A Meta Analysis on Aluminium based Knee Implants

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Abstract

Aluminium implants are popular, especially Aluminium-based knee implants. This Review analysis had the objective to spot out the active authors, organizations, journals, and countries involved in the research regarding "Aluminium knee-implants". All published articles related to "Aluminium knee-implants" from "Scopus", were analyzed. This article had set the objective to consolidate the high-quality research regarding "Aluminium knee-implants" and also to find out the trends related to the same. The leading Journals were the Biomaterials, American Journal of Sports Medicine, and Clinical Orthopedics and Related Research. The most active country was the United States of America. The leading organization engaged in the research regarding Aluminium-implants was the Australian Drug Information Services, Australia. The most active authors who had made valuable contributions related to Vanadium-implants were Avery G.S., Brogden R.N, Heel R.C, and Speight T.M.

Keywords: Aluminium, Knee-implants, Material engineering ,Review analysis, Meta Analysis,

1. Introduction

Aluminium had been popularly used for diversified implants including knee implants(Dörner *et al.*, 2006). Various combination of metals was used for the preparation of knee implants. There are several advantages and challenges associated with Aluminium knee implants.

The major challenges connected with Aluminium-based knee implants are corrosion of the implants; and specifically, the issues of orthopaedic implant fretting corrosion. The challenge of corrosion of Aluminium implants can be handled by the surface coating; by using advances in material engineering and by using Aluminium free implants (Choudhary *et al.*, 2014). The other challenges before the Aluminium knee implants are the allergy or hypersensitivity (Kręcisz, Kieć-Świerczyńska and Chomiczewska-Skóra, 2012). The possible issues related to the toxicity of Aluminium implants should also be further researched. The toxicity and allergy of Aluminium implants are comparatively at a lower level. Another issue associated with the Aluminium implants is the high level of serum Aluminium level (Grübl *et al.*, 2006)(Daley *et al.*, 2004)(Sargeant, Goswami and Swank, 2006);cracks of Aluminium-based implants (Kubota *et al.*, 1998). In the starting stages of Aluminium implants, the chances of renal failure in dialyzed patients were very high.

Material engineering and surface engineering have a crucial role in improving the performance and life of Aluminium knee–implants along with measures for reducing toxicity and hypersensitivity of the metal. All these can improve the safety of metal and its implants. This Review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Aluminium knee 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 Aluminium-based knee-implants
b) To find out the trends related to research in Aluminium-based knee-implants

1.2 Research Questions

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

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Aluminium knee). The software used for this paper Microsoft Excel,Meta Analysis, Mendeley, and Grammarly. 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 preliminary round of search came out with 261 documents, in ten languages, out of which 233 documents were in English. The classification of document categories is shown in Figure 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 169English 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 1964 had been shown in Figure 2.

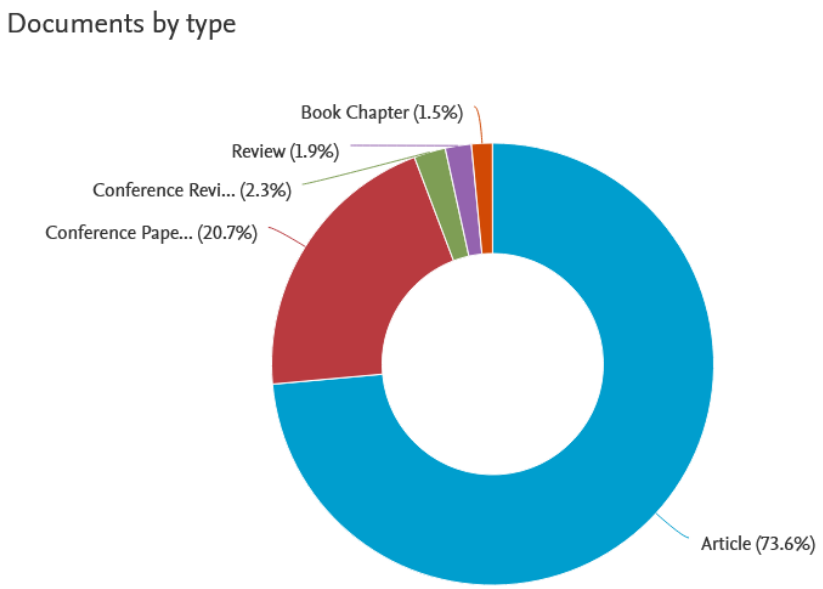

Figure 1: Classification of the documents on "Aluminium -implants

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 two and the minimum number of citations of authors as one. This combination plotted the map of 41authors, in 14clusters. 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 leading publication, citations, and co-authorship links	Avery G.S.	3	176	59	10
	BrogdenR.N	3	176	59	10
	Heel R.C	3	176	59	10
	Speight T.M	3	176	59	10

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 28thresholds, in four clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leading organizations engaged in research on "Aluminium knee-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 "Aluminium knee-implants", with the highest number of publications and citations, was the Australian Drug Information Services, Australia(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
Australian Drug Information Services	Australia	3	176	59

Co-authorship analysis of the countries engaged in the research on "Aluminium knee-implants" had been shown in Table 5. The overlay visualization map of co-authorship analysis plotted in Table 5, points out the main countries with their strong co-authorship linkages and clusters involved.

Table 5: Co-authorship analysis on basis of countries

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	55	1838	11

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 "Aluminium knee-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	Clinical Orthopedics and Related Research	5	180	36	0
Journal with highest co-authorship	American Journal of Sports Medicine	2	206	103	4
Journal with the highestcitations	Biomaterials	3	265	88	0

From the above discussion regarding the Review patterns in the research regarding Aluminium knee-implants, this research had observed a gradual increase in research interest regarding Aluminium knee-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 Avery G.S., Brogden R.N, Heel R.C, and Speight T.M with the highest publication, citations, and co-authorship links respectively(Refer to table 1).The overlay analysis of top countries researching Aluminium-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, American Journal of Sports Medicine and Clinical Orthopedics, and related 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 Aluminium knee–implants.

4. Conclusion

Aluminium -implants was an interesting research domain and the most active journals related to this research domain were Biomaterials, American Journal of Sports Medicine and Clinical Orthopedics, and related Research. The most active country was the United States of America. The leading organization engaged in the research regarding Aluminium-implants was the Australian Drug Information Services, Australia. The most active authors who had made valuable contributions related to Vanadium-implants were Avery G.S., Brogden R.N, Heel R.C and Speight T.M. This research domain offers a new avenue for researchers and future research can be on innovations in Aluminium-implants.

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