

A Detailed Review on Zinc Cochlear-Implants

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Abstract

Zinc is one of the popularly used metals for implants. There view analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the research domain of “Zinc cochlear implants”. All published articles related to “Zinc cochlear-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 “Zinc cochlear implants” and also to find out the trends related to the same. The leading Journals were the Hearing Research and Journal of Comparative Neurology. The most active country was the United States of America. The leading organization engaged in the research regarding Zinc cochlear implants was the University of Pittsburgh, United States of America. The most active author who had made valuable contributions related to Zinc cochlear-implants was Tzounopoulos T and Ding D.

Keywords: Zinc, Cochlear-implants, Material engineering, Review analysis, Meta Analysis,

1. Introduction

Zinc-based medical implants are widely used for diversified medical purposes. The Bio-compatibility of Zinc and its biodegradability had been helpful for diversified medical applications(Chen *et al.*, 2011). Similarly, the high concentration of metals in body fluids, toxicity, allergy, and corrosion are minor threats to Zinc implants.; however, there is evidence for the fact that the Zinc coating of implants can resist corrosion.

The anti-bio-film properties of Zinc, make it a biocompatible option for surface-coating of dental implants; zinc phosphate-calcium phosphate composite coatings on pure iron for biodegradable implant applications; zinc phosphate coating for biodegradable implant applications.

Zinc metal is used for cochlear implants and Zinc oxide is used for powering the cochlear implants. Nuclear zinc protein is used for cochlear growth and cell fate(Chen *et al.*, 2008). Similarly, zinc supplementation can decrease respiratory complications (Franco-Vidal *et al.*, 2007)(Nagy *et al.*, 2005) (McFadden *et al.*, 1999).

Material engineering and surface engineering can play a significant role in improving the performance and life of Zinc cochlear-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 Zinc. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding zinc cochlear 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

- To consolidate the literature regarding Zinc cochlear-implants
- To find out the trends related to research in Zinc cochlear-implants

1.2 Research Questions

- Who are the active researchers working on Zinc cochlear implants?
- Which are the main organizations and countries working on the Zinc based cochlear-implants?
- Which are the main journals on Zinc cochlear implants?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (ZincCochlear). 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 58 documents, in three languages, out of which 55 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 46 English 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 1973 had been shown in Table 1. Co-authorship analysis of top authors had been shown in Table 1. 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 21 authors, in six clusters. The overlay visualization map of co-authorship analysis plotted in Table 1, 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	Tzounopoulos T	6	181	30	32
Authors with the highest citations	Ding D	2	245	122.5	10

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 10. This combination plotted the map of 20 thresholds, in two clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table 2. The leading organizations engaged in research on “Zinc cochlear-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 “Zinccochlear implants”, with the highest number of publications and citations, were the University of Pittsburgh, sUnited 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 Pittsburgh	United States of America	6	181	30

Co-authorship analysis of the countries engaged in the research on “Zinc cochlear-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	32	1254	16

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 “Zinc cochlear 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	Hearing Research	6	121	20	10
Journal with highest citations and links	Journal of Comparative Neurology	3	353	118	10

From the above discussion regarding the review patterns in the research regarding Zinc-cochlear implants,this research had observed a gradual increase in research interest regarding Zinccochlear 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 Tzounopoulos T and Ding D with the highest publication, links; and citations respectively(Refer to table 1).The overlay analysis of

top countries researching Zinccochlear 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 journals of this research domain were identified as Hearing Research and Journal of Comparative Neurology. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Zinc cochlear-implants.

4. Conclusion

Zinccochlear implants was an interesting research domain and the most active journals related to this research domain were Hearing Research and Journal of Comparative Neurology. The most active country was the United States of America. The leading organization engaged in the research regarding Zinccochlear implants was the University of Pittsburgh, United States of America. The most active author who had made valuable contributions related to Zinc cochlear-implants was Tzounopoulos T and Ding D with the highest publication, links; and citations respectively. This research domain offers a new avenue for researchers and future research can be on innovations in Zinc cochlear-implants.

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