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100 years of the Journal of Dental Research: A Bibliometric Analysis

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100 years of the Journal of Dental Research: A Bibliometric Analysis

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Abstract

Since its inception in 1919, the *Journal of Dental Research* has continually published high quality articles that span the breadth of research topic relevant to dentistry, oral surgery and medicine. As part of the journal’s centennial celebrations, we have conducted an electronic search on Scopus to identify and analyse the top 100 most-cited papers from 1919 to 2018. Since the Scopus does not capture older citations, we conducted an additional analysis by Google Scholar to identify key papers published in the first 50 years of the journal. Based on the Scopus, the articles were ranked in descending order based on their citation counts. The citation counts of the 100 selected most-cited articles varied from 262 to 1503. The year in which the largest number of top 100 articles were published was 2004 (n=6). Among 334 authors, the greatest contribution was made by D.H. Pashley (n=9). Within the top 100, the majority of articles originated from the United States (n=52). ‘Research Reports – Biomaterials & Bioengineering’ was the most frequent category of cited articles (n=35). There was no significant association between total citation count and time since publication (correlation coefficient = -0.051, $p = 0.656$). However, there was a significant negative association of citation density (correlation coefficient = -0.610, $p < 0.01$) with time since publication. Our analyses demonstrate the broad reach of the *JDR* and the dynamics in citation patterns and research agenda over its 100-year history. There is considerable evidence of the inequality in research output, if measured via citations, across the globe. Moreover, it remains unclear how patients’ priorities and dental healthcare needs are aligned with the perceived influence of single research pieces identified by our search. Our findings may help to inspire future research in tackling these inequalities and highlight the need for conceptualizing research priorities.

Keywords: Bibliometric analysis; classic articles; Journal of Dental Research; most-cited articles.

INTRODUCTION

“Journal of Dental Research will neither be a supply-house dummy, nor an advertising circular. It will endeavor to equal in quality the best of the research journals in the medical and biological sciences”. These promising words were written by William J. Gies (the founding editor) in the introductory article of the first volume of the *Journal of Dental Research* (JDR) in 1919. Today, the *JDR* is ranked #1 or #2 in dentistry in almost all the different metrics that are available, and covers all areas of research in the dental, oral and craniofacial sciences. On its inception in 1919, *JDR* published four issues per annum and this was increased to six in 1928. The journal kept on growing and started publishing 12 issues per year from 1977. Since 2016, the journal has published 13 issues every year, reflecting the strong influence it is having in the scientific community with thousands of papers being submitted from all over the world.

When journals celebrate a significant anniversary, editorials (Barley 2016; Shugan 2006), special issues (Kozlowski et al. 2017), reviews (Van Fleet et al. 2006), and bibliometric overviews (Merigó et al. 2015) are oftentimes conducted and published. To date, no bibliometric analysis has been performed to celebrate the 100th anniversary of any professional dentistry journal.

While citations are by no means an infallible indicator of whether a piece of research is useful to researchers or clinicians (Bellini 2012), citations of research within one research domain associate well with other indices of scientific acknowledgement (Parker et al. 2013). Citations and citation analysis can be used to quantify the impact of a publication, an author, a topic of discussion, a country, a journal, a given disease, or a specialty (Ibrahim et al. 2012). Bibliometric analysis building on citation analysis aids in providing information on the dominant areas of a research field as well as indicating its growth and development (Park et al. 2017).

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Therefore, in order to highlight the changing trends, dominant study designs, centres of excellence, and the most substantial advancements made on over time in dental research, this study aimed to analyse the scientific impact, measured by citations, of articles in the *JDR* over the last 100 years. This article complements other centennial celebrations such as the *JDR* Centennial Articles and the Historical Highlights series (Giannobile et al. 2019; Jakubovics and Giannobile 2019).

METHODS

Search strategy

An electronic literature search was performed on 20th May 2019 using Elsevier’s Scopus (from 1919 to 2018). The search subject was “Journal of Dental Research” in the source title with no restriction on study design of the article. According to Scopus, out of 20,502 results, the top 100 articles were identified based on the citation counts received. The selected articles were ranked in descending order on the basis of their citation counts. After ranking the top 100 articles, these were then cross-matched with the citation data from Clarivate Analytics’ Web of Science “Core Collection” and Google Scholar to assess any fluctuation in citation counts. Google Scholar was also used to systematically search for the top five articles from each of the first five decades of the *JDR*. Since Google Scholar does not allow sorting of articles based on the citation counts, the top 400 papers from each decade were screened for those with the highest citation counts.

Data extraction and bibliometric parameters.

The top 100 most-cited articles were included and their complete text was obtained. The following bibliometric parameters of each article were recorded: article title, citation count, citation density, i.e. average number of citations received by an article per annum (Li et al. 2015), current citation index, i.e. number of citations received in 2018, year of publication,

authorship, country of origin, institution of publication (based on the corresponding author), study design and field of interest. The articles were categorized based on the classification that is used in the index of the journal for each issue, i.e. Reviews, Research Reports – Biomaterials & Bioengineering, Research Reports – Clinical and Research Reports – Biological.

Data analysis

The Visualization of Similarities (VOS) viewer software (van Eck and Waltman 2009) was used for graphical mapping of the bibliometric material including co-citation (Small 1973) and bibliographic coupling (Kessler 1963) and to create collaboration network maps among contributing authors and countries as well as co-occurrences of all keywords.

Statistical analysis

Descriptive and bivariate analyses were performed using SPSS 24.0 (IBM, Armonk, NY). Shapiro-Wilk test was used to detect departures from normality. Mean (standard deviation) or median (interquartile range) were used depending on the distribution of data and normality. The Kruskal-Wallis test was performed in order to determine if the difference between the median of two or more independent groups was statistically significant. When necessary, Bonferroni *post-hoc* testing was used for testing significant difference between each of the variables. For testing and determining correlations between several variables, the Spearman rank test was performed. The significance level was set to $p < 0.05$.

RESULTS

Citation count, citation density and current citation index

Based on the Scopus database, the ranking of the top 100 most-cited articles including their title, first author, year of publication, country of origin, institution of origin, total citation counts, citation density, and current citation index is shown in Table 1. The top 100 most-cited articles received a total of 41,822 citations. The citation range was 262 to 1503. Citation

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density, i.e. the average number of citations per annum was 418.22 collectively. The most cited article with 1503 citations was “A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces” (Buonocore 1955), with a citation density of 23.85. This was followed by “Factors affecting wound healing” (Guo and DiPietro 2010), with 1323 citations and a citation density of 165.37. The third ranked article with 1146 citations was “Stem cell properties of human dental pulp stem cells” (Gronthos et al. 2002), with a citation density of 71.62. The article with the highest citation density, i.e. 165.37 was; “Factors affecting wound healing” (Guo and DiPietro 2010). The mean citation density was 27.53 (range: 4.8 – 165.37). Based on the current citation index (citation count in 2018), the first ranked article with 261 citations was “Factors affecting wound healing” (Guo and DiPietro 2010). The second ranked article with 124 citations was “Global burden of oral conditions in 1990-2010: a systematic analysis” (Marcenes et al. 2013). The third ranked article with 116 citations was “Global burden of severe periodontitis in 1990-2010: a systematic review and meta-regression” (Kassebaum et al. 2014).

Data on the citation count, citation density, and age of publication were not normally distributed (Shapiro-Wilk test; $p < 0.01$). There was no significant association between citation count and length of time since publication (correlation coefficient = -0.051, $p = 0.656$) (Figure 1A). There was a negative, significant association between citation density and time since publication (correlation coefficient = -0.610, $p < 0.01$) (Figure 1B). Generally, the order of the top-100 articles in the Scopus analysis agreed well with two other citation indices, Web of Science “Core Collection” and Google Scholar (Table 1). However, citation counts were generally slightly lower in Web of Science and higher in Google Scholar.

Year of publication

The top 100 most-cited articles were published between 1954 (Salley 1954) and 2015 (Kassebaum et al. 2015). It is important to note that Scopus database currently only includes

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3 citations dating back to 1970, and therefore older papers will not be adequately represented in
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5 this analysis. Google Scholar provides a broader analysis that includes citations dating back to
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7 the start of the *JDR*. All top-100 papers in Table 1 had > 360 citations by Google Scholar. An
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9 analysis of the top 20 papers published between 1919-1969 using Google Scholar (Table S1)
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11 identified 17 papers with > 360 citations. The top-5 papers were already included in the Scopus
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13 top-100, along with two others from the top-10. The other 10 papers had citation counts ranging
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15 between 383 to 546, which was towards the lower end of the citation counts of papers in Table
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17 1. It is highly unlikely that more than a handful of these older papers would have been included
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19 in the overall top-100 papers using Google Scholar. Therefore, the limitation of the Scopus
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21 database for identifying older papers did not appear to have a major influence on the
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23 identification of the top papers throughout the history of the *JDR*. By the Scopus analysis, the
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25 highest number of articles published in a single year was 6, and this occurred in 2004. The
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27 number of most-cited articles published was 4 during the 1950s, 3 during the 1960s, 2 during
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29 the 1970s, 18 during the 1980s, 24 during the 1990s, 35 during the 2000s, and 14 during the
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31 2010s (Figure 2). The number of top-cited articles reached its peak from 2000 to 2010, i.e. (n
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33 = 39). Of the top 100 articles, 49% were published after the year 1999.
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40 Contributing authors

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43 A total of 334 authors contributed to the top 100 most-cited articles. The most
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45 contributions were made by Pashley DH (n=9) (2447 citations), van Meerbeek B (n=7) (3598
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47 citations), Lambrechts P (n=6) (3239 citations), Tay FR (n=5) (1709 citations), Davidson CL
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49 (n=4) (2228 citations), de Munck J (n=4) (2485 citations), Marcenes W (n=4) (1492 citations),
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51 Tjäderhane L (n=4) (1354 citations), Vanherle G (n=4) (1567 citations), and Yoshida Y (n=4)
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53 (1713 citations). In terms of the total citation count, the most-cited authors were van Meerbeek
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55 B (2523 citations), Lambrechts P (3239 citations), and de Munck J (2485 citations). The
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57 bibliographic coupling of authors that published in the *JDR* is shown in Figure S1.
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Country and institution of publication

Based on the institutional address of the corresponding author, individuals from 16 countries contributed to the top 100 articles (Figure 3). Among these, the United States had the largest number of publications (n=52) than any other single country.

Among 71 institutions, the greatest contribution was made by School of Dentistry, Catholic University of Leuven, Belgium (n=7) followed by the Academic Center for Dentistry Amsterdam (ACTA), University of Amsterdam, Netherlands (n=4), Forsyth Dental Center, USA (n=4), National Institute of Dental and Craniofacial Research, National Institutes of Health, USA (n=4). Others institutions that contributed more than one article were Tokyo Medical and Dental University, Japan (n=3), School of Dentistry, University of California, Los Angeles (UCLA), USA (n=3), College of Dentistry, University of Illinois at Chicago, USA (n=2), Dental School, University of Maryland at Baltimore, USA (n=2), School of Dentistry, State University of New York at Buffalo, USA (n=2), Okayama University Graduate School of Medicine and Dentistry, Japan (n=2), School of Dentistry, Medical College of Georgia, USA (n=2), School of Dentistry, Hokkaido University, Japan (n=2), Institute for Health Metrics and Evaluation, University of Washington, USA (n=2), School of Dentistry, University Of Michigan, USA (n=2), and School of Dental Science, The University of Melbourne, Australia (n=2).

Article category

The most common article category of the top 100 most-cited articles was ‘Research Reports - Biomaterials & Bioengineering’ (n=35) followed by Reviews (including Systematic Reviews) (n=27), ‘Research Reports – Clinical’ (n=26), and ‘Research Reports – Biological’ (n=12) (Figure 4).

However, the difference in the median number of citations per article, between ‘Research Reports – Biomaterials & Bioengineering’ (426, range: 265-1503), Reviews (420, range: 262-1323), ‘Research Reports – Clinical’ (418, range: 266-1112), and ‘Research Reports – Biological’ (388, range: 262-1146), was non-significant ($p = 0.538$).

Field of interest

Major fields of interest in the top 100 most-cited articles were materials science ($n=28$), oral biology ($n=13$), periodontology ($n=11$), restorative dentistry ($n=10$), caries ($n=9$), regenerative dentistry ($n=6$), implant dentistry ($n=5$), bone morphology/histology ($n=4$), oral hygiene ($n=4$), oral medicine/pathology ($n=3$), prosthodontics ($n=2$), orthodontics ($n=2$), behaviour management ($n=2$) and endodontics ($n=1$).

The difference in the median number of citations per article, between materials science (426, range: 262-1503), oral biology (390, range: 266-1112), periodontology (392, range: 289-757), restorative dentistry (350, range: 293-599), caries (327, range: 268-418), regenerative dentistry (567, range: 267-1146), implant dentistry (413, range: 262-772), bone morphology/histology (756, range: 278-1323), oral medicine/pathology (386, range: 283-499), oral hygiene (336, range: 269-435), prosthodontics (379, range: 362-395), orthodontics (277, range: 264-290), and behaviour management (544, range: 382-706), was non-significant ($p=0.891$).

Key words

Of the 100 top-cited articles, a total of 674 unique keywords were identified. The most frequently occurring keywords were dentin ($n=13$), *in-vitro* ($n=10$), adhesion ($n=7$), inflammation ($n=6$), plaque ($n=6$), expression ($n=5$), epidemiology ($n=5$), dental caries ($n=5$), enamel ($n=5$), degradation ($n=4$), nf-kappa-b ($n=4$), periodontal disease ($n=4$), *in-vivo* ($n=4$),

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prevalence (n=4), durability (n=4), caries (n=4), oral health (n=4), and teeth (n=4). The co-occurrence of all keywords of articles published in the journal is shown in **Figure S2**.

Older papers (1919 – 1969)

Since the top-100 papers only included 7 papers from the first 50 years of the *JDR*, and none from the first 30 years, a separate analysis was conducted by Google Scholar to identify the most highly cited papers from each of the first 5 decades (Table 2). There was a clear increase in citation counts for the first 4 decades: the range of citations for the top-5 papers between 1919 – 1929 was 50 – 144 citations, between 1930 – 1939 was 164 – 239 citations, between 1940 – 1949 was 217 – 517 citations, from 1950 – 1959 was 526 – 4015 citations. The range of top citations was slightly lower between 1960 – 1969, ranging from 437 to 2126 citations. Until 1959, the top-5 most highly cited papers for each decade were from North America, one from Canada and the rest from the USA. However, only 2 of the top-5 papers between 1960 – 1969 were from the USA; the others were from Denmark, the Netherlands and Japan.

DISCUSSION

This study aimed to determine and analyse the main features of the top 100 most-cited articles published in the *Journal of Dental Research*. An article having 400 or more citations is considered, by some, as a ‘classic’ article based on the field of research (Yılmaz 2019); however, in the field with fewer researchers, a publication having 100 or more citations may already fall into this category (Andersen et al. 2006). Based on this, *JDR* has published a total of 30 articles (0.14%) which have secured 400 or more citations and 729 articles (3.5%) which have secured 100 or more citations throughout its history of 100 years. Therefore, in the present study, all of the 100 articles could be considered as ‘classics’ based on their citation counts,

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3 using 100 citations as the threshold. The ‘classic’ articles were cited between 262 and 1503
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5 times when the analysis was performed using Elsevier’s Scopus.
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8 We also retrieved the top 100 articles using the Web of Science (WoS) “Core Collection”
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10 (Table 1). Overall the identified articles were very similar to those retrieved by Scopus,
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12 although citation counts were approximately 4% higher on average using Scopus. At the lower
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14 end of Table 1 (positions 88-100) there were several differences between the two platforms.
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16 More importantly, 5 articles dating between 1955-1963 were not identified by WoS “Core
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18 Collection”. For example, the most heavily cited article using Scopus with a citation count of
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20 1503 was “A simple method of increasing the adhesion of acrylic filling materials to enamel
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22 surfaces” (Buonocore 1955). This article unveiled the concept of adhesion in restorative
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24 dentistry by describing a novel procedure for acid etching in order to increase adhesion of
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26 acrylic filling materials, and was the most highly cited article according to the Google Scholar,
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28 too. This key paper was overlooked by the WoS “Core Collection”. It was identified by
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30 searching the WoS “All Databases” but even then, many citations were missed and the total
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32 citation count was only 385. The other highly cited articles that were not identified in WoS
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34 “Core Collection” were “Age variation of formation stages for ten permanent teeth” (Moorrees
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36 et al. 1963), “Variations in the growth pattern of the human mandible: longitudinal radiographic
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38 study by the implant method” (Björk 1963), “A system of classification and scoring for
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40 prevalence surveys of periodontal disease” (Russell 1956), “Dental caries in the molar teeth of
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42 rats: II. A method for diagnosing and scoring several types of lesions simultaneously” (Keyes
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44 1958), Effect on caries of restricting sugars intake: Systematic review to inform WHO
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46 guidelines (Moynihan and Kelly 2014), Oral health-related quality of life: What, why, how,
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48 and future implications (Sischo and Broder 2011), The continuum of dental caries - Evidence
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50 for a dynamic disease process (Featherstone 2004) and 12-year survival of composite vs.
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amalgam restorations (Opdam et al. 2010). It is not clear why these articles were missed when searching the WoS “Core Collection”.

Generally, there was a fluctuation in the citation counts when different databases were interrogated; for example, the range of articles varied from 262 to 1503 (Scopus), from 239 to 1130 (WoS) and from 361 to 4015 (Google Scholar). This fluctuation highlights the significance of choosing an appropriate database in Scientometry. Google Scholar and WoS were not selected as benchmark databases in this study for several reasons. Google Scholar contains citation data from thesis and dissertations, technical reports, conference papers, books and preprints, which can influence the analysis of the top publications when the target is more specific as in the current study. Also, there is no means to order search results by citation counts in Google Scholar, which is a major limitation for citation analysis. In WoS, missing references are a significant problem, which might be a potential reason why Buonocore’s highly cited article in Scopus and Google Scholar was so under-cited in WoS. The problem of incorrect references is even more serious (van Eck and Waltman 2019). Scopus database was used as a benchmark for several reasons. First, Elsevier developed the Scopus database, combining the features of both WoS and PubMed. These combined features allow for improved utility, both for academic requirements (citation analysis) and medical literature research (Falagas et al. 2008). Second, Scopus is considered the largest abstract and citation search engine of peer-reviewed literature. It is designed to facilitate researchers not only to access the scientific data, but to study literature for the purpose of analyses and it has been used in several published bibliometric studies (Chiang et al. 2018). Third, Scopus includes a more expanded spectrum of journals (n=12,850) than WoS (n=8,700), and its citation analysis is faster and includes more articles than the citation analysis of WoS (Walsh et al. 2018). Recently, a study performed to assess the accuracy of citation data in Scopus and WoS databases reported that WoS contained 55% missing references, 26.7% error in references such as incorrect publication year or volume

number, and 16.7% incorrect references (also known as phantom references) (van Eck and Waltman 2019). Overall, we felt that Scopus was the best tool for identifying highly cited articles from the archives of the *JDR*.

Year of publication is a definitive indicator of citation count a paper would receive. Generally, older publications gain more citations than more recent papers, regardless of their impact, given that there is more time to cite them (Ugolini et al. 2012), and articles published in the last 15 years usually do not appear in the most frequently cited articles in many fields of research (Feijoo et al. 2014). We, however, observed a mixed trend with 51% of highly cited articles being published between 1919 and 1999, and 49% articles between 2000 and 2015. In total, 33 out of the 100 papers were published in the last 15 years, i.e. 2004 to 2018. It is important to note that the Scopus database only includes citations from 1970 onwards, and therefore many pre-1970 citations of papers published in the *JDR* will not have been counted. However, even allowing for this, there was no clear correlation between article age and citation rate for the papers published since 1970, where the citation counts should be complete. We assume that the quality of an article, and its perceived relevance to the clinical practice and research, determine citation sums more than mere article age. In line with this, several articles published after 2015 also received a relatively high number of citations, although it is too early to foresee whether these publications will be cited more often as time passes.

The results of this study support previous findings (Baltussen and Kindler 2004b; 2004c; Fenton et al. 2002; Paladugu et al. 2002a) that the first authors as well as the corresponding authors from Asia, the Middle East, and Africa made a negligible contribution to the top 100 most-cited articles. This might be due to constraints in conducting research, achieving publications, language barriers and lack of access to information. Clearly, there is a need to shift the emphasis and promote research related to dentistry in countries of the world that are developing where the burden of oral diseases is more widespread (Uthman et al. 2013).

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It is important that key organizations such as the World Health Organization and the United Nations Organization help to promote oral health research in low and middle-income countries to address these global inequalities.

Several authors were associated with the ‘classic’ articles but interestingly, most of them contributed as both corresponding author and first author at the same time. Pashley DH contributed the most as the corresponding author (n=7). Out of the top 100 classics, 21 articles were written by one author and 32 articles were written by two authors. Interestingly, amongst the top 100 articles, 14 authors were included in three articles each and 31 authors were included in two articles each.

As evidenced by the current study and in agreement with several other papers, academic institutions from the United States were involved in the list of the top 100 most-cited articles (Baltussen and Kindler 2004a; Brandt et al. 2010; Fardi et al. 2011; Lefaivre et al. 2010; Loonen et al. 2008; Paladugu et al. 2002b). The presence of a large scientific population, the fact that the journal is based in the US, large financial resources as well as an extensive community of active researchers explains the major contribution of the United States (Shadgan et al. 2010).

According to the hierarchy of research evidence, meta-analyses, systematic reviews and randomized controlled trials provide the highest quality of evidence for clinical research (Daly et al. 2007). Interestingly, the top-100 most cited papers in the *JDR* included only 10 randomized controlled trials and five systematic reviews, compared with 22 narrative reviews. In the current study, there was a predominance of ‘Research Reports - Biomaterials & Bioengineering’ over ‘Reviews’ and those reporting clinical and biological research in earlier times. More recently (from 2000 onwards), this trend has shifted towards highly cited review articles and clinical studies. During the 2010s, a sudden decline in the citation counts of

1
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3 ‘Research Reports – Biomaterial & Bioengineering’ articles has been noticed. This shift in
4 trend towards reviews might be attributed to the gain of reviews’ popularity because they are
5 an accepted instrument of evidence-based medicine, with dentistry increasingly adopting this
6 philosophy (Sackett et al. 1996). Moreover, with an overall massively increasing number of
7 publications, both the authors and the readers may feel the need to compile and synthesize the
8 available body of evidence on a topic in the form of a review. This finding has already been
9 noticed in medical disciplines including general surgery (Paladugu et al. 2002b), orthopaedic
10 surgery (Lefaivre et al. 2011), and anaesthesia (Baltussen and Kindler 2004a). Regarding the
11 field of interest, there has been an overall predominance of highly cited publications on material
12 science, particularly on the subject of adhesive restorations. During the 2000s, the trend shifted
13 towards articles related to application of dental pulp stem cells in dentistry (regenerative
14 dentistry), following the identification of this cell population in 2000 (Gronthos et al. 2000).
15 From 2010 onwards, the trend has shifted towards reports on the global burden of oral diseases
16 such as dental caries, and periodontitis. This has occurred since the introduction of the Global
17 Burden of the Diseases Study in 2010. According to Table 1, the topic that has secured the
18 highest current citation index 2018 after the global burden of caries and periodontitis is the
19 application of dental pulp stem cells in dentistry.

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22 A comparative analysis of the most-cited articles over the history of *JDR*’s 100 years
23 with the highly cited articles of the first 50 years of the Journal showed that ‘Research Report
24 – Clinical’ was the most predominant article category. Interestingly, no review article could
25 secure its position in the most-cited articles published in the first 50 years of the Journal.
26 Regarding the field of interest, oral biology and dental caries were the predominant ones. The
27 majority of the articles originated from institutions in the USA (n=17, 85%). The greatest
28 contribution was made by Eastman Dental Dispensary, USA (n=3) and National Institute of
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Dental Research, National Institute of Health, USA (n=3). Buonocore MG, Moorrees CF and Garn SM were the major contributors with two publications each.

This study has a number of limitations. First, and as mentioned, the Scopus database does currently not include citations prior to 1970. However, a separate Google Scholar search was used to identify the citation counts of the articles which were collected prior to 1969. Second, by using the institutional address of the corresponding author listed in the article, only those institutions and countries could be recognized where the author was employed during the research or where the article was written. Third, the validity of citation count to judge a scientific article may be debated, although it has been shown that there is a strong association between citation count and impact (Ioannidis et al. 2014). However, various factors influence the citation of an article including the reputation of the author, citing again already highly cited articles, and journal preference while citing. All these factors act as an antagonist for the citation count being an impartial reflector of the quality and influence of a manuscript. Contemporary tools including Tweets, Likes, and article downloads demonstrate the impact of social media and the reputation of a publication and interestingly may even show the most-cited articles within the first three days of their publication (Eysenbach 2011).

In conclusion, and considering these limitations, our analyses show the breadth of topics that receive high citation rates at the *JDR* and highlight how citation patterns have changed over time. It is particularly notable that landmark discoveries such as the identification of dental pulp stem cells or the Global Burden of Diseases study have rapidly led to a flurry of highly cited papers in their field. Our analysis of the history of the *JDR* has also highlighted historical inequalities, such as the underrepresentation of regions such as Asia, the Middle East, and Africa, at least in terms of the host institution of the corresponding author. A major challenge for the future will be to ensure that the journal is inclusive for authors from right across the globe.

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AUTHOR CONTRIBUTIONS

P.A: Contributed to conception, design, data acquisition and interpretation, performed all statistical analyses, and drafted manuscript.

M.K.A: Contributed to conception, design, data acquisition and interpretation, drafted and critically revised the manuscript.

N.S.J: Contributed to design, data interpretation, drafted and critically revised the manuscript.

F.S: Contributed to design, data interpretation, drafted and critically revised the manuscript.

J.A.A: Contributed to conception, design, data analysis and critically revised the manuscript.

All authors gave their final approval and agree to be accountable for all aspects of the work.

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FIGURE LEGENDS

Fig. 1: Association of (A) citation count with age of publication and (B) citation density with age of publication.

Fig. 2: Bibliometric analysis of number of citations over the decades.

Fig. 3: Country of origin of the top 100 papers.

Fig. 4: The time trends in the top 100 most-cited articles according to their categories.

For Peer Review

Table 1. The ranking of the top 100 most-cited articles published in the *JDR*.

Rank	Title of article	First author	Publication year	Country of origin	Total citations (Scopus)	Total citations (Web of Science)	Total citations (Google Scholar)	Citation density	Current citation index (2018)
1	A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces	Buonocore MG	1955	USA	1503	-	4015	23.85	36
2	Factors affecting wound healing	Guo S	2010	USA	1323	1130	2425	141.25	261
3	Stem cell properties of human dental pulp stem cells	Gronthos S	2002	Australia	1146	1071	2015	66.93	89
4	Age Variation of Formation Stages for Ten Permanent Teeth	Moorrees CFA	1963	USA	1112	-	2126	20.21	79
5	A critical review of the durability of adhesion to tooth tissue: methods and results	de Munck JD	2005	Belgium	1074	960	2073	73.84	86
6	Setting stress in composite resin in relation to configuration of the restoration	Feilzer AJ	1987	Netherlands	897	795	1510	25.64	26
7	Mesenchymal stem cells derived from dental tissues vs. those from	Huang GT-J	2009	USA	871	804	1442	89.33	92

1										
2										
3		other sources: their								
4										
5		biology and role in								
6										
7		regenerative medicine								
8										
9	8	Enhanced bone	Buser D	2004	Switzerlan	772	745	1163	53.21	62
10										
11		apposition to a			d					
12										
13		chemically modified								
14										
15		SLA titanium surface								
16										
17	9	Prevalence of	Eke PI	2012	USA	757	707	1258	117.83	104
18										
19		periodontitis in adults in								
20										
21		the United States: 2009								
22										
23		and 2010								
24	10	Development of a dental	Corah NL	1969	USA	706	677	1424	13.81	36
25										
26		anxiety scale								
27										
28	11	Comparative study on	Yoshida Y	2004	Japan	661	616	1080	44.00	39
29										
30		adhesive performance								
31										
32		of functional monomers								
33										
34	12	The competition	Davidson	1984	Netherlan	639	540	1112	15.88	18
35										
36		between the composite-	CL		ds					
37										
38		dentin bond strength								
39										
40		and the polymerization								
41										
42		contraction stress								
43	13	Black-pigmented	Slots J	1984	USA	627	738	967	21.70	5
44										
45		Bacteroides species,								
46										
47		Capnocytophage								
48										
49		species, and								
50										
51		Actinobacillus								
52										
53		actinomycetemcomitans								
54										
55		in human periodontal								
56										
57		disease: virulence								
58										
59		factors in colonization,								
60										

survival, and tissue
destruction

14	Collagen degradation by	Pashley	2004	USA	605	554	988	39.57	42
8	host-derived enzymes	DH							
11	during aging								
15	Assessment of	Johnston	1989	USA	599	559	1067	19.27	46
14	appearance match by	WM							
16	visual observation and								
18	clinical colorimetry								
16	Bone morphogenetic	Urist MR	1971	USA	510	522	1033	11.10	17
21	protein								
17	Global burden of oral	Marcenes	2013	UK	499	448	905	89.60	124
25	conditions in 1990-	W							
27	2010: a systematic								
29	analysis								
18	Morphological aspects	van	1992	Belgium	482	463	736	17.80	9
33	of the resin-dentin	Meerbeek							
35	interdiffusion zone with	B							
37	different dentin								
39	adhesive systems								
19	In vivo degradation of	Hashimoto	2000	Japan	479	434	770	24.11	22
42	resin-dentin bonds in	M							
44	humans over 1 to 3 years								
20	In vitro infection and of	Haapasalo	1987	Norway	467	393	966	78.60	22
48	dentinal tubules	M							
21	Four-year water	de Munck	2003	Belgium	454	405	748	27.00	23
52	degradation of total-etch	JD							
54	adhesives bonded to								
56	dentin								

1										
2										
3	22	Variations in the	Björk A	1963	Denmark	453	-	1060	8.23	15
4		Growth Pattern of the								
5		Human Mandible:								
6		Longitudinal								
7		Radiographic Study by								
8		the Implant Method								
9										
10										
11										
12										
13										
14	23	Two modes of	Tay FR	2002	China	451	407	639	25.43	22
15		nanoleakage expression								
16		in single-step adhesives								
17										
18										
19										
20	24	Bovine teeth as possible	Nakamichi	1983	Japan	449	401	720	11.45	10
21		substitutes in the	I							
22		adhesion test								
23										
24										
25										
26	25	Validity and reliability	Jokovic A	2002	Canada	435	385	760	24.06	33
27		of a questionnaire for								
28		measuring child oral-								
29		health-related quality of								
30		life								
31										
32										
33										
34										
35	26	The role of bacteria in	Takahashi	2011	Japan	418	366	678	52.28	69
36		the caries process:	N							
37		Ecological perspective								
38										
39										
40										
41	27	Periodontitis and	D'Aiuto F	2004	UK	417	375	703	26.78	19
42		systemic inflammation:								
43		control of the local								
44		infection is associated								
45		with a reduction in								
46		serum inflammatory								
47		markers								
48										
49										
50										
51										
52										
53										
54	28	Initial acquisition of	Caufield	1993	USA	405	335	958	13.40	11
55		mutans streptococci by	PW							
56		infants: evidence for a								
57										
58										
59										
60										

discrete window of
infectivity

29	Role of micro-	van Houte	1994	USA	401	351	825	14.62	21
31	organisms in caries	J							
31	etiology								
30	The functions of saliva	Mandel ID	1987	USA	397	358	732	11.54	17
31	Biting and chewing in	Fontijn-	2000	Netherlan	395	356	691	19.77	40
31	overdentures, full	Tekamp		ds					
31	dentures, and natural	FA							
31	dentitions								
32	Relaxation of	Davidson	1984	Netherlan	390	362	701	10.64	9
32	polymerization	CL		ds					
32	contraction stresses by								
32	flow in dental								
32	composites								
33	Cell-interactive alginate	Alsberg E	2001	USA	386	344	514	20.23	15
33	hydrogels for bone								
33	tissue engineering								
34	Long-term durability of	Sano H	1999	Japan	385	345	600	18.15	5
34	dentin bonds made with								
34	a self-etching primer, in								
34	vivo								
35	Pyrosequencing	Keijser BJF	2008	Netherlan	384	369	618	36.90	29
35	analysis of the oral			ds					
35	microflora of healthy								
35	adults								
36	Sleep bruxism: validity	Lavigne GJ	1996	Canada	382	359	649	16.31	26
36	of clinical research								
36	diagnostic criteria in a								
36	controlled								

1										
2										
3		polysomnographic								
4										
5		study								
6										
7	37	Risk factors in dental	Jarvinen	1991	Finland	377	311	695	11.51	18
8										
9		erosion	VK							
10										
11	38	Physiological factors	Dawes C	1987	Canada	377	329	692	10.61	23
12										
13		affecting salivary flow								
14										
15		rate, oral sugar								
16										
17		clearance, and the								
18										
19		sensation of dry mouth								
20										
21		in man								
22	39	Photodynamic therapy	Konopka K	2007	USA	375	335	686	30.45	39
23										
24		in dentistry								
25										
26	40	Indentation damage and	Xu HHK	1998	USA	374	340	524	17.00	16
27										
28		mechanical properties								
29										
30		of human enamel and								
31										
32		dentin								
33										
34	41	Global burden of severe	Kassebaum	2014	USA	371	345	598	86.25	116
35										
36		periodontitis in 1990-	NJ							
37										
38		2010: a systematic								
39		review and meta-								
40										
41		regression								
42										
43	42	The activation and	Tjäderhane	1998	Canada	365	337	577	16.85	21
44										
45		function of host matrix	L							
46										
47		metalloproteinases in								
48										
49		dentin matrix								
50										
51		breakdown in caries								
52										
53		lesions								
54										
55	43	Antifungal resistance of	Chandra J	2001	USA	362	326	585	19.17	14
56										
57		candidal biofilms								
58										
59										
60										

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3	formed on denture								
4									
5	acrylic in vitro								
6									
7	Hydrolytic degradation	Söderholm	1984	USA	356	294	569	8.64	7
8									
9	of dental composites	KJ							
10									
11	Bonding to ground	Watanabe I	1994	Japan	353	310	560	12.91	1
12									
13	dentin by a phenyl-P								
14									
15	self-etching primer								
16									
17	Molecular mechanisms	Ai-Aql ZS	2008	USA	350	329	562	32.90	41
18									
19	controlling bone								
20									
21	formation during								
22									
23	fracture healing and								
24									
25	distraction osteogenesis								
26									
27	Chlorhexidine arrests	Hebling J	2005	Brazil	347	311	596	23.92	12
28									
29	subclinical degradation								
30									
31	of dentin hybrid layers								
32									
33	in vivo								
34									
35	A comparative study of	Somerman	1988	USA	345	357	578	11.90	10
36									
37	human periodontal	MJ							
38									
39	ligament cells and								
40									
41	gingival fibroblasts in								
42									
43	vitro								
44									
45	Poor oral health and	Joshupura	1996	USA	343	317	666	14.40	6
46									
47	coronary heart disease	KJ							
48									
49	Effects of calcium	Schröder U	1985	Sweden	342	306	617	9.27	12
50									
51	hydroxide-containing								
52									
53	pulp-capping agents on								
54									
55	pulp cell migration,								
56									
57	proliferation, and								
58									
59	differentiation								
60									

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3	51	Assessment by nano-	van	1993	Belgium	338	317	539	12.68	5
4		indentation of the	Meerbeek							
5		hardness and elasticity	B							
6		of the resin-dentin								
7		bonding area								
8										
9										
10										
11										
12										
13	52	In vivo preservation of	Carrilho	2007	Brazil	336	312	569	28.36	23
14		the hybrid layer by	MRO							
15		chlorhexidine								
16										
17										
18										
19	53	Remineralization of	Reynolds	1997	Australia	335	288	642	13.71	26
20		enamel subsurface	EC							
21		lesions by casein								
22		phosphopeptide-								
23		stabilized calcium								
24		phosphate solutions								
25										
26										
27										
28										
29										
30	54	Tissue engineering of	Young CS	2002	USA	332	273	568	17.06	12
31		complex tooth								
32		structures on								
33		biodegradable polymer								
34		scaffolds								
35										
36										
37										
38										
39										
40	55	The effect of oxygen	Rueggeber	1990	USA	329	302	536	10.78	12
41		inhibition on an	g FA							
42		unfilled/filled								
43		composite system								
44										
45										
46										
47	56	Coronal caries in the	Kaste LM	1996	USA	326	274	618	12.45	14
48		primary and permanent								
49		dentition of children and								
50		adolescents 1–17 years								
51		of age: United States,								
52		1988–1991								
53										
54										
55										
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3	57	A comparison of whole	Navazesh	1982	USA	325	303	515	8.41	18
4		mouth resting and	M							
5		stimulated salivary								
6		measurement								
7		procedures								
8										
9										
10										
11										
12	58	Relationship of bacteria	Socransky	1970	USA	324	438	818	9.12	7
13		to the etiology of	SS							
14		periodontal disease								
15										
16										
17										
18	59	Global burden of	Kassebaum	2015	USA	323	263	554	87.66	115
19		untreated caries: a	NJ							
20		systematic review and								
21		metaregression								
22										
23										
24										
25										
26	60	Genetic and cellular	Schweikl H	2006	Germany	322	293	464	24.41	21
27		toxicology of dental								
28		resin monomers								
29										
30										
31										
32	61	Correlation of	Rueggebe	1988	USA	317	299	550	9.96	10
33		parameters used to	g F							
34		estimate monomer								
35		conversion in a light-								
36		cured composite								
37										
38										
39										
40										
41	62	Recent advances and	Cramer NB	2011	USA	307	255	517	36.42	40
42		developments in								
43		composite dental								
44		restorative materials								
45										
46										
47										
48										
49	63	Limitations in bonding	Liu Y	2011	China	306	271	493	38.71	51
50		to dentin and								
51		experimental strategies								
52		to prevent bond								
53		degradation								
54										
55										
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3	64	Bacterial adhesion to	Gibbons RJ	1989	USA	305	316	567	10.89	5
4		oral tissues: a model for								
5		infectious diseases								
6										
7										
8										
9	65	Tensile properties of	Sano H	1994	Japan	304	264	486	11.00	6
10		mineralized and								
11		demineralized human								
12		and bovine dentin								
13										
14										
15										
16										
17	66	Evidence of chemical	Yoshida Y	2000	Japan	302	272	504	15.11	14
18		bonding at biomaterial-								
19		hard tissue interfaces								
20										
21										
22	67	Complete marginal seal	Kemp-	1990	Netherlan	301	273	470	9.75	6
23		of Class V resin	Scholte		ds					
24		composite restorations	CM							
25		effected by increased								
26		flexibility								
27										
28										
29										
30										
31										
32	68	A System of	Russell AL	1956	USA	299	-	820	4.82	2
33		Classification and								
34		Scoring for Prevalence								
35		Surveys of Periodontal								
36		Disease								
37										
38										
39										
40										
41										
42										
43	69	Implant surface	Shalabi	2006	Netherlan	298	274	466	22.83	25
44		roughness and bone	MM		ds					
45		healing: a systematic								
46		review								
47										
48										
49										
50										
51	70	Resolution of	van Dyke	2003	USA	297	268	500	17.86	13
52		inflammation: a new	TE							
53		paradigm for the								
54		pathogenesis of								
55		periodontal diseases								
56										
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3	71	The relationship among	Sheiham A	2001	UK	296	269	552	15.82	17
4		dental status, nutrient								
5		intake, and nutritional								
6		status in older people								
7										
8										
9										
10										
11	72	Biofilm dispersal:	Kaplan JB	2010	USA	296	281	586	35.12	42
12		mechanisms, clinical								
13		implications, and								
14		potential therapeutic								
15		uses								
16										
17										
18										
19										
20	73	Monomer-solvent phase	van	2005	Belgium	296	270	450	20.76	5
21		separation in one-step	Landuyt							
22		self-etch adhesives	KL							
23										
24										
25										
26	74	Destructive and	Garlet GP	2010	Brazil	294	279	485	34.87	34
27		protective roles of								
28		cytokines in								
29		periodontitis: a re-								
30		appraisal from host								
31		defense and tissue								
32		destruction viewpoints								
33										
34										
35										
36										
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38										
39	75	Comparative SEM and	van	1993	Belgium	293	284	416	11.36	5
40		TEM examination of the	Meerbeek							
41		ultrastructure of the	B							
42		resin-dentin								
43		interdiffusion zone								
44										
45										
46										
47										
48										
49	76	Cytotoxic effects of	Hanks CT	1991	USA	293	287	440	10.62	11
50		resin components on								
51		cultured mammalian								
52		fibroblasts								
53										
54										
55										
56										
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3	77	New bacterial species	Kumar PS	2003	USA	292	281	477	18.73	21
4		associated with chronic								
5		periodontitis								
6										
7										
8										
9	78	Dental Caries in the	Keyes PH	1958	USA	292	-	519	4.86	14
10		Molar Teeth of Rats: II.								
11		a Method for								
12		Diagnosing and Scoring								
13		Several Types of								
14		Lesions Simultaneously								
15										
16										
17										
18										
19										
20	79	Does an incremental	Versluis A	1996	USA	292	251	536	11.40	8
21		filling technique reduce								
22		polymerization								
23		shrinkage stresses?								
24										
25										
26										
27										
28	80	Visual and instrumental	Seghi RR	1989	USA	291	284	551	9.79	23
29		colorimetric								
30		assessments of small								
31		color differences on								
32		translucent dental								
33		porcelain								
34										
35										
36										
37										
38										
39	81	Occlusal forces in	Proffit WR	1983	USA	290	276	543	7.88	10
40		normal-and long-face								
41		adults								
42										
43										
44										
45	82	Acute-phase	Slade GD	2000	USA	289	265	537	14.72	12
46		inflammatory response								
47		to periodontal disease in								
48		the US population								
49										
50										
51										
52										
53	83	A multiple logistic	Pullinger	1993	USA	283	260	544	10.40	9
54		regression analysis of	AG							
55		the risk and relative								
56		odds of								
57										
58										
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temporomandibular
disorders as a function
of common occlusal
features

1184	Shear vs. tensile bond	Della Bona	1995	UK	281	240	479	10.43	16
12	strength of resin	A							
13	composite bonded to								
14	ceramic								
15									
16									
17									
18	Peri-implant	Broggini N	2006	USA	279	260	459	21.66	36
19	inflammation defined								
20	by the implant-abutment								
21	interface								
22									
23									
24									
25									
26	Wear and marginal	Ferracane	1997	USA	279	259	469	12.44	19
27	breakdown of	JL							
28	composites with various								
29	degrees of cure								
30									
31									
32									
33									
34	TLR-signaling	Brown J	2011	USA	278	255	418	36.42	26
35	networks: an integration								
36	of adaptor molecules,								
37	kinases, and cross-talk								
38									
39									
40									
41	Stem-cell-based tissue	Ohazama A	2004	UK	277	240	487	17.14	8
42	engineering of murine								
43	teeth								
44									
45									
46									
47	Experimental	Salley JJ	1954	USA	277	337	526	5.26	3
48	carcinogenesis in the								
49	cheek pouch of the								
50	Syrian hamster								
51									
52									
53									
54									
55	Effect on caries of	Moynihan	2014	UK	273	-	510	68.25	47
56	restricting sugars intake:	PJ							
57									
58									
59									
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3		Systematic review to								
4		inform WHO guidelines								
5										
6										
7	91	Oral health-related	Sischo L	2011	USA	269	-	526	38.42	54
8		quality of life: What,								
9		why, how, and future								
10		implications								
11										
12										
13										
14		The continuum of dental	Featherston	2004	USA	268	-	602	19.14	35
15	92	caries - Evidence for a	e JDB							
16		dynamic disease process								
17										
18										
19										
20										
21										
22	93	Comparison of stem-	Batouli S	2003	USA	267	246	495	16.40	10
23		cell-mediated								
24		osteogenesis and								
25		dentinogenesis								
26										
27										
28										
29										
30	94	Retention in plaque and	Reynolds	2003	Australia	266	247	481	16.46	16
31		remineralization of	EC							
32		enamel lesions by								
33		various forms of								
34		calcium in a mouthrinse								
35		or sugar-free chewing								
36		gum								
37										
38										
39										
40										
41										
42										
43	95	Identification and	Bickenbach	1981	-	266	244	409	6.59	4
44		behavior of label-	JR							
45		retaining cells in oral								
46		mucosa and skin								
47										
48										
49										
50										
51	96	12-year survival of	Opdam	2010	Netherlan	265	-	439	33.12	42
52		composite vs. amalgam	NJM		ds					
53		restorations								
54										
55										
56										
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97	Setting reaction and	Ginebra	1997	Spain	265	247	361	11.76	7
	hardening of an apatitic	MP							
	calcium phosphate								
	cement								
98	Mechanisms of tooth	Wise GE	2008	USA	264	239	461	23.90	25
	eruption and								
	orthodontic tooth								
	movement								
99	Degradation, fatigue,	Drummond	2008	USA	262	241	432	26.20	35
	and failure of resin	JL							
	dental composite								
	materials								
100	An in vivo study of the	Quirynen	1993	Belgium	262	250	435	10.00	19
	influence of the surface	MV							
	roughness of implants								
	on the microbiology of								
	supra-and subgingival								
	plaque								

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Table 2. The list of the top 20 highly cited articles of each decade published in the first 50 years of the *JDR*

1919 – 1929					
Rank	Title of article	Country of origin	Citation count (Google Scholar)	Citation density	Current citation index (2018)
1	Rosenow EC. 1919. Studies on elective localization focal infection with special reference to oral sepsis'. Journal of Dental Research. 1(3):205-267.	USA	144	1.45	2
2	Hirschfeld I. 1923. A study of skulls in the american museum of natural history in relation to periodontal disease. Journal of Dental Research. 5(4):241-265.	USA	141	1.48	1
3	Williams JL. 1923. Mottled enamel, and other studies of normal and pathological conditions of this tissue. Journal of Dental Research. 5(3):117-195.	USA	53	0.55	0
4	Fraser CJ. 1929. A study of the efficiency of dental fillings. Journal of Dental Research. 9(4):507-517.	Canada	51	0.57	0
5	Klein H, Amberson WR. 1929. A physico-chemical study of the structure of dental enamel. Journal of Dental Research. 9(5):667-688.	USA	50	0.56	0
5	Hellman M. 1929. The face and teeth of man: A study of growth and position. Journal of Dental Research. 9(2):179-201.	USA	50	0.56	2
1930 – 1939					
1	Zander H. 1939. Reaction of the pulp to calcium hydroxide. Journal of Dental Research. 18(4):373-379.	USA	239	3.02	3
2	Manly RS, Hodge HC. 1939. Density and refractive index studies of dental hard tissues: I. Methods for separation and determination of purity. Journal of Dental Research. 18(2):133-141.	USA	209	2.64	0

3	Hadley FP. 1933. A quantitative method for estimating	USA	201	2.36	0
4	<i>bacillus acidophilus</i> in saliva. <i>Journal of Dental Research</i> .				
5	13(5):415-428.				
9	4 Burket LW, Burn CG. 1937. Bacteremias following dental	USA	168	2.07	1
10	extraction. Demonstration of source of bacteria by means				
11	of a non-pathogen (<i>serratia marcesens</i>). <i>Journal of Dental</i>				
12	Research. 16(6):521-530.				
16	5 Enright J, Friesell H, Trescher M. 1932. Studies of the		164	1.90	1
17	cause and nature of dental caries. <i>Journal of Dental</i>				
18	Research. 12(5):759-851.				

1940 – 1949

1	Stephan RM. 1944. Intra-oral hydrogen-ion concentrations	USA	517	6.98	18
25	associated with dental caries activity. <i>Journal of dental</i>				
26	research. 23(4):257-266.				
30	2 Morse A. 1945. Formic acid-sodium citrate decalcification	USA	268	3.67	4
31	and butyl alcohol dehydration of teeth and bones for				
32	sectioning in paraffin. <i>Journal of Dental Research</i> . 24(3-				
33	4):143-153.				
37	3 Glass R, Zander H. 1949. Pulp healing. <i>Journal of Dental</i>	USA	258	3.73	5
38	Research. 28(2):97-107.				
41	4 Howell A, Manly R. 1948. An electronic strain gauge for	USA	221	3.15	5
42	measuring oral forces. <i>Journal of dental research</i> .				
43	27(6):705-712.				
47	5 Deakins M. 1942. Changes in the ash, water, and organic	USA	217	2.85	0
48	content of pig enamel during calcification. <i>Journal of</i>				
49	Dental Research. 21(5):429-435.				

1950 – 1959

1	Buonocore MG. 1955. A simple method of increasing the	USA	4015	63.73	126
55	adhesion of acrylic filling materials to enamel surfaces.				
56	<i>Journal of dental research</i> . 34(6):849-853.				

1							
2							
3	2	Russell A. 1956. A system of classification and scoring for	USA	820	13.22	11	
4		prevalence surveys of periodontal disease. Journal of					
5		Dental Research. 35(3):350-359.					
6							
7							
8							
9	3	Manly RS, Braley LC. 1950. Masticatory performance and	USA	705	10.36	21	
10		efficiency. Journal of Dental Research. 29(4):448-462.					
11							
12							
13	4	Moorrees CF, Thomsen SØ, Jensen E, Yen PK-J. 1957.	USA	546	8.95	19	
14		Mesiodistal crown diameters of the deciduous and					
15		permanent teeth in individuals. Journal of Dental Research.					
16		36(1):39-47.					
17							
18							
19							
20	5	Salley JJ. 1954. Experimental carcinogenesis in the cheek	USA	526	8.21	5	
21		pouch of the syrian hamster. Journal of dental research.					
22		33(2):253-262.					
23							
24							
25							
26	1960 – 1969						
27							
28	1	Moorrees CF, Fanning EA, Hunt Jr EE. 1963. Age	USA	2126	38.65	122	
29		variation of formation stages for ten permanent teeth.					
30		Journal of dental research. 42(6):1490-1502.					
31							
32							
33							
34	2	Corah NL. 1969. Development of a dental anxiety scale.	USA	1424	29.06	73	
35		Journal of dental research. 48(4):596-596.					
36							
37							
38	3	Björk A. 1963. Variations in the growth pattern of the	Denmark	1060	19.27	27	
39		human mandible: Longitudinal radiographic study by the					
40		implant method. Journal of dental Research. 42(1):400-					
41		411.					
42							
43							
44							
45	4	Dirks OB. 1966. Posteruptive changes in dental enamel.	Netherlands	490	9.42	8	
46		Journal of Dental Research. 45(3):503-511.					
47							
48							
49	5	Sunada I. 1962. New method for measuring the length of	Japan	437	7.80	19	
50		the root canal. Journal of Dental Research. 41(2):375-387.					
51							
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Figure 1A & 1B

160x166mm (300 x 300 DPI)

Bibliometric analysis of number of citations over the decades

159x93mm (300 x 300 DPI)

Country of origin of the top 100 papers.

159x97mm (300 x 300 DPI)

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The time trends in the top 100 most-cited articles according to their categories.

159x88mm (300 x 300 DPI)

Supplemental Appendix

Title of the article: “100 years of the Journal of Dental Research: A Bibliometric Analysis”

Author names: Paras Ahmad¹, Mohammad Khursheed Alam^{2*}, Nicholas S. Jakubovics³,
Falk Schwendicke⁴, Jawaad Ahmed Asif^{5*}

For Peer Review

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Appendix Table 1. The list of the top 20 highly cited articles published in the first 50 years of the *JDR*

Rank	Title of article	Country of origin	Citation count (Google Scholar)	Citation density	Current citation index
1	Buonocore MG. 1955. A simple method of increasing the adhesion of acrylic filling materials to enamel surfaces. J Dent Res. 34(6):849-853.	USA	4015	63.73	126
2	Moorrees CF, Fanning EA, Hunt Jr EE. 1963. Age variation of formation stages for ten permanent teeth. J Dent Res. 42(6):1490-1502.	USA	2126	38.65	122
3	Corah NL. 1969. Development of a dental anxiety scale. J Dent Res. 48(4):596-596.	USA	1424	29.06	73
4	Björk A. 1963. Variations in the growth pattern of the human mandible: Longitudinal radiographic study by the implant method. J Dent Res. 42(1):400-411.	Denmark	1060	19.27	27
5	Russell A. 1956. A system of classification and scoring for prevalence surveys of periodontal disease. J Dent Res. 35(3):350-359.	USA	820	13.22	11
6	Manly RS, Braley LC. 1950. Masticatory performance and efficiency. J Dent Res. 29(4):448-462.	USA	705	10.36	21

7	Moorrees CF, Thomsen SØ, Jensen E, Yen PK-J.	USA	546	8.95	19
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8	Salley JJ. 1954. Experimental carcinogenesis in the cheek pouch of the syrian hamster. J Dent Res. 33(2):253-262.	USA	526	8.21	5
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10	Stephan RM. 1944. Intra-oral hydrogen-ion concentrations associated with dental caries activity. J Dent Res. 23(4):257-266.	USA	517	6.98	18
11	Dirks OB. 1966. Posteruptive changes in dental enamel. J Dent Res. 45(3):503-511.	Netherlands	490	9.42	8
12	Baume LJ. 1950. Physiological tooth migration and its significance for the development of occlusion: I. The biogenetic course of the deciduous dentition. J Dent Res. 29(2):123-132.	USA	441	6.48	21
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Appendix Figure 1. Network analysis of authors that published in the *JDR*. The size of the nodes represents the frequency of co-authorship. The edges (line connecting the nodes) represent the collaboration between authors. The thicker the line, the closer the collaboration between authors. Note that the colors of the nodes of the authors represent the cluster to which authors belong.

Appendix Figure 2. Network analysis of keywords. The size of the nodes represents the frequency of the keywords, with larger nodes indicating higher frequency. The thickness of the edges is related to the closeness of the interactions between two nodes. Note that the colors of the nodes of the keywords indicate the cluster to which keywords belong.