Altmetric analysis of the contemporary scientific literature in Endodontology

Abstract

Aim To analyze and visualize the knowledge structure of scientific articles in the field of Endodontology with high altmetric attention scores to discover hot topics, active researchers and which journals were involved.

Methodology On 5 June 2019 the altmetric database (Altmetric LLP, London, UK) was searched using the titles of 11 endodontic journals. Bibliometric data from endodontic articles and journals with an altmetric score>5 (top 5%) were retrieved from PubMed and analyzed using the VOSviewer. Science mapping of articles with an altmetric score>5 at two levels was created: author keywords co-occurrence and co-authorship network analysis.

Results Of the 2197 articles in the field of Endodontology identified with altmetrics, 192 had altmetric scores>5 (top 5%). Considering the total mentions among all altmetric resources, the Journal of Endodontics had the highest rank followed by the International Endodontic Journal and Australian Endodontic Journal. Twitter was the most popular altmetric data resource followed by patents andFacebook. Meta-analysis, systematic review and pulpitiswere the hot topics. At the author level, Dummer P.M.H had the greatest influence on the network. There was no significant correlation between altmetric score and citations count (P>0.05). Mendeley mentions correlated with citations (P<0.05).

Conclusions Overall, the altmetric scores of topics within Endodontology were low, possibly due to the specific and specialized nature of the specialty, as well as the difficulty members of the public probably have in understanding endodontic research. Journals and researchers with a focus on Endodontology would have more influence if they were to set-up their own social media profiles and thus enhance their visibility and social impact by immediately sharing research findings and communicating with their network and audience.

Keywords: altmetrics, endodontology, social media, Twitter, Facebook.

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Introduction

Altmetrics, short for alternative metrics, is a tool that measures both the volume and nature of the online attention surrounding research findings (Kwok 2013, Kolahi 2015a, Konkiel 2017, Warren *et al.* 2017) and thus complements traditional citation-based metrics, e.g. impact factor and H-index (Melero 2015). There are several resources for altmetrics, including Altmetric (altmetric.com), Plum Analytics (plumanalytics.com) and Impact Story (impactstory.org). Many publishers, including John Wiley & Sons, Taylor and Francis, the JAMA Network and Springer Nature use Altmetric; Elsevier Publishing uses Plum Analytics (PlumX metrics).

Data resources for altmetrics include: Twitter, Facebook (mentions on public pages only), Google+, Wikipedia, mainstream news outlets, scientific blogs, policy documents, patents, post-publication peer reviews (Faculty of 1,000 Prime, PubPeer), Weibo, Reddit, Pinterest, YouTube, online reference managers, e.g. Mendeley, and sites running Stack Exchange (Q&A) (Konkiel 2017, Patthi *et al.* 2017). The Altmetric Institution (Altmetric LLP, London, UK) uses different weighting values for the various data resources to calculate the altmetric attention score (Weighting algorithm is available via http://bit.ly/2QS9Qr2).

Altmetrics is very rapidin comparison to traditional citation-based metrics (Konkiel 2016). Traditional citation-based metrics can only be provided some years after publication. For example, it has been reported that only 50% of articles are cited in the first three years after publication or after 26 years (Wang 2013). On the other hand, the typical altmetric data resources are updated on a real-time feed (e.g. Twitter and Wikipedia) or daily-basis (e.g. Facebook and Googl+).

In a large-scale study, a significant correlation was found between six altmetric resources (tweets, Facebook wall posts, research highlights, blog mentions, mainstream media mentions and forum posts) and citation counts (Thelwall *et al.* 2013). A recent study that covered six PloS specialized journals, revealed a significant positive correlation between the normalized altmetric scores and normalized citations (Huang *et al.* 2018). The number of Twitter mentions can forecast highly cited articles within the first 3 days of their

publication (Eysenbach 2011). Also, blog mentions were able to recognize highly cited articles with greater levels of accuracy than journal citation scores. Among general and internal medicine journals, the number of Twitter followers is significantly correlated with citations and impact factor (Cosco 2015).

In contrast, it has been reported that altmetric mentions do not always reflect the impact of highly-cited articles when compared to traditional journal citation counts (Costas *et al.* 2015). A recent cross sectional study analyzed full-length original research articles published in specific high-impact general medicine journals and found that altmetrics correlated poorly with the number of citations (Barakat *et al.* 2019). Also, moderate correlation was reported among articles in the Cardiovascular field (Barakat *et al.* 2018) and a weak correlation was found among articles in the specialty of Radiology (Rosenkrantz *et al.* 2017).

In previous studies, the altmetric status of the general dental (Kolahi & Khazaei 2016a, 2018, Delli *et al.* 2017, Kolahi *et al.* 2017, 2019a,b, Kolahi & Iranmanesh 2018) and orthodontic literature (Livas & Delli 2018) was analyzed. However, the status of altmetrics among articles on Endodontology has not been studied.

Hence, in the context of increasing demand among Endodontists to disseminate research findings on the World Wide Web and social media, this study aimed to analyze and visualize the knowledge structure of articles in the field of Endodontology with high altmetric attention scores to discover hot topics, active researchers and journals.

Materials and Methods

On 5 June 2019, the altmetric database (Altmetric LLP, London, UK) was searched using the titles of 11 endodontic journals (Australian Endodontic Journal (ISSN: 1329-1947), Endodoncia (ISSN: 0071-0261), Endodontic Practice (ISSN:1465-9417), Endodontic Practice Today (ISSN:1753-2809), Endodontic Topics (ISSN: 1601-1538), Endodontology (ISSN:0970-7212), Evidence-Based Endodontics (ISSN: 2364-9526), International Endodontic Journal (ISSN: 0143-2885), Iranian Endodontic Journal (ISSN: 1735-7497), Journal of Endodontics (ISSN: 0099-2399), Saudi Endodontic Journal (ISSN: 1658-5984)). Bibliometric

data of endodontic articles and journals with an altmetric score>5 were analyzed using the VOSviewer 1.6.6 (http://www.vosviewer.com/, Leiden University Centre for Science and Technology Studies). The science mapping of articles with an altmetric score>5 at two levels of author keywords co-occurrence and co-authorship network analysis, was used. The present study used the Dimensions citations database, which was created by the London-based technology firm Digital Science (www.dimensions.ai/) (operated by the Holtzbrinck Publishing Group, which also has a majority share in the publisher of Nature). The product goes beyond traditional bibliometric data and connects publications to their related grants, funding agencies, patents and clinical trials.

Data management

The Pearson coefficient was employed for the correlation analysis using Rattle (Graphical User Interface for Data Science in R). In this step, along with altmetric data, citation counts (according to Dimensions database) and number of Mendeley readers were also included. Microsoft Office Excel 2016 was used for descriptive statistics, graphs and trend-line analysis.

Results

Out of 11 endodontic journals, seven were included in the study. Considering the total mentions among all altmetric resources, the Journal of Endodontics had the highest rank followed by the International Endodontic Journal and Australian Endodontic Journal (Figures 1 and 2). Twitter was the most popular altmetric data resource followed by patents and Facebook (Figure 3). Tweets were generally from the United States (20.2%), Mexico (16.3%) and Saudi Arabia (6.9%). Facebook posts were generally from Norway (12%), United States (8.6%) and India (4.5%).

Of the 2331 articles in the field of Endodontology identified using Altmetric database, 192 had altmetric scores>5(top 5%)(Figure 4)(Table 1). Bibliometric data of 181 articles found in PubMed were included in the bibliometric analysis. Science mapping via keyword co-occurrence network analysis using PubMed author keywords revealed that meta-analysis, systematic review and pulpitis had the greatest rate of

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occurrence (Figure 5). At the author level, Dummer P.M.H (Cardiff University, Cardiff, United Kingdom; h-index: 43 based on Scopus) had the greatest influence on the network (Figure 6).

Among endodontic articles (altmetric score >5), the mean altmetric score was 9.7 (95% confidence interval (C.I): 8.6 to 11.1), mean citations were 63.3 (95% C.I: 47.5 to 80.6) and mean of Mendeley mentions was 78.8 (95% C.I: 67.1 to 92). There was no significant correlation between altmetric score and citations count (P>0.05). Mendeley mentions correlated with citations (P<0.05) (Figure 7).

Discussion

The number of social network users worldwide in 2018 was 2.62 billion (Statista 2018). At the present time, new internet-based tools, e.g. social media, act as a keystone in disseminating scholarly information and distributing cross-disciplinary knowledge. Health care professionals can use social media to develop virtual communities to share reliable medical knowledge with patients and connect with a worldwide network of peers (Rolls *et al.* 2016). The reasons that an article or specific subject achieves a high altmetric score or online attention may be the popularity of the subject matter for non-professional members of the public. Also, authors, publishers, and associations may use self-propagation or self-mention. So, the reasons why high scores occur is complex and altmetric data providers need to separate self-mentions by authors, publishers, and associations in order for there to be greater clarity and transparency.

Altmetrics is an effective tool to assess the social impact of research findings. As with citation-based bibliometrics, altmetrics does not reflect the quality of a research output; it only measures online attention surrounding the output.

This is the first attempt to analyze altmetric data of the contemporary literature in Endodontology. High impact mainstream journals in the field of Endodontology received the highest online attention. Overall, the altmetric scores were low, possibly due to the specific and specialized nature of this branch of Dentistry and difficulty members of the public have in understanding endodontic research. A recent investigation demonstrated that a substantial number of non-academics were interested enough in research to tweet scientific articles. Since the broadcasting of academic information to members of the public is a growing

trend in the academic world, it is becoming more important for Endodontists to be able to write tweets, Facebook posts, etc., that are comprehensible by non-professional audiences (Mohammadi *et al.* 2018).

As with all dental literature, Twitter and Facebook were popular for disseminating information about Endodontology publications. Overall, most Tweets and Facebook posts ofthe mainstream dental literature were from the US and UK (Kolahi 2017a,b). In Endodontology, a wide geographic distribution of Tweets and Facebook posts were noted from a variety of countries, e.g. Mexico and Norway.

Interestingly, in contrast with the result of the analysis of the entire dental literature (Kolahi & Khazaei 2016a, 2018, Kolahi *et al.* 2017), there was a substantial number of Patent mentions in Endodontology (Figure 3). This is a promising finding and demonstrates a close relationship between research and industry within the specialty (Kolahi 2015b). On the other hand, post-publication peer review sites (e.g. PubPeer) and article recommendation services (e.g. F1000 prime) are rarely used in Endodontology and more attention to these sites is required to increase knowledge and impact on the attitude of Endodontists in this regard (Kolahi & Khazaei 2016b, Sahin *et al.* 2018).

The results of the present study agreed with the reports of Delli *et al.*(2017) and Livas & Delli (2018) that concluded there was no significant correlation among the top 100 dental articles and top 200 orthodontic articles with the highest altmetric scores. Despite the non-significant correlation between altmetric score and citation, popular articles in Endodontology had an acceptable citation rate (mean citations: 63.3).

In the present study, a science mapping approach was used to summarize and visualize the complex network of bibliometric data of popular articles on Endodontology. In this regard, co-occurrences of keywords and co-authorship network analysis were employed. It is well-known that keywords signify the core of a research article. By way of definition, A, B, and C keywords might be defined to "co-occur" if they appear in a specific article. Another article might encompass B, C, and D keywords. Connecting A, B, C, and D create a co-occurrence network of these four keywords. The number of co-occurrences of two keywords is the number of articles in which both keywords co-occur (Cheng *et al.* 2018). Keywords co-occurrence

network analysis allows a mapping knowledge structure to be created based on endodontic articles with an altmetric score>5. In the same way, co-authorship occurs when names of authors α and β both appear in a specific article. Co-authorship network analysis provides a vision of collaboration patterns between researchers and organization.

However, a pivotal finding of this study is that in Endodontology, articles with the high level of evidence such as systematic reviews and meta-analysis, received the most online attention (Figure 5), not articles with buzzword in the title. Yet, these high-quality articles are rarely used for evidence-based policy making (Figure 3) (Kolahi 2017c). Disappointingly, the entire ground breaking issues and cutting-edge technologies in the dental literature, e.g. artificial intelligence, nano-technology, and genomic medicine were not seen among hot topics in Endodontology (Kolahi & Soltani 2018).

The limitations of the present study should be noted. Altmetric analysis is a dynamic process that reveals real-time online attention surrounding research findings. In contrast with traditional citation-based metrics, altmetrics may fluctuate over time. Atthe same time, the present study covered only endodontic journals and it is possible that popular endodontic articles may have been published in other scientific journals. Some well-known social media outlets are not covered by the Altmetric institution, for example, LinkedIn, Sina Weibo and Pinterest mentions are no longer available because the companies closed their open data stream via their application programming interface (API). LinkedIn on May, 2015 changed its API Terms of Use and restricted broad API use to approved partners, e.g. Microsoft and Salesforce. ResearchGate data is not now obtainable because of a lack of an API. Instagram posts do not include links, so could not be included in the altmetric analysis.

As a recommendation for future research, it would be interesting to analyze the knowledge structure of the highly shared scientific literature in Endodontology in Twittersphere, Facebook, Google+, Wikipedia, etc. As a final point, Endodontic associations and journals could be more active on the World Wide Web. It is forecast that the number of social network users worldwide will be 3 billion in 2021 (Statista 2018). It

should bear in mind that journals with their own Twitter account get 34 percent more citations and 46 percent more tweets than journals without a Twitter account (Ortega 2017).

Conflict of interest

This study was not financially supported by any institution or commercial sources and the authors declare that they have no competing interest.

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