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Research Article

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Bibliometric and Altmetric Analyses of the 100 Top-Cited Letters in Endodontics

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ABSTRACT

Objective: The purpose of this study was to analyze bibliometric and altmetric features of the 100 top-cited letters in endodontics and the relationships of these features with the number of citations.

Material and Methods: Scopus, Web of Science, Altmetric and PlumX databases were reviewed to identify the relevant letters and/or obtain their bibliometric and altmetric measures. Univariate statistical tests were used to analyze the relationships between the number of citations and various continuous (Altmetric Attention Score, captures, usage) and categorical (publication model, journal type, social media, institutional collaboration type) parameters of the letters. Poisson regression in a generalized linear model was used for analysis of the parameters found to be significant in the univariate tests.

Results: The top-cited letter received 58 citations. Regenerative endodontics had the most letters of any subspecialty (n = 10). There were 13 different types of letters. Opinion letters received the most citations in total. The most frequent type included the letters commenting on a previous document (n = 31). Articles were the most common type of document commented on, whereas the majority of the comments were negative. The multivariate test revealed that the number of captures (p = 0.001) and the non-dental journal type (p = 0.001) increased the number of citations by 2.533 and 1.008 times, respectively.

Conclusion: Endodontic letters published in non-dental journals or captured by readers in bibliographic management programs are more likely to be cited. Letters expressing opinions on any free topic were the most cited letter type.

Keywords: Bibliometrics, Endodontics, Letter, Regenerative Endodontics, Social Media

In bibliometrics, citation analysis evaluates citations received by articles, authors, journals, or other aggregates of scientific activity [1]. Garfield have played an active role in entering the 'highly cited articles' issue into the scope of citation analysis. In 1973, he compiled a list of the 25 most cited articles published by science and technology journals [2]. Subsequently, similar present-day citation analyses were applied to many other subjects including endodontics to retrieve information from many aspects of the subjects analyzed, such as collaboration patterns, research trends, and predictors of citation numbers. Different document types including systematic reviews, meta-analyses and case reports were also analyzed from this perspective [3-7]. However, the letters written on endodontics have not yet been analyzed.

The limitations of traditional citation-based metrics in accurately assessing the impact of scientific articles, such as failing to account for reader interest and inability to measure social influence, led to a search for alternative metrics. Later, advancements in web tools and environment, such as the Digital Object Identifier System, social networking sites, and reference managers, transformed the web into an acceptable platform for obtaining these required metrics. 'Altmetrics', a portmanteau word coined in 2010 to name these alternative metrics and their related field of research, gained popularity in the information science community following a few previous proposals [8-10].

To the best of our knowledge, only two studies have investigated the altmetric features of endodontic articles. Neither of these studies examined letters in endodontics [7,11]. Therefore, this study aimed to identify the 100 top-cited letters in endodontics and analyze their bibliometric and altmetric features. Another aim of the study was to investigate how some bibliometric (publishing model, journal type, and collaboration type) and altmetric (social media, Altmetric Attention Score (AAS), capture, and usage) parameters affected the number of citations.

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Material and Methods

Search Strategy

Scopus (Elsevier B.V., Amsterdam, Netherlands) and Web of Science (WoS) (Clarivate Analytics, Philadelphia, PA, USA), citation index databases that provide bibliographic data on scientific materials, were scanned without any time limit. First, two investigators independently searched both databases to retrieve all documents registered in the research area of dentistry. SUBJAREA (dent) and SU = (Dentistry, Oral Surgery & Medicine) were the recommended query sets for Scopus and WoS, respectively. The 'all databases' option was selected for the WoS search. Then, the results were refined by document type, selecting the 'letter' option. After sorting the letters by using the 'Times Cited-highest to lowest' feature, their titles and, if necessary, full texts were sequentially read.

Eligibility Criteria

The letters on odontogenic or orofacial infections where endodontic etiology is uncertain, atypical odontalgia, and dentin proteoglycans were excluded from the draft lists. Those written on iatrogenic dental injuries, coronal discolorations and morphological tooth anomalies but did not address endodontic treatment approaches on these topics were also excluded because they were not completely specific to endodontics.

Identification of the Top-Cited Letters

Letters with the same number of citations were sorted according to their date of publication, with a recently published letter ranking higher than an older one. If the citation number of a particular letter varied between entries in two databases, the higher value was considered for the ranking. The two draft lists were then compared to establish a final list. Figure 1 depicts the flowchart of the draft list prepared by B.Y.

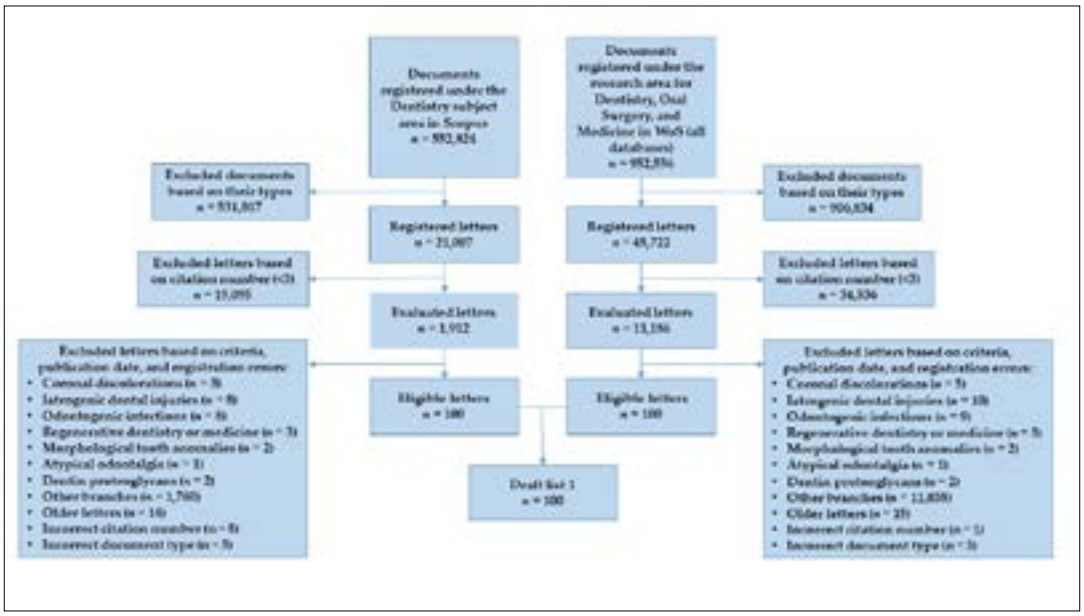

Figure 1: The flowchart of the draft list prepared by B.Y.

Data Extraction

The following traditional metrics and bibliometric characteristics of each letter were compiled and analyzed: citation number, citation benchmarking percentile, field-weighted citation impact (FWCI), source and its type (endodontic, dental, non-dental), publishing model (open access or subscription-based), publication year, author(s), institution and country of author(s), subspecialty(ies), letter type, type(s) of the previous document(s) commented on, comment type(s) and number of cited references. The first author's address determined the country and institution of origin. The institutions of the authors, irrespective of their departments, were also considered to determine institutional collaboration type – affiliated single authorship, single-institutional, multi-institutional (national), international or unaffiliated. AAS (Altmetric LLP, London, UK) and PlumX (Plum Analytics, Elsevier B.V., Philadelphia, PA, USA) metrics including the categories of social media, mentions, captures, and usage were compiled for alternative metrics of each letter using the bookmarklet 'Altmetric it!' and Scopus's link, respectively. The data collection process began in January 2023 and was completed within two months.

Data Visualization

VOSviewer version 1.6.10 software and Biblioshiny, a web interface application of Bibliometrix, were used for advanced bibliometric analyses of data and visualization of results [12,13].

Statistical Analysis

The IBM SPSS Statistics, Version 22.0 software (IBM Corp. Armonk, NY, USA) was utilized for statistical analyses when evaluating the data acquired in the study. The suitability of the parameters for normal distribution was evaluated with the Kolmogorov-Smirnov test, and it was determined that the parameters did not show normal distribution. After descriptive statistical methods (mean, standard deviation (SD), frequency), Spearman's rank correlation analysis was used to examine the relationships between the number of citations and continuous parameters. For analyses of categorical parameters, the Kruskal-Wallis test (post-hoc Dunn's test) was used between more than two groups, and the Mann-Whitney U test was used between the two groups. The Poisson regression in a generalized linear model was applied for multivariate analysis to evaluate the

effects of the parameters, which were found to have significant associations with the number of citations in univariate analyses. Significance was set at $p < 0.05$.

Results

Citation Numbers, Citation Benchmarking Percentiles and Fwci Scores

The top-cited letter, written on COVID-19, was published by the International Endodontic Journal. Supplementary Table 1 lists the 100 top-cited letters. The mean and SD of citation numbers per item were 10.75±15.25 and 11.77±15.99 for WoS and Scopus, respectively. These descriptive values were calculated as 11.23±11.23 when the higher citation numbers for each item were taken into account.

Citation benchmarking percentiles of 86 letters were obtained from Scopus. The mean and SD of the percentiles were 85.03±20.49. Of these letters, 16, with 7 to 58 citations, were within the 99th percentile.

The FWCI scores of 75 letters were available. The mean and SD of FWCI scores were 7.63±12.27.

Alternative Metrics

Twenty-one of the letters achieved an AAS. Of the letters with an AAS, 20 were mentioned in tweets, and one was mentioned in blogs. The mean and SD of AAS (n = 100) were 0.7±2.47. The letter that was mentioned by 25 tweeters had the highest AAS of 15 and was in the top 25% of all research outputs scored by Altmetric.

According to PlumX, 17 letters attracted the attention of social media. The letter that attracted the most attention was the subject of 521 shares, likes or comments on Facebook. When the results of the two aggregators were combined, 22 letters appeared to attract social media attention. In the category of mentions, no letter had a metric. The mean and SD of captures and usage were 23.01±38.89 and 70.27±220.59, respectively. Figure 2 shows the total scores for the letters (n = 100) from Altmetric and PlumX data sources.

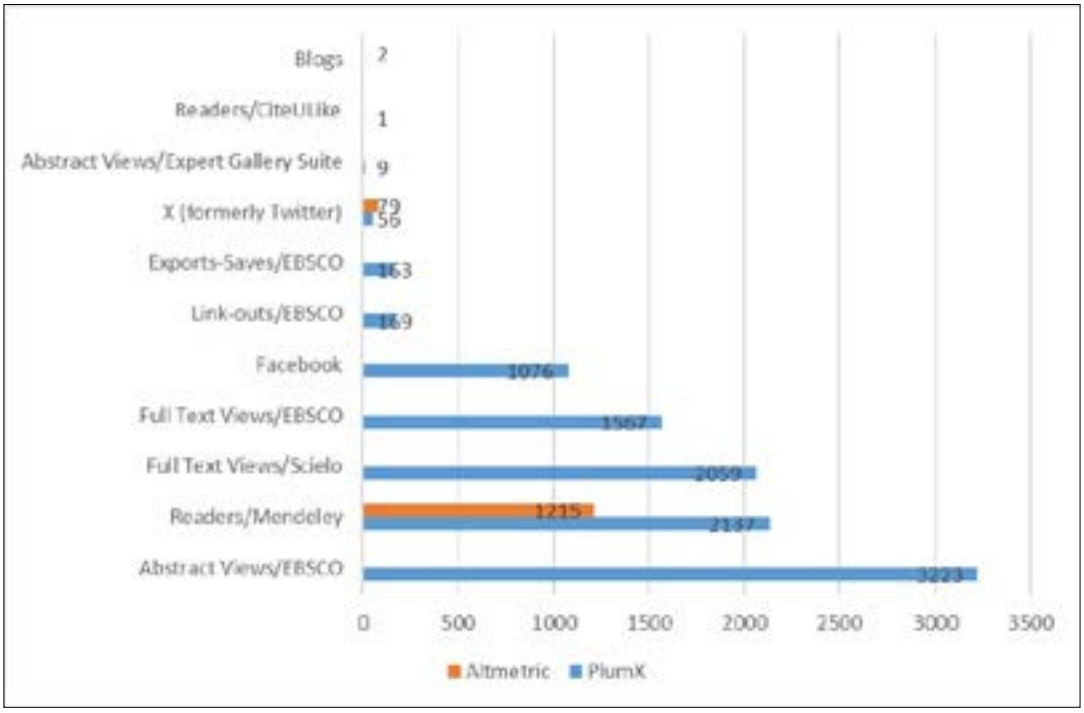

Figure 2: Total scores for all letters provided by Altmetric and PlumX utilizing various data sources.

Table 1 shows the correlation test between the number of citations and continuous parameters. A positive and moderate ($r = 0.31$) correlation ($p = 0.002$; $p < 0.05$) was found between the number of citations and captures.

Table 1: Correlation between the number of citations and AAS, captures and usage

Continuous Parameters	Number of Citations	
	r	p
AAS	0.038	0.705
Captures	0.310	0.002*
Usage	0.031	0.762

*$p < 0.05$ (Spearman's rank correlation test)

Journals and Publication Years

The 100 top-cited letters were published in 35 different journals. 39 of the letters were published open access. The journal that published the most letters was the International Endodontic Journal (IEJ) (n = 21, total citation number (TCN) = 265), followed by the Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology (OOOO) (n = 10, TCN = 72) and the British Dental Journal (BDJ) (n = 9, TCN = 75). Biblioshiny showed that these were core journals. When considering TCN, the second and third ranked journals were replaced by the Journal of Biological Regulators and Homeostatic Agents (n = 2, TCN = 103) and the Journal of Endodontics (JOE) (n = 8, TCN = 92), respectively. Twelve different non-endodontic dental journals published 36 of the letters and 16 non-dental journals published 18. Figure 3 illustrates the dynamics of the 5 most productive journals in a cumulative manner.

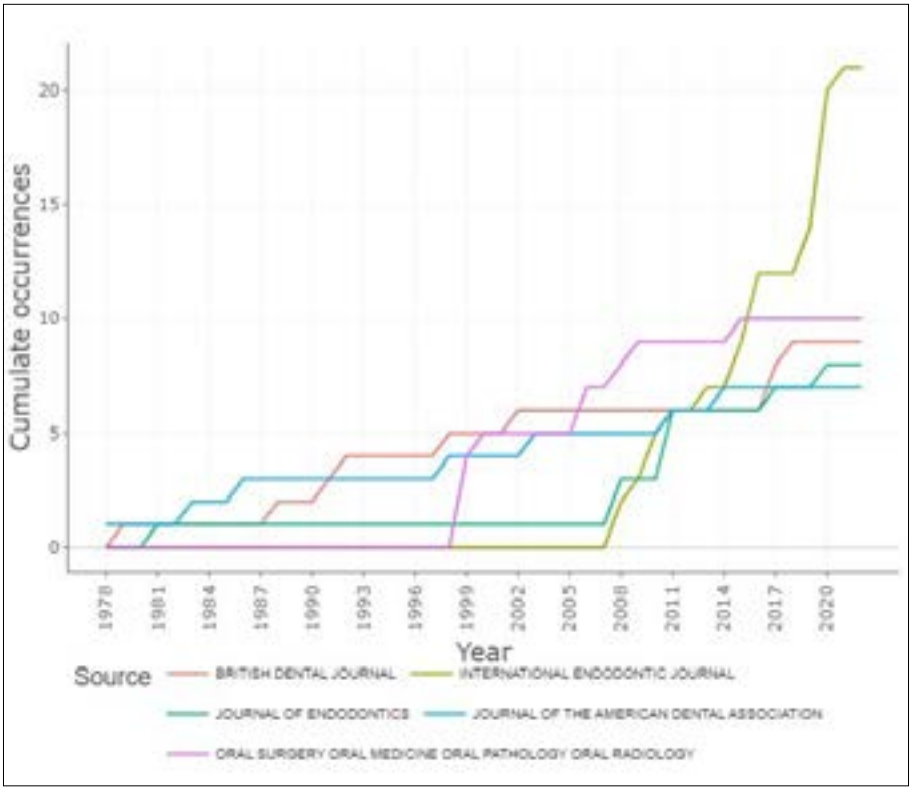

Figure 3: A graph showing the dynamics of the 5 most productive journals in a cumulative manner.

Journal type was the only parameter that significantly affected the number of citations among all categorical parameters tested (Table 2). The post-hoc Dunn's test revealed that the number of citations from non-dental journals was significantly higher than those from dental ($p = 0.001$) and endodontic ($p = 0.018$) journals. The dental and endodontic journals did not differ significantly. Poisson regression analysis was revealed that the non-dental journal type and the number of captures increased the number of citations by 2.533 and 1.008 times, respectively (Table 3).

Table 2: Descriptive characteristics and univariate statistical tests of categorical parameters in terms of the number of citations

Categorical Parameters		n	Number of Citations	
			Mean±SD (Median)	p
Publishing model	Open access	39	12.95±14.78 (7)	[a]0.650
	Subscription-based	61	10.13±8.16 (8)	
Journal type	Dental	36	7.61±6.50 (5)	[b]0.001*
	Non-dental	18	19.94±16.42 (13)	
	Endodontic	46	10.65±10.08 (7)	
Social media	Yes	17	15.94±18.68 (7)	[a]0.982
	No	83	10.26±8.87 (7)	
Collaboration type	National	14	18.14±20.22 (8.5)	[b]0.748
	International	15	12.33±12.56 (7)	
	Single-institutional	37	11.03±9.10 (7)	
	Affiliated single authorship	24	7.92±4.77 (5.5)	
	Unaffiliated	10	8.60±6.98 (6)	

SD: Standard Deviation, [a]Mann Whitney U test, [b]Kruskal Wallis Test, *$p < 0.05$.

Table 3: The Poisson regression analysis.

Parameters	Odds Ratio	95% Confidence Interval		p
		Lower	Upper	
Journal type (non-dental)	2.533	2.182	2.939	0.001*
Captures	1.008	1.007	1.009	0.001*

*p < 0.05

The letters had a mean age of 14.1 years. The year 2020 had the greatest number of top-cited letters (n = 11) (Figure 4). The 2010s (n = 40) and 2000s (n = 25) were the two most productive decades.

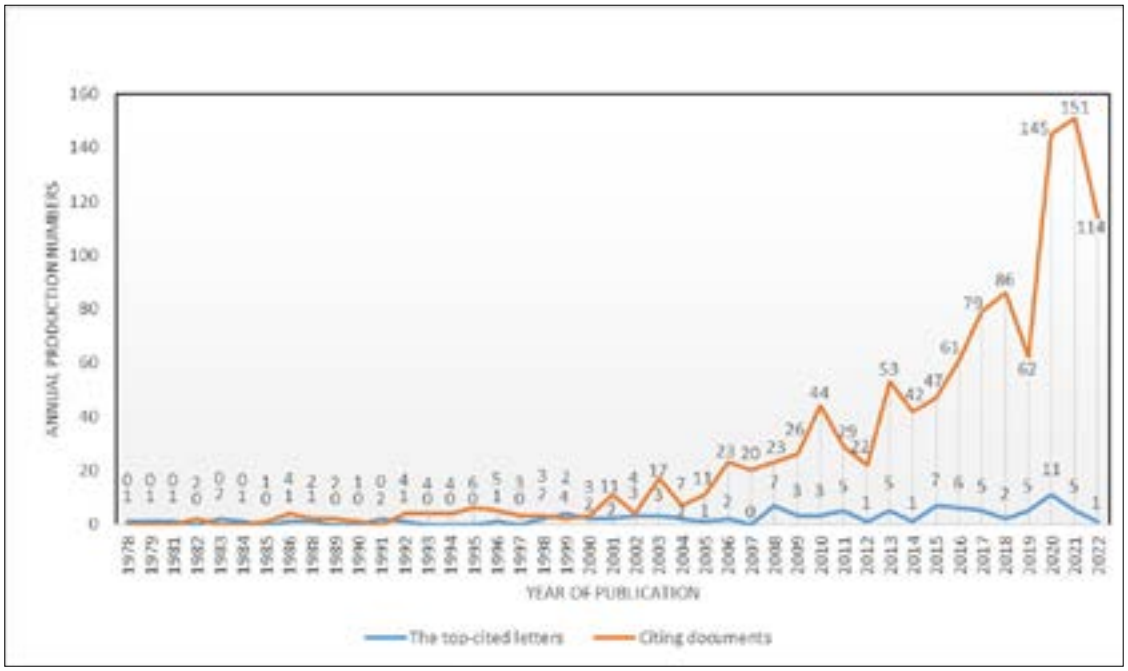

Figure 4: A graph that shows the annual production numbers of the top-cited letters and documents referring to one of them at least.

Authors, Institutions and Countries

The 100 top-cited letters were written by 281 different authors. While most authors contributed to only a single letter, 21 authors had their signatures on two separate letters. The most prolific author was G. De-Deus, as the first author of four letters, followed by E. Souza and M. Versiani (n = 3). The average number of authors per letter was 3.11. There were 32 monographs. Most letters (n = 57) had between two and five authors. Each of the nine different letters was signed by six to 10 authors. The remaining two letters were written by 11 and 16 authors, respectively.

There was a total of 73 institutions with which the first authors were affiliated. The most prolific institutions were the Academic Centre for Dentistry Amsterdam, the Saveetha University and the University of Sao Paulo (n = 3). Each of the 11 different institutions contributed two letters. When all the authors of a letter were considered, 37 letters were observed to be produced by a single institution, and by 14 national and 15 international collaborations. Of all the letters, 24 were written by a single author affiliated with an institution, whereas the authors of 10 letters were not affiliated with any institution.

The letters originated from 22 countries. The most prolific country was the United States of America (n = 20), followed by Brazil (n = 14), India (n = 8), Italy (n = 8) and the United Kingdom (n = 8).

Types of Subspecialties, Letters, Previous Documents Commented on, and Comments

Eleven of the letters were considered to be associated with two subspecialties. The largest number of letters belonged to the subspecialty of regenerative endodontics (n = 10, TCN = 224), followed by endodontic complications (n = 9, TCN = 67).

Examination of the letters revealed that there were 13 different types of letters: author's reply (1), case(s) (2), comment on previous document(s) (CPD) (3), case(s) and CPD (4), response to editorial policy and CPD (5), editor's reply (6), opinion (7), re-discussion (letter type in which the author mentioned their document) (8), in vitro research (9), consensus report (10), presentation of data from an observational study (11), presentation of data from an observational study and CPD (12) and presentation of data from a retrospective cohort and CPD (13). Type 3 was the most frequent (n = 31), and type 7 received the largest number of citations (TCN = 349) (Supplementary Table 2).

Forty-one letters featured comments, either as the whole of the letter (type 3) or as one of its constituent parts (types 4, 5, 12

and 13). Five of these letters had two types of comments (Supplementary Table 3). Article (n = 25) was the most common type of document commented on. The most common type of comment was a negative critique of the results' interpretation (n = 17).

Cited References

The 100 top-cited letters cited a total of 818 references. While 13 of the letters had no cited references, nine of them had only one reference. Most letters (n = 53) had between two and ten references. Each of the remaining 25 letters had more than ten references. A co-citation analysis was performed with VOSviewer using the 'cited references' option as a unit of analysis. The analysis revealed that some of the 818 references are connected to each other. Figure 5 shows the largest set of connected references.

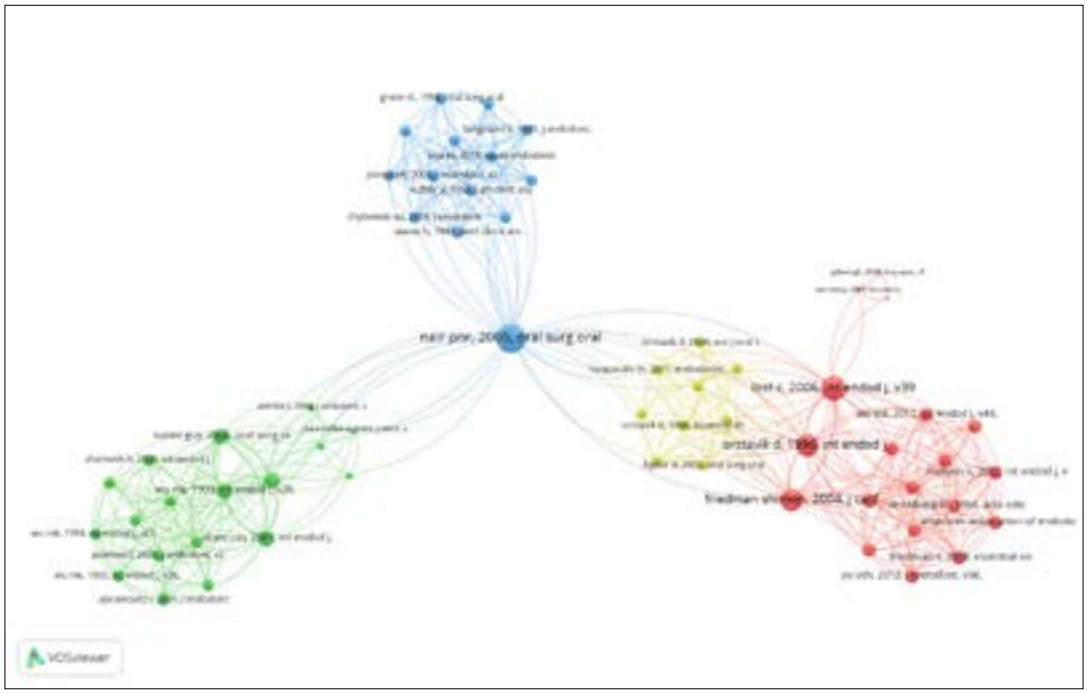

Figure 5: A network map that shows the largest set of connected cited references (n = 60). In the software program, the 'LinLog/modularity' option was selected in the 'Normalization Method' drop down list. To update the layout, the default values were altered, with 2 serving as the attraction value and -1 as the repulsion value. Colors are used to represent four distinct clusters. The label size denotes the frequency of the examined item. The links between the labels show references that were cited in the same letter.

Discussion

Besides raw citation numbers, metrics of FWCI and citation benchmarking percentile are also used to determine a document's impact. The FWCI is the ratio of the document's citations to the average number of citations received by all similar documents over a three-year window. It considers publication year, document type and disciplines linked with its source [14]. In the present study, 71 of the letters had a FWCI score greater than 1, indicating that they obtained more citations than the expected world average. Furthermore, 16 letters had a percentile rank of 99, placing it in the top 1% worldwide. These 16 letters were published in journals related to endodontics or general dentistry, so they can be considered influential examples of letters that have been published in dentistry journals.

In the present study, we used two aggregators providing alternative metrics: Altmetric gave scores for only 21 out of 100 letters, while PlumX's coverage reached 97. In a previous study, Doğramacı and Rossi-Fedele found that Altmetric scored 37% of endodontic documents published in 2019 and that the document type affected both the Altmetric coverage rate and score [7]. Their study, which did not include letters as a document type, presented a significantly lower mean AAS of 0.34 for case report compared to that of the other types. The present study's mean AAS of 0.7 was compatible with this score. In the present study, the average age of the letters was 14.1 years, and the number of the letters published in 2019 and later was only 22. We think that the publication date of documents may also affect the coverage rate due to the possible temporal changes in the overall alternative events that Altmetric specifically tracked. To our knowledge, no study has yet evaluated the coverage rate of PlumX for endodontic documents.

Predictors of citations have received significant attention from researchers. Doğramacı and Rossi-Fedele found that having an AAS significantly increased the number of citations in endodontic articles published in 2019 [7]. However, Kolahi et al. did not observe a correlation between these two parameters in articles with an AAS greater than 5 [11]. Our results show that most of the top-cited letters did not have an AAS. There was also no significant correlation between AAS and the number of citations, consistent with the results of Kolahi et al. In their unique statistical analysis, Doğramacı and Rossi-Fedele applied the AAS parameter categorically, as present or absent, rather than quantitatively. In Kolahi et al.'s study, as in the present study, there was no limitation regarding the year of publication of the evaluated documents. There were no letters among the types of endodontic documents evaluated by Doğramacı and Rossi-Fedele. Therefore, we believe the discrepancy in the results is related to the differences in statistical methodology and the types and publication years of the documents evaluated.

Doğramacı and Rossi-Fedele found that publication model and journal type had no significant effect on citations [7]. The present study's findings were also not in favor of open-access publishing. There were fewer open access letters (n = 39), and although their mean (12.95) was higher than that of subscription-based ones (10.13), the difference was not statistically significant. However, we found that the non-dental journal type significantly increased the number of citations. We classified journals into three groups: endodontic, dental, and non-dental, whereas they had classified journals into endodontic or non-endodontic groups. We think this methodological difference may explain the inconsistency of the results.

In 1934, Bradford described his bibliometric law, with the following claim:
If scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same numbers of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as 1: n: n2 ... [15].

The accuracy of Bradford's law was supported by some studies on top-cited articles [16]. JOE was the most prolific source in all similar endodontic analyses, publishing 36% to 70% of the top-cited articles. IEJ was in the second position, except for one analysis [3,4,6]. IEJ, OOOO and BDJ were identified as the core journals in the present study. Interestingly, a non-endodontic dental journal, BDJ, was in the core zone, whereas the 4th-ranked JOE was not. We think the core journals identified in such analysis may not accurately represent the relevant subject because the journals that publish the most articles may not also publish the largest number of top-cited articles [17].

For the first time in 2019, regenerative endodontics emerged as the second most frequent subspecialty in a previous citation analysis [4]. As in the current study, it was found to be the most frequent subspecialty in a study that analyzed only the top-cited case reports and case series in 2021 [6]. We anticipate that various articles on regenerative endodontics will continue to receive frequent citations by maintaining their impact, at least in the short term. COVID-19 was a newly recognized subspecialty in this research, and it was also the most common (n = 7) among all subspecialties of the letters scored by Altmetric. The COVID-19 pandemic has highlighted the importance of letters in the medical sciences by demonstrating that they can be a source of critical peer-reviewed information [18].

We observed that ten letters were written to comment on a previous document and for a secondary purpose, such as presenting data from an observational study or retrospective cohort. A similar complicated letter was not reported in previous bibliometric studies, which also labelled certain letters as 'presenting initiatives', 'other – not relating to original journal material' or 'miscellaneous' [19-21]. These non-detailed classifications may have resulted in fewer letter types than those we identified. The most prevalent letter type in the present study was CPD. By identifying this type frequently, most bibliometric studies also highlighted its importance [19,21,22]. A cohort study by Tierney et al. revealed that Clinical Otolaryngology gave priority to the letters discussing previous documents among all other letters [20]. Therefore, the proportions of letter types reported by cohort studies were mainly determined by author preferences and editorial policies, but not citation numbers. Citation analyses can provide distinct insights from those obtained through cohort studies because a top-cited letter occurs when additional scientific dynamics come into play after its publication. For example, this analysis indicated that the letters written by the authors to express their opinions on a free topic received the most citations. This finding is consistent with Peritz's observation that 'reacting' letters published in The Lancet are less cited than 'spontaneous' ones [22].

A bibliometric analysis of letters submitted to the British Medical Journal in 1989 found that 'research paper' was the document type commented on most frequently in published letters. The journal published more of the letters disagreeing with commented documents than those agreeing [23]. However, when the letters published by the Medical Journal of Australia in 1991 were analyzed, the relevant document type was determined as 'letter' [21]. Another study found that the leading otolaryngology journals published more agreeing letters than letters including any other comment types within the specified periods [20]. In the present study, 'article' was found to be the most common type of document that was commented on, and most of the letters that included comments on a previous document featured various forms of negative critique. Hence, letters with disagreeing comments may tend to attract more citations than those agreeing in endodontics. In our study, the most frequent type of comment on articles was the negative critique of the research method. This finding was consistent with those revealed by studies that analyzed the contents of cross-sectional samples of letters commenting on the original articles published in leading medical journals [20,21,24].

In studies examining the parameters affecting number of citations, some parameters found significant in basic statistical tests may lose their significance if all significant parameters are analyzed simultaneously by a multivariate test appropriate to the distribution of data [7,25]. One of this study's strengths is that the significance of the two parameters determined to be significant by univariate tests was confirmed using a multivariate test. However, several inherent limitations of citation analyses should not be overlooked. For example, the number of citations received by a document does not provide sufficient information about its scientific quality [26,27].

Conclusion

This study revealed the following key features of the top-cited letters: In recent years, the number of documents citing the top-cited letters has increased, indicating that the letter is becoming more important in endodontic literature. Letters expressing opinions on any free topic were the most cited letter type; additionally, publication in a non-dental journal increased the number of citations. Captures can prove effective in predicting future citations.

Conflict of Interest: None declared.

Authorship Contributions

Idea/Concept: Bülent Yılmaz; Design: Bülent Yılmaz, Muzaffer Emir Dinçol; Control/Supervision: Bülent Yılmaz; Data

Collection and/or Processing: Bülent Yılmaz, Muzaffer Emir Dinçol; Analysis and/or Interpretation: Bülent Yılmaz, Muzaffer Emir Dinçol; Literature Review: Bülent Yılmaz, Muzaffer Emir Dinçol; Writing the Article: Bülent Yılmaz; Critical Review: Muzaffer Emir Dinçol.

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