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REVIEW ARTICLE

Indian Orthopaedics Research Landscape: A Bibliometric Analysis of the *Indian Journal of Orthopaedics* (2007–2024)

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Abstract

Background The *Indian Journal of Orthopaedics (IJO)* has played a pivotal role in disseminating Indian orthopaedic research. However, a comprehensive bibliometric assessment of its publication trends, citation impact, and research landscape has been lacking.

Methods A bibliometric and scientometric analysis was conducted on all Indian-authored articles published in the *IJO* and indexed in Scopus from 2007 to 2024. 1614 records were analyzed for publication trends, citation metrics, document types, funding, international collaboration, geographical distribution, subject areas, and institutional productivity.

Results The *IJO* demonstrated substantial growth, with annual publications rising from 80 in 2007 to a peak of 280 in 2023 (total 2763 articles & 23,188 citations). Indian authors contributed 58.4% (n = 1614) of articles during 2007 and 2024, and received 13,821 citations, with an average of 8.56 citations per publication (CPP). A significant inverse relationship is observed between publication volume and per-article impact ($r = -0.870$; $p < 0.001$). Research articles dominated (67.2%), while reviews (12.2%) and conference papers (3.7%) had higher CPPs (14.11 and 20.63, respectively). Only 2.79% of papers received external funding. International collaboration was most frequent with the UK (45 papers, CPP 16.51) and the USA (36 papers, CPP 8.17). Delhi and Maharashtra led in output, while Assam showed the highest CPP (16.83). Thematically, trauma, spine, and metabolic diseases were most researched, but regenerative medicine was underrepresented. The top 35 institutions contributed 67.5% of papers.

Conclusions The *IJO* has achieved significant quantitative growth and increased research diversity, but declining citation impact and limited funding highlight the need for enhanced research quality and broader collaborations. These findings provide actionable insights for strengthening the global relevance and scientific excellence of Indian orthopaedic research.

Keywords Orthopedics · Bibliometrics · Journals · India · Research Trends · Citation Analysis · Collaboration

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Introduction

Orthopaedic research in India has witnessed remarkable growth over the past two decades, reflecting both the rising burden of musculoskeletal disorders and the expansion of clinical and academic infrastructure across the country [1–3]. The *Indian Journal of Orthopaedics (IJO)*, as the flagship publication of the Indian Orthopaedic Association (IOA), is published by Springer-Nature (https://link.springer.com/journal/43465). It has been pivotal in disseminating original research, reviews, and clinical advancements, contributing to the global orthopaedic knowledge base [4, 5]. This growth is underscored by a significant increase in publication volume, international collaborations, and the emergence of high-impact research from leading Indian institutions [1–3].

Despite these advances, several gaps persist in the Indian orthopaedic research landscape. While the number of publications has surged, only a small proportion of Indian papers achieve high citation rates, indicating a need for enhanced research quality and impact [1, 3, 6]. Research output remains concentrated in a few leading institutions and metropolitan regions, with underrepresentation from many states and cities [1–3]. Limited external funding and relatively low rates of international collaboration restrict the potential for high-quality, globally relevant research [1–3]. Certain subspecialties, such as trauma, arthroplasty, and spine, dominate the literature, while areas like regenerative medicine and rare bone diseases receive less attention [1, 3, 5].

Comprehensive, up-to-date bibliometric analyses of Indian orthopaedic research, particularly focusing on the *IJO,* are sparse, limiting the ability to identify trends, strengths, and areas for improvement [7–10].

This study addresses these gaps by providing a systematic bibliometric and scientometric analysis of Indian orthopaedic research published in the *IJO* from 2007 to 2024. The specific objectives are to evaluate trends in publication volume, citation impact, and subject distribution within the IJO; to characterize the types of documents, funding patterns, and extent of international collaboration; to map the geographical distribution of research output across Indian states and cities; to identify the most productive institutions, authors, and highly cited papers (HCPs); and to highlight prevailing research themes and emerging areas, thereby informing future directions for Indian orthopaedic research.

Through this comprehensive analysis, the paper seeks to inform researchers, policy-makers, and funding agencies about the current status, achievements, and challenges of Indian orthopaedic research and to provide actionable insights for enhancing its global impact and relevance.

Materials and Methods

This study employed bibliometric and scientometric methods to analyze all Indian orthopaedic research documents indexed in the *IJO* within the Scopus database, spanning 18 years from 2007 to 2024. Scopus was chosen for this bibliometric study due to its comprehensive coverage of scholarly literature across diverse disciplines, robust indexing, and advanced search capabilities, enabling a thorough analysis of the research landscape. The inclusion of papers from 2007 to 2024 in this study is justified by the *IJO* being indexed in Scopus during this period, following a significant gap from 1982 to 2007, where there was no coverage. This timeline allows for a focused analysis of recent trends and developments in the field of orthopaedic research, providing valuable insights into the journal's impact and contributions within the last two decades.

On July 1st, 2025, a search strategy was executed using the journal title tag and restricting the publication years to 2007–2024, which initially yielded 2763 global documents. This search was refined to include only documents published in India, resulting in a final dataset of 1614 records for analysis. The following search strategy was used:

SRCTITLE (Indian Journal of Orthopaedics) AND PUBYEAR > 2006 AND PUBYEAR < 2025) AND (LIMIT-TO (AFFILCOUNTRY, "India"))

The research methodology involved meticulously extracting comprehensive data from 1614 publication records, including author and institution details, funding, collaboration, citations, and publication type/source, all analyzed using MS Excel. The bibliometric analysis focused on several key indicators: assessing overall publication trends and growth, characterizing publication types and sources, evaluating the extent of external funding and identifying supporting agencies, determining the scope of international collaboration by identifying key countries, organizations, and authors, and analyzing the geographical distribution of publications across Indian states and major cities. Additionally, the study classified papers by broad subject areas, keywords, and organ/bone focus, and identified the top 35 most productive organizations (with ≥ 13 papers), the top 29 most productive authors (with ≥ 13 papers), and highly cited papers or HCPs (with ≥ 50 citations).

Descriptive statistical analysis was carried out. Categorical data were presented in numbers (%). Pearson correlation analysis was carried out to evaluate the relationship between Citation Per Publication (CPP) and Total Publications (TP). A p-value less than 0.05 was considered statistically significant. All analyses were performed using IBM SPSS Statistics version 29.0 Armonk, NY: IBM Corp.

Results

Annual & Cumulative Growth of Publications in the *Indian Journal of Orthopaedics*

The *IJO* demonstrated substantial growth in publication volume from 2007 to 2024, with TP increasing from 80 in 2007 to a peak of 280 in 2023 (3.5 fold increase), before settling at 225 in 2024 (Fig. 1).

Over these 18 years, the journal amassed 2763 total articles and 23,188 total citations (TC), yielding an overall average of 8.39 CPP. Indian publications were dominant, contributing 1614 articles (58.41%) and receiving 13,821 citations, with a slightly higher average CPP of 8.56. Statistically, a significant inverse relationship is observed between publication volume and per-article impact ($r = -0.870$; $p < 0.001$) (Fig. 2).

While TP surged, particularly from 2019 (n = 126) to 2022 (n = 278), the CPP experienced a drastic decline from 19.16 in 2009 to a mere 0.68 in 2024. This trend is further underscored by the period analysis: 2007–2012 saw 636 TP with a high CPP of 15.19, which then dropped to 10.9 CPP for 753 TP in 2013–2018, and plummeted to an average of just 3.87 CPP for the massive 1374 TP published between 2019 and 2024 (Table 1).

Type of Documents

The research articles were the predominant document type, accounting for 1085 publications (67.22% of total TP) and 9143 citations, with a CPP of 8.43. Reviews, though fewer in number (197 TP, 12.21% of total TP), demonstrated the highest impact with 2779 citations and a significantly higher CPP of 14.11. With only 60 TP (3.72%), conference papers surprisingly yielded the highest CPP at 20.63, indicating high per-paper impact despite low volume. Conversely, Letters (177 TP, 10.97% of total TP) had a very low CPP of 1.61, and Erratum (10 TP, 0.62% of total TP) had the lowest CPP at 0.10. Editorials contributed 67 publications (4.15% of total TP) with a CPP of 5.09, while Notes (16 TP, 0.99% of total TP) and Short Surveys (1 TP, 0.06% of total TP) had CPPs of 1.69 and 7.00, respectively. The distribution of publications across periods shows a general increase in research articles over time, with 312 in 2007–12, 245 in 2013–18, and 528 in 2019–24, reflecting the growing output of Indian authors in the journal (Supplementary Table 1).

Funded Research

Out of 1614 global documents published in the *IJO*, a mere 45 (2.79%) received external funding support, collectively garnering 637 citations with an average of 14.15 CPP.

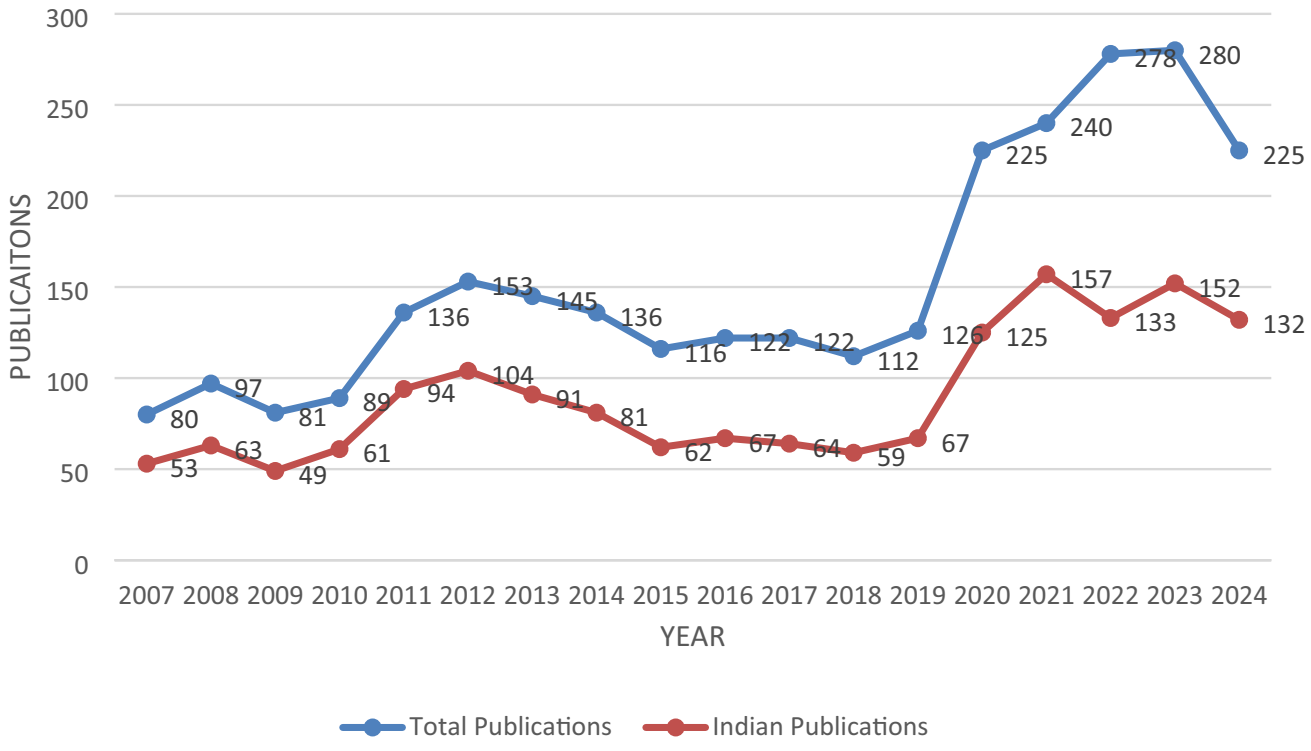

Fig. 1 Annual Publication Trendline showing a rising Trend of Indian and Total Publications of the *Indian Journal of Orthopaedics* from 2007 to 2024

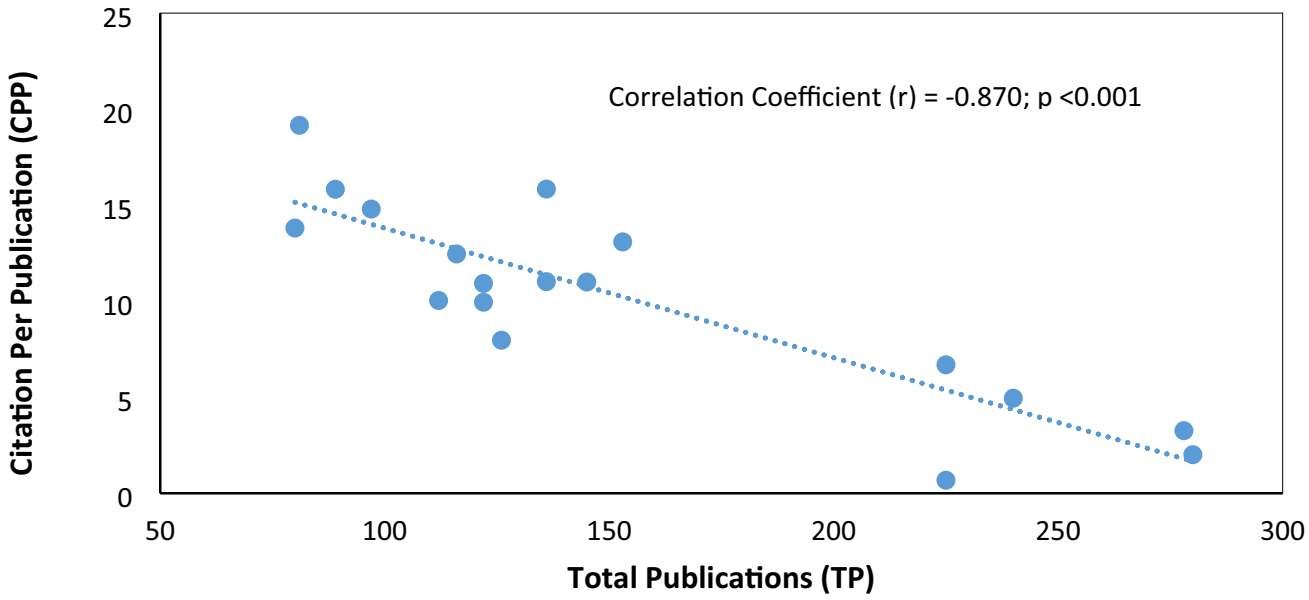

Fig. 2 Scatter plot showing correlation between Citation per Publication and Total Publications during 2007 -2024

Table 1 Annual Growth of Literature in the *Indian Journal of Orthopaedics* (2007–2024)

Total publications				Indian publications		
Year	TP	TC	CPP	TP	TC	CPP
2007	80	1105	13.81	53	682	12.87
2008	97	1436	14.80	63	753	11.95
2009	81	1552	19.16	49	775	15.82
2010	89	1409	15.83	61	1010	16.56
2011	136	2154	15.84	94	1471	15.65
2012	153	2003	13.09	104	1382	13.29
2013	145	1595	11.00	91	887	9.75
2014	136	1499	11.02	81	930	11.48
2015	116	1445	12.46	62	869	14.02
2016	122	1214	9.95	67	732	10.93
2017	122	1333	10.93	64	620	9.69
2018	112	1125	10.04	59	554	9.39
2019	126	1004	7.97	67	565	8.43
2020	225	1506	6.69	125	906	7.25
2021	240	1187	4.95	157	811	5.17
2022	278	907	3.26	133	464	3.49
2023	280	562	2.01	152	315	2.07
2024	225	152	0.68	132	95	0.72
	2763	23,188	8.39	1614	13,821	8.56
2007–12	636	9659	15.19	424	6073	14.32
2013–18	753	8211	10.90	424	4592	10.83
2019–24	1374	5318	3.87	766	3156	4.12
	2763	23,188	8.39	1614	13,821	8.56

TP Total Publications, *TC* Total Citations, *CPP* Citations Per Publication

Leading Indian funding agencies included the Department of Biotechnology and the Department of Science and Technology (both Ministry of Science and Technology, India), each supporting six and five papers respectively, followed by All-India Institute of Medical Sciences (AIIMS), New Delhi (four papers), and Biotechnology Industry Association Council (three papers). Other Indian contributors included Rajiv Gandhi S&T Commission, Maharashtra; MAHE, Manipal; JIPMER, Pondicherry; ICMR; and IIT-Bombay, each supporting two papers. Prominent foreign funding agencies included BC Children's Hospital, Canada, the National Health and Medical Research Council, and the UK-Indian Education Initiative, each supporting 3 papers.

International Collaboration

Foreign Countries

India's orthopaedic research shows significant international collaboration, with the United Kingdom (UK) being the leading partner, contributing 45 TP and accumulating 743 TC, resulting in a high average of 16.51 CPP. The United States of America (USA) follows with 36 TP and 294 TC, yielding a CPP of 8.17. While Singapore has a lower publication volume of 5 TP, it demonstrates the highest impact with a CPP of 16.60 and 83 TC, indicating highly cited collaborative work. Canada also strongly collaborates with 17 TP, 187 TC, and a respectable CPP of 11.00. Other notable collaborators include Australia (11 TP, 100 TC, 9.09 CPP), South Korea (12 TP, 93 TC, 7.75 CPP), and Nepal (5 TP, 39 TC, 7.80 CPP). Conversely, Italy (7 TP, 23 TC, 3.29 CPP) and China (3 TP, 16 TC, 5.33 CPP) exhibit lower per-publication citation rates, suggesting less impactful collaborative output despite their contributions (Supplementary Table 2).

Foreign Organizations

Among the leading foreign organizations collaborating with India in orthopaedic research, 15 institutions contributed 73 papers, accumulating 936 citations with an average of 12.82 CPP. McMaster University, Canada, stands out as the most prolific partner with 10 publications and 116 citations, achieving a strong CPP of 11.60, primarily collaborating with UCMS, New Delhi. However, the University of Oxford, UK, despite having only four publications, demonstrates an exceptionally high impact with 480 citations and an astounding CPP of 120.00, indicating highly influential collaborative work. Other significant collaborators include South Texas Orthopedic Research Institute (STORI), USA (8 TP, 40 TC, 5.00 CPP), Hywel Dda NHS Trust, UK (7 TP, 31 TC, 4.43 CPP), and Konkuk University of Medical University, South Korea (four TP, 41 TC, 10.25 CPP). The National University of Singapore also shows a substantial per-paper impact with three publications, 40 citations, and a CPP of 13.33 (Supplementary Table 3). This data highlights a diverse range of international partnerships, with varying levels of publication volume and citation impact across different foreign institutions.

Foreign Authors

Thirteen leading foreign authors, each with three or more papers, contributed 59 publications to orthopaedic research in collaboration with Indian authors, accumulating 356 TC with an average of 6.03 CPP. M. Bhandari from McMaster University, Canada, is the most prolific, with eight papers and 87 citations, achieving a strong CPP of 10.88, primarily collaborating with Anil Jain. Kwang-Jun Oh from Konkuk University Hospital, South Korea, demonstrates the highest impact among these authors, with three papers, 40 citations, and an impressive CPP of 13.33. Other significant contributors include R. Mohammed (Hywel Dda NHS Trust, UK) with seven papers and a CPP of 4.43. Conversely, authors like K.P. Iyengar (Southport & Ormskirk NHS Trust, UK) and Ashim Gupta (Future Biologics, USA, and South Texas Orthopaedic Research Institute, USA) show lower CPPs of 2.33 and 1.67, respectively, despite their notable publication counts. These top 13 authors account for a significant 42.14% of the total foreign author output in publications and 24.27% of the TC, indicating their substantial contribution to collaborative research (Supplementary Table 4).

Geographical Distribution of Indian Papers

States/Union Territories

Delhi emerged as the leading contributor, accounting for 413 TP, representing 25.59% of the total, and garnering 4057 TC with a strong 9.82 CPP (Fig. 3). Maharashtra followed closely with 333 TP (20.63% of total TP) and 2754 TC, yielding an 8.27 CPP. Tamil Nadu (216 TP, 13.38% TP, 7.26 CPP), Chandigarh (141 TP, 8.74% TP, 7.84 CPP), and Uttar Pradesh (131 TP, 8.12% TP, 9.16 CPP) were also significant contributors. Notably, despite a lower volume of 18 TP (1.12% TP), Assam demonstrated the highest impact with an impressive 16.83 CPP, followed by Sikkim with one publication and a 17.00 CPP. Conversely, Jharkhand (21 TP, 1.30% TP, 1.81 CPP) and Bihar (31 TP, 1.92% TP, 3.48 CPP) showed relatively lower per-publication impact. The publication trend across periods indicates a general increase in output for most leading states in the 2019–2024 period compared to earlier ones, with Delhi increasing from 117 TP (2007–12) to 180 TP (2019–24). Maharashtra from 81 to 177 TP in the same periods, highlighting a growing research output from these regions over time (Supplementary Table 5).

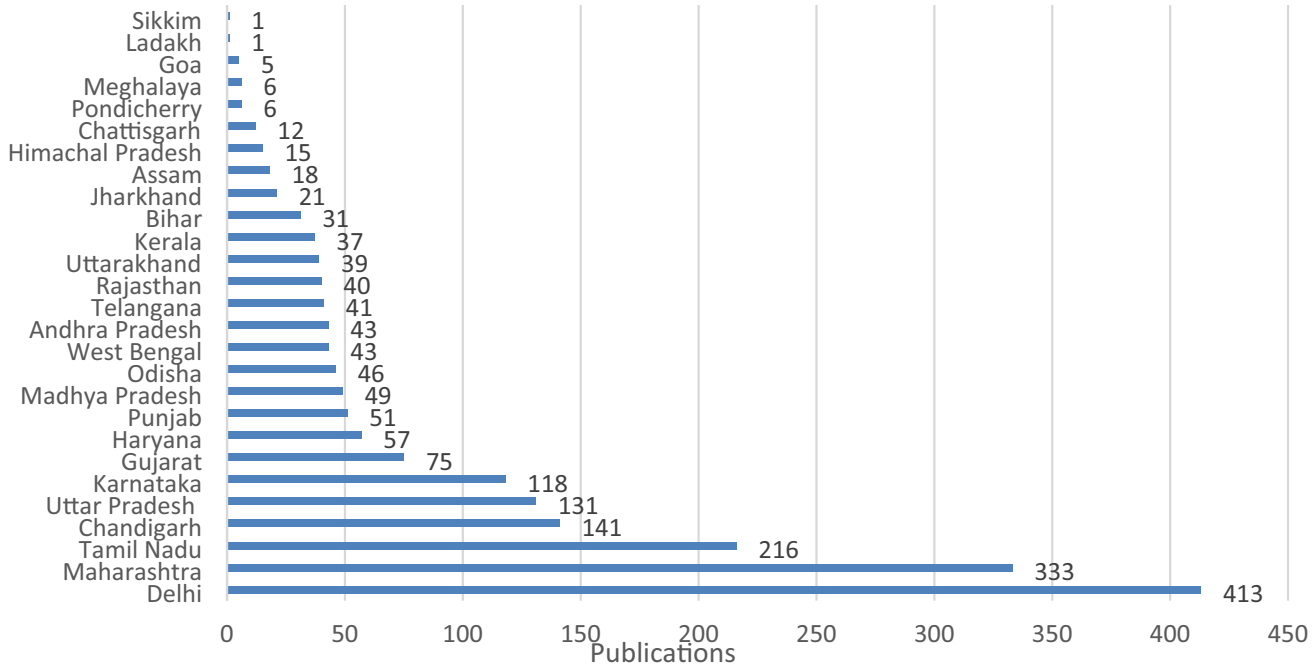

Fig. 3 Geographical Distribution of Papers by India States and Union Territories (2007–2024)

Leading Indian Cities

From 2007 to 2024, Delhi emerged as the leading city in orthopaedic research contributions, with 413 TP, accounting for 25.59% of all papers, and accumulating 4019 TC with a CPP of 9.73. Mumbai was the second most prolific city, contributing 238 TP (14.75% of total TP) and 2009 TC, achieving a CPP of 8.44. Chandigarh was also a significant contributor with 141 TP (8.74% of total TP) and 1090 TC, yielding a CPP of 7.73. While Rohtak had a relatively lower volume of 35 TP, it demonstrated a remarkably high impact with a CPP of 12.46 and 436 TC. Similarly, with only 10 TP, Indore showed a strong CPP of 10.20. Conversely, Patna, despite contributing 28 TP, had a significantly lower CPP of 3.43, indicating less cited work per paper. The data also reveals a general increase in publication output from most major cities in the latest period (2019–2024), with Delhi's contributions rising from 117 TP (2007–2012) to 180 TP (2019–2024), and Mumbai's from 50 to 134 TP in the same periods, showcasing a growing research focus in these urban centers (Supplementary Table 6).

Distribution of Papers

Subject-Wise

"Trauma, Fracture & Dislocation" was the most dominant subject, accounting for 356 TP, or 22.06% of the total, and receiving 3914 TC with a CPP of 10.99. "Spine/Spinal Surgery," despite having a lower volume of 99 TP (6.13% of total TP), demonstrated the highest impact with a CPP of 14.37 and 1423 TC. "Metabolic Diseases" also showed substantial per-paper impact with 67 TP and a CPP of 13.16. "Arthroplasty/Joint Replacement" (161 TP, 9.98% TP, 7.76 CPP) and "Sports Injury & Arthroscopy" (145 TP, 8.98% TP, 9.26 CPP) were other significant areas in terms of publication volume. Notably, "Infections (Covid-19)" saw a significant surge in the 2019–2024 period, with 37 TP compared to 6 TP in previous periods, reflecting recent research focus. Conversely, "Regenerative Medicine" had the lowest volume (6 TP) and the lowest CPP (2.83), indicating it is an emerging or less cited area within the journal during this period (Fig. 4 and Supplementary Table 7).

Anatomical Region-Wise

The Knee was the most frequently studied region (Fig. 5), accounting for 189 TP, representing 11.71% of all papers, and receiving 1451 TC with a CPP of 7.68. The Hip followed with 131 TP (8.12% of total TP) and demonstrated a higher impact, garnering 1630 TC and a CPP of 12.44. Other significant region-related research areas included the Elbow (40 TP, 6.00 CPP) and Neck (49 TP, 8.90 CPP). The distribution across periods indicates a consistent and increasing focus on the Knee, with publications rising from 14 TP in 2007–12 to 129 TP in 2019–24, and the Hip also showing a steady increase from 24 to 72 TP over the same periods. Conversely, region-related areas like the Chest and Face had

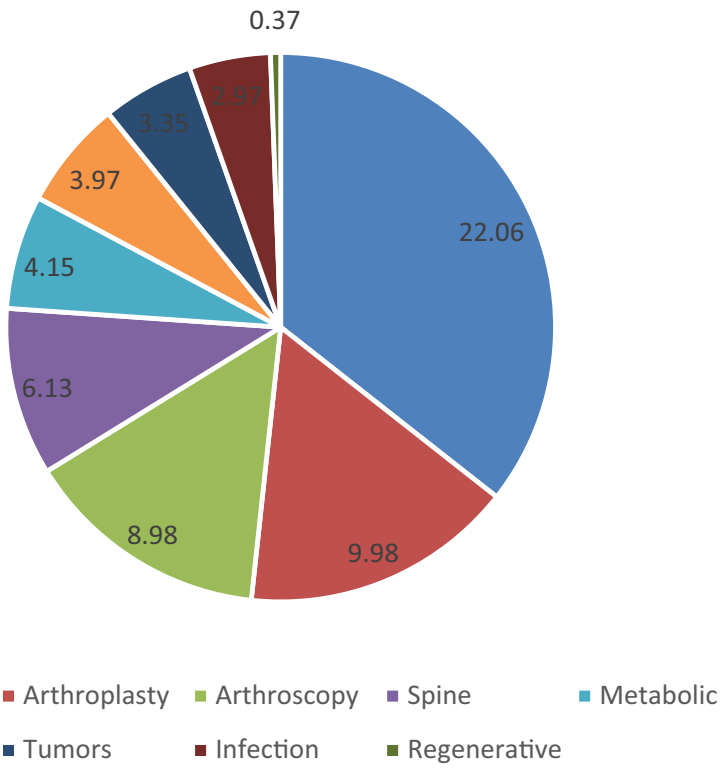

Fig. 4 Subject-Wise Classification of Papers in the *Indian Journal of Orthopaedics* (2007–2024), demonstrating the primary focus on Trauma, Arthroplasty, and Arthroscopy

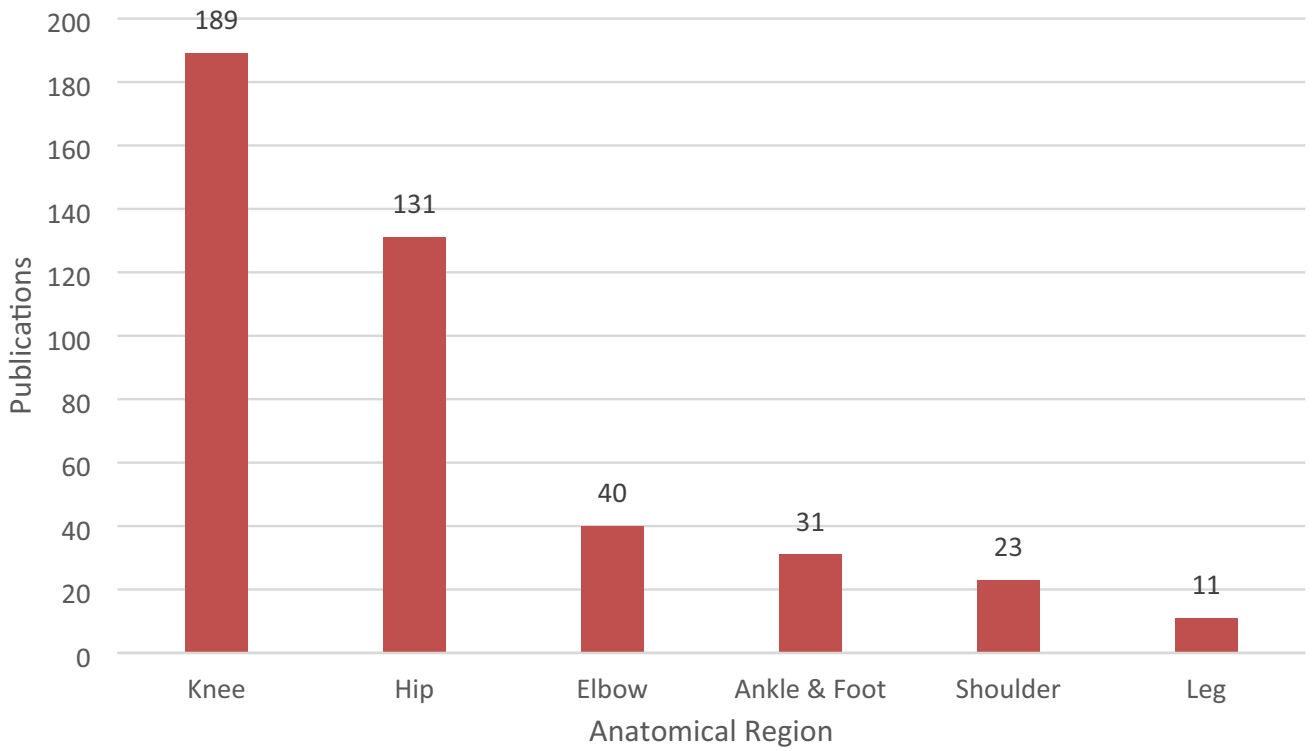

Fig. 5 Anatomical Region-Wise Classification of Papers in the *Indian Journal of Orthopaedics* (2007–2024)

very low publication volumes throughout (Supplementary Table 8).

Bone-Wise

The Femur bone was the most frequently studied, accounting for 124 TP, representing 7.68% of all papers, and accumulating 1159 TC with a CPP of 9.35. The Vertebra (Spine) followed closely with 99 TP (6.13% of total TP) and demonstrated the highest impact, garnering 1423 TC and a remarkable CPP of 14.37. The Tibia was another significant area with 66 TP and a CPP of 9.17. Despite a lower volume of 22 TP, the Fibula notably showed a substantial per-paper impact with a CPP of 11.41. Conversely, the Scaphoid (10 TP, 3.30 CPP) and Scapula (4 TP, 3.00 CPP) exhibited lower citation rates per publication. The distribution across periods generally indicates an increasing trend in publications for major bones like the Femur/Femoral and Tibia in the later period (2019–2024), reflecting sustained research interest in these areas (Supplementary Table 9).

Keyword Subject-Wise

Keyword subject analysis reveals that "Osteoporosis" is the most frequently occurring keyword in 36 papers. This is closely followed by "Fractures" (33 papers), "Osteoarthritis" and "Arthroscopy" (both 27 papers), and "Arthroplasty" (26 papers). Other significant keywords include "Avascular Necrosis" (18 papers), "Giant Cell Tumor" (17 papers), "Covid-19" (16 papers), "Trauma" and "Nonunion" (both 15 papers), and "Cerebral Palsy" (14 papers). Several terms like "Surgery," "Rehabilitation," "Arthrodesis," "Tuberculosis," and "Infection" also appear frequently (11–13 papers each), while specific procedures or materials like "Platelet-rich Plasma," "Osteosynthesis," "Intermedullary Nailing," "Fracture Fixation," and "Autograft" each account for 10 papers. Less frequent but still notable keywords include "Osteonecrosis," "Bone Screws," "Osteosarcoma," "Fracture Healing," "Allograft," "Ewing Sarcoma," and "Bone Mineral Density."

Top Indian Organizations

468 Indian organisations contributed to research in the *IJO* from 2007 to 2024. The top 35 organizations collectively produced 1090 papers and garnered 9620 citations, accounting for a significant 67.53% of TP and 69.60% of TC, with an average productivity of 31.14 papers per organization (Supplementary Table 10). Among these, nine organizations surpassed the average productivity, led by Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh (114 papers), University College of Medical Sciences (UCMS), Delhi (109 papers), and All India Institute of Medical Sciences (AIIMS), New Delhi (94 papers). Regarding citation impact, 17 organizations registered a CPP higher than the overall average, with Maulana Azad Medical College (MAMC), Delhi, and University of Delhi both achieving a high CPP of 14.0, and Bombay Hospital & Medical Research Centre following with 13.31. Specifically, the top six most productive organizations were PGIMER, Chandigarh (114 TP, 8.91 CPP), UCMS, Delhi (109 TP, 11.66 CPP), and AIIMS, New Delhi (94 TP, 9.91 CPP). The top six most impactful organizations by CPP included the University of Delhi (22 TP, 14.0 CPP), MAMC, Delhi (46

Table 2 Top Six Productive and Impactful Indian Organizations

S.No	Name of the Organization	TP	TC	CPP	RCI	ICP	% ICP
	Top Six Productive Organizations						
1	Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh	114	1016	8.91	1.04	9	7.89
2	University College of Medical Sciences (UCMS), Delhi	109	1271	11.66	1.36	8	7.34
3	All India Institute of Medical Sciences (AIIMS), New Delhi	94	932	9.91	1.16	8	8.51
4	Maulana Azad Medical College (MAMC), Delhi	46	644	14.00	1.64	1	2.17
5	Indraprastha Apollo Hospital, New Delhi	44	446	10.14	1.18	8	18.18
6	Kasturba Medical College (KMC), Manipal	42	340	8.10	0.95	6	14.29
Top Six Impactful Organization							
1	University of Delhi	22	308	14	1.64	6	27.27
2	Maulana Azad Medical College (MAMC), Delhi	46	644	14	1.64	1	2.17
3	Bombay Hospital & Medical Research Centre	16	213	13.31	1.56	3	18.75
4	Pt. B.D. Sharma PGIMS, Rohtak	36	465	12.92	1.51	1	2.78
5	Tata Memorial Hospital (TMH), Mumbai	24	309	12.88	1.5	2	8.33
6	University College of Medical Sciences (UCMS), Delhi	109	1271	11.66	1.36	8	7.34

TP Total Publications, *TC* Total Citations, *CPP* Citations Per Publication, *RCI* Relative Citation Index, *ICP* International Collaborative Papers

TP, 14.0 CPP), and Bombay Hospital & Medical Research Centre (16 TP, 13.31 CPP). The average share of international collaborative papers in the national output for these organizations varied widely, from 0.0% to 56.25%, with an overall average of 10.83% (Table 2).

Most Productive Authors

A total of 2542 Indian authors contributed to research in the *IJO*. The top 29 authors were highly productive, individually contributing between 13 and 48 papers, and collectively accounting for 615 papers and 5696 citations, representing 38.10% of TP and 41.21% of TC in the journal (Supplementary Table 11). The average productivity for these top authors was 20.76 papers per author. Eleven authors surpassed this average productivity, with M.S. Dhillon (Chandigarh) leading with 48 papers, followed by A.K. Jain (Delhi) and R. Vaishya (Delhi) with 37 papers each. Regarding citation impact, 15 authors registered a citations per publication (CPP) higher than the overall average of 9.46. R.K. Sen (Mohali) demonstrated the highest impact with a CPP of 16.42, followed by R. Gupta (Chandigarh) with 14.43, and I.K. Dhammi (Delhi) and R. Malhotra (Delhi) both with 13.59. The top six most productive authors were M.S. Dhillon (48 TP, 7.69 CPP), A.K. Jain (37 TP, 11.65 CPP), and R. Vaishya (37 TP, 10.11 CPP). The top six most impactful authors by CPP included R.K. Sen (19 TP, 16.42 CPP), R. Gupta (14 TP, 14.43 CPP), and I.K. Dhammi (27 TP, 13.59 CPP). The average share of international collaborative papers among these top authors ranged from 0.0% to 42.86%, with an overall average of 12.36% (Table 3).

Highly-Cited Papers (HCPs)

Among the 1614 Indian publications in the *IJO* from 2007 to 2024, only 31 (1.92%) were highly cited papers (HCPs), each receiving 50 or more citations, and these were published between 2007 and 2020. These 31 Indian HCPs collectively amassed 2778 citations, averaging 89.61 citations per paper, though their citation distribution was uneven, with most falling in the 51–92 range. The highest number of Indian HCPs was published in 2009, 2011, and 2014, but their 7-year cumulative output decreased from 20 (2007–2013) to 11 (2014–2020). These HCPs comprised 15 articles, 10 reviews, four conference papers, and one each of an editorial and a letter. The majority (23, or 74.2%) involved single organizations, while 8 involved collaborations (five national, three international with Australia, Canada, and the UK). A total of 27 Indian organizations and 82 authors contributed to these HCPs, with PGIMER, Chandigarh, leading with five papers (350 citations), and Mandeep S. Dhillon (Chandigarh) being the top author with four papers (260 citations).

Discussion

This comprehensive bibliometric and scientometric analysis of the *IJO* from 2007 to 2024 reveals several vital trends in Indian orthopaedic research. The *IJO* has demonstrated a substantial increase in publication volume, with total publications rising from 80 in 2007 to a peak of 280 in 2023 (3.5-fold increase). Indian authors contributed 58.4% of the total articles, and their work accounted for a slightly higher

Table 3 Top Six Productive and Impactful Indian Authors

S.No	Name of the author	Affiliation of the author	TP	TC	CPP	RCI	ICP	%ICP
Top Six Productive Authors								
1	M.S. Dhillon	Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh	48	369	7.69	0.90	4	8.33
2	A.K. Jain	University College of Medical Sciences (UCMS), Delhi	37	431	11.65	1.36	2	5.41
3	R. Vaishya	Indraprastha Apollo Hospitals, New Delhi	37	374	10.11	1.18	7	18.92
4	S. Rajasekaran	Ganga Hospital, Coimbatore	34	422	12.41	1.45	2	5.88
5	M. Jeyaraman	Dr MGR Educational & Research Institute, Chennai	31	99	3.19	0.37	11	35.48
6	I.K. Dhammi	University College of Medical Sciences (UCMS), Delhi	27	367	13.59	1.59	1	3.70
Top Six Impactful Authors								
1	R.K. Sen	Max Hospital, Mohali	19	312	16.42	1.92	3	15.79
2	R. Gupta	Government Medical College & Hospital (GMCH), Chandigarh	14	202	14.43	1.69	0	0.00
3	I.K. Dhammi	University College of Medical Sciences (UCMS), Delhi	27	367	13.59	1.59	1	3.70
4	R. Malhotra	All India Institute of Medical Sciences (AIIMS), New Delhi	22	299	13.59	1.59	5	22.73
5	S. Kumar	University College of Medical Sciences (UCMS), Delhi	18	240	13.33	1.56	0	0.00
6	T. Goyal	All India Institute of Medical Sciences (AIIMS), Rishikesh	15	195	13.00	1.52	3	20.00

TP: Total Publications; TC: Total Citations; CPP: Citations Per Publication; RCI: Relative Citation Index; ICP: International Collaborative Papers

average CPP than the global average. However, despite this quantitative growth, there has been a decline in CPP, falling from 19.16 in 2009 to 0.68 in 2024, indicating a dilution of citation impact with increased output. Despite increased output, this notable decrease in CPP suggests a significant shift in the journal's citation dynamics or the average impact of its published works over time. The reason for this phenomenon is due to 'citation lag' that happens with the recent publications, as it may take many years for the citations to peak [11].

Research articles remain the predominant document type, but reviews and conference papers, though fewer, demonstrate higher CPPs. External funding remains limited, supporting only 2.79% of papers, and international collaboration, while present, is concentrated with a few countries and institutions. Geographically, Delhi and Maharashtra lead in research output, while cities like Assam and Sikkim, despite lower volumes, show higher per-paper impact. Thematically, trauma, spine, and metabolic diseases are the most researched areas, while regenerative medicine remains underrepresented, perhaps due to 'citation lag' since this is a relatively new field and publications on this topic have only recently started coming in [11]**.** We expect the citations and numbers in this field to increase in the coming years.

When compared with other Indian orthopaedic journals, such as the *Journal of Clinical Orthopaedics and Trauma (JCOT)* and the *Journal of Orthopaedics (JOO)*, the *IJO* stands out as the oldest and most established, being the official publication of the IOA [1, 2]**.** While all three journals have seen a rise in publication and citation trends, *JCOT* and *JOO* have experienced more rapid recent growth, possibly due to their recent inception and broader scopes [1, 5, 12, 13]**.** One possible reason for a slower growth of the *IJO* compared to these journals is the recent change in its publisher and the change of publication frequency from a six issues per year model to a 12 issues per year model. Since 2025, changes in the leadership to form two Editors have indicated an increase in productivity of the articles (from 15 to 25 per issue) [14]**.** Hence, a small dip in the CPP of the *IJO* is expected in the near future, due to this increase in the denominator and the citations (numerator) to catch up with this number due to the phenomenon of "citation lag" [11]**.** Furthermore, the *IJO* is currently in a phase of expansion with an increasing number of publications [14]. We expect that once the number of articles per year stabilizes with consistent numbers over three years, the phenomenon of 'citation lag' would stabilise and become more predictable. Until then, the citation numbers may be expected to be less than the previous 3–4 years. The *IJO*, however, maintains a consistent output and remains a benchmark for quality and academic rigor in Indian orthopaedics.

Internationally, leading orthopaedic journals such as *Spine* and the *Journal of Bone and Joint Surgery (JBJS)* have higher impact factors and citation metrics, reflecting their broader global reach and more extended history of high-impact publications [14]. Nonetheless, the *IJO*'s increasing international collaborations and its role in disseminating research from low- and middle-income countries position it as a critical platform for regional and global orthopaedic scholarship [14]**.**

The *IJO's* journal metrics reflect its evolving status. The *IJO*'s Cite Score and Journal impact factor (JIF) have shown a positive trajectory over the last decade. After achieving its first impact factor in 2012, the journal has consistently improved its citation metrics, reflecting increased visibility and influence within the orthopaedic research community [1, 4, 7]**.** Its impact factor has grown from 0.503 in the early 2010s to 1.1 in 2024, with a Cites Score that has steadily increased from 0.973 in 2018 to 2.0 in 2024 [4, 6, 14, 15]. The journal is ranked in the third quartile (Q3) in the orthopaedics category, with an H-index of 50 [12, 14]**.** While these metrics are modest compared to top-tier international journals, they represent significant progress for an Indian specialty journal and underscore the IJO's role as a leader among national orthopaedic publications. The steady rise in Cite Score, particularly between 2018 and 2021, mirrors the journal's efforts to enhance publication quality, attract international submissions, and foster collaborations. However, the recent decline in CPP despite higher publication volumes suggests a need for strategies to maintain and enhance research impact.

The *IJO* demonstrates several strengths, including its comprehensive coverage of orthopaedic topics, offering a platform for diverse research areas and methodologies [1, 8]**.** As the official journal of the IOA, the *IJO* exhibits national leadership by setting academic standards and driving research priorities within India [5]**.** Furthermore, it has fostered international collaboration, particularly with the UK, USA, and Canada institutions, thereby enhancing the global relevance of Indian orthopaedic research. The current analysis, underpinned by bibliometric rigor, is based on a large, meticulously curated dataset, providing robust insights into publication trends, citation impact, and research themes [16]**.** Other limitations include limited external funding for studies [12], a geographical and thematic imbalance in research output, and the inherent database dependence, potential citation lag, and bias associated with bibliometric analyses [14]**.**

Study's Limitations While this study offers valuable insights into the landscape of Indian orthopaedic research through a bibliometric analysis of publications in the *IJO*, it is limited by the reliance on a single database, Scopus. This constraint may restrict the comprehensiveness of the findings, as it excludes relevant research that could be indexed in other databases, such as PubMed or Web of Science. Consequently, the analysis may not fully capture the breadth

of orthopaedic research output or the citation impact from a wider array of sources, potentially underrepresenting the contributions and trends within the field.

Recommendations To enhance the *IJO*'s standing, several key recommendations should be implemented. First, research quality must be prioritized by encouraging methodological rigor, fostering multicenter collaborations, and ensuring adherence to reporting guidelines to boost citation impact [14]**.** Simultaneously, efforts should be made to diversify funding sources, advocating for increased support from government, industry, and philanthropic organizations to underpin high-quality research. To broaden its scope, the journal should also actively promote underrepresented areas like regenerative medicine and rare bone diseases. Strengthening the peer review process through improved transparency and efficiency is crucial for the timely publication of high-quality manuscripts [14]**.** Furthermore, expanding international collaborations will build on existing partnerships and forge new ones, enhancing the global visibility and impact of Indian orthopaedic research. Finally, it is vital to regularly monitor and adapt metrics, implementing strategies to address any declines in citation impact and other key indicators [17–20]**.**

Conclusion

The *Indian Journal of Orthopaedics (IJO)* has experienced substantial growth in publication volume and research diversity from 2007 to 2024. Key strengths of the *IJO* include its national leadership, comprehensive subject coverage, and increasing international collaborations, which have elevated its visibility and influence within the orthopaedic community. Geographical and thematic imbalances and limited external funding remain areas for improvement to ensure more equitable and impactful research contributions. Overall, the *IJO*'s evolution reflects the achievements and ongoing challenges of Indian orthopaedic research, providing critical insights to guide future strategies for greater global relevance and scientific excellence.

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Declarations

Conflict of interest All the authors declare no direct conflict of interest related to this manuscript, except that the Authors #1,3, 4, & 5 are on the Editorial board of the IJO, but will not have any role to play in the review and decision-making of this paper.

Ethical Approval The paper is a review article so no ethical approval is required.

Informed Consent For this type of study informed consent is not required.

Use of AI Tool We have used Grammarly software to enhance the readability and improving the English grammar of manuscript. However, the final version was rechecked and the authors take the full responsibility of its contents.

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