An Analysis on Review Visualisation of implementation of Aluminium in Dentistry

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Abstract

The visualisation of research trends of usage of Aluminium in dentistry by using review analysis had been conducted in this paper. This research will help to understand the active authors, organizations, journals, and countries involved in the research on "usage of Aluminium in dentistry". All published articles related to "Aluminium in dentistry" from "Scopus", were analyzed using the Meta Analysis to prepare and present the research trends. This article had set the objective to consolidate the scientific literature regarding "Aluminium usage in dentistry" and also to find out the trends related to the same. The leading Journals were the Journal of Prosthetic Dentistry. The most active country was the United States of America. The leading organization engaged in research regarding Aluminium in dentistry was the Sao Paulo State University, Brazil. The most active authors who had made valuable contributions related to Aluminium dental implants were Correr-Sobrinho.

Keywords: Aluminium, Dentistry, Material engineering, review analysis, Meta Analysis,

1. Introduction

Aluminium is used for treating dental bones and coating (Beldüz *et al.*, 2010).Corrosion of dental implants is a major threat to Aluminium-based implants.(Bayer, Tiwari and Megaridis, 2008) but can be handled by the advances in material engineering; surface coating; and by using Aluminium free implants (Choudhary *et al.*, 2014). The major challenges to be noted while using Aluminium in dentistry are the allergy or hypersensitivity; and toxicity of Aluminium implants; high level of serum Aluminium level and lead to various complicated health issues. But contradictory studies are highlighting that there is no evidence for high-level Aluminium content (Adams *et al.*, 2003)

Aluminium metal and aluminium oxide have diversified usage in dentistry(Petrû *et al.*, 1982). Aluminium is used for prosthetic dentistry. Similarly, Aluminium is used to treat dental pulp tissues (Beldüz *et al.*, 2010). Aluminium phthalocyanine nanoparticles were used for local fluorescence spectroscopy in dentistry (Vasilchenko *et al.*, 2010) and skin auto transplantology(Vasilchenko *et al.*, 2010). Aluminium oxides were also used for various dental ceramic implants (Büsing *et al.*, 1983)(Cook, Anderson and Lavernia, 1983)(Cook, Klawitter and Weinstein, 1981)(Cook, Weinstein and Klawitter, 1982, 1983; Cook *et al.*, 1983); Aluminium usage for dental fillings; for biocompatible film coating on dental alloys (Chung *et al.*, 2004).

Innovations in material and surface engineering by using Aluminium can revolutionize the performance and life of dental–implants along with measures for reducing toxicity and hypersensitivity of the metal. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Aluminium dental implants.

This article is arranged into four sections. The first section is the introduction, followed by the discussion of the methodology by which the research was conducted. The third section deals with results and discussion. The fourth section deals with the conclusion. The following research objectives and research questions were framed for conducting review analysis systematically.

1.1 Research Objectives

a) To consolidate the literature regarding Aluminium in dentistry
b) To find out the trends related to research in Aluminium in dentistry

1.2 Research Questions

a) Who are the active researchers working on Aluminium usage in dentistry?
b) Which are the main organizations and countries working on Aluminium usage in dentistry?
c) Which are the main journals on Aluminium usage in dentistry?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Aluminium in dentistry). All the tables in this paper were created by using Microsoft Excel and Meta Analysis. Grammarly was used for spelling and grammar checks. Mendeley was used for article review and citation. This paper had been inspired by review analysis in its presentation style, analysis, and methodology from the works.

3. Results and discussion

3.1 Results

This first round of search produced an outcome of 222 documents, in 9 languages, out of which 213 documents were in English. The classification of document categories is shown in Table 1. For improving the quality of the analysis, we had selected only the peer-reviewed articles and all other documents had not been considered. Thus after using filters “Article” and “English” the second round search produced an outcome of181English articles (both open access and others) and had been used to conduct review analysis and visualization using Meta Analysis. The English research articles in this domain since 1953 had been shown in Figure 1.

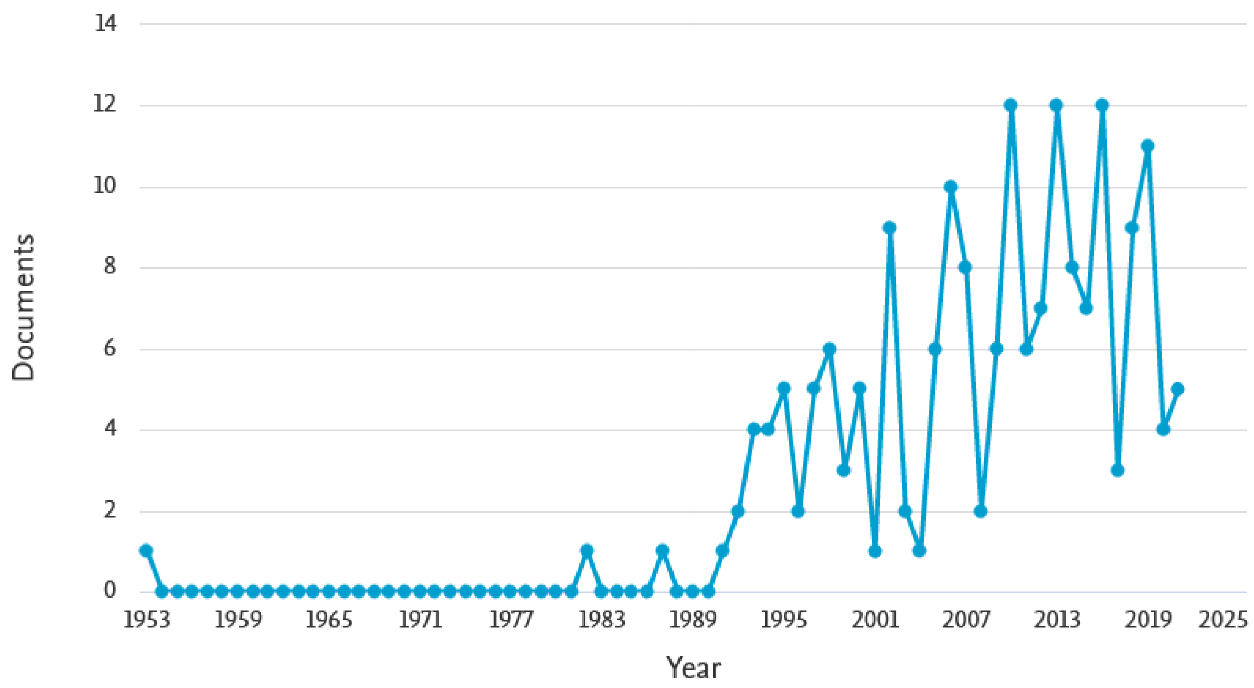

Figure 1: Period wise publication of articles

Co-authorship analysis of top authors had been shown in Table1. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as two and the minimum number of citations of authors as one. This combination plotted the map of 24 authors, in 16 clusters. The overlay visualization map of co-authorship analysis plotted in Table1, points out the major researchers with their strong co-authorship linkages and clusters involved. The citation analysis of top authors had been shown in table 1, along with co-authorship links. For the citation analysis, the parameters used were the minimum number of documents of an author as one and the minimum citations of an author as one.

Table 1: Highlights of most active authors

Description	Authors	Documents	Citations	Average citations per documents	Link strength
Authors with the highest publication and co-authorship links	Correr-Sobrinho	3	123	41	13
Authors with the highest citations	Alleyne D	1	585	585	2
	Cawley P	1	585	585	2
	Meredith N	1	585	585	2

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 20. This combination plotted the map of 28 thresholds, in five clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Aluminium in dentistry" had been found out by the volume of publications and citation analysis, the parameters used are the minimum number of documents of an organization as one and the minimum number of citations of organizations as one(Singh and Kumar, 2013). The leading organization in the research regarding "Aluminium in dentistry", with the highest number of publications and citations, was the Sao Paulo State University, Brazil(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
Sao Paulo State University	Brazil	8	142	18

Co-authorship analysis of the countries engaged in the research on "Aluminium in dentistry" had been shown in Table2. The overlay visualization map of co-authorship analysis plotted in Table3, points out the main countries with their strong co-authorship linkages and clusters involved. The citation analysis of top countries had been shown in table 3, along with co-authorship links. For the citation analysis, the parameters used were the minimum number of documents of a country as one and the minimum citations of the country as one.

Table 3: Highlights of Active Countries

Description	Country	Documents	Citations	Link strength
The country with the highest publication, citations, and co-authorship links	United States of America	45	2437	23

The most active country in this research domain was the United States of America, with the highest number of publications, and citations.

Link analysis and citation analysis were used to identify the most active journal in this research domain. We have taken the parameters of the minimum number of documents of a journal as one and the minimum number of citations of a journal as one for the link analysis and citation analysis. Highlights of the most active and relevant journals related to "Aluminium in dentistry" are shown in table 4. Table 4shows the journal activity of this research domain through parameters of publication volume, citations, and co-authorship linkages.

Table 4: Analysis of journal activity

Description	Journal details	Documents	Citations	Average citations per documents	Links
Journal with the highest publications, citations and links	Journal of Prosthetic Dentistry	42	2184	52	21

From the above discussion regarding the review patterns in the research regarding Aluminium in dentistry, this research had observed a gradual increase in research interest regarding Aluminium in dentistryfrom the starting of the millennium, and the momentum is going on positively. This points out the relevance and potential of this research domain (Refer to Table 2).The most active authors in this research domain were Correr-Sobrinho with the highest publication and co-authorship links(Refer to table 1).The overlay analysis of top countries researching Aluminium in dentistry indicates that the United States of America was the leading country relating to the highest number of publications, citations, and co-authorship links(Refer to Table 5). The top journals of this research domain were identified as the Journal of Prosthetic Dentistry. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Aluminium in dentistry.

4. Conclusion

Aluminium in dentistry was an interesting research domain and the most active journals related to this research domain was the Journal of Prosthetic Dentistry. The most active country was the United States of America. The leading organization engaged in research regarding Aluminium in dentistry was the Sao Paulo State University, Brazil. The most active authors who had made valuable contributions related to Aluminium dental implants were Correr-Sobrinho. This research domain offers a new avenue for researchers and future research can be on innovations in Aluminium in dentistry.

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