A detailed Review on Magnesium Dental-Implants

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Abstract

Magnesium 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 "Magnesium dental-implants". All published articles related to "Magnesium dental 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 "Magnesium dental-implants" and also to find out the trends related to the same. The leading Journals were Clinical Oral Implants Research and Journal of Biomedical Materials Research. The most active country was United States of America and Germany. The leading organization engaged in research regarding Magnesium dental implants was the Gothenberg University, Sweden. The leading authors were Sul Y.T. and Knabe C.

Keywords: Magnesium, Dental-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. The Bio-compatibility of Magnesium and its biodegradability had been helpful for diversified medical applications.

The high degradation rate and poor antibacterial properties are the main drawbacks of magnesium implants(Atrens, Liu and Zainal Abidin, 2011). There are pieces of evidence that the Cyto-compatible and antibacterial coating layer on magnesium implants can improve the performance of implants.

Dental implant coating is an important niche in dentistry. Magnesium-containing mixed coatings on zirconia for dental implants can improve the performance of the implants in terms of mechanical stability, compositional properties of bone, and better bone in growth; similarly, Magnesium-based bone cement can be used for securing immediate dental implants (Sehlke et al., 2013). The Mechanical properties and osteoblast proliferation of complex porous dental implants filled with magnesium alloy were found effective. Titanium-Magnesium bioactive metal-metal composite can be utilized for the fabrication of dental implants. This Titanium-Magnesium composite for dental implants was named BIACOM, having improved mechanical compatibility and better osseointegration potential.

Material engineering and surface engineering can play a significant role in improving the performance and life of Magnesium dental–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 Magnesium. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Magnesium dental implants. This article is arranged into four sections. The first section is 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 Magnesium based dental-implants

    b) To find out the trends related to research in Magnesium based dental-implants

1.2 Research Questions

    a) Who are the active researchers working on Magnesium based dental-implants?

    b) Which are the main organizations and countries working on Magnesium based dental-implants?

    c) Which are the main journals on Magnesium based dental-implants?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Magnesium dental 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 223 documents, in four languages, out of which 229 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 163English 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 1935 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 three and the minimum number of citations of authors as one. This combination plotted the map of 24 authors, in nine 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	Sul Y.T	7	619	88.4	25
Authors with the highest citation	Knabe C	2	770	385	13

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as25. This combination plotted the map of 30thresholds, in four clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Magnesium dental 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 "Magnesium dental-implants", with the highest number of publications and citations, were the Gothenberg University, Sweden(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
Gothenberg University	Sweden	7	619	88.4

Co-authorship analysis of the countries engaged in the research on "Magnesium dental 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 highestpublication, and co-authorship links	United States of America	26	1057	15
The country with the highest citations	Germany	21	1568	9

The most active countries in this research domain were the United States of America and Germany, with the highest number of publications, links; and citations respectively.

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 "Magnesium dental-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, and links	Clinical Oral Implants Research	11	429	39	45
Journal with the highest citations	Journal of Biomedical Materials Research	4	951	238	26

From the above discussion regarding the review patterns in the research regarding Magnesium dental implants,this research had observed a gradual increase in research interest regarding Magnesium dental 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 Sul Y.T. and Knabe C with the highest publication and co-authorship links; citations respectively(Refer to table 1).The overlay analysis of top countries researching Magnesium dental implants indicates that the United States of America and Germany were the leading country relating to the highest number of publications andco-authorship links, and citations respectively(Refer to Table 5). The top journals of this research domain were identified as Clinical Oral Implants Research and Journal of Biomedical Materials Research. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Magnesium dental–implants.

4. **Conclusion**

Magnesium-implants was an interesting research domain and the most active journals related to this research domain were Clinical Oral Implants Research and Journal of Biomedical Materials Research. The most active country was United States of America and Germany. The leading organization engaged in research regarding Magnesium dental implants was the Gothenberg University, Sweden. The leading authors were Sul Y.T. and Knabe C with the highest publication and co-authorship links; citations respectively. This research domain offers a new avenue for researchers and future research can be on innovations in Magnesium dental implants.

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