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Radiofrequency in facial wrinkles: a scientometric analysis

Radiofrequência em rugas faciais: uma análise cienciométrica

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ABSTRACT

The present study is a scientometric analysis aiming to verify the scientific production about radiofrequency in facial wrinkles. The databases used were the Web of Science and Pubmed. We searched the literature for all articles with the terms "Radiofrequency", "Facial", and "Wrinkle" in the title, abstract, or keywords. For each study, we analyzed the following scientometric indicators: publication number per year, name of the journal, authors, impact factor, country of publication, and type of study.

Keywords: Aging; Aesthetic equipment; Plasma

RESUMO

O presente trabalho faz uma análise a partir de um estudo bibliográfico com técnicas cienciométricas, objetivando verificar a produção científica sobre o tema "radiofrequência em rugas faciais". As bases de dados utilizadas foram o Web of Science e o Pubmed. Foi realizada uma busca de todos os trabalhos que apresentavam no título, resumo ou palavras-chave os termos "Radiofrequency", "Facial", "Wrinkle". Para cada estudo, foram analisados os seguintes indicadores cienciométricos: número de publicação por ano, nome do periódico em que o trabalho foi publicado, autores das publicações, fator de impacto dos periódicos, país de publicação e tipo de trabalho.

Palavras-chave: *Envelhecimento; Equipamentos para estética; Plasma*

Review Article

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INTRODUCTION

Radiofrequency is a daily treatment modality for a range of medical and aesthetic indications due to its versatility, efficacy, and safety.[1,2,3] The technology is used to treat cellulite, acne scars, sagging skin, and facial rejuvenation. Also, it is suitable for various skin types.[4,5,6] Its effects are based on heating the skin layers inducing thermal damage to stimulate neocollagenesis or adipolysis, subsequently remodeling the cutaneous and subcutaneous tissues.[1,2,7] Previous studies show beneficial effects of radiofrequency in treating sagging skin and wrinkless.[3,8]

As a result of aging, facial wrinkles are a frequent concern. There is an alteration of enzymes and proteins, reduced cell proliferation, and loss of tissue elasticity, affecting the appearance negatively. Radiofrequency helps to decrease the effects of skin aging.[2] There is a vast literature on radiofrequency devices with an effective, safe, and less invasive therapeutic proposal, with a low risk of complications in facial rejuvenation.[9] However, because it is an evolving field, clinical evidence lacks robustness. Many of these devices have not been tested, and their parameters and results have little scientific evidence. Little is known about the methodological quality level of equipment with national or imported manufacturers.[10]

Scientometrics enables to survey quantitative aspects of scientific production, making it possible to identify patterns or trends in specific themes, authors, and institutions, contributing to periodically ordering a set of information and results already produced. Scientometrics also aims to explain and increase the visibility of scientific and technological development.[11] This study aims to analyze, through scientometrics, the scientific production on the topic "radiofrequency in facial wrinkles".

METHODS

It is a scientometric study on facial radiofrequency in wrinkles. The analysis aimed to measure the scientific production published in journals indexed in Pubmed and Web of Science. We searched the literature in May 2021 using the following descriptors: "Radiofrequency" and "Facial" and "Wrinkle". Then, we selected the scientific articles through the evaluation of titles and abstracts. The selected studies followed these inclusion criteria: literature review, experimental research, cohort study, case study, and publications related to facial radiofrequency in wrinkles. Opinion articles were excluded due to the unavailability of the text or abstract. We also excluded studies whose descriptors did not correspond to the proposed theme, for example, the use of the word "wrinkles" in an article on botulinum toxin or the word "radiofrequency" used as a treatment of a body region. This method used is characterized as bibliographic and exploratory.

The data analysis of these studies allowed the identification of the following information: number of publications per year, authors of the articles, year of publication, names of the journals, countries of the journals, areas of concentration, and classification of the journals according to the WebQualis criterion. We analyzed the articles from 2000, the first year of registration for the topic, to October 2019. Data were exported from Pubmed in XML via NCBI (National Center for Biotechnology Information), and from Web of Science, in tabulated text format. All data were imported, processed, and analyzed in Graphpad Prism, version 9.0. The data were presented descriptively through the construction of tables and graphs.

RESULTS AND DISCUSSION

We identified 352 studies in the literature search, 269 in the PubMed database and 93 in the Web of Science database. After excluding duplicate articles (found in both databases) and applying the inclusion and exclusion criteria, 212 articles were selected (Figure 1). These were published in 51 different journals.

Most of the articles were published in the following journals: Dermatology Surgery (n=28), Journal of Cosmetic and Laser Therapy (n=27), Journal of Drugs in Dermatology (n=25), and Journal of Cosmetic Dermatology (n=16) (Table 1). We found only one publication in a Brazilian journal, the Anais Brasileiros de Dermatologia. Table 1 shows the journals with two or more publications. The journals with the highest impact factor (IF) that published articles on the topic "radiofrequency in the treatment of wrinkles" were the Archives of Dermatology (FI=10,282 in 2020) and the Journal of the American Academy of Dermatology (JAAD) (FI =8,277 in the year 2020). The journal with the lowest impact factor with published studies on radiofrequency to treat wrinkles was the French Revue de Laryngologie D'otologie et de Rhinologie (FI=0.056). For comparison, the mean impact factors of the journals published in the area in question was also calculated (mean FI = 2,830).

Figure 2 displays the data referring to the temporal analysis of the publications. We observed that the studies directed at facial radiofrequency in wrinkles started in 2000 (n=2), persisting without great numerical expression until 2003. From 2004, there was an upward trend in publications. In 2020, we noted a drop in scientific production on the subject. However, we believe this phenomenon has been observed in health topics not related to the COVID-19 pandemic. The years in which most articles on the theme were published were 2016 (n=19), 2017 (n=20), 2018 (n=20) and 2019 (n=26) (Figure 2).

We believe this increasing trend in the number of publications regarding radiofrequency is linked to the fact that, in 2002, the Food and Drug Administration (FDA) approved the first radiofrequency device aiming at a non-invasive treatment to attenuate wrinkles and improve the temporary appearance of cellulite.[13,14] The increased publications in the last decade regarding "radiofrequency in facial wrinkles" indicates a raised interest in this field, as well as its scientific and technological progress, considering that the number of publications is one of the most used measures to quantify the progress and evolution of a given topic in science.[15]

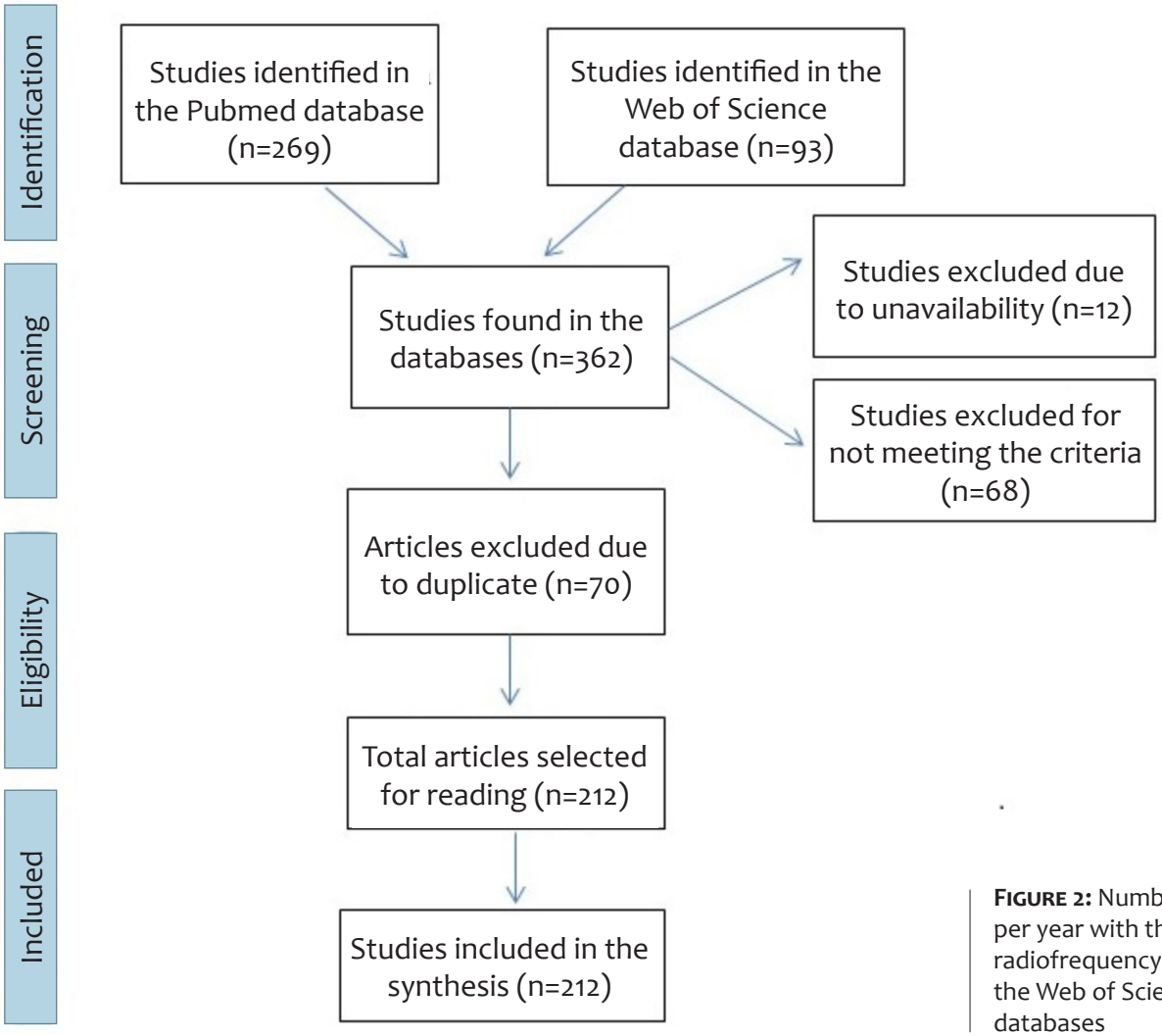

Figure 2: Number of publications per year with the theme "facial radiofrequency and wrinkles" in the Web of Science and Pubmed databases

Regarding the authors who wrote the most on the theme "facial radiofrequency in wrinkles", Neil S. Sadick (n=11) and Michael H. Gold (n=10) stand out. Table 2 shows the authors with a minimum of three publications on the subject. According to Sadick, as aging affects the population in our society, new technologies and promising procedures for rejuvenation emerge. Stimulated by this technological advance, Sadick considers radiofrequency a new method to treat many aesthetic and medical indications and seeks to elucidate the safety and efficacy of these innovative devices.[16] He also recommends acquiring more than one device to meet the needs of patients' different aesthetic complaints since these instruments differ in terms of energy delivery, number of electrodes, and ability to be associated with other treatments. The author considers radiofrequency, at temperatures between 55oC and 68oC, safe and capable of generating satisfactory results for rejuvenation, although there is a lack of research evaluating the ideal temperature.[17]

The studies published by Michael Gold comprised in this study are related to fractional and bipolar radiofrequency devices.[18,19] The author also seeks to elucidate the safety and efficacy of different application techniques and draws our attention to the versatility of this treatment modality due to the possibility of domestic use. His study used a radiofrequency device associated with LED to treat periorbital wrinkles and improve the appearance of the skin, presenting safety and efficacy.[20]

Regarding the affiliation of authors with more publications, we observed that 75.1% of the articles on radiofrequency in facial wrinkles were developed in educational institutions. The institutions with the most papers on the topic were Cornell Medical College, with 15.1% of the papers, followed by the Tennessee Clinical Research Center and Seoul National University, with 14.1% and 13.2% of the publications, respectively.

Among the countries with the most publications on the topic "facial radiofrequency in wrinkles", the United States (n=159), England (n=46), and South Korea (n=23) stood out. In this scenario, Brazil presented only one published work.

Table 1: List of journals, impact factor, and number of publications

Journal	IF	Publications
Dermatologic Surgery	3,398	28
Journal of Cosmetic and Laser Therapy	1,266	27
Journal of Drugs in Dermatology	1,464	25
Journal of Cosmetic Dermatology	1,611	16
Lasers in Surgery and Medicine	3,020	12
Facial Plastic Surgery Clinics of North America	1,918	6
Clinics in Plastic Surgery	1,959	5
Aesthetic Surgery Journal	4,283	5
Seminars in Cutaneous Medicine and Surgery	1,425	3
Facial Plastic Surgery	1,446	3
Lasers in Medical Science	2,342	3
Archives of Facial Plastic Surgery	4,611	3
Journal of the American Academy of Dermatology	8,277	3
Archives of Dermatology	10,282	3
Revue de Laryngologie D'otologie et de Rhinologie	0,56	2
Ophthalmic Plastic and Reconstructive Surgery	1,331	2
Annals of Dermatology	1,412	2
The Journal of Clinical and Aesthetic Dermatology	1,531	2
Journal of Dermatological Treatment	1,669	2
Dermatologic Therapy	2,327	2
Journal of the German Society of Dermatology	5,584	2

IF = Impact factor of journals that published on the researched topic. Publications = Quantitative number of articles published on the topic by each journal over the period surveyed. Only journals that published two or more articles on the search topic "Radiofrequency" and "Facial" and "Wrinkle" are present in the table.

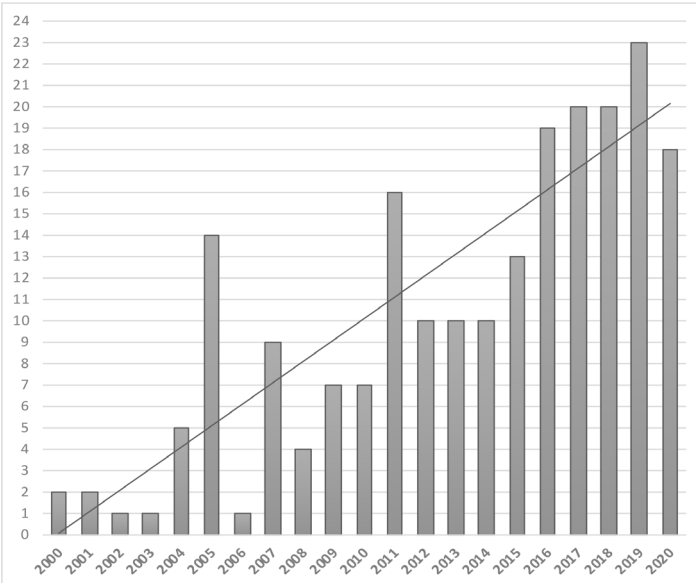

Figure 1: Flowchart of the study identification and inclusion process

Despite being the second country in the world in aesthetic surgical procedures and the third largest global market for beauty and aesthetics, Brazil has not yet given due importance to the research for developing the area.[21] It forces the Brazilian market to import radiofrequency technology from other countries or, worse, to use national equipment without satisfactory safety and effectiveness studies, adequate scientific parameters, or even not yet tested as safe.[10,22]

Among the studies analyzed, 69.6% were in humans. Of these, only 7.0% (15 articles) were randomized clinical trials; 28.4%, bibliographic reviews; 7.6%, case studies; and 6.0%, cohort studies. Although the number of publications of clinical trials was high, most of the studies were uncontrolled studies, presenting some biases such as selection with convenience sampling, small groups, unblinded study, or incomplete blinding.[23] Only 4,2 % (9 articles) generated a patent. It means that most of the studies were conducted using already patented equipment.

Another criterion that assesses scientific studies is the

Table 2: Authors who published the most on the topic "radiofrequency and wrinkles"

Author	Publications	Institutions
Neil S. Sadick	11	Cornell Medical College
Michael H. Gold	10	Tennessee Clinical Research Center
Beom Joon Kim	9	Seoul National University
Mitchel P. Goldman	8	University of California in San Diego
David J. Goldberg	6	Skin Laser & Surgery Center of New York
Robert Weiss	6	Maryland Dermatology Laser Skin & Vein
Gyeong-hun Park	5	Seoul National University
Macrene A. Alexiades	5	Dermatology and Laser Center of New York
Yohei Tanaka	4	Reconstructive Surgery and Aging Center of Japan
Bradley Renton	3	Main Line Center for Laser Surgery of Pennsylvania
Hyuk Kim	3	Incheon Medical Center
James Newman	3	Stanford University
Jeffrey S. Dover	3	Yale School of Medicine
Kei Negishi	3	Seoul National University
Kenneth O. Rothaus	3	Cornell Medical College, New York
Kui Young Park	3	Chung-Ang University Hospital of Korea
Tina S. Alster	3	Georgetown University Medical in Washington
Whitney Sensing	3	Tennessee Clinical Research Center
Won-Seok Park	3	Chonbuk National College of Medicine of Korea

Publications = Quantitative number of publications by the author on the topic "radiofrequency and wrinkles". Institutions = Institution to which the author is affiliated

frequency an article is cited by other publications. The number of citations is used to analyze the impact of the research on the scientific community and is directly linked to the field of the study. Thus, it is expected that several other authors will cite a comprehensive study with interesting and innovative results. However, most published articles, in general, are not cited or have a low citation frequency.[24] The present study maintained this pattern. About 63.2% (133) of the studies were not cited, and more than 5% (11 articles) were cited only once. Three articles stood out due to the high number of citations (over 50 citations): Hruza *et al.*, 2009, with 76 citations; Sadick & Trelles, 2005, 56 citations; and Gold *et al.*, 2007, 53 citations.[25,26,27]

We observed a trend in academic-scientific research: the collaboration between researchers and institutions to develop a study. When studies are conducted in partnership, there is a reduction in the distances to enter the international spheres of publication, improving the research qualitatively and quantitatively.[28] Our study confirmed this pattern of collaborative research. One hundred and fifty-eight (74.5%) articles analyzed presented two or more authors. Also, 132 (62.2%) studies were conducted in collaboration by more than one institution. Thus, this scientometric analysis confirms an international trend that science today must be carried out collectively and collaboratively.

CONCLUSION

The present study demonstrated, through scientometric techniques, that the scientific production on the theme "facial radiofrequency" has increased significantly in the last decade. The country that stood out with the highest number of publications on the subject was the United States, and the year with the highest number of publications was 2019. Among the experimental studies in humans, the predominant type of experiment was the uncontrolled clinical trial. Most of the articles were published in the Dermatologic Surgery and the Journal of Cosmetic and Laser Therapy. Despite the growing demand for radiofrequency devices in Brazil, national studies conducted on this topic have not followed this increase. The effectiveness and safety of Brazilian equipment also need to be elucidated. Despite the positive role in clinical practice, the lack of techniques parameterization makes radiofrequency technology to treat facial wrinkles remain an insufficiently researched field, as the findings are usually based on uncontrolled case series, with limited validity. We consider it crucial to investigate the safety and effectiveness of new techniques that employ radiofrequency technology. It would also be essential to conduct a study demonstrating whether radiofrequency has superior benefits than other methods, with controlled, randomized, double-blind studies to increase the level of evidence. ●

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Approval of the final version of the manuscript; study design and planning; preparation and writing of the manuscript; data collection, analysis, and interpretation; active participation in research orientation; critical literature review; critical revision of the manuscript.