ORIGINAL ARTICLE

Articles published in the Giornale Italiano di Endodonzia from 1987 to 2021: a bibliometric analysis

ABSTRACT

Aim: The "Giornale italiano di Endodonzia" (GIE) is a peer-reviewed journal founded in 1987. It is the official journal of the Italian Society of Endodontics (SIE) and it is currently indexed in Scopus and Embase. In order to offer a comprehensive and quantitative evaluation of the scientific journal production, we carried out a bibliometric analysis of the complete collection of articles published on GIE.

Methodology: We searched the journal website archive for the non-indexed articles and Scopus database for the indexed articles published until March 2022. Relevant data were extracted from each article. Bibliometric analysis was performed using Biblioshiny, Publish and Perish and VOSviewer.

Results: A total of 601 documents were found, 246 (41%) of them were indexed in electronic databases. The annual production ranges from 4 (1987) to 37 (2021) with a mean annual growth rate of 6,76%. The most frequently published studies were in vitro/ex vivo studies. The total number of citations was 454. Dabelian 2016 was the most cited document with 29 citations. 1,177 different authors contributed with at least 1 article. Gagliani M was the most contributing author with 34 documents. The most cited author was Iandolo A with 78 citations. The most important contributing country was Italy, followed by Brazil and Iran. The most contributing institution was the University La Sapienza of Rome, followed by the University of Turin and the University of Naples. The most frequent keywords were "endo-dontics", "MTA", "CBCT", "cyclic fatigue" and "root canal treatment".

Conclusions: Bibliometric studies involve a rigorous process of analysis and classification of large volumes of bibliographic material to evaluate the impact of scientific publications, highlight the trend of topic interest and map the relationships between authors, documents, articles, affiliations and nations. GIE scientific production and number of citations have grown over the years. Some articles published on GIE had a moderate impact on the international literature. Alongside classic topics of interest, new "hot topics" have emerged regarding innovative materials and technologies.

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Introduction

The Giornale Italiano di Endo- donzia (GIE) was founded in 1987 and is the official journal of the Società Italiana di Endo- donzia, SIE (Italian Society of Endodontics). Formerly named Giornale di Endodonzia, it is a peer-reviewed journal currently available only in electronic for- mat. It publishes original scientific articles, reviews, clinical articles, case reports, book reviews, summaries, abstracts of scientific meetings and news in the field of Endodon- tology. GIE is indexed in Scopus (from 1990 to 1991 and from 2011 to now), Science Direct (from 2011 to 2018) and Embase (from 1990 to 1991 and from 2011 to now). Currently, it is published online by Ariesdue (Milan, Italy) and hosted by PAGEPress (Pavia, Italy), an Open Access scientific publisher. All articles are freely available on www.giornaleitalianoendo- donzia.it. New articles are published monthly in the Early View section, while the full Journal is issued twice a year, in June and November. Considering the year 2020, GIE was the only Italian journal listed in CiteScore Rank for the category General Dentistry (Rank#89/111). Doubt- less, it is the most important Italian journal concerning Endodontology and over the years has published the scientific contri- butions of the most famous Italian research- ers and clinicians in this field. Since it was indexed in the major international biomed- ical databases, the number of potential readers and authors has greatly expanded. Bibliometrics, as firstly proposed by Pritchard in 1969, is the application of mathematics and statistical methods to books and other media of communications [1]. In other words, is a process of analysis and classification of bibliographic material by framing representative summaries of the extant literature [2]. Recently, several bibliometric analyses focused on the sci- entific production of selected dental journal have been published [3-5]. This type of research is aimed at publishers and editors to assess the extent to which the journal performs, as long as at researchers and scholars to identify suitable journals for publication or potential collaborators and areas of research.

In 2022 GIE achieved its 35th year of publi- cation and, to celebrate this anniversary, we want to offer, for the first time, a com- prehensive evaluation of the scientific journal production in order to examine productivity, performance, publication trends, impact and mapping bibliometric networks.

Methodology

We searched the journal website archive for the non-indexed articles and the Scopus database for the indexed articles. Relevant data were manually extracted from each non-indexed article. Searching was carried out in March 2022. Articles were classified into 8 categories: 1 - original clinical stud- ies (randomized controlled clinical trials, cohort studies, retrospective studies); 2 - *in vitro*, *ex-vivo*, animal original studies; 3 - systematic reviews; 4 - narrative reviews; 5 - case reports/case series; 6 - editorials, letters, communications, opinions; 7 - tech- nical notes; 8 - surveys.

Bibliometric metadata of indexed articles were exported from Scopus in BibTex format to import in Biblioshiny software [6], in RIS format to import in Harzing's Publis or Perish software (PoP) [7] and in CSV format to import in VOSviewer soft- ware [8]. Journal metrics (CiteScore, SCIma- go Journal Rank, Source Normalized Im- pact per Paper, h-index) were obtained and reported. The calculation of Citescore for the current year was based on the number of citations received by the journal in the latest four years, divided by the number of documents published in the journal in those four years [9]. SCImago Journal Rank (SJR) is a measure of the scientific influence of scholarly journals that accounts for both the number of citations received by a jour- nal and the importance or prestige of the journals where the citations come from [10]. SJR indicator is a numeric value represent- ing the average number of weighted cita- tions received during a selected year per document published in the journal during

Table 1
Main information about GIE

Journal name	Giornale Italiano di Endodonzia Formerly Giornale di Endodonzia
Timespan	1987-2021
Current Publisher	Ariesdue Srl
Number of documents	601
Number of documents indexed in Scopus	246 (41%)
CiteScore	0,6
SJR 2020	0,160
SNIP 2020	0,260
Total citations	463
H-index	12
Authors	1,177

the previous three years, as indexed by Scopus. Higher SJR indicator values are meant to indicate greater journal prestige. Source Normalized Impact per Paper (SNIP) was calculated as the number of citations given in the present year to publications in the past three years divided by the total number of publications in the past three years (10). It is a metric that intrinsically accounts for field-specific differences in citation practices. The h-index measures the productivity and citation impact and it is the maximum value of h of such that the given author published at least h papers that have been cited at least h times (11). The publication trend by year, the annual growth rate and the citation trend by year were calculated and graphed. The production of publications by country was calculated and mapped with the dedicated function in Biblioshiny. The 10 most active affiliations as well as the most productive authors were identified and reported. Using PoP software the following data were reported for each author: total citations (TC), number of cited papers (NCP) and citations per cited paper (C/CP). C/CP was calculated by dividing the total number of citations by the total number of cited papers.

The 5 most cited articles were identified and reported. Co-authorship analysis was conducted with VOSviewer to measure the extent to which countries collaborated among them. Keywords analysis was done using WordCloud function of Biblioshiny. Analysis of co-occurrence of keywords was carried out with VOSviewer and showed selecting overlay visualisation.

Results

Main information were resumed in the Table 1. A total of 601 documents were found, with a mean of 17,7 documents per year. 246/601 articles (41%) were indexed in Scopus, while the remaining 355 were consulted on the online journal archive. Sixty-one studies were classified as original clinical studies, 276 as *in vitro*, *ex-vivo* or animal original studies; 4 as systematic reviews; 72 as narrative reviews; 93 as case reports/case series; 28 as editorials, letters, communications or opinions; 58 as technical notes; and 9 as surveys. The first randomized controlled clinical trial was published in 2004 (12).

1,177 different authors contributed with at least 1 article and 108 documents were single-authored. The annual production ranges from 4 (1987) to 37 (2021) with a mean annual growth rate of 6,76% (Fig. 1). The total number of citations, as reported by Scopus for indexed articles, was 454. 2016 was the year in which the articles with the highest number of citations (98) were published. The citations per citable years trend was reported in Figure 2. Regarding this parameter, 2016 was the year
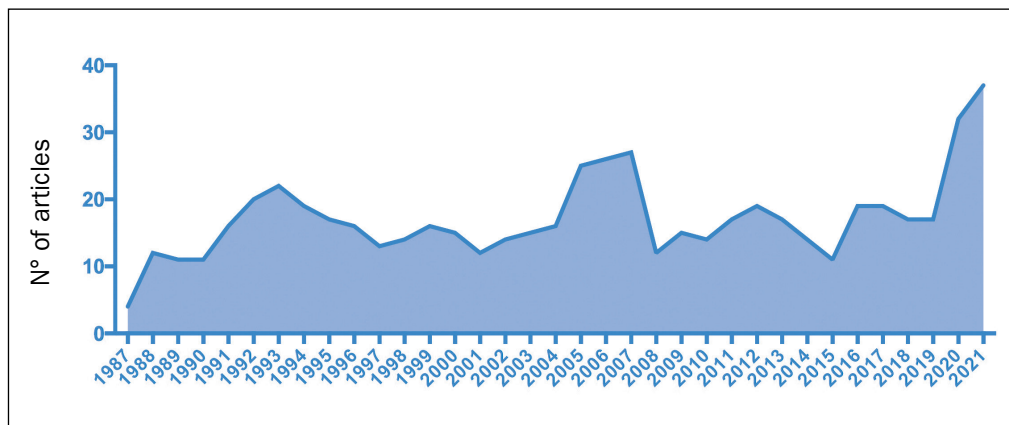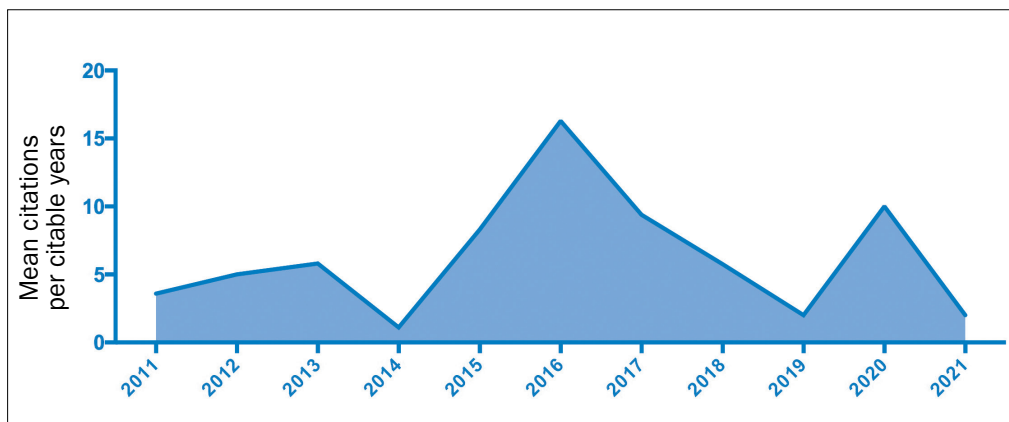
Figure 1
Number of publications by year.

Figure 2
Citation trend by year. The "y" axis values were obtained by dividing the number of citations received by articles published in that year by the number of citable years (e.g. articles published in 2020 received 20 citations in 2 years, then the average citation per citable years is 10).

with the highest value, while 2014 was the year with the lowest value. As expected, Italy was the most important contributing country, followed by Brazil and Iran (Fig. 3). The most contributing affiliations were Università La Sapienza di Roma, Università di Torino and Università di Napoli Federico II with 38, 29 and 26 documents,

Table 2
Top-10 most active authors

Author Name	N° of authored articles	Affiliation	Country
Gagliani M	34	Università degli Studi di Milano, Milan	Italy
Gambarini G	28	Università La Sapienza di Roma, Rome	Italy
Rengo S	28	Università degli Studi di Napoli Federico II, Naples	Italy
Berutti E	22	Università degli Studi di Torino, Turin	Italy
Malagnino VA	20	Università degli Studi G. d'Annunzio di Chieti, Chieti	Italy
Cavalleri G	19	Università di Verona, Verona	Italy
Gerosa R	19	Università di Verona, Verona	Italy
Plotino G	19	Private practice, Rome	Italy
Castellucci A	18	Private practice, Florence	Italy
Testori T	17	Università degli Studi di Milano, Milan	Italy

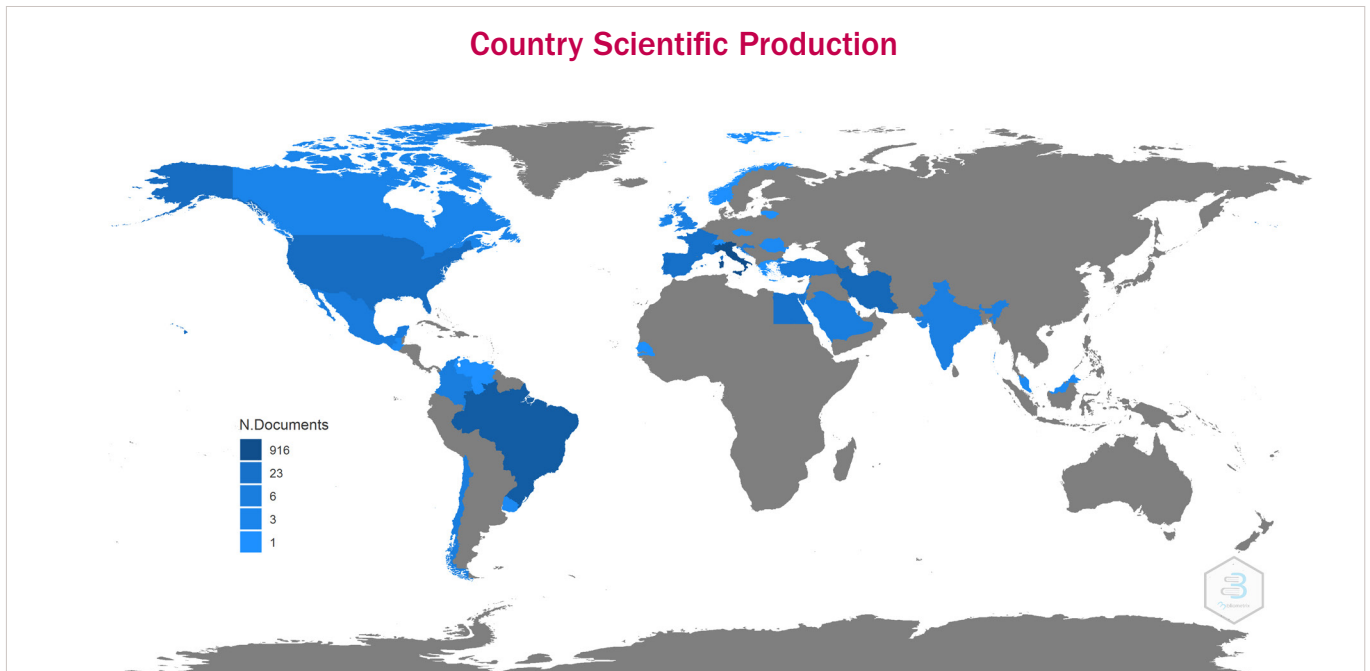## Country Scientific Production

respectively. The most productive authors were Gagliani M, Gambarini G and Rengo S with 34, 28 and 28 articles, respectively (Table 2). The most cited author was Iandolo A from Università degli Studi di Salerno with 78 citations. Metrics of the most cited authors are reported in Table 3. The article entitled "The use of premixed bioceramic materials in endodontics" by Dabelian et al. published in 2016 was the most cited document with 29 citations (13) (Table 4). Co-authorship analysis conducted at country level showed international collaborations of Italian authors with colleagues from Brazil, US, India, Egypt, Turkey and UK (Fig. 4). In the picture, the size of circles (items) relates to the production weight of each country, while the links connecting

Table 3
Top-10 most cited authors

Author name	Total citations	Affiliation	Country	NCP	C/CP
Iandolo A	74	Università degli Studi di Salerno, Salerno	Italy	8	9,3
Rengo S	48	Università degli Studi di Napoli Federico II, Naples	Italy	5	9,6
Gambarini G	48	Università La Sapienza di Roma, Rome	Italy	8	6
Plotino G	42	Private practive, Rome	Italy	9	4,7
Angerame D	37	Università degli Studi di Trieste, Trieste	Italy	6	6,2
Grande NM	29	Università Cattolica del Sacro Cuore, Rome	Italy	5	5,8
De Biasi M	22	Università degli Studi di Trieste, Trieste	Italy	5	4,4
Pappen FG	13	Universitade Federal de Pelotas, Pelotas	Brazil	3	4,3
Gagliani M	11	Univesità degli Studi di Milano, Milan	Italy	3	3,7
Berutti E	6	Università degli Studi di Torino, Turin	Italy	4	1,5

NCP: number of cited papers, C/CP: citations per cited papers.

Table 4
Top-5 most cited articles

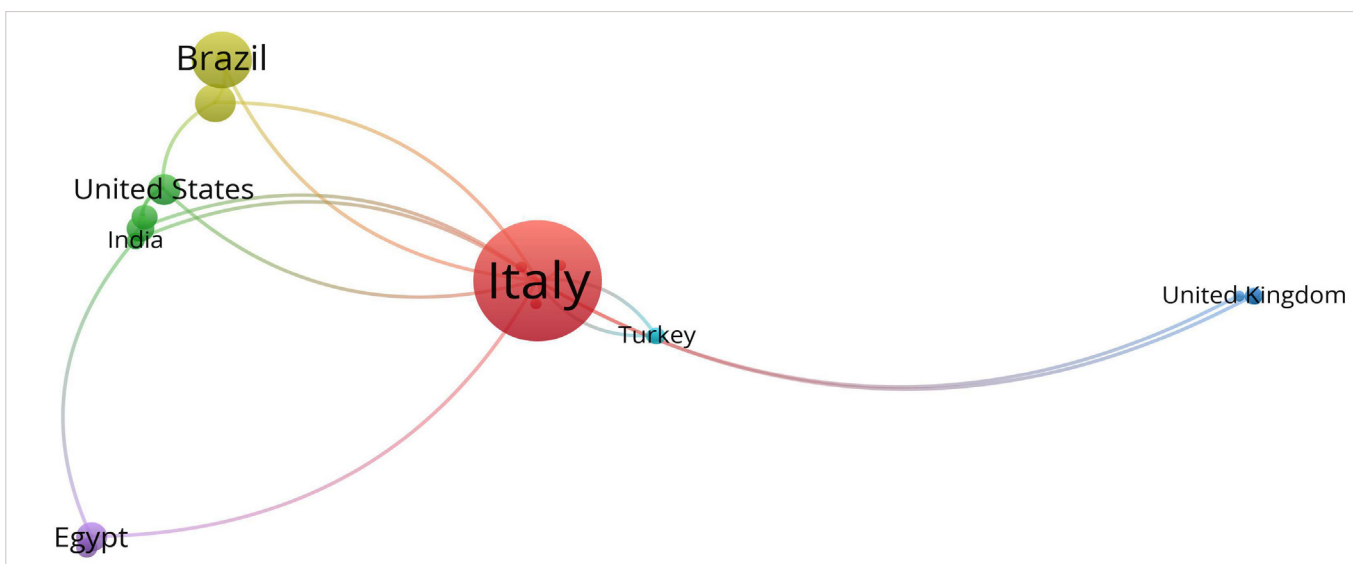| Title	Authors	Year	Citations
The use of premixed bioceramic materials in endodontics (13)	Debelian G., Trope M.	2016	29
Cyst-like periapical lesion healing in an orthodontic patient: a case report with five-year follow-up (15)	Paduano S., Uomo R., Amato M., Riccitiello F., Simeone M., Valletta R.	2013	22
Biodentine: from biochemical and bioactive properties to clinical applications (14)	About I.	2016	21
Operating microscope: diffusion and limits (17)	Riccitiello F., Maddaloni G., D'Ambrosio C., Amato M., Rengo S., Simeone M.	2012	21
IG-File: a novel tool to improve root canal cleaning and measurement of the apical foramen (16)	Iandolo A., Ametrano G., Amato, M., Rengo S., Simeone M	2011	19

the circles refer to collaborations. The distance among the circles relates to the strength (frequency) of collaborations. The closest international collaboration of Italian authors was with colleagues from Turkey. The most frequent keywords were "endodontics", "MTA", "CBCT", "cyclic fatigue" and "root canal treatment" (Fig. 5). Co-occurrence keywords analysis was performed using VOSviewer software. The overlay visualization showed in Figure 6 report information regarding the weight of the single terms, the co-occurrence of them (links among circles) and the evolutions of terms over times. Keywords appeared more recently were coloured in yellow. While keywords such as "apexification", "composite", "microscope" and "gutta-percha" where used more frequently earlier in the time range considered, keywords such as "Wave one", "Protaper gold" and "pain" appeared later.

Discussion

The Giornale Italiano di Endodonzia has been a reliable reference for more than thirty years for all general dentists practicing endodontics and for endodontic specialists. Initially aimed at

Figure 4
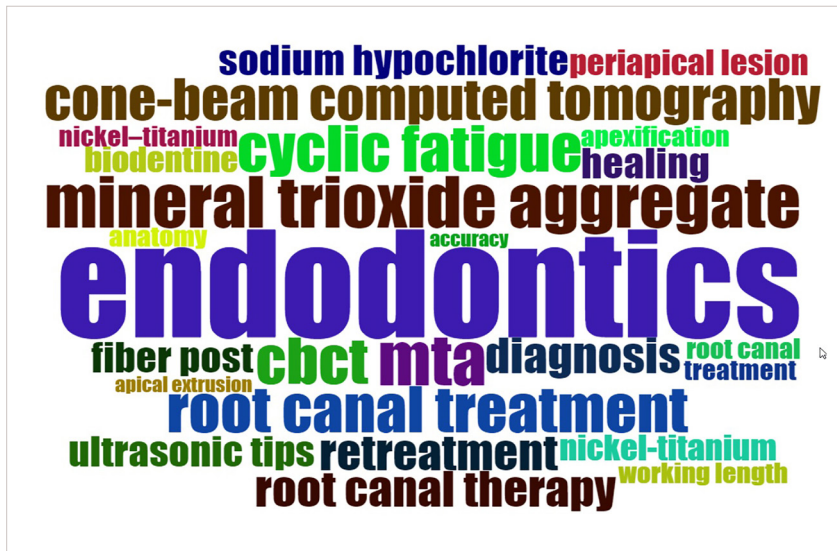Co-authorship analysis conducted at country level.

Figure 5
Most frequent author keywords showed as a wordcloud.

Italian readers, since it started publishing articles exclusively in English and was indexed on the main international databases, it has interested a greater number of readers, even outside the national borders. Likewise, foreign authors have considered GIE for publications of their research. In an era in which the quantification of scientific production and the analytical assessment of its impact are playing an increasing role, bibliometric analysis has progressively gained attention among scholars. The availability of freeware software to conduct such analyses, such as those utilized in this study, has greatly facilitated carrying out bibliometric investigations. Less than half of the studies published on GIE are indexed on Scopus, specifically the articles published from 1990 to 1991 and from 2011 to now. All the counts concerning the citations involved only the indexed articles, as it was not possible to trace the number of citations of the non-indexed articles. Most of the articles were signed by multiple authors and more than a thousand different authors authored at least one article. Many but not all the single-authored articles were Editorials. Eleven of the 34 articles by the most productive author (Gagliani M) were Editorials. The most cited author was Iandolo A.: his ten articles investigated cleaning with irrigant solutions, the resistance of modern NiTi instruments and technical

aspects of root canal treatment. Two of the top-5 most cited articles, specifically the first and the third, are literature reviews dealing with the "new" calcium silicate hydraulic cements and were authored respectively by 2 American authors and 1 French author (13, 14). The second most cited article, authored by Italian researchers, was a case report of a successfully non-surgical root canal treatment of the upper central incisors associated with a large cist-like lesion in a patient undergoing orthodontic treatment (15). The fourth and the fifth most cited articles, both authored by Italian researchers, were respectively a survey on the use of the operating microscope in endodontics and an *in vitro* study on a new file created for sonic activation of irrigants and apical gauging (16, 17). The observation that the first three most cited articles are assignable at low levels of the hierarchy of evidence (literature reviews and case reports) leads to some considerations. A robust scientific methodology does not always correspond to a high impact in the literature (number of citations), in particular in journals such as GIE which are not aimed exclusively at those involved in research but also at clinicians involved in everyday practice. This fact should be kept in mind for example by young researchers who need citations to improve their bibliometric performances for advancement in their academic career.

Almost half of the published studies (46%) consisted of *in vitro* or *ex vivo* investigations plus a few studies conducted on animal models. The preferred study models were human extracted teeth. These types of studies are generally easier to conduct than clinical studies and allow to investigate the subject of research under strictly controlled conditions. On the other side, the conclusions obtained from these studies cannot always be transferred to the clinical situation. The second most frequent type of article was the case report/case series. This type of publication, although has little scientific value, is indicated for reporting peculiar cases due to the type of pathology, the clinical manifestations, the difficulty of treatment or the outcome of the therapy. This type of article is attractive
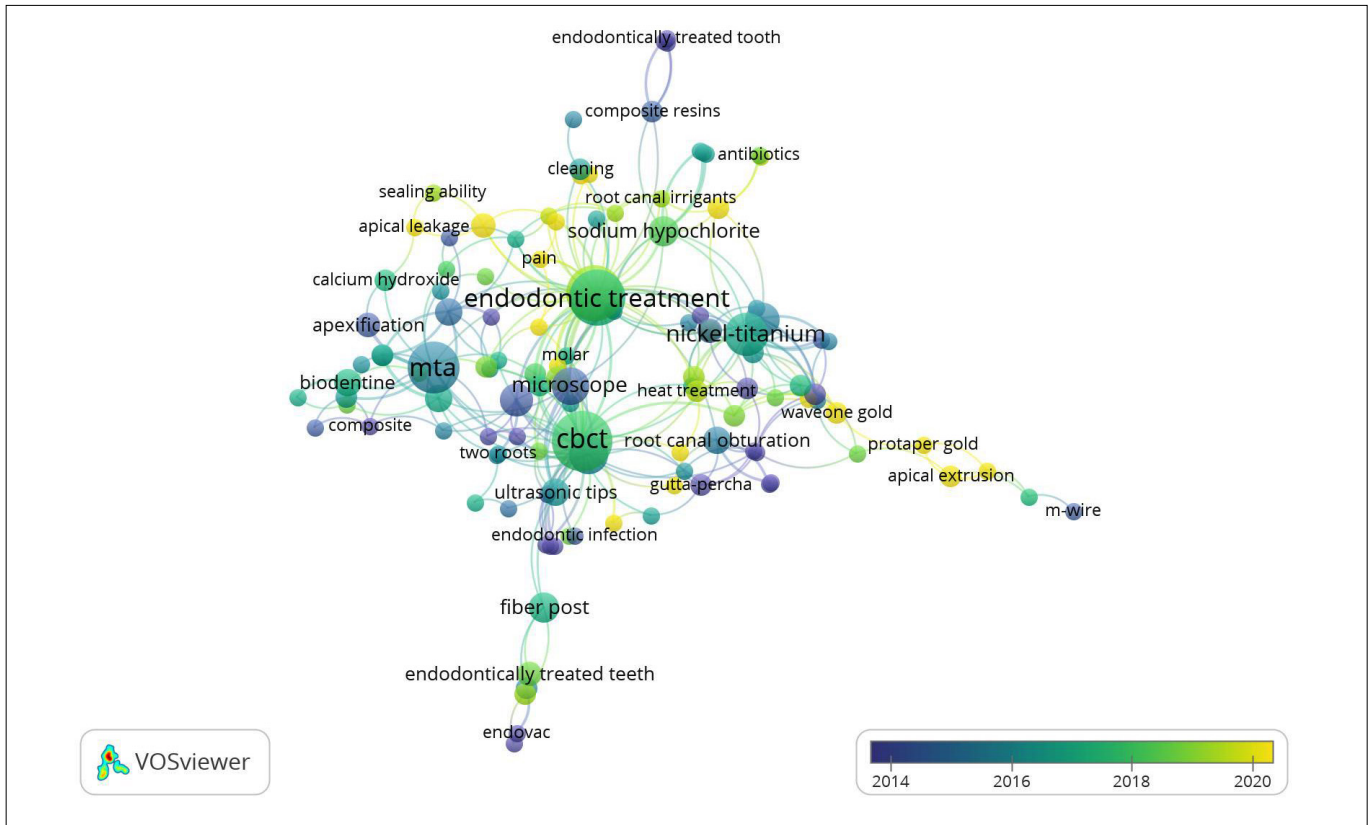
mainly for clinicians who can draw useful lessons for their daily activities. The third most frequent type of article was the narrative review. In this type of article certain specific topics are addressed based on the available literature. Compared to the systematic review, the methodology to write a narrative review is far less rigorous, but it represents a very useful educational tool to get quick and comprehensive information about a specific topic. Considering that technical aspects are often crucial in endodontic practice, it is not surprising the high number of articles classified as technical notes. In this kind of publication particular techniques or instruments are described in detail, often accompanied by images or illustrations and clinical instructions. Looking at these articles sorted chronologically is a good way to get an overview of the historical development of endodontology.

Among the outputs of bibliometric investigations, the maps of network analyses are probably the most attractive. Using VOSviewer it is possible to construct and visualize the newtwork of documents, authors, affiliations or countries based on co-authorship, citation and co-citation relations. In the images provided by the software the distance between two items approximately indicated the relatedness of the items. A simple and straightforward method to represent the keywords most used by authors is the so called "word-cloud", which is the visual representation of words that give greater prominence to words that appear more frequently. A more sophisticated investigation of keywords is represented by the overlay visualization of the co-occurrence keywords analysis. In this map, the keywords that are used together are linked by a line. The distance between two keywords approximately indicated the grade of co-occurrence. The frequency of the keywords correlates with the size of the circles. The colour of the circles expresses the currentness of the keywords. Such analyses are useful to appreciate the emerging trend in research topics. Figure 5 shows that heat-treated alloy instruments have gained a lot of at-

tention in the very last few years, as long as classical topics such as infection, apical leakage and pain. Only a few years earlier, however, studies on the use of CBCT were prevalent. Even before that, the most frequently published studies focused on MTA.

Conclusions

A bibliometric study implies a rigorous process of analysis and classification of large volumes of bibliographic material to evaluate the impact of scientific publications, highlight the trend of topics of interest and map the relationships between documents, articles, affiliations and nations. In recent years, GIE has progressively consolidated on a process of internationalization. Some articles published on GIE had a moderate impact on the international literature. Alongside classic topics of interest, new "hot topics" have emerged regarding innovative materials and technologies. To continue the progressive strengthening of this journal in the international panorama, it will be important to attract international researchers to publish their solid scientific papers on GIE and we hope that this article contributes to this direction.

Clinical Relevance

GIE proves the progress of Italian endodontics over the last 35 years and has become attractive also to the international scientific community.

Conflict of Interest

None.

Acknowledgement

None.

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