Review on Use of IT in Aluminium Based Bone Implants

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Abstract

This research paper is the visualisation of research trends in Aluminium bone implants through Review analysis. This research will help to understand the active authors, organizations, journals, and countries involved in the research of "Aluminium bone-implants". All published articles related to "Aluminium bone-implants" from "Scopus", were analyzed using the Meta Analysis to develop analysis tables and visualization maps. This article had set the objective to consolidate the scientific literature regarding "Aluminium bone-implants" and also to find out the trends related to the same. The leading Journals were the International Journal of Oral and Maxillofacial Implants. The most active country was the United States of America. The leading organization engaged in the research regarding Aluminium bone implants was the University of Texas. The most active authors who had made valuable contributions related to Aluminium bone implants were Boyan B.D, Schwartz Z.; and Albrektsson .T

Keywords: Aluminium, Bone-implants, Material engineering, Review analysis, Meta Analysis,

Introduction

Bone implants are a common type of implants. Various metals like Titanium, Steel, Nickel, Aluminium etc are commonly used for bone implants. The major challenge associated with Aluminium-based orthopaedic implants is corrosion. (Bayer, Tiwari and Megaridis, 2008); allergy or hypersensitivity and toxicity of Aluminium implants; the high level of serum Aluminium level (Grübl *et al.*, 2006) 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) Issues of cracks were also associated with Aluminium-based implants (Kubota *et al.*, 1998).However, the threat of corrosion of Aluminium implants can be handled by the advances in material engineering; surface coating; and by using Aluminium free implants (Choudhary *et al.*, 2014).

Aluminium based materials were used for various types of tissue repairs and tissue replacements (Alexander *et al.*, 1985). Aluminium foils were widely applied for tissue engineering (Singh and Kumar, 2013). Various types of orthopaedic treatments can be conducted the Aluminium and Aluminium-based alloys. Aluminium implants are widely used for diversified medical purposes including dental, knee and hip implants. The aluminium oxide coating is used for 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 oxide for bone regeneration (Isa Majluf, Harán Vega and Moreno Zárate, 2007); hip implants (Christel *et al.*, 1986)(Ingram, 1988)(Kedra *et al.*, 1987); knee implants; Aluminium wire implants.

This Review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Aluminium ortho-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 bone-implants
b) To find out the trends related to research in Aluminium bone-implants

1.2 Research Questions

a) Who are the active researchers working on Aluminium bone implants?
b) Which are the main organizations and countries working on Aluminium bone implants?
c) Which are the main journals on Aluminium bone implants?

Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Aluminium bone implant). This paper had used the software of Microsoft Excel, Mendeley, Grammarly and Meta Analysis.This paper had been inspired by Review analysis in its presentation style, analysis, and methodology from the works.

Results and discussion

1.1 Results

This first round of search produced an outcome of 466 documents, in13languages, out of which 428 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. The filters “Article” and “English” were used in the second-round search, produced an outcome of319English articles (both open access and others) andhad been used to conduct Review analysis and visualization using Meta Analysis. The English research articles in this domain since 1971had been shown in Figure 1.

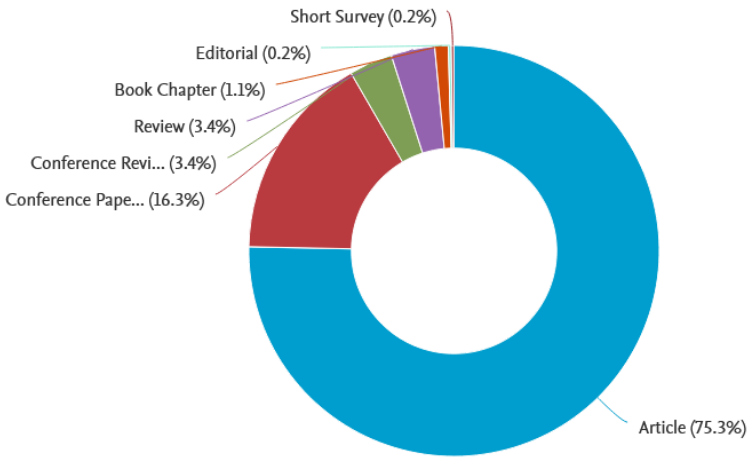

Figure 1: Classification of the documents on “Aluminium bone implant”,

Co-authorship analysis of top authors had been shown in Table 3. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as four and the minimum number of citations of authors as one. This combination plotted the map of21authors, in 10clusters. The overlay visualization map of co-authorship analysis plotted in Table3, 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.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	Boyan B.D	12	561	46.7	66
	Schwartz Z.	12	561	46.7	66
Authors with the highest citations	Albrektsson .T.	5	688	137.6	17

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as50. This combination plotted the map of 24thresholds, in threeclusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Aluminium bone-implants" 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. The leading organization in the research regarding "Aluminium bone-implants", with the highest number of publications and citations, was the University of Texas, United States of America(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
University of Texas	United States of America	11	456	41.4

Co-authorship analysis of the countries engaged in the research on "Aluminium bone-implants" had been shown in Table3. 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.

Table 5: Co-authorship analysis on basis of countries

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 leading publication, citations, and co-authorship links	United States of America	82	3544	40

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 bone-implants" are shown in table 4. Table 4shows the journal activity of this research domain through parameters of publication volume and citations.

Table 4: Analysis of journal activity

Description	Journal details	Documents	Citations	Average citations per documents
Journal with the highest publications and citations	International Journal of Oral and Maxillofacial Implants	24	1280	53.3

From the above discussion regarding the Review patterns in the research regarding Aluminium bone implants, this research had observed a gradual increase in research interest regarding Aluminium bone implantsfrom 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 Boyan B.D, Schwartz Z.; and Albrektsson .T with the highest publication and links; and citations respectively(Refer to table 1).The overlay analysis of top countries researching Aluminium bone implants indicates that the United States of America was the leading country relating to the highest number of publications and citations (Refer to Table 5). The top journals of this research domain were identified as the International Journal of Oral and Maxillofacial Implants. 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 bone–implants.

Conclusion

Aluminium bone implants was an interesting research domain and the most active journals related to this research domain was the International Journal of Oral and Maxillofacial Implants. The most active country was the United States of America. The leading organization engaged in the research regarding Aluminium bone implants was the University of Texas. The most active authors who had made valuable contributions related to Aluminium bone implants were Boyan B.D, Schwartz Z.; and Albrektsson .T. This research domain offers a new avenue for researchers and future research can be on innovations in Aluminium bone implants.

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