Review on Chromium based Dental Implants

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Abstract

Chromium isone of the most used metals for implants. TheReview analysis had been conducted to understand the active authors, organizations, journals, and countries involved in the research domain of "Chromium dental implants". All published articles related to "Chromium 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 "Chromium dental implants"and also to find out the trends related to the same.The most active journals in this research domainwere the Journal of Prosthetic Dentistry and the International Journal of Oral and Maxillofacial Implants. The most active country was the United States of America and followed by the United Kingdom. The leading organization engaged in the research regarding Chromium dental implants were the KarolinskaInstitutet of Sweden and the King Saud University of Saudi Arabia. The most active authors were Klawitter J.J and Weinstein A.M

Keywords: Chromiumimplants, 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 and the most popularly used metals and alloys for bio-implants are stainless steel, cobalt-chromium alloy, and Titanium[1]. Rough surfaced implants have better bone anchoring and biomechanical stability [2]. Chromium is widely used for diversified applications in dentistry [3].

Corrosion of Chromium-based dental implants is a serious issue and the study on the corrosion behavior of dental implants based on Chromium and Cobalt had found high passivation against corrosion. The intensity of its uniform corrosion increases with increasing the immersion time in the artificial saliva from 1 to 24 and further to 48 h. However, the severity of pitting corrosion had decreased with time [4].A flexible chromium-coated polymer mask can be used for the fabrication of micro-structured dental implant surfaces, which can be used for contact guidance of human gingival fibroblasts or endothelial cells. This will enhance the wound healing process and the overall soft-tissue integration[5]. Chromium is also used to remove dental implants and its superiority over the trephine bur in terms of bone preservation, thermal damage, and cutting efficiency [6]. For controlling the pore structure and enabling the growth of bones and fibrous tissues, a gravity sintering fabrication technique can be used for dental implants with porous coating on the root portion. Digital technology can be applied for the designing and manufacturing of cobalt-chromium (Co-Cr) surgical templates for static computer-aided implant surgery. Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) can be used for this purpose. Similarly,CAD and CAM can be used for fabricating the Chromium-based dental frameworks and the CAD/CAM frameworks exhibited better fit accuracy than the conventionally fabricated frameworks. Diamond-like carbon coating can be used as a galvanic corrosion barrier between dental implant abutments and nickel-chromium superstructures for improving the performance and resisting corrosion.

Material engineering and surface engineering play a very important role in providing solutions to diversified issues connected with Chromium-based dental implants. This Review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding bio-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 Chromium dental implants
b) To find out the trends related to research in Chromium dental implants

1.2 Research Questions

a) Who are the active researchers working on Chromium dental implants?
b) Which are the main organizations and countries working on Chromium dental implants?
c) Which are the main journals related to Chromium dental implants?

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS (Chromium dental implants). 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 179 documents, inninelanguages, out of which 171 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 122 English articles (both open access and others) andhad been used to conduct Review analysis and visualization using Meta Analysis. The English research articles in this domain since 1971 had been shown in Table 2. Co-authorship analysis of top authors had been shown in Table 3. For a better presentation of the analysis, the parameters used were the minimum number of documents of an author as 3and the minimum number of citations of authors as one. This combination plotted the map of 27 authors, in 12 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 werethe 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, citations, and co-authorship links	KlawitterJ.J	3	56	18.67	10
	Weinstein A.M	3	56	18.67	10

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as15. This combination plotted the map of 26thresholds, in twoclusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table2.The leadingorganizations engaged in research on "Chromium 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 organization in the research regarding "Chromium dental implants", with the highest number of publications and citations,was the University of Pennsylvania of United States of America(Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
King Saud University	Saudi Arabia	4	128	32
Karolinska Institutet	Sweden	4	110	27.5

Co-authorship analysis of the countries engaged in the research on "Chromium dentalimplants" 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 acountry 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,	United States of America	23	394	4
The country with the highest co-authorship links	United Kingdom	9	102	10

The most active country in this research domain was the United States of America, with the highest number ofpublications, and citations; followed by the United Kingdom with the highest co-authorship.

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 "Chromium dentalimplants"are shown in table 4. Table 4 shows 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
Journal with the highest publications and citations	Journal of Prosthetic Dentistry	15	403	3
Journal with the highest co-authorship links	International Journal of Oral and Maxillofacial Implants	7	77	6

From the above discussion regarding the Review patterns in the research regarding Chromium dental implants,this research had observed a gradual increase in research interest regarding Chromium dental implantsfrom 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 domainwere Klawitter J.J and Weinstein A.M with the highest publication,co-authorship links, and citations(Refer to table 1).The overlay analysis of top countries researching Chromium dental implants indicates that the United States of America was the leading countryrelating tothe highest numberof publications, citations, and the United Kingdom with the highest co-authorship links(Refer to Table 5). The top journals of this research domain were identified as the Journal of Prosthetic Dentistry and the International Journal of Oral and Maxillofacial Implants.Fromthese wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Chromium dental implants.

4. Conclusion

Chromium dental implantwas an interesting research domain and the most active journals related to this research domain were the Journal of Prosthetic Dentistry and the International Journal of Oral and Maxillofacial Implants.The most active countrywas the United States of America and followed by the United Kingdom.The leading organization engaged in the research regarding Chromium dental implants werethe KarolinskaInstitutet of Sweden and the King Saud University of Saudi Arabia. The most active authors who had made valuable contributions related toChromium dental implantswere Klawitter J.J and Weinstein A.Mwith 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 Chromium dental implant.

References

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