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Systematic Review on Education of Tungsten-Implants

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Abstract

Tungsten 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 "Tungsten-implants". All published articles related to "Tungsten-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 "Tungsten-implants" and also to find out the trends related to the same. The leading Journals were the Nuclear Instruments and Methods in Physical Research, Journal of Neural Engineering, and Frontiers in Neuro Engineering. The most active country was the United States of America. The leading organization engaged in the research regarding Tungsten-implants were the Delft University of Technology, the University of Florida, and the University of Miami, USA. The most active authors who had made valuable contributions related to Tungsten-implants were Van Der Kolk G.J,Van Veen A; and Prasad A,Sanchez J.C.

Keywords: Tungsten-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. Tungsten had been used for diversified purposes. Similarly, the high concentration of metals in body fluids, toxicity, and allergy of metals should also be considered in the cases of bio-implants.

Tungsten metal had been popularly used for neuro implants. There are several limitations too associated with Tungsten implants, which should be considered before the medical procedures. A significant number of people were suffering from different types of body paralysis. Chronic implants of multi electrode made of Tungsten can be used for the treatment of such patients by using tungsten microelectrode arrays in the distribution and morphology of inter neurons reactive to calcium-binding proteins calbindin (CB), calretinin (CR), and parvalbumin (PV). Tungsten had also been used for chronic neurocortical implants (Prasad, Q.-S. Xue, Sankar, Nishida, Shaw, W. Streit

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and Sanchez, 2012)(Prasad, Q. S. Xue, *et al.*, 2012). However, the inability to reliably record high-quality neural signals was a serious limitation for the efficacy for neuro prosthetic applications based on Tungsten metal (Prasad, Q.-S. Xue, Sankar, Nishida, Shaw, W. J. Streit and Sanchez, 2012).

Bioabsorbable implants are getting wider attention in modern medicine due to their strength and biocompatibility. zinc-tungsten carbide (Zn-WC) nanocomposite can revolutionize the field of bioabsorbable implants. However, Tungsten implants are not free from demerits, there are issues of Tungsten contamination associated with various Tungsten based implants (Liebert, Angel, and Kase, 1996).

Material engineering and surface engineering can play a significant role in improving the performance and life of Tungsten–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 Tungsten. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Tungsten-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 Tungsten-implants
b) To find out the trends related to research in Tungsten-implants

1.2 Research Questions

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

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Tungsten-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

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3.1 Results

This first round of search produced an outcome of 329 documents, in five languages, out of which 319 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 191 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 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 three 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	Van Der Kolk G.J	6	60	10	19
	Van Veen A.	6	60	10	19
Authors with the highest co-authorship links and citations	Prasad A	4	304	76	23
	Sanchez J.C	4	304	76	23

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as10. This combination plotted the map of 32thresholds, in three clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Tungsten-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 "Tungsten-implants", with the highest number of publications and citations, were the Delft University of Technology, University of Florida, and the University of Miami(Refer to table 2).

Table 2: Highlights of the most active organization

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Organizations	Country	Documents	Citations	Average Citations per document
Delft University of Technology	United States of America	6	60	10
University of Florida	United States of America	6	304	50.5
University of Miami	United States of America	6	369	61.5

Co-authorship analysis of the countries engaged in the research on "Tungsten-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	82	1747	30

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 "Tungsten -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	Nuclear Instruments and	9	78	8.7	

	Methods in Physical research				0
Journal with highest citations	Journal of Neural Engineering	2	261	130.5	4
Journal with highest co-authorship links	Frontiers in Neuro Engineering	2	120	60	7

From the above discussion regarding the review patterns in the research regarding Tungsten-implants,this research had observed a gradual increase in research interest regarding Tungsten-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 Van Der Kolk G.J,Van Veen A; and Prasad A,SanchezJ.C with the highest publication; and co-authorship links, and citations respectively(Refer to table 1).The overlay analysis of top countries researching Tungsten-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 Nuclear Instruments and Methods in Physical Research, Journal of Neural Engineering, and Frontiers in Neuro Engineering. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Tungsten–implants.

4. Conclusion

Tungsten-implants was an interesting research domain and the most active journals related to this research domain were the Nuclear Instruments and Methods in Physical Research, Journal of Neural Engineering, and Frontiers in Neuro Engineering. The most active country was the United States of America. The leading organization engaged in the research regarding Tungsten-implants were the Delft University of Technology, the University of Florida, and the University of Miami, USA. The most active authors who had made valuable contributions related to Tungsten-implants were Van Der Kolk G.J,Van Veen A; and Prasad A,Sanchez J.C 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 Tungsten-implants.

References

1. Farhat, T. *et al.* (2013) ‘Research in congenital heart disease: A comparative review analysis between developing and developed countries’, *Pediatric Cardiology*, 34(2), pp.

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375–382. doi: 10.1007/s00246-012-0466-6.

2. Liebert, R. B., Angel, G. C. and Kase, M. (1996) 'Tungsten contamination in BF2 implants', in Ishida E. Banerjee S., M. S. S. T. C. C. M. et al (ed.) *Proceedings of the International Conference on Ion Implantation Technology*. Austin, TX, USA: IEEE, Piscataway, NJ, United States, pp. 135–138.
3. Prasad, A., Xue, Q.-S., Sankar, V., Nishida, T., Shaw, G., Streit, W. J. and Sanchez, J. C. (2012) 'Comprehensive characterization and failure modes of tungsten microwire arrays in chronic neural implants', *Journal of Neural Engineering*, 9(5). doi: 10.1088/1741-2560/9/5/056015.
4. Prasad, A., Xue, Q. S., *et al.* (2012) 'Comprehensive characterization of tungsten microwires in chronic neurocortical implants.', *Conference proceedings : ... Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Conference*, 2012, pp. 755–758.
5. Prasad, A., Xue, Q.-S., Sankar, V., Nishida, T., Shaw, G., Streit, W. and Sanchez, J. C. (2012) 'Comprehensive characterization of tungsten microwires in chronic neurocortical implants', in *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*. San Diego, CA, pp. 755–758. doi: 10.1109/EMBC.2012.6346041.