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Bisphosphonate therapy as a risk factor for success of dental implants

Abstract

Dental implants to replace missing teeth considered a standard of care and usually it has 95% success rate. Most people seeking implants are part of an older population and they may have some systemic disease including osteoporosis. Osteoporosis reduces bone strength; decreases bone mineral density and cause detrition of bone tissue, resulting in increased bone fragility and risk of bone fracture.[1] There is some evidence that implant placement may be protective against alveolar bone resorption and may be protective against bone loss due to aging process. Dental implants are increasing sought by the aging population. It is necessary to look at the effect of osteoporosis and success of implant and treatment for osteoporosis with either oral or IV bisphosphonates.[2] Most investigations concluded that no compelling basis exist to expect osteoporosis to be a risk factor for osseointegration of dental implant. Still many questions exist about treatment of osteoporosis with either oral or IV bisphosphonates. Bisphosphonate use considered a possible risk factor for dental implant success.

Purpose: The purpose of this study was to review literature on patients with osteoporosis who were under treatment with either oral bisphosphonate or IV bisphosphonate receiving implants and determine if implant success rates within these groups were adversely affected.

Method: Systemic search using Pub Med (Medline) to look for patients with osteoporosis and taking either oral bisphosphonate or IV Bisphosphonate from January 2010 to May 2020.

Result: Initial keyword search combination yield in 730 studies with 21 additional records found through other sources. Nine studies meeting the proposed inclusion criteria were included. Six were retrospective studies, two were case series and one was a prospective study. 991 patients receiving 1,989 total implants were included.

There was no report of any side effects. There was not adequate evidence either oral or intravenous bisphosphonate had a negative effect on implant success.

Conclusion: Our review results show there was no notable reduction of success of implants on patients which had osteoporosis and were receiving bisphosphonates. Although less desirable implant success rates were seen in controls, this difference was determined to be not significant (P=0.15). Further investigation is required.

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Introduction

The National Osteoporosis Foundation has projected by the end of 2020 the number of US adults age 50 years or older with osteoporosis or low bone mass, osteopenia, will approximate 64 million. If current osteoporosis prevalence rates in Americans remain unchanged the number affected may likely increase to 71.2 million by 2030.[3] Osteoporosis is a slowly progressive bone disease denoted by decreased bone density and structural deterioration which can cause increased fracture risk bones throughout the skeletal system.[4,5] Bisphosphonate therapy is one of the most widely used medications for osteoporosis by physicians.In fact, it considered the first line defensive treatment for women without contraindications for the reduction of fracture due to low bone density.[6] Major indications for use include osteopenia, osteoporosis, osteoma, and other related bone cancers.[2,7,8]

Bisphosphonates mimic inorganic pyrophosphate that is a naturally occurring compound formed as a by-product of synthesis reactions throughout the human body. Both compounds known to possess a high deposition rate into bone due to very high affinity rate with hydroxyapatite crystals of bone. Bisphosphonates are favorably incorporated into sites of active bone turnover (i.e. maxilla and mandible) where it acts to effectively inhibit hydroxyapatite crystal degradation and limit bone resorption.[9] By this method, physicians aim to prevent further bone resorption and limit the damaging effects of osteoporosis, multiple myeloma, osteitis deformans (Paget's) and bone cancers.[9,10] Bisphosphonates a divided into 2 categories: nitrogen containing and non-nitrogen containing. Nitrogen containing bisphosphonates have been associated with increased risk of osteonecrosis of the jaw following invasive dental treatment.[11] Further division based on two routes of administration commonly chosen for its indication of use. Oral bisphosphonates most commonly used to treat osteoporosis. Whereas, intravenous (IV) preparations of bisphosphonates such as zoledronic acid (Reclast) are primarily used to treat cancers and other bone maladies.[12]The most common bisphosphonate prescribed is Alendronate (Fosamax). This medication is a nitrogen containing oral bisphosphonate used in osteopenia/osteoporosis treatment.[6,8] Additionally, a newer nitrogen containing bisphosphonate therapy, Zoledronate/Zoledronic Acid (Reclast), is becoming more widely prescribed since once-yearly IV

administrations have been used to successfully treat postmenopausal osteoporosis and will likely increase in use due to higher patient adherence.[12,13]

The purpose of this study was to review literature to view patients with osteoporosis who were under treatment with either oral bisphosphonate or IV bisphosphonate receiving implants and determine if implant success rates within these groups adversely affected.

Materials and methods

The PubMed (Medline) database of the United States National Library of Medicine utilized for the literature search of articles published from January 2010 to May 2020. The following keyword search terms were used in different combinations: "dental implant(s)," "bisphosphonate(s)," "oral bisphosphonate", "IV bisphosphonate", "etidronate," "clodronate," "risedronate," "alendronate," "ibandronate," "pamidronate," "Zoledronate", and "zoledronic acid." Research publication titles and associated abstracts were reviewed by two examiners (CGD and YJC), and no blinding was carried out regarding names of authors, journal names, or publication date.

The search completed with a review of the references of the selected articles to identify additional studies not found in the initial literature search. In addition, a manual search was made of the following journals: Clinical Oral Implants Research, European Journal of Oral Implantology, Implant Dentistry, Clinical Implant Dentistry and Related Research, Clinical Oral Investigations, The International Journal of Oral and Maxillofacial Implants, Journal of Clinical Periodontology, Journal of Oral Implantology, Journal of Periodontology, Journal of Prosthodontics, Journal for Oral Medicine and Oral Surgery, and Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology.

Inclusion criteria

1. Patients with a history of bisphosphonate therapy either oral or IV receiving at least one endosseous dental implant before or after bisphosphonate treatment.
2. Retrospective, Prospective, Case control, or Case series.
3. In English Language.

Exclusion criteria

a. *In Vitro* or animal studies.

b. Case series with <3 cases and Case reports.

c. Studies without Implant success rates (Figure 1).

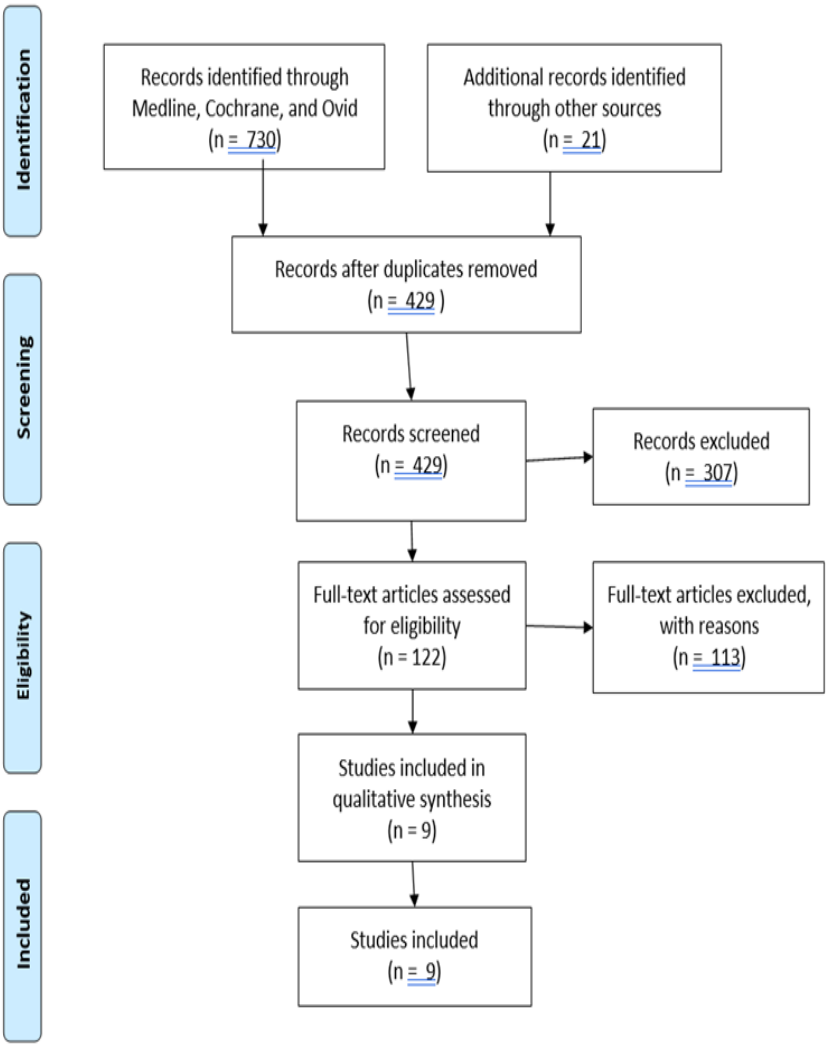

Figure 1

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Results

Initial keyword search combination yield in 730 studies with 21 additional records found through other sources. Nine studies meeting the proposed inclusion criteria were included. Six were retrospective studies, two were case series and one was a prospective study. Nine hundred ninety-one patients receiving1,989 total implants were included. There was no report of any side effects. There was not adequate evidence either oral or intravenous bisphosphonate had a negative effect on implant success (p=015).

Discussion

Osteoporosis is a major health problem. Most people seeking dental implants are elderly and some may have osteoporosis. Osteoporosis can cause bone resorption, and bone fracture, and it is a multifactorial systemic and skeletal disease (Famili).Dental implant usually sought out by this group of people. Bisphosphonate has ability to inactivate osteoclasts, reduce risk of fractures, and usually use to treat osteoporosis.

The purpose of this review paper was to evaluate the implant success on patients with osteoporosis who were under treatment with either oral or IV bisphosphonate.

Koka et al.[14] looked at survival of dental implants in postmenopausal women taking Bisphosphonate. Fifty post-menopausal had 121 implants and taking Bisphosphonate and eighty two patient had 166 implants without BP., no major reported and survival rate was 99.17 in BP group and 98.19 in non BP group no statistically different.

Jeffcoat et al. studied 25 patients on alendoronate or residronate with matched control and found no different in implant survival.

Zahid et al.[15] on their retrospective study of362 patients who were taking either Alendronate 70 my orally or Ibandronate 150mg6 - 192 moths, reviewed of 227 females and 135 male pts (Mean age 56 y/o; range: 17-87) receiving implants but 62 pts excluded.

Remaining 300 pts received 661 implants placed – 19 implants failed (2 in anterior and 17 posterior).Success rates:94.1% for BP users and 97.1% for controls. Famili et al.[1] Reviewed Treatment records of 211 female pts– 50+ y/o used to denote post-menopausal status. The patients Received 592 implants (82/510 [test/control])– 10/6 implants failed.72 pts used Alendronate with 6 failures, 23 used Risedronate with 1 failure, and 5 used Ibandronate with 3 failures (highest of 3 BPs) - follow up interval not given. No significant difference in BP use, Implant failure, and implant location. Success rates: 98.7% for BP users.

Menon et al.[16] 200 Treatment records reviewed of female pt(Mean age test/control 66/63 y/o) receiving 285 implants (153/106 [test/control]) but 62 pts excluded. They Received 285 implants (153/106 [test/control])–10/6 implants failed.

72 pts used Alendronate with 6 failures, 23 used Risedronate with 1 failure, and 5 used Ibandronate with 3 failures (highest of 3 BPs) - follow up interval not given.

No significant difference in BP use, Implant failure, and implant location.

Success rates:93.5% for BP users and 95.5% for controls.

Tallarico et al.[17] Did prospective study on 40 partially edentulous female pts enrolled with no control pts (Mean age 64 y/o) - 8 dropped out – 32 pts remaining at end of study.

Receiving 98 implants and 36-month implant follow-up–1 implant failure reported in maxilla. They used Oral Alendronate 70mg/week for at least 36 months – BPs suspended 6 months prior to surgery. Success rates:98.98% for BP users and not given for controls.

Suvarna et al.[18] Record of 112 pts (30 males/82 females)of patients on oral BP therapy prior to implant placement were reviewed. No significant difference in BP use and Implant failure Success rates:92.9% for.

Taxel et al.[19] Did prospective study on58 post-menopausal females divided into either BP–**bone** therapy group (test; n=20) or non-BP group (control; n=38) prior to implant placement (Mean age 62 y/o)–1 implant site evaluated for stability (ISQ) at surgery and 8 weeks later. Bone turnover markers (sCTX, PINP) measured at pre-treatment, 1 and 8 weeks after treatment.

RFA ISQ values increased between implant placement and 8 weeks' post-surgery demonstrating successful osseointegration. Lower bone turnover was associated with better implant stability among patients with a history of BP exposure.

Most study were either retrospective or review. However, most of they concluded that oral bisphosphonate did not significantly affect implant success and women with osteoporosis taking bisphosphonate did not develop osteonecrosis of the jaw. This needs further investigation with prospective study and larger group of patients to confirm our finding.[20–25]

Conclusion

Our review results show there was no notable reduction of success of implants on patients, which had osteoporosis and were receiving bisphosphonates. Although less desirable implant success rates were seen in controls, this difference was determined to be not significant (P=0.15). Further investigation is required. Despite this finding, there exist several instances, albeit small, in which severe complications have occurred with bisphosphonate (medication)-related osteonecrosis of the jaws occurring because of the invasive nature of dental implant therapy. Given the few studies in our review and most were retrospective in nature, further prospective studies involving larger sample sizes and longer durations of follow-up are required to further evidence of the results obtained in this review.

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Conflicts of interest

The authors declare no conflicts of interest related to this study.

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