

A Scientometric Analysis of Recent Development in Iridium Breast-Implants

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Abstract

Iridium 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 “Iridium breast-implants”. All published articles related to “Iridium breast-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 “Iridium breast-implants and also to find out the trends related to the same. The leading Journal was the International Journal of Radiation, Oncology, Biology, Physics. The most active country was the United States of America. The leading organization engaged in the research regarding Iridium-implants was the William Beaumont Hospital, USA. The most active authors who had made valuable contributions related to Iridium-implants were Mansfield C.M, Bartelink H. and Fentiman I.S.

Keywords: Iridium, Breast-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. Iridium 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. Iridium had been mainly used for the treatment of various types of implants for cancer including breast cancer and breast implants.

Iridium had also been used for breast implants (Hutchings, 1985); similarly, Iridium wires had been used for treating breast cancer (Fentiman *et al.*, 1991)(Baily, 1982)(Inwang *et al.*, 1991). Boost irradiation with the interstitial iridium-192 implant in the conservative management of breast cancer (Irigaray *et al.*, 1989). However there is evidence for the inadequacy of iridium implant as sole radiation treatment for operable breast cancer, specifically the Iridium implant is not an effective means of achieving local control in patients with operable breast cancer(Dale, Jones and Price, 1997)(Fentiman *et al.*, 1996). One of the major determining factor of Iridium treatment for breast cancer is the dose rate and dose per fraction of external irradiation on clinical outcome (Deore *et al.*, 1993)(Mazeron *et al.*, 1991)(Sun *et al.*, 1992). There is also evidence for the use of iodine-125 seeds as a substitute for iridium-192 seeds in temporary interstitial breast implants (Singh and Kumar, 2013).

Material engineering and surface engineering can play a significant role in improving the performance and life of Iridium-implants along with measures for reducing toxicity and hypersensitivity of the metal implants. Future research can also be on surface coatings of, metal implants using Iridium. This review analysis will be a useful platform for future researchers by realizing the top researchers, organizations, and countries involved in research regarding Iridium-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 Iridium breast-implants
- b) To find out the trends related to research in Iridium breast-implants

1.2 Research Questions

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

2. Research Methodology

Scopus files had been used for this article. For the article selection, the Boolean used was TITLE-ABS-KEY(Iridium breast 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 167 documents, in six languages, out of which 152 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 138 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 1973 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 four and the minimum number of citations of authors as one. This combination plotted the map of 23 authors, in five 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	Mansfield C.M	9	378	42	50
Authors with the highest citations	Bartelink H.	6	1037	173	37
Authors with the highest links	Fentiman I.S.	8	998	124.7	53

In Co-occurrence analysis, we had used all keyword analyses, by keeping the minimum number of occurrences of a keyword as 30. This combination plotted the map of 25 thresholds, in two clusters. The overlay visualization of co-occurrence analysis of keywords has been shown in Table-2. The leading organizations engaged in research on “Iridium breast-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 “Iridium breast-implants”, with the highest number of publications and citations, was the William Beaumont Hospital, USA (Refer to table 2).

Table 2: Highlights of the most active organization

Organizations	Country	Documents	Citations	Average Citations per document
William Beaumont Hospital	United States of America	10	749	74.9

Co-authorship analysis of the countries engaged in the research on “Iridium breast-implants” had been shown in Table 3. The overlay visualization map of co-authorship analysis plotted in Table 3, 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	76	3076	3

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 “Iridium breast-implants” 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	Links
Journal with the highest publications, citations, and co-authorship links	International Journal of Radiation, Oncology, Biology, Physics	46	2024	44	138

From the above discussion regarding the review patterns in the research regarding Iridium breast-implants, this research had observed a gradual increase in research interest regarding Iridium breast-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 authors in this research domain were Mansfield C.M, Bartelink H. and Fentiman I.S. with the highest publication, citations, and links respectively (Refer to table 1). The overlay analysis of top countries researching Iridium breast-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 International Journal of Radiation, Oncology, Biology, Physics. From these wide sources of information, researchers can focus on top journals where they can identify the most relevant and highly cited articles regarding Iridium breast-implants.

4. Conclusion

Iridium breast-implants was an interesting research domain and the most active journals related to this research domain was the International Journal of Radiation, Oncology, Biology, Physics. The most active country was the United States of America. The leading organization engaged in the research regarding Iridium-implants was the William Beaumont Hospital, USA. The most active authors who had made valuable contributions related to Iridium-implants were Mansfield C.M, Bartelink H. and Fentiman I.S. This research domain offers a new avenue for researchers and future research can be on innovations in Iridium breast implants.

References

1. Baily, B. (1982) 'Iridium wire implants for treatment of cancer of the breast.', *The British journal of radiology*, 55(653), p. 379. doi: 10.1259/0007-1285-55-653-379-a.
2. Dale, R. G., Jones, B. and Price, P. (1997) 'Comments on Inadequacy of iridium implant as sole radiation treatment for operable breast cancer', *European journal of cancer (Oxford, England : 1990)*, 33(10), pp. 1707–1708. doi: 10.1016/S0959-8049(97)00112-3.
3. Deore, S. M. *et al.* (1993) 'Influence of dose-rate and dose per fraction on clinical outcome of breast cancer treated by external beam irradiation plus iridium-192 implants: Analysis of 289 cases', *International Journal of Radiation Oncology, Biology, Physics*, 26(4), pp. 601–606. doi: 10.1016/0360-3016(93)90275-Z.
4. Farhat, T. *et al.* (2013) 'Research in congenital heart disease: A comparative review analysis between developing and developed countries', *Pediatric Cardiology*, 34(2), pp. 375–382. doi: 10.1007/s00246-012-0466-6.
5. Fentiman, I. S. *et al.* (1991) 'Iridium implant treatment without external radiotherapy for operable breast cancer: a pilot study', *European Journal of Cancer and Clinical Oncology*, 27(4), pp. 447–450. doi: 10.1016/0277-5379(91)90383-O.
6. Fentiman, I. S. *et al.* (1996) 'Inadequacy of Iridium Implant as Sole Radiation Treatment for Operable Breast Cancer', *European Journal of Cancer*, 32(4), pp. 608–611. doi: 10.1016/0959-8049(95)00639-7.
7. Hutchings, R. E. (1985) 'PTFE as a source guide in iridium-192 breast implants', *British Journal of Radiology*, 58(689), pp. 456–458. doi: 10.1259/0007-1285-58-689-456.
8. Inwang, R. *et al.* (1991) 'A controlled trial of short-term versus standard axillary drainage after axillary clearance and iridium implant treatment of early breast cancer', *Annals of the Royal College of Surgeons of England*, 73(5), pp. 326–328.
9. Irigaray, J. M. *et al.* (1989) 'Boost irradiation with interstitial iridium-192 implant in the conservative management of breast cancer [SOBREIMPRESION MEDIANTE IMPLANTE DE IRIDIO-192 EN EL TRATAMIENTO NO MUTILANTE DEL CANCER DE MAMA]', *Oncologia*, 12(10), pp. 499–503.
10. Mazon, J.-J. *et al.* (1991) 'Influence of dose rate on local control of breast carcinoma

treated by external beam irradiation plus iridium 192 implant', *International Journal of Radiation Oncology, Biology, Physics*, 21(5), pp. 1173–1177. doi: 10.1016/0360-3016(91)90273-7.

11. Singh, H. and Kumar, R. (2013) 'Measuring the utilization index of advanced manufacturing technologies: A case study', in *IFAC Proceedings Volumes (IFAC-PapersOnline)*. Saint Petersburg: IFAC Secretariat, pp. 899–904. doi: 10.3182/20130619-3-RU-3018.00395.
12. Sun, S. *et al.* (1992) 'Breast conservative therapy in Chongking (China): A preliminary report on high-dose-rate afterloading iridium-192 implants [2]', *Bulletin du Cancer/Radiotherapie*, 79(2), pp. 169–171.

