Reflections of Research Output on Odontoma During 1969-2018: A Fifty Year Account

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Abstract

Odontoma refers to a kind of tumor of odontogenic origin and a number of researches have been conducted on this disease. Keeping in view the further research developments in the field of dentistry it becomes mandatory to know the amount of research work done in this field. The present study has been conducted to identify fifty years research output on Odontoma bibliometric analysis. A list of studies about Odontoma was obtained by using the Scopus database. A continuous increase in publication of papers on Odontoma was noted from fist decade 1969-78 to last decade except the decade 1989-98, impact of which is reflected in growth rate of this decadal period which is -15.06. In 1989-98 there was a decrease in productivity but citation count was highest. Lowest ACPP was noted in the latest decade 2009-18. There were 17 papers on Odontoma received highest share of citations (20.02%) of total citation followed by 166 papers (17.77 %), 33 papers (16.5%), 72 papers (12.94%) and 42 papers (10.75%) while other papers credited less than 10 percent of share of total citations. Single authors published 197 papers which was comparatively less among all type of authorship while multi-authored publications remained highest i.e. 395 papers during fifty year period. Collaboration coefficient (CC) remained 0.38 over the fifty years, indicating a moderate level of collaboration. Oral Surgery, Oral Medicine, Oral Pathology was most preferred journals for publications of journals. Ide, F. from Universidade de Sao Paulo contributed highest publications on Odontoma. USA among all countries published highest research papers (18.91% share) on Odontoma. The study provides a comprehensive overview of the research landscape on Odontoma, offering insights into publication trends, authorship patterns, and the global distribution of research output. This analysis serves as a valuable resource for researchers, practitioners, and policymakers to identify gaps and guide future research endeavors in the field of odontogenic tumors and oral pathology.

Keywords: Research Output, Odontoma, odontogenic tumors, Dentistry, Bibliometrics, Publications

1. Introduction

Bibliometrics is defined as ‘‘the use of statistical methods in the analysis of a body of literature to reveal the historical development of subject fields and patterns of authorship, publication, and use”(Tarazona, et al, 2018). In every scientific and medical field, bibliometric studies are of great value as they are helpful to assess research activities and trends by using bibliometrics. Research productivity in the field of dentistry, especially in oral surgery, has increased due to the increasing interest and demand by researchers in this field.

The term odontoma has evolved since its introduction in 1868 from being applied to several odontogenic tumors to its current usage for a hamartomatous odontogenic lesion that matures to the point of producing calcified dental tissues (Kaugars, Miller & Abbey, 1989). “Odontomas are considered to be developmental anomalies resulting from the growth of completely differentiated epithelial and mesenchymal cells that give rise to ameloblasts and odontoblasts. These tumors are basically formed of enamel and dentin, but they can also have variables amounts of cement and pulp tissue (Singh, et al, 2005). **“**During the development of the tumor, enamel and dentin can be deposited in such a way that the resulting structures show an anatomic similarity to normal teeth, in which case the lesion is classified as a compound odontoma. However, when the dental tissues form a simple irregular mass occurring in a disorderly pattern, it is described as a complex Odontoma” (Serindere & Serindere, 2020). “Odontomas are the most common odontogenic tumors. They are lesions of children and young adults, especially in the second decade of life. There is no significant gender predilection”(Tekkesin, M.S et al, 2012). Odontogenic tumors are lesions that arise from the dental lamina or any of its derivatives. As a group, odontogenic tumors are uncommon lesions, and malignant odontogenic tumors are rare (Worawongvasu & Tiensuwan, 2015). “Although odontomas are generally included in the classification of odontogenic tumors, most authorities will concede that these lesions arc more properly considered being malformations rather than true ncoplasms” (Budnick, 1976).

A bibliometric analysis always helps scientists or researchers to explore the latest trends and information in field of their interest. The bibliometric indicators help them to identify the latest trends of their interest in a particular region or country, documentary sources, human sources, etc. While exploring the literature on Odontoma, it was found that a scanty work has been done on bibliometric study, which motivated the researcher to conduct this study.

2. Objectives Of The Study

The main objective of this study is to analyse the research productivity on Odontoma in the field of oral pathology during a period of 50 years. The specific objectives are:

1. To identify the global research output on Odontoma;
2. To analyse the yearly research output on Odontoma;
3. To find out growth trends in research output on Odontoma;
4. To study the citation trend and top cited papers;
5. To study the authorship pattern;
6. To identify the most prolific authors conducting research;
7. To study the top ten most preferred sources by authors for publishing;
8. To identify the top countries conducting research;

3. Methodology

For the present study, data was obtained from Scopus database, which is the world's largest abstract and citation database of peer-reviewed literature. It covers nearly 22,000 titles from over 5,000 international publishers and has about 55 million records in the scientific, technical, medical, and social sciences (including arts and humanities) field. Data on world publications about Odontoma published from 1969-2018 was extracted from the Scopus database using search string Title, Abstract, Key word on "odontoma". After exporting the data from the Scopus database to an excel sheet, it was delimited in certain ways to analyse results and put them into tabular form. Calculations and statistical techniques were applied in the excel sheet to derive specific results. Out of the total documents, Conference Papers, Book Chapters, Erratum, lectures, short surveys were not included in this study; Only 1269 Articles published in journals and 95 review papers are included.

4. Literature Review

A few previous studies on bibliometrics, specifically in the field of medical sciences, have been consulted for the present study. Tarazona, et al. (2018) analyzed the 100 most-cited articles in orthodontics indexed in the Web of Science Category of ''Dental, Oral Surgery and Medicine'' from 1946 to 2016. Kramer, et al. (2016) analysed the profile of articles on traumatic dental injuries (TDI) in the primary dentition published in Dental Traumatology years 2000-2014 using bibliometric analysis. Serindere, & Serindere (2020) analyzed the citation features and review articles on odontomas retrieved through the Scopus database. Moraes, et al. (2020) analysed bibliometric characteristics of research output of the Brazilian Dental Journal (BDJ) during 1990–2019 and found the factors related to citation rates. Goncalves, et al. (2019) assessed top-100 most cited articles of international dental journals with at least one co author affiliated to Brazil during 1996 and 2017. Liu, et al. (2020) provided the worldwide tendency and perspectives in Traumatic dental injuries (TDIs) during 1999-2018 via bibliometric analysis. Primo, et al. (2014) analysed the profiles of

Brazilian and international studies published in two scientific orthodontic journals. i.e., 'Dental Press Journal of Orthodontics' and; 'American Journal of Orthodontics and Dentofacial Orthopaedics'. They analyzed the same at interval often year period (1999 – 2004 – 2009). A few other studies were also consulted to have a better understanding.

5. Data Analysis

For analysing the research output on Odontoma, Data of refined 1364 articles was presented into following tables, drawing clear findings based on the presented data:

5.1 Decadal share of research output during 1969-2018

It is reflected in Table 1 that there has been a continuous increase from the first decade 1969-78 to the last decade except 1989-98 in publication of papers on Odontoma. The impact of this can be seen in the growth rate of this decadal period, which is -15.06. The citation count can be seen as highest in the decade 1999-2008, ACPP of which was also highest (18.27). It has also been observed that during the decade 1989-98, there was a decrease in productivity of research papers on Odontoma, but citation count during this decade increased much more than double. The lowest ACPP was noted in the latest decade 2009-18.

Table 1
Distribution of Articles during 1969-2018

Year	Total Publications	Total Citations	ACPP	Growth Rate
1969-78	180	1599	8.88	-
1979-88	239	1394	5.83	32.78
1989-98	203	3328	16.39	**-15.06**
1999-2008	280	5117	18.27	37.93
2009-2018	462	2304	4.99	65
Total	**1364**	**13742**	**10.07**	

(TP= Total Publications; ACPP= Average Citation Per Paper)

5.2 Citation account of research papers on Odontoma

The citation profile has been visualised through Table 2, which shows that highest citations (more than 100) were received by 17 papers (1.25%) while 51-100 citations were received by 33 papers (2.41%). It is also observant that out of the total papers (1364), 60 percent of papers (858 papers) received only 5 or fewer than 5 citations.

If the number of papers is distributed according to the citation share of the total citations received by papers on Odontoma during fifty years, it is clear that 17 papers (1.25%) on odontoma received the highest share of citations (20.02%) of the total citations, followed by 166 papers (12.17%) that received (17.77%), 33 (2.41%) papers received (16.5%), 72 (5.28%) papers (12.94%) and 42 (3.08%) papers (10.75%). All other papers have credited less than 10 percent of the share of the total citations.

Table 2
Citations profile during fifty years

No. of Citation	TPS	%age	TCS	%age
0	423	31.01	0	0
1	154	11.29	154	1.12
2	95	6.96	190	1.38
3	76	5.57	228	1.66
4	59	4.33	236	1.72
5	51	3.74	255	1.86
10	159	11.66	1220	8.88
20	166	12.17	2442	17.77
21-30	72	5.28	1778	12.94
31-40	42	3.08	1477	10.75
41-50	17	1.25	743	5.4
51-100	33	2.41	2268	16.5
More than 100	17	1.25	2751	20.02
Total	**1364**	**100**	**13742**	**100**

(TPS = Total Citation Share; TCS= Total Citation Share)

5.3 Research output of top authors

The list of the top ten authors who have written the highest number of articles on Odontoma during the period 1969-2018 is given in Table 3. In terms of the number of publications, Ide, F. is the most productive author with 14 articles, followed by Kusama, K. with 11 articles. It is also noticed that these ten authors collectively produced 6.59 percent papers of the total publications published on Odontoma.

Table 3
Most Prolific Authors

Name of the Author	Affiliation	Total Publications (N=1364)
Ide, F.	Universidade de Sao Paulo - USP	14
Kusama, K.	Osaka University	11

Noda, T.	Tel Aviv University	10
Piattelli, A.	UNESP-UniversidadeEstadualPaulista	10
Reichart, P.A.	Tokyo Medical and Dental University	9
Buchner, A.	University of G. d'Annunzio Chieti and Pescara	8
Donath, K.	Meikai University	7
Gomez, R.S.	Western University	7
Takeda, Y.	Universidade Federal de Minas Gerais	7
Gardner, D.G.	University of Toronto	7
Total		**90 (6.59%)**

5.4 Pattern of Authorship

The above table shows the decadal authorship pattern for publications produced during 1969-2018 and also the collaborative coefficient which shows the measure of collaboration in research. Single Authors published 197 papers, which were comparatively fewer among all types of authorship, while multi-authored publications remained the highest i.e. 395 papers during fifty year period. It reflects that multiple authorship pattern took the lead over other authorship patterns. CC has been remained 0.38 for the fifty year period. The highest CC has been recorded in the latest decadal period 2009-2018, while the lowest CC has been recorded in earlier years 1969-78.

Table 4
Authorship Pattern during 1969-2018

Authorship pattern	2009-2018	1999-2008	1989-98	1979-88	1969-78	Total
Single Author	23	27	34	59	54	197
Two Authors	53	44	38	55	51	241
Three Authors	74	63	55	66	30	288
Four Authors	96	61	31	36	19	243
Five or More Authors	216	85	45	23	26	395
Collaborative Coefficient	**0.69**	**0.63**	**0.57**	**0.49**	**0.45**	**0.38**

"(Collaboration Coefficient (CC) is a measure of collaboration in research that reproduces in the mean number of authors per paper and the proportion of multi-authored papers. Writing of articles with co-authorship is one of the indicators of reliability in scientific articles" (Yadav, SK etal). Collaborative writing refers to a distributed process of labor involving writing, resulting in the co-authorship of a text by more than one writer). Collaborative Coefficient The methodology of Collaboration Coefficient has been suggested by

Ajiferuke, Burrell, and Tague (1988). It is based on the counting of fractional productivity defined by Price and Beaver. It is given by following formula below:

$$CC = 1 - \frac{\sum_{j=1}^{A}(1/j)f_j}{N}$$

Here, Fj denotes the number of j authored research papers; N denotes total number of research papers published; and k is the greatest number of authors per paper. It is observed by Ajiferuke, that CC will indicate zero when a single-authored papers dominate and counted 1-1/j then j authored papers being dominate. This implication shows that higher the value of CC, means higher the probability of multi or mega authored papers.

5.5 Top Sources in terms of research output

Table 5 lists the top ten sources that were preferred by researchers for writing articles on Odontoma and made the highest contribution in terms of research output during 1969-2018.

These top ten sources together produced around 17.74% of the total research productivity. Oral Surgery, Oral Medicine, Oral Pathology published by Elsevier contributed the highest research output on Odontoma (47 papers) among top the ten preferred sources followed *by* Journal of Oral and Maxillofacial Surgery with 37 articles. The source at ninth and tenth position contributed 16 papers each.

Table 5
Most Prolific Journals

Journal Title	Publisher	Total Publications (N=1364)	Impact Factor	H-Index (Scimago)
Oral Surgery, Oral Medicine, Oral Pathology	Elsevier	47	-	108
Journal of Oral and Maxillofacial Surgery	W. B. Saunders	37	1.779	109
Journal of Oral Pathology and Medicine	Blackwell Publishing Ltd.	29	-	74
Minerva Stomatologica	Edizioni Minerva Medica	26	-	24
BMJ Case Reports	BMJ Publishing Group	19	-	20
Journal of Craniofacial Surgery	Lippincott Williams & Wilkins Ltd.	18	-	66
Journal of Clinical Pediatric	Tufts University	17	0.854	38

Dentistry				
Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology	Elsevier	17	-	
Medicina Oral, Patologia Oral Y CirugiaBucal	Medicina Oral S.L.	16	-	47
Quintessence International	Quintessence Publishing Company	16	1.088	66
Total		**242 (17.74%)**		

5.6 Most cited research papers on Odontoma

Table 6 shows the top ten highly cited articles on Odontoma. These articles collectively received 13.86 citations of the total citations received to all articles. It is also observed that the highest citations were received for the article "Odontogenic tumors: analysis of 706 cases" (356 citations) published in 1978, followed by "Relative incidence of odontogenic tumors and oral and jaw cysts in a Canadian population" (256 citations) published in 1994. The article at the 10th top position, "Odontogenic tumors: A review of 319 cases in a Nigerian teaching hospital" was published in 2005 and received 131 citations.

Table 6
Highly Cited Papers

Author(s)	Title	Year	Journal	Citations (N=13742)
Regezi, J.A., et al.	Odontogenic tumors: analysis of 706 cases.	1978	Journal of oral surgery (American Dental Association : 1965)	356
Daley, T.D., et al.	Relative incidence of odontogenic tumors and oral and jaw cysts in a Canadian population	1994	Oral Surgery, Oral Medicine, Oral Pathology	256
Miller, R.W., Rubinstein, J.H.	Tumors in Rubinstein-Taybi syndrome	1995	American Journal of Medical Genetics	210
Philipsen, H.P., et al.	Mixed odontogenic tumours and odontomas. Considerations on interrelationship. Review of the literature and presentation of 134 new cases of odontomas	1997	European Journal of Cancer Part B: Oral Oncology	190

Mosqueda-Taylor, A., et al.	Odontogenic tumors in Mexico: A collaborative retrospective study of 349 cases	1997	Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics	168
Slootweg, P.J.	An analysis of the interrelationship of the mixed odontogenic tumors-ameloblastic fibroma, ameloblastic fibro-odontoma, and the odontomas	1981	Oral Surgery, Oral Medicine, Oral Pathology	160
Lu, Y., et al.	Odontogenic tumors: A demographic study of 759 cases in a Chinese population	1998	Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics	156
Jing, W., et al.	Odontogenic tumours: a retrospective study of 1642 cases in a Chinese population	2007	International Journal of Oral and Maxillofacial Surgery	144
Philipsen, H.P., Reichart, P.A.	Calcifying epithelial odontogenic tumour: Biological profile based on 181 cases from the literature	2000	Oral Oncology	135
Ladeinde, A.L., et al.	Odontogenic tumors: A review of 319 cases in a Nigerian teaching hospital	2005	Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology	131
Total				**1906 (13.86%)**

5.7 Top ten countries

Table 7 shows the top ten countries that published literature on Odontoma. These top ten countries together produced more than half of the research output on the disease. The United States contributed the highest research output on Odontoma (18.91 %) followed by Japan with 10.26% publication share, India with a 8.06 % share, Brazil with a 6.96% share. Other countries shared less than 5% of total productivity. Italy was at 5th position with 3.30% share while Germany, Turkey and the UK shared almost equal share, i.e. 2.93%, 2.79%, and 2.71%, respectively. Canada and France were found at the 9th and 10th position with 1.98% & 1.91% share respectively.

Table 7
Top ten countries in terms of publications on Odontoma

Country	TP	% of TP (N=1364)

United States	258	18.91
Japan	140	10.26
India	110	8.06
Brazil	95	6.96
Italy	45	3.30
Germany	40	2.93
Turkey	38	2.79
United Kingdom	37	2.71
Canada	27	1.98
France	26	1.91
Total	816	59.82

6. Conclusion

Bibliometric Analysis is helpful in undrestanding different aspects of latest research trends. The present study aims to analyze research productivity on Odontoma, a type of odontogenic tumor, in the field of oral pathology over a fifty-year period i.e., 1969-2018. The study explores various aspects of literature on Odontoma, which helps the researchers, practitioners and policy makers to identify the gaps in research on Odontoma and related diseases and to conduct further research on the same. Bibliometric analysis of related diseases may also be conducted by researchers to undrestand recent trends/findings, identify the infirmities and address them. The findings can guide future research endeavours and collaborations in the area of odontogenic tumors and oral pathology.

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Supporting Tables

Table 1: Year-wise growth of publications

Year	Total Publications	Growth Rate	Total Citations	ACPP
2018	37	-19.56	41	1.10
2017	46	-13.21	91	1.98
2016	53	-13.11	127	2.40
2015	61	22	161	2.64
2014	50	-1.96	160	3.2
2013	51	4.08	272	5.33
2012	49	13.95	300	6.12
2011	43	30.30	283	6.58
2010	33	-15.38	361	10.93
2009	39	2.63	508	13.02
2008	38	-2.56	565	14.87
2007	39	34.48	732	18.77
2006	29	20.83	494	17.03
2005	24	-20	661	27.54
2004	30	-3.23	364	12.13
2003	31	40.91	554	17.87
2002	22	-12	512	23.27
2001	25	-	385	15.4
2000	25	47.06	502	20.08
1999	17	-10.53	348	20.47
1998	19	26.67	405	21.31
1997	15	-11.76	603	40.2
1996	17	-	226	13.29

1995	17	41.67	356	20.94
1994	12	-25	405	33.75
1993	16	14.28	180	11.25
1992	14	-48.15	339	24.21
1991	27	-10	394	14.59
1990	30	-16.67	140	4.67
1989	36	12.5	280	7.78
1988	32	-	141	4.41
1987	32	23.08	227	7.09
1986	26	-13.33	87	3.35
1985	30	-	100	3.33
1984	30	50	213	7.1
1983	20	11.11	118	5.9
1982	18	28.57	80	4.44
1981	14	-22.22	224	16
1980	18	-5.26	153	8.5
1979	19	-	51	2.68
1978	19	29.63	447	23.53
1977	27	17.39	250	9.26
1976	23	-25.82	160	6.96
1975	31	63.16	247	7.97
1974	19	58.33	96	5.05
1973	12	50	75	6.25
1972	8	-50	66	8.25
1971	16	45.45	86	5.37
1970	11	-21.43	54	4.91
1969	14	-	118	8.43
Total	**1364**	**13742**	13742	

Table: 2 Yearly Authorship Pattern

Year	Single Author	Two Authors	Three Authors	Four Authors	Five or More Authors	Collaborative Coefficient
2018	1	4	7	5	20	0.71
2017	2	2	7	10	25	0.72
2016	-	6	7	15	25	0.73
2015	3	6	11	14	27	0.69
2014	4	5	6	14	21	0.68
2013	-	8	7	15	21	0.72

2012	10	4	9	-	26	0.59
2011	1	6	9	8	19	0.70
2010	1	5	7	6	14	0.69
2009	1	7	4	9	18	0.70
2008	4	10	5	7	12	0.61
2007	1	3	13	9	13	0.70
2006	1	5	8	9	6	0.66
2005	1	3	3	6	11	0.70
2004	3	3	8	7	9	0.64
2003	2	6	5	10	8	0.65
2002	2	5	5	-	10	0.63
2001	3	4	5	6	7	0.61
2000	3	4	10	4	4	0.59
1999	7	1	1	3	5	0.44
1998	2	3	6	-	8	0.63
1997	-	1	5	4	5	0.72
1996	3	3	5	1	5	0.56
1995	4	4	3	3	3	0.51
1994	-	-	5	2	5	0.73
1993	4	3	5	3	1	0.49
1992	1	4	4	4	1	0.60
1991	6	7	5	4	5	0.51
1990	6	5	7	6	6	0.55
1989	8	8	10	4	6	0.51
1988	6	9	8	5	4	0.52
1987	7	7	10	5	3	0.51
1986	5	8	6	6	1	0.51
1985	4	9	9	1	7	0.56
1984	10	3	8	8	1	0.45
1983	4	6	4	5	1	0.51
1982	7	2	3	2	4	0.43
1981	6	3	3	1	1	0.44
1980	4	4	7	2	1	0.52
1979	6	4	8	1	-	0.48
1978	7	7	3	1	1	0.37
1977	6	12	1	2	6	0.48
1976	5	3	9	5	1	0.52
1975	12	5	-	2	12	0.44
1974	7	3	2	4	3	0.43
1973	3	2	3	3	1	0.53

1972	1	3	3	1	-	0.50
1971	5	5	4	1	1	0.42
1970	4	4	2	-	1	0.37
1969	4	7	3	-	-	0.39
Total	197	241	288	243	395	