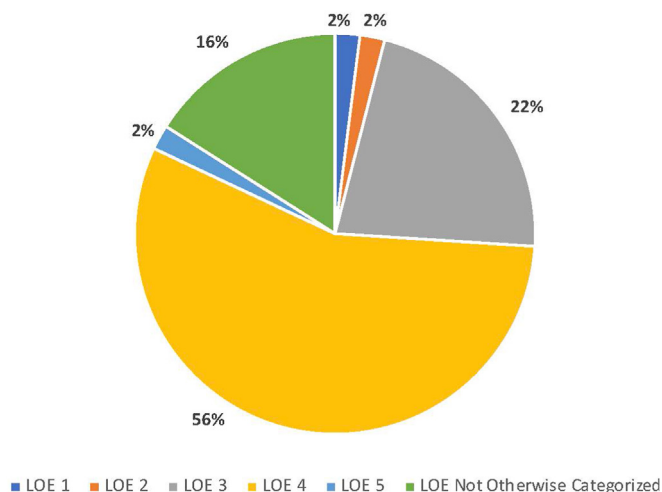


Figure 2 Level of evidence of top 50 highly cited articles. LOE, level of evidence.

whereas Switzerland and South Korea were tied for second (n = 6 [12%]). All case reports, case series and small cohort studies (Level IV evidence dominated the articles present in the top 50 (n = 20 [41%]).

In more detail, the top 50 articles were more often published before 2010 and characterized clinical outcomes of elderly populations. Studies discussing surgical technique and diagnostic evaluation were sparsely present, as were those examining younger, athletic populations and articles with longer-term follow-up. These findings promote the vacancy present within the current impactful literature concerning this topic. Posing contemporary studies may be overlooked and have relevance within the existing apertures. This comprehensive synthesis of research is a useful guide for practitioners to reference when searching for highly cited articles related to mRCTs. Given the relatively low levels of evidence provided in these most commonly cited articles, there is a need for higher-quality clinical research focused on these lesions.

The 10 highest-impact articles were each cited at least 112 times with an index of 16, and the most-cited article (1461 citations) also demonstrated the highest citation index (76 citations per year).^{3,5,6,10,19,23,25,26,60,73} Previous studies have examined the articles within other shoulder topics, including humeral avulsion of the glenohumeral ligament lesions, shoulder arthroplasty and rotator cuff tears, with varying amounts of citations among the most highly cited.^{24,53,71} The 50 most-cited articles on shoulder arthroplasty highlighted the top 10 articles were cited at least 118 times each, while top 10 articles on humeral avulsion of the glenohumeral

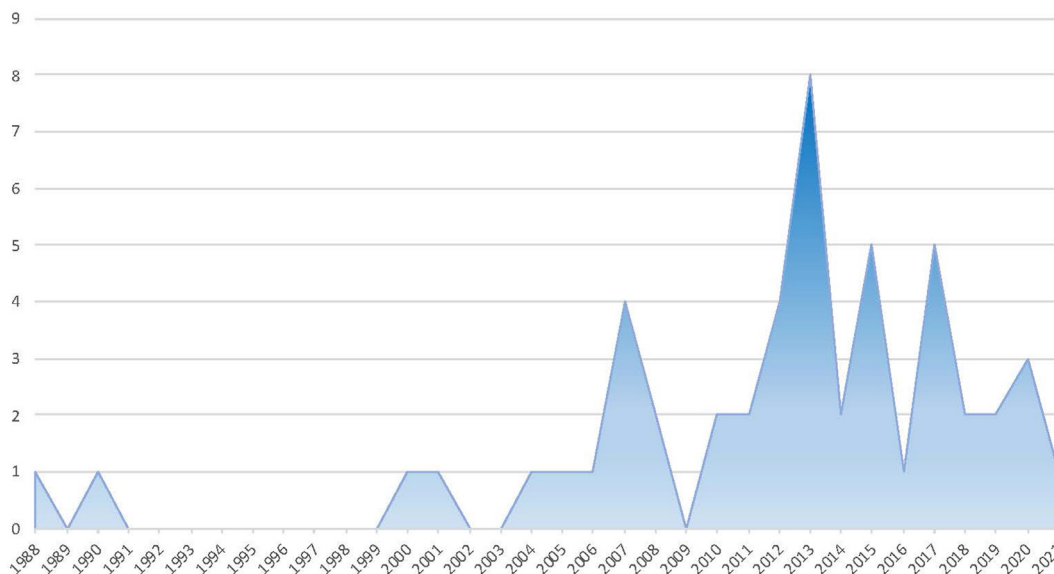


Figure 3 Number of highly cited articles by year.

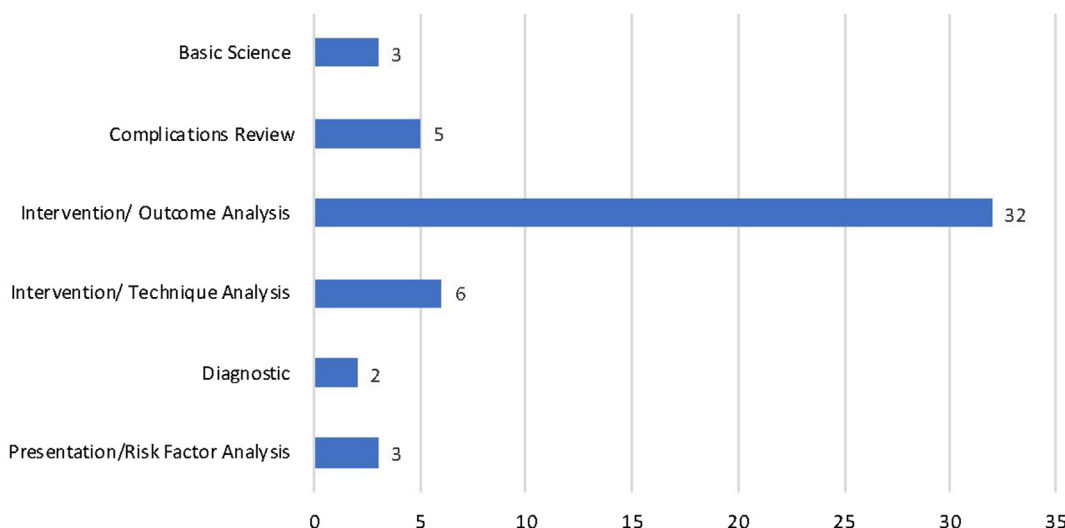


Figure 4 Type of outcome studied in top 50 highly cited articles.

ligament lesions were only cited at least 35 times.^{53,71} More clinically similar, the 50 most-cited rotator cuff tear articles, the top 10 articles all had at least 633 citations.²⁴ This is more than 4 times the amount of the top 10 articles concerning mRCTs, despite massive tears comprising 10%–40% of all tears.^{21,22,33} However, much like the current study, 63% of clinical articles on rotator cuff tears presented Level IV evidence, demonstrating despite the increased relevance of the literature on the topic, the quality has not improved.²⁴

Given the complexity of this topic, from the mere definition of an mRCT to the high failure and revision rates, reviews of the literature and subsequent recommendations based on the available findings are necessary to provide some sort of direction to care providers. Therefore, also published within the JBJS, one of the most highly cited studies, *Bedi et al's "Massive Tears of the Rotator Cuff"*, reviews the current concepts surround mRCTs and expands on diagnosis, various tendon-related dysfunctions that pose obstacles to effective repair, the importance of detailed patient history and exam, understanding of imaging, and emphasizing consideration of

patient's desired activity level when determining the best operative technique.³ When choosing to operate, tendon transfer may have favorable outcomes for high-demand patients, while partial repair and débridement is better indicated for patients of low activity levels, and rTSA in the event of irreparable tears and glenohumeral arthritis.^{4,8,49} As the indications for rTSA continue to expand, it is worth noting worse outcomes have been seen for repairs with late conversion to rTSA compared to controls who underwent replacement at an earlier time point.^{49,69}

Most of the impactful publications comprised populations from the United States (44%), followed by Switzerland and South Korea (12% each), just as previous studies have shown the United States was the site for 41% of all rotator cuff research published.⁴⁸ This mirrors the American trend in surgical volume, as the number of rotator cuff repairs has increased 141% from 1996 to 2006 and accelerated by 188% from 2007 to 2015.^{14,16} Additionally, the rate of rotator cuff repairs per 100,000 patients in the United States was 103 compared to just 13 cases per 100,000 in South Korea in 2006,

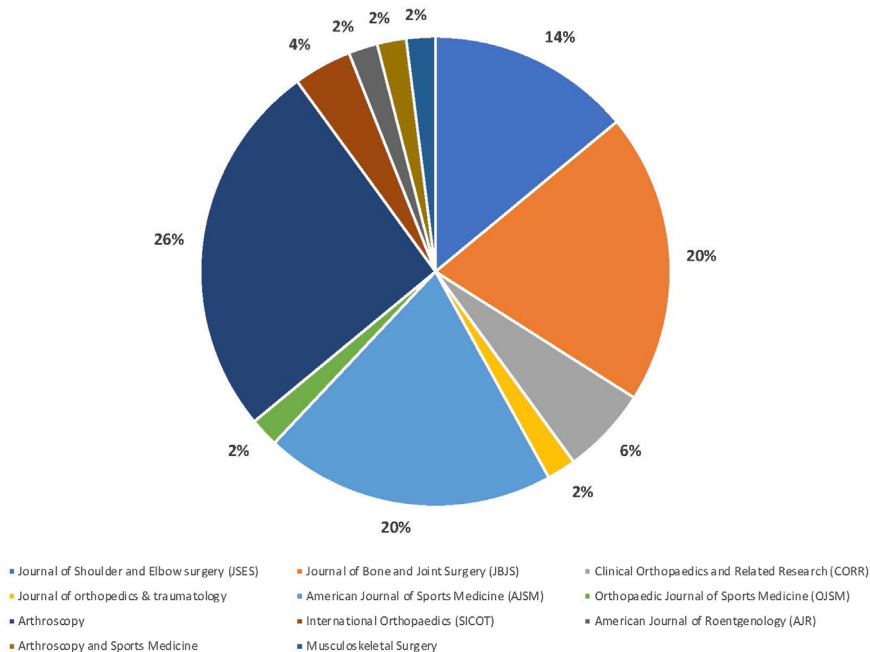


Figure 5 Proportion of highly cited articles by publishing journal.

Distribution of Top 50 Articles by Country of Author Origin

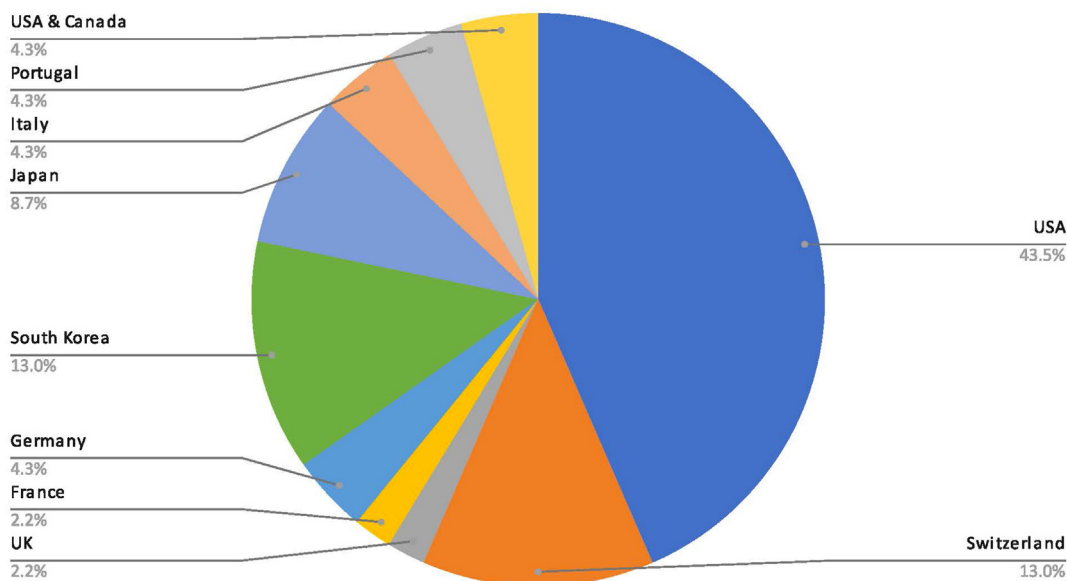


Figure 6 Proportion of highly cited articles by country.

possibly explained by the increasing amount of outpatient repairs, evolution of diagnostic evaluation, understanding of the underlying pathology, and rising number of surgeons focusing on rotator cuff surgery.^{41,48} However, it did not take South Korea long to catch up, as their repair volume dramatically increased to 106 per 100,000 in 2012, which is coincidentally one of the most productive years by volume of publications in the top 50.⁴¹

This study successfully analyzes and presents the characteristics among the highest-cited articles related to mRCTs. The article LOE showed no impact on an article’s influence and further

demonstrated the low-quality evidence dominating the current discussion. While the heterogeneity of pathology has a large effect on the quality of evidence on this topic and the treatment algorithms we have previously been able to derive, the findings from this study may offer guidance for future authors hoping to contribute to the literature of this unique and complex entity. In turn, this would allow researchers to focus on the areas with the lowest degree and amount of evidence to better characterize our current surgical options and better inform surgeons faced with these difficult questions. Difficult pathologies like the anterior

cruciate ligament once were understudied with little guidance provided for surgical intervention, until certain interest groups took the initiative to stimulate research within the topic and have turned it into one of the more-studied topics in orthopedics today. Studies like this one provide the footing for exploring the paucities within mRCT understanding to provide better insight and recommendations to those treating them on a regular basis.

Limitations

There are several limitations in this study. The articles included were evaluated solely based on quantitative measures, so the quality of articles was not assessed. The SCOPUS Database was the only database used for the evaluation of articles and different sources may track citations in a separate manner, which present conflicting results. Because citation number, citation index, reads, and mentions in tweets were the only measures of impact, this study cannot be considered to be completely comprehensive, such as journal impact factor. Additionally, the authors manually reviewed all search results to identify articles that discussed mRCTs meaningfully and, given the subjective nature involved in several analysis steps, such as article inclusion and determining LOE, this allows for an increased opportunity for bias. However, due to the complexity of the topic and pathology, variety of treatment methods, and newly innovative techniques to treat mRCTs, there may be subjectivity among what is currently relevant and impactful regarding this topic. We did not factor in author contribution when assessing the most productive authors, which is a consideration for future citation analysis within this realm.

Conclusion

The most impactful articles focusing on mRCT research were comprehensively and objectively analyzed. The most common article type was clinical outcomes (62%) followed by surgical technique (12%) and complications (8%). Despite the relatively high prevalence of mRCTs (40% of all tears), this topic comprises only a small proportion of all rotator cuff research, in addition to a lower LOE to support the available studies, indicating there is a lack of influential research regarding clinical guidelines to patient-specific treatment, especially in the younger population. This analysis has identified gaps within and limitations of the findings concerning mRCTs for researchers to propose research questions targeting under-studied topics and influence the future treatment and outcomes of this clinically difficult diagnosis.

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