

A detailed review on Allergy of Vanadium-Implants

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Abstract

Vanadium implants are known for their allergy. This review analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the “Vanadium implants and allergies”. All published articles related to “allergy of 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 associated allergies” and also to find out the trends related to the same. The leading Journals were Contact dermatitis and Biomaterials. The most active country was the United States of America. The leading organization engaged in the research regarding an allergy to Vanadium-implants was the United States Environmental Protection Agency, USA. The most active authors who had made valuable contributions related to Vanadium-implants were Bocca B and Baldini N.

Keywords: Vanadium-implants, Allergy, Material engineering, Review analysis, Meta Analysis,

1. Introduction

Vanadium implants are used for diversified medical applications like Vanadium 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; cytotoxicity of Vanadium implants.

The metal release can happen even from the ornaments like earrings based on Vanadium and may lead to dermatitis (Bocca *et al.*, 2007). Vanadium allergy can be expected with Vanadium implants and the allergic reactions due to Vanadium may even lead to failure of the implant. Scientific allergy testing is very essential for checking chronic dermatitis. There are evidence for the Vanadium skin allergy due to usage Vanadium pentoxide. Similarly the development of systematic dermatitis and implant failure (Motolese *et al.*, 1993). Allergic reactions of Vanadium implant was also observed in the study (Kręcis, Kieć-Świerczyńska and Chomiczewska-Skóra, 2012). There are cases where allergy, following Vanadium implant (knee arthroplasty) was reported ((Van Opstal and Verheyden, 2011).

In short, 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

- To consolidate the literature regarding allergy of Vanadium-implants
- To find out the trends related to research in allergy of Vanadium-implants

1.2 Research Questions

- Who are the active researchers working on the allergy of Vanadium-implants?
- Which are the main organizations and countries working on the allergy of Vanadium-implants?
- Which are the main journals on the allergy of Vanadium-implants?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS-KEY(Vanadium allergy). 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 90 documents, in eight languages, out of which 75 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 58 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 1951 had been shown in Table1. Co-authorship analysis of top authors had been shown in Table2. 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 23 authors, in nine clusters. The overlay visualization map of co-authorship analysis plotted in Table2, 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	Bocca B	3	139	46	9
Authors with the highest citations	Baldini N	2	198	99	6

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 15. This combination plotted the map of 20 thresholds, in two clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2. The leading organizations engaged in research on “allergy of 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 “allergy of Vanadium-implants”, with the highest number of publications and citations, was the United States Environmental Protection Agency(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
The United States Environmental Protection Agency	United States of America	12	147	12.25

Co-authorship analysis of the countries engaged in the research on “allergy of 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	Average citation
The country with the highest publication, citations, and co-authorship links	United States of America	20	594	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 “allergy of 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 and citations	Contact Dermatitis	9	104	11.5	10
Journal with highest co-authorship	Biomaterials	1	110	110	7

From the above discussion regarding the review patterns in the research regarding allergy of Vanadium -implants, this research had observed a gradual increase in research interest regarding allergy of Vanadium -implants from 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 author in this research domain was Bocca B and Baldini N with the highest publication and citations (Refer to table 1). The overlay analysis of top countries researching allergy on 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 Biomaterials and Contact Dermatitis. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding an allergy to Vanadium-implants.

4. Conclusion

Allergy on Vanadium -implants was an interesting research domain and the most active journals related to this research domain were the Contact dermatitis and Biomaterials. The most active country was the United States of America. The leading organization engaged in the research regarding an allergy to Vanadium-implants was the United States Environmental Protection Agency, USA. The most active authors who had made valuable contributions related to Vanadium-implants were Bocca B and Baldini N. This research domain offers a new avenue for researchers and future research can be on innovations in allergy on Vanadium-implants.

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