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A Review Analysis of Use of IC in Vanadium-Implants

Gitanjali Mehta, Associate Professor, Department of Electronics, Electrical and Communications, Galgotias University

Abstract

Vanadium 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 "Vanadium-implants". All published articles related to "Vanadium-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 "Vanadium -implants" and also to find out the trends related to the same. The leading Journals were the International Journal of Oral and Maxillofacial Implants and Biomaterials. The most active country was the United States of America. The leading organization engaged in the research regarding Vanadium-implants was the Georgia Institute of Technology, USA. The most active authors who had made valuable contributions related to Vanadium-implants were Boyan B.D, Schwartz. Z; and Jacobs J.J.

Keywords: Vanadium-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 (Priyanka *et al.*, 2014). Various types of implants had been used in modern medicine and include dental implants (Bhola *et al.*, 2010) dental crown (Er and Unsaldi, 2013)sensory implants, neurological implants, cardiovascular implants, orthopedic implants(Er and Unsaldi, 2013), contraceptive implants, and cosmetic implants.

Vanadium implants range from orthopedic implants, knee implants, dental implants (Zagury *et al.*, 2007).The major issues associated with implants of Vanadium are the hypersensitivity and toxicity of the metal; development of systematic dermatitis and implant failure; Similarly poor functioning of implant and issues of cytotoxicity are also associated with Vanadium implants.

Corrosion of Vanadium–implants is also an issue to be addressed. Various types of surface engineering and surface coating can be conducted in Vanadium–implants to improve their

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performance and longevity. Thermal and chemical modifications in Vanadium implants can improve the performance of the implant. (MacDonald *et al.*, 2004). Vanadium can be used for biomaterials and researchers had found that vanadium doesn't have any adverse effect on red blood cells and can improve the anti-bacterial functions of the implant.

Material engineering and surface engineering can play a significant role in improving the performance and life of Vanadium –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 Vanadium-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 Vanadium-implants
b) To find out the trends related to research in Vanadium -implants

1.2 Research Questions

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

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Vanadium-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 380 documents, in eight languages, out of which 364 documents were in English. The classification of document categories is shown in Table 1. For

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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 299 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 1971 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 35 authors, in 15clusters. 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	Boyan B.D	12	465	38.7	64
	Schwartz. Z	12	465	38.7	64
Authors with the highest citations	Jacobs J.J	8	909	113.6	29

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 35. This combination plotted the map of 29thresholds, in three clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Vanadium -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 "Vanadium-implants", with the highest number of publications and citations, was the Georgia Institute of Technology (Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
Georgia Institute of Technology	United States of America	12	465	38.8

IJMTARC – VOLUME – IV – ISSUE - 16 – DEC 2016

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Co-authorship analysis of the countries engaged in the research on "Vanadium-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	98	49112	30

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 "Vanadium -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	International Journal of Oral and Maxillofacial Implants	18	538	30	16
Journal with highest co-authorship and citations	Biomaterials	10	1175	117.5	21

From the above discussion regarding the review patterns in the research regarding Vanadium -implants,this research had observed a gradual increase in research interest regarding Vanadium -implantsfrom the starting of the millennium, and the momentum are 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 Jacobs J.J with the highest

publication and co-authorship links; and citations respectively(Refer to table 1).The overlay analysis of top countries researching Vanadium-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 the Biomaterials and 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 Vanadium–implants.

4. Conclusion

Vanadium -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 and Biomaterials. The most active country was the United States of America. The leading organization engaged in the research regarding Vanadium-implants was the Georgia Institute of Technology, USA. The most active authors who had made valuable contributions related to Vanadium-implants were Boyan B.D, Schwartz. Z; and Jacobs J.J. This research domain offers a new avenue for researchers and future research can be on innovations in Vanadium-implants.

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