A Comprehensive Analysis and Visualisation of Research Trends in Lithium-Implants

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Abstract

Lithium is one of the most used metals for implants. The review analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the research domain of "Lithium-implants". All published articles related to "Lithium-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 "Lithium-implants" and also to find out the trends related to the same. The leading Journals were Journal of Prosthetic Dentistry. The most active country was the United States of America. The leading organization engaged in the research regarding Lithium-implants was the Chinese Academy of Sciences, China. The most active author who had made valuable contributions related to Magnesium-implants wasKern M. and Niessen R.A

Keywords: Lithium-implants, Material engineering, Review analysis, Meta Analysis

1. Introduction

An engineered medical device to replace a missing or damaged biological structure is known as an implant. Different types of metals and materials are used to create implants. Lithium-doped biological-derived hydroxyl apatite coating scan improve the mechanical characteristics and other properties of the implant. Lithium metal had diversified applications in the medical field, especially in dentistry. Dental crowns fabricated with Lithium disilicate can have a long survival level and the Fabrication of dental crowns with Lithium disilicate is an important medical application of Lithium metal (Cardelli, Belletti, and Murmura, 2014) (Maló *et al.*, 2014) (Mitsias *et al.*, 2014). However there are concerns of fatigue loading on the fracture strength and failure mode of lithium disilicate; Lithium chloride enhances bone regeneration and implant osseointegration in osteoporotic conditions; similarly, there is evidence for Lithium chloride improves bone filling around implants placed in estrogen-deficient rats;.

Material engineering and surface engineering can play a significant role in improving the performance and life of Lithium–implants along with measures for reducing toxicity and hypersensitivity of the metal implants. Future research can also be on surface coatings by using, metal implants using Lithium. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Lithium-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 Lithium-implants
b) To find out the trends related to research in Lithium-implants

1.2 Research Questions

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

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Lithium implant). 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 394 documents, in eighteen languages, out of which 370 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 of 311English 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 1972 had been shown in Table1.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 four and the minimum number of citations of authors as one. This combination plotted the map of15authors, in six 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 links	Kern M.	10	127	12.7	38
Authors with the highest citations	Niessen R.A.H	2	352	176	5

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as40. This combination plotted the map of 28thresholds, in four clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Lithium-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 organizations in the research regarding "Lithium-implants", with the highest number of publications and citations, were the University of Kiel,Germany(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
University of Kiel	Germany	10	127	12.7

Co-authorship analysis of the countries engaged in the research on "Lithium-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. 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	93	1526	53

The most active country in this research domain was the United States of America, with the highest number of publications, links, 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 "Lithium-implants" 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	28	339	12.1	96

From the above discussion regarding the review patterns in the research regarding Lithium-implants,this research had observed a gradual increase in research interest regarding Lithium-implants from 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 Kern M. and Niessen R.A.Hwith the highest publication, citations, and co-authorship links (Refer to table 1).The overlay analysis of top countries researching Lithium-implants 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 journal of this research domain was 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 Lithium–implants.

4. Conclusion

Lithium-implants was an interesting research domain and the most active journals related to this research domain were Journal of Prosthetic Dentistry. The most active country was the United States of America. The leading organization engaged in the research regarding Lithium-implants was the Chinese Academy of Sciences, China. The most active author who had made valuable contributions related to Lithium-implants was Kern M. and Niessen R.A.H with the highest publication and co-authorship links; and citations respectively. This research domain offers a new avenue for researchers and future research can be on innovations in Lithium-implants.

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