



Bibliometric Study on Treatments for the Osteonecrosis of the Jaw Associated with Bisphosphonates

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Abstract

Introduction: Bisphosphonates are a group of medicines used in the treatment of metastatic malignancies and other diseases of bone repercussion such as osteoporosis. However, the use of these drugs is associated with a complication called bisphosphonate-induced osteonecrosis of the jaw (BRONJ). Pathology of difficult treatment and handling.

Objective: To map the international scientific production on existing treatments for the (BRONJ) in a reliable database.

Methods: The search terms ("osteonecrosis of the jaw*" and "treatment" and bisphosphonate) or "maxillary osteonecrosis" and treatment and bisphosphonate were used in one of the main databases, the ISI Web of Knowledge / Web of Science, in the temporal cut between the years of 2004 and 2017. The quotation marks indicate exact results for the expression and the asterisk makes possible the search in the plurals of the words. The records that present the terms selected for the search were analyzed, based on the A total of 875 publication records were identified in 299 different journals, written by 3846 authors of 1237 Institutions of Higher Education in 59 countries. The journal and the author, respectively, who had more articles published on the subject, were the American Journal of Oral and Maxillofacial Surgery and Otto S of Germany.

Conclusion: The study allowed observing the evolution of the publications of the BRONJ treatments, as well as contributing to the identification of the most productive authors, as well as institutions with greater collaboration on the theme.

Keywords

Osteonecrosis of the Jaw; Treatment; Bisphosphonates

Introduction

Patients who have metastatic bone dissemination not only suffer substantial pain, but may also develop fractures with devastating consequences. As it is known that the mechanisms of osteolysis associated with metastatic bone destruction are essentially mediated by osteoclasts, the inhibition of osteoclastic activity by bisphosphonates has become an important target in the drug for the treatment of such patients [1]. They inhibit both the osteoclastic activity and the recruited osteoclasts, and in addition, they decrease the life span of these cells. The efficacy of bisphosphonates has been established in numerous studies. Based on guidelines by the American Society of Clinical Oncology, bisphosphonates are standard treatments in patients with hypercalcemia associated with malignancy and metastases [2]. But since 2003, the use of bisphosphonates associated with maxillary osteonecrosis (BRONJ) has emerged as an important comorbidity, especially in patients treated with high doses of bisphosphonates over a long period of time [3]. Clinical symptoms and lesions are quite similar to those seen in patients with osteoradionecrosis. The necrotic bone is exposed to the oral cavity. The lesions are often painless; however, patients may experience pain because of the soft tissue inflammation surrounding the reactions and show symptoms and radiological signs of bone sequestration and/or osteomyelitis [4,5]. Risk factors for BRONJ include high doses of intravenous aminobiphosphonate, intravenous treatment for cancer (as compared to those treated orally), smoking, concomitant treatment with immunosuppressants and/or chemotherapy drugs, invasive dental procedures, oral infections, mechanical trauma to the jawbone and long-term treatment for bisphosphonates [3]. The American Association of Oral and Maxillofacial Surgeons [6] recommends suspected BRONJ if all of the following three characteristics are present: current or previous treatment with a bisphosphonate, bone exposed in the maxillofacial region persisting for more than 8 weeks, and no history of radiotherapy in the jaws. Four clinical stages of BRONJ were established:

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- A. **Stage 0:** No clinical evidence of necrotic bone, but nonspecific clinical findings and symptoms
- B. **Stage 1:** exposed and necrotic bone in asymptomatic patients with no evidence of infection
- C. **Stage 2:** Exposed and necrotic bone associated with infection evidenced by pain and erythema in the region of exposed bone with or without purulent drainage
- D. **Stage 3:** Exposed and necrotic bone in patients with pain, infection, and one or more of the following: exposed and necrotic bone extending beyond the alveolar bone region (ie, lower border and branch at the maxillary sinus, maxillary and zygoma in the maxilla) resulting in pathological fracture, extra oral fistula, and intraoral / oral nasal communication, or osteolysis that extends to the lower border of the mandible. BRONJ treatment remains controversial [7].

Surgical treatment is needed in severe cases. Surgery may range from sequestrectomy to resection of the affected bone or the floor of the sinus in the mandible or maxilla. The gold standard treatments for stage 3 and advanced stage 2 of the disease are the surgical removal of necrotic bone tissue, sufficient free tension closure with mucoperiosteal flap and intravenous antibiotic therapy [8]. Although many studies on the types of treatment have been reported, BRONJ is still quite challenging and enlightened standards have yet to be established. Many patients have deteriorated after long-term therapy, conventional antibiotic treatment, and analgesics, and surgical intervention is necessary [9]. Therefore, this study sought to map and quantify through scientific and reliable database the work on the subject in question.

Methodological Procedures

In this paper a bibliometric research was carried out, whose importance has been emphasized enough [10,11]. It is a "quantitative and statistical technique for measuring production indices and disseminating scientific knowledge" [12]. In this work it was used for the analysis of the academic production on the treatments for osteonecrosis of the jaws induced by bisphosphonates from publications indexed in the main collection of the Web database of Sciencetm. This type of study prioritizes indicators and bibliographic data in order to identify the trajectory of the scientific development of a certain subject or subject area [12]. Thus, the ISI Web of Knowledge/ Web of Science (SSCI Social Sciences Citation Index) was chosen as the database for its "academic recognition of being considered one of the most comprehensive journal bases covering several areas of scientific knowledge" [13]. The procedures for bibliometric analysis follow three steps similar to those proposed by Santos et al. (2014): the choice of the database and the criteria to be used for the collection; the data collection itself; the representation and analysis of the data. After data collection, the material was analyzed by exporting this data to the bibliometric HistCite analysis software package in order to organize information and facilitate analysis. The data were analyzed considering the evolution of the publications; the journals with the largest number of records; authors with more publications; the articles with the greatest impact and the institutions with the largest number of publications. In addition to these data, the relationships between the 20 articles with the greatest impact were analyzed. For this analysis, the work was divided into two groups: 1- Articles that received more quotes from other works throughout the ISI of Science (GCS) Web, defined here as citations for all indexed production in the database and 2 - group of articles that received further citations from the work of the selection group of this bibliometric study (LCS), defined as local citations, involved only the 875 articles selected for bibliometric analysis.

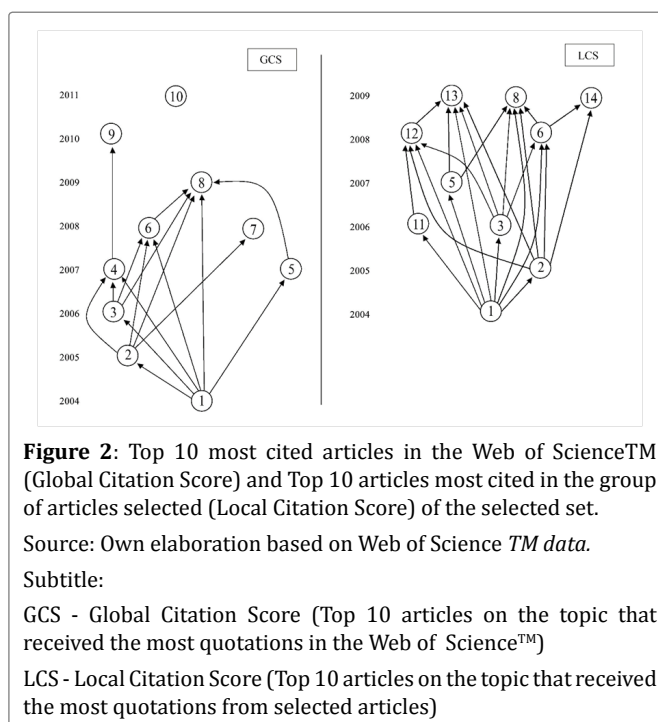
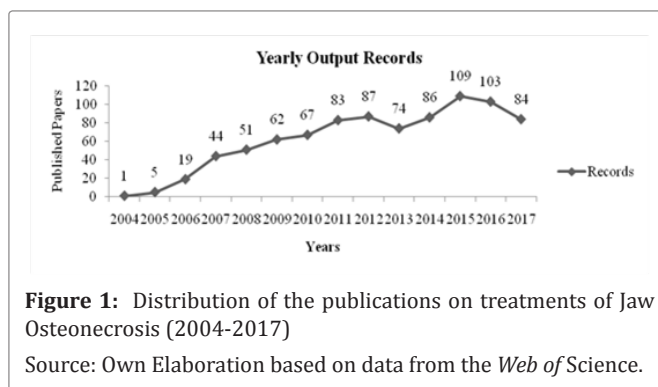
Presentation and Analysis of Results

After conducting a bibliometric survey in the main collection of the Web of Sciencetm, 875 articles on bisphosphonate induced treatments for osteonecrosis of the jaws were identified. These articles are published in 299 different journals indexed to the

Bibliometric Data	Quantity
Publications (Articles)	875
Indexed Journals	299
Authors	3846
Institutions (authors' links)	1237
Countries	59
Cited References	13553

Source: Own elaboration based on data from the Web of Science.

Table 1: General Results of the Bibliometric Survey on treatments of Jaw Osteonecrosis (2004-2017)



database in question and written by 3846 authors who have links to 1237 institutions located in 59 countries. To achieve these articles, 13553 references were used with an average of approximately 15 references per article. In Table 1, these results are presented. In 2004, publications were launched and one article was published. In 2015, the year of greatest publication quality, 109 records were identified. And in 2017, 84 articles were published, reaching 875 records in the temporal cut (2004 - 2017). These publications are distributed in Figure 1 & 2 regarding the year of publication and number of records. The total number of publications was organized by the corresponding journals evidenced in Table 2. The journals with the highest number of publications records are "Journal of Oral and Maxillofacial Surgery" and "Journal of Cranio-Maxillofacial Surgery", with 61 and 38 articles, respectively. The impact of each

Periodicals	Quantity of Articles	Global Citations	Citations/ Quantity
Journal of Oral and Maxillofacial Surgery	61	3932	64,46
Journal of Cranio-Maxillofacial Surgery	38	728	19,16
Clinical Oral Investigations	25	306	12,24
International Journal of Oral and Maxillofacial Surgery	25	511	20,44
Oral Surgery Oral Medicine Oral Pathology Oral Radiology	20	227	11,35
Osteoporosis International	19	405	21,31
Medicina Oral Patologia Oral y Cirugia Bucal	17	161	9,47
Bone	16	677	42,31
Journal of the American Dental Association	16	771	48,19

Source: Own elaboration based on data the Web of Science. The others repeated the amount of 15 articles per periodical to position 12 and the others with 14 articles each, to position 14.

Table 2: Top Journals with more published articles (2004-2017)

Authors	Number of Articles	Global citations	Affiliation (Institution of link)	Country
Otto S	21	477	University of Munich	Germany
Walter C	17	452	Johannes Gutenberg University Mainz	Germany
Pautke C	16	425	Ludwig Maximilians University Munchen	Germany
Vescovi P	14	412	University Parma	Italy
Ehrenfeld M	13	364	Ludwig Maximilians University Munchen	Germany
Ziebart T	13	205	Johannes Gutenberg University Mainz	Germany
Flavia G	11	221	University of Bari Aldo Moro	Italy
Felsenberg D	11	596	Humboldt University	Germany
Ruggiero SL	11	2183	Hofstra North Shore LIJ Sch Med	USA

Source: Own elaboration based on data from the *Web of Science*. The others repeated the number of 10 articles per authors to position 12 and the others with 9 articles each, to position 16.

Table 3: Authors with the highest number of publications (2004-2017)

journal was verified by an index of division of the citations value, by the number of articles published, showing the Journal of Oral and Maxillofacial Surgery as the one with the highest index. The authors with the highest number of publications are distributed in Table 3 & 4. It presents 10 authors with the highest number of publications. The author who most published was Otto S followed by Walter C with 21 and 17 publications respectively.

Discussion

From this research, it was possible to search for documents of high scientific quality indexed in the Web of Science and to have an overview of the scientific production of the developed world in relation to the subject. Regarding the annual evolution of the publication, it was observed that in the period between 2004 and 2006, the publications remained between 1 and 19 records, therefore, with small growth. The numbers only increased in 2007 with 44 records and in 2015 with 109 records, this last year being the peak of published productions. The first observations on this pathology, as well as the first attempts of treatment conduits were reported [2], which treated 63 cases of osteonecrosis of the jaws induced by bisphosphonates with surgical procedures, among them, sequestromias and bone resections. As already mentioned, BRONJ is a pathology that is difficult to treat because it presents causal and modifying mechanisms that are still poorly defined, resulting in constant research that looks for efficient forms of treatment. The publication of these methods in periodicals, mainly foreign ones, has the United States as the country with the highest scientific production, 222 published articles, followed by two European countries with 246 records and an Asian one with the number of 72. In a less favorable position with 44 in this study, we observe the relevance of Brazil in this study, which, even though it is a third-world country, occupies a prominent place in the production of knowledge, generating 146 global citations. Among the most relevant journals, that is, those with more articles, leads the ranking of the American "Journal of Oral and Maxillofacial Surgery" corroborating previous data on the origin of the most published articles. The journal is one of the leading journals

in oral and maxillofacial surgery in the world and has 61 articles published, with a rate of 64.46 citations in other journals, which also has a higher impact factor. With 38 citations, is the second "Journal of Cranio-Maxillofacial Surgery", the official journal of the European Association of Cranio-Maxillofacial Surgery? This information is important in the process of building scientific knowledge since it provides data that can support groups and research centers in the location of academic journals specialized in the topic with greater representativeness in both numbers of articles published and in the quantity of citations received per study. In relation to the authors with the greatest number of publications, two researchers from Germany stand out. With 21 and 17 records in that order, Otto S and Walter C, have the largest number of publications. However, none of these authors remain in articles with more quotations. Ruggiero, in spite of occupying the eleventh position and like unique American representative, is the author with greater production and is the one that has more quantity of citations. As regards the relation between the other articles cited in the Web of Science and those cited by the selected articles (Local Citation Score), between the selection set (2004-2017), we highlight the articles by Ruggiero H [3,6].

Among the 10 most cited in the Global Citation Score, the author has 2 records, the 2 being constructed with the collaboration of coauthors. His article of 2004 is the most cited in the relation among the 10 with the largest number of citations, however the work has this impact factor among the ten articles most cited due to the occurrence of self-citation. The same study published in 2004 [1] gains relevance in relation to the one observed among the 10 most cited articles in the Local Citation Index. In this respect, the study of the author, besides being among the 10 most cited, is one of the two most relevant of the list of citations among the 10 most cited articles, presenting itself as an article of authority. The study published in 2004 [1] is characterized as a pioneering study still seen as a reference, as it is cited by several studies conducted over the years [7,8,10,12,14,15,16]. The other studies are among the 18 articles with the highest impact factor [3,6,8,10,12,14,15,16]. These 18 articles with greater impact identified in the study, whether the

Country	Quantity	Global citations
United States	222	12197
Germany	135	3673
Italy	111	2825
Japan	72	1099
United Kingdom	61	3659
Spain	56	920
Brazil	44	146
Canada	35	1775
Belgium	33	907
France	32	2081

Source: Own elaboration based on data from the Web of Science.

Table 4: Number of Articles by country of origin of the authors' institution links

BRONJ	Clinical condition	Treatment Strategies
RISK STAGE	No evidence of necrotic bone in asymptomatic patients who have been treated with IV or oral bisphosphonates	No treatment indicated, patient education
STAGE 0	No clinical evidence of necrotic bone, but non-specific clinical findings and symptoms	Systemic administration, including the use of pain medication and antibiotics
STAGE 1	Asymptomatic exposed necrotic bone without soft tissue infection.	Antimicrobial mouthwashes (ie, chlorhexidine 0,12%, hydrogen peroxide), no surgical treatment is indicated, clinical follow-up.
STAGE 2	Presence of symptoms around the area of necrotic and exposed bone associated with pain, soft tissue inflammatory swelling or secondary infection.	Antimicrobial rinses (ie, chlorhexidine 0,12%), systemic antibiotics or antifungals (infections may exacerbate BRONJ), pain control, and superficial debridement to relieve soft tissue irritation.
STAGE 3	Presence of a pathological fracture (not related to metastatic disease), necrotic and exposed bone with associated infection, pain, and at least one of the following: pathologic fracture, extraoral fistula, oral antral/oral nasal communication osteolysis extending to the inferior border of mandible.	This stage of necrosis usually requires surgical debridement/resection to reduce the volume of necrotic bone in addition to conservative measures of analgesics, culture directed oral/intravenous antibiotics and oral antimicrobial rinses (ie, chlorhexidine 0,12%).

Source: own elaboration

Table 5: Table of the American Association of Oral and Maxillofacial Surgeons on the stages of BRONJ and its treatments - 2009 update

Authors	Number of Accomplished Cases	Accomplished Treatments
Ruggiero et al. [2]	63 (56 users of Bisphosphonates IV and 7 of Chronic Oral Bisphosphonates).	45 sequestrectomies, 4 marginal mandibular resections, 6 segmental mandibular resections, 5 partial maxilectomies, and 1 complete maxilectomy. 2 patients underwent hyperbaric oxygen therapy (30 hours sessions), they did marginal mandibular and necrotic bone resection
Bamias et al. [17] E Brados et al. (2007)	52 (Bamias) e 146 (Badros) (All users of Bisphosphonates IV).	All patients received several courses of antibiotics.
Kyle et al. [14]	The author used several studies to analyze the methods and their evidences.	All patients were treated according to the 2004 AAOMS White Paper recommendations (Updated in 2009).
Marx, Cillo & Ulloa [4]	146 (30 Users of Oral bisphosphonates and 116 users of bisphosphonates IV)	All patients had bone debridement
Hoff et al. (2008) Cummings et al. (2009)	4019 (All users of bisphosphonates IV)	Patient management was antibiotic therapy, oral hygiene instructions and debridement or sequestration as needed.
e Fizazi et al. (2011) e Morgan et al. (2010).	1904 de Fizazi et al. (2011).	Alternative medications (Denosumab and zoledronic acid) to replace bisphosphonates in the treatment of bone metastases and thus decrease their adverse effects such as BRONJ
Drake, Clarke & Khosla (2008)	This is a literature review.	They reported evidence of treatments with positive results, with the administration of teriparatide protein for bone regeneration
Ruggiero et al. [21]	Issue of the 2009 White Paper update	Updating recommendations

Table 6: Authors x Treatments Accomplished from the 10 most cited articles

origin of articles, periodicals or citations, indicates that the treatment has been well evidenced as an object of relevant study of the health of individuals. These searches for efficient treatments according to Kyle [14] have led various groups and organizations to develop or issue recommendations, position papers, or statements regarding the association of bisphosphonates with osteonecrosis of the jaw. In 2004, a multidisciplinary team was formed to review the literature and clinical evidence and to identify the risk factors of this disease, as well as to develop clinical guidelines for prevention, diagnosis, treatment and with a multidisciplinary effect. The recommendations resulted in a panel, which was distributed as a White Paper in the Annual of 2004 and published later (Table 5). Then the American Academy of Oral Medicine and the American Academy of Oral and Maxillofacial Pathology published position papers, and the American Association of Endodontists issued a statement. All these documents agreed that the prevention of osteonecrosis of the jaw associated with bisphosphonates is the best approach for the treatment of this complication. This table was updated in 2009 [6]. Since then, this document has been influencing behaviors used in several studies, including those most cited in scientific circles. Table 6 shows the list of authors and their respective treatments used by BRONJ for the 10 most cited articles. Authors with similar methods were placed in the same position as happened with Fizazi et al. (2011) and Morgan et al. (2010). In this work it was also possible to access the most recent productions on the subject. In the Jung study [9] involving 17 patients, subjects were first submitted to sequestrectomy under general or local anesthesia and suspension of the bisphosphonate used. The rate of bone regeneration was compared in concomitant computed tomography (CBCT), acquired immediately after the operation and after 3 months. Patients were then divided into groups that based on their treatment regimens, using: teriparatide combined with rhBMP-2 (PTH + BMP), rhBMP-2 (BMP) and control [17-19]. The comparison was made from biochemical markers that were evaluated at baseline (T0), 1 month (T1) and 3 months (T2) after surgery. Significant increase in these values of biochemical markers, osteocalcin and C-terminal telopeptide cross-linking of type I collagen serum was observed within 3 months of surgery in the PTH + BMP group, while the mean value in the BMP group showed no significant change [20,21]. In all groups, the lesions were cured and new bone formation was detected in the CBCT images. The regeneration rate was significantly higher in the 2PTH + BMP group than the BMP and control groups. This has shown that new management possibilities are being tested and have had positive results [22,23].

Conclusion

The study allowed to observe the evolution of the publications of more than 15 years on the treatments of BRONJ, as well as contributed to the identification of the most productive authors, as well as institutions with greater collaboration for the theme. There are 875 articles published in 399 different journals indexed in the Web of Science from 2004 to 2017. These articles were written by 3846 authors of 1237 Higher Education Institutions in 59 countries. The 18 articles with the greatest impact were published in the period between 2004 and 2009. It can be seen that research on treatments for BRONJ is developed in several higher education institutions distributed throughout the world, with highlights for the United States, Germany and Italy. The scientific evidence on this subject can contribute to the development of new research to fill knowledge gaps and thus achieve higher success rates for the management of this pathology.

References

- Torsten H, Martin K, Achim W, C James K. Osteonecrosis of the jaws in patients treated with bisphosphonates - histomorphologic analysis in comparison with infected osteoradionecrosis. *J Oral Pathol Med*. 2006; 35(3):155-60.
- Ruggiero SL, Mehrotra B, Rosenberg TJ, Stephen L Engroff. Osteonecrosis of the jaws associated with the use of bisphosphonates: A review of 63 cases. *J Oral Maxillofac Surg*. 2004 May;62(5):527-534.
- García-de Marcos JA, Rey-Biel J. Submental Perforator Flap for Soft-Tissue Reconstruction in Bisphosphonate-Related Osteonecrosis of the Jaws. *Craniomaxillofac Trauma Reconstr*. 2017 Dec;10(4):299-305.
- Marx RE, Sawatari Y, Fortin M, Vishtasb B. Bisphosphonate-induced exposed bone (osteonecrosis/osteopetrosis) of the jaws: Risk factors, recognition, prevention, and treatment. *J Oral Maxillofac Surg*. 2005 Nov;63(11):1567-1575.
- Migliorati CA, Schubert MM, Peterson DE, LM Seneda. Bisphosphonate-associated osteonecrosis of mandibular and maxillary bone: An emerging oral complication of supportive cancer therapy. *Cancer*. 2005 Jul;104(1):83-93.
- American Association of Oral and Maxillofacial Surgeons: American Association of Oral and Maxillofacial Surgeons position paper on bisphosphonate related osteonecrosis of the jaws. *J Oral Maxillofac Surg*. 2007 Mar;65:369-376.
- Lemound J, Eckardt A, Kokemüller H, Constantin Von S, Frank T, et al. Bisphosphonate-associated osteonecrosis of the mandible: reliable soft tissue reconstruction using a local myofascial flap. *Clin Oral Investig*. 2012 Aug;16(4):1143-1152.
- Jabbour Z, El-Hakim M, Mesbah-Ardakani P, Henderson JE, Albuquerque R Jr. The outcomes of conservative and surgical treatment of stage 2 bisphosphonate-related osteonecrosis of the jaws: a case series. *Int J Oral Maxillofac Surg*. 2012 Nov;41(11):1404-1409.
- Junho J, Hee-Young, Gyu-Tae K, Jung-Woo L, Yeon-Ah L, et al. Short-term Teriparatide and Recombinant Human Bone Morphogenetic Protein-2 for Regenerative Approach to Medication-Related Osteonecrosis of the Jaws: A Preliminary Study. *Journal of Bone and Mineral Research*. 2017 Aug;33(12):2445-2452.
- Diem A, Wolter SC. The use of bibliometrics to measure research performance in education sciences. *Iran J Public Health*. 2012 Jun.
- Miguel S, Dimitri, P. La investigación en bibliometría en la Argentina: quiénes son y qué producen los autores argentinos que realizan estudios bibliométricos. *Informacion, Cultura Y Sociedad*. 2013; 29:117-138.
- Araújo CA. Bibliometria: evolução histórica e questões atuais. *Em questão*. 2006 Jan/ Jun;12(1):11-32.
- Santos JLS, Maldonado MU, Santos RNM. Mapeamento das Publicações Acadêmico-Científicas sobre Memória Organizacional. XXXV. Encontro da ANPAD. Rio de Janeiro. 2011.
- Kyle RA, Remstein ED, Thorneau TM, Dispenzieri A, Kurtin PJ, et al. Clinical course and prognosis of smoldering (asymptomatic) multiple myeloma. *N Engl J Med*. 2007 Jun;356(25):2582-2590.
- Carlson ER, Basile JD. The role of surgical resection in the management of bisphosphonate-related osteonecrosis of the jaws. *J Oral Maxillofac Surg*. 2009 May;67(5 Suppl):85-95.
- Badros A, Weikel D, Salama A, Olga G, Abraham S, et al: Osteonecrosis of the jaw in multiple myeloma patients: Clinical features and risk factors. *J Clin Oncol*. 2006;24(6):945-952.
- Bamias A, Kastritis E, Bamia C, et al: Osteonecrosis of the jaw in cancer after treatment with bisphosphonates: Incidence and risk factors. *J Clin Oncol*. 2005; 23(34):8580-8587.
- Dimopoulos MA, Kastritis E, Anagnostopoulos A, Melakopoulos I, Dimika G, et al. Osteonecrosis of the jaw in patients with multiple myeloma treated with bisphosphonates: Evidence of increased risk after treatment with zoledronic acid. *Haematologica*. 2006 Jul;91(7):968-971.
- Heim N, Warwas FB, Wilms CT, Reich R, Martini M. Vitamin D (25-OHD) deficiency may increase the prevalence of medication-related osteonecrosis of the jaw. *Journal of Cranio-Maxillofacial Surgery*. 2017 Dec;45(12):2068-2074.
- Robert EM, Joseph EC, Jr Juan JU. American Association of Oral and Maxillofacial Surgeons. *J Oral Maxillofac Surg*. 2007; 65:2397-2410.
- Ruggiero SL, Dodson TB, Assael LA, Landesberg R, Marx RE, et al. American Association of Oral and Maxillofacial Surgeons position paper on bisphosphonate-related osteonecrosis of the jaws-2009 update. *J Oral Maxillofac Surg*. 2009 May;67(5 Suppl):2-12.
- Santos JLS, Kalsing M, Hansen PB. Redes de cooperação interorganizacional: uma análise sistemática da produção científica na Web of Science de 1981-2013. *Anais. XVII Semead, Seminários em Administração*, São Paulo, 2014.
- Stanton DC, Balasanian E. Outcome of surgical management of bisphosphonate-related osteonecrosis of the jaws: review of 33 surgical cases. *J Oral Maxillofac Surg*. 2009 May;67(5):943-950.