

# Oral Bisphosphonates and Dental Implants: A Retrospective Study

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**Purpose:** The objective of this retrospective study was to examine whether patients who take medications containing bisphosphonates (BPs) are at greater risk of bone graft and implant failure than other patients.

**Patients and Methods:** This study involved the examination of 42 patients (101 implants) who had taken medications containing BPs prior to surgeries involving oral bone grafting or endosseous implant placement. Patients had been taking BP medications from 6 months to 11 years prior to implant surgery, and most continue to take these medications through the present time. Patients were examined to determine implant loss, changes in pocket depth bleeding on probing, the height of the ridge, and any evidence of osteonecrosis of the jaw.

**Results:** Five implants failed, giving a 95% success rate, which is comparable to the normal success rate of 96.5% by the same operator. No patient showed signs of osteonecrosis of the jaw.

**Conclusion:** Patients who take oral BPs are no more at risk of implant or bone graft failure than other patients.

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Bisphosphonates (BPs) are a class of drugs commonly used to decrease osteoclast activity and bone turnover, typically giving higher bone density. BPs can be administered either orally or intravenously. Several studies suggest that patients using BPs given intravenously are at a greater risk of developing osteonecrosis of the jaw (ONJ), although a direct causal relationship has yet to be determined.<sup>1</sup> However, according to a task force set up by the American Society for Bone and Mineral Research, there is little information available about the risks of the less-potent oral BPs.<sup>1</sup>

Oral BPs, also called nitrogen-containing BPs, are commonly administered to people suffering from osteoporosis. Non-nitrogen BPs function by competing with ATP in osteoclasts and triggering apoptosis in these cells, thus decreasing bone resorption.<sup>2</sup> The mechanism of nitrogen-containing BPs is less well known. According to Reszka and Rodan,<sup>3</sup> nitrogen-containing BPs inhibit the farnesyl diphosphate synthase enzyme of the cholesterol biosynthesis pathway and disrupt the isoprenylation branch pathway, which inhib-

its proteins and other factors that play a rate-limiting role in osteoclast resorption of bone.

There has been discussion regarding the risks associated with the performance of oral surgical procedures, particularly bone grafting and implant placement, on patients who are taking oral BPs. Marx et al<sup>4</sup> concluded that prevention of BP-related ONJ is not completely possible, but noninvasive preventative procedures could help decrease its incidence. Hewitt and Farah<sup>5</sup> came to similar conclusions, recommending surgical treatment be completed before a patient begins to take BPs, and preventative measures be taken afterward. In a case study and literature report, Wong et al<sup>6</sup> suggested long-term oral BP users be treated with caution, although more study was needed. An official statement by the American Association of Oral and Maxillofacial Surgeons<sup>7</sup> recommends patients cease using BPs 3 months prior to and 3 months after oral surgery if possible, especially if a patient has been using BPs for over 3 years.

On the other hand, Jeffcoat<sup>8</sup> published 2 prospective studies in 2006 which suggest that oral BPs may not increase the incidence of ONJ. In the first study, 335 patients (173 women) were randomly assigned to a placebo or 70 mg of alendronate weekly for 2 years, then alveolar bone height and safety were examined. No evidence of alveolar damage was seen, and there was a lower occurrence of infection and tooth loss in the alendronate group. In the second single-blind study, implant success in 50 consecutive patients, 25 taking BPs and 25 age-matched control subjects, was

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blindly assessed for 3 years. No significant difference was seen in the 2 groups.

The purpose of this retrospective study was to determine whether patients who take oral BP medications are at greater risk of implant and bone graft failure than other patients.

## Patients and Methods

Medical records for all patients who had been seen since 1990 were reviewed, and those patients who took medications containing BPs prior to receiving dental implants or bone grafts were used for the study. A total of 100 implants were placed in 42 patients. The patients were predominantly female (95%). Thirty of these patients also received bone grafts, for a total of 68 bone grafts. There were 41 socket grafts, 6 sinus lifts, 4 closed sinus lifts, 13 guided tissue regenerations, 1 tunnel graft, and 3 buccal contour grafts. Thirty-four patients took alendronate at the time of surgery, 6 risedronate, and 2 ibandronate.

The 42 patients were called in for a follow-up appointment to examine their jaws. Patients were asked about their history with BPs. During the examinations, periodontal probing was performed and pocket depths recorded, as well as bleeding on probing. Panoramic and periapical x-rays were taken and examined to ensure that patients were not suffering from bone loss.

Data gathered from the patients' charts included the date and description of oral surgeries, other medical problems and medications taken, the stability of the implant at the time of surgery, bone graft type and material, whether antibiotics were given prophylactically and what type.

The average length of follow-up was 3 years and 1 month, the shortest period was 4 months, and the longest was 7 years and 5 months.

## Results

Of the 100 implants placed, 5 failed, giving a 95% success rate, which is comparable to the success rate of 96.5% for the 734 implants placed in patients not taking BPs by the same operator in 2006. Five patients, all females, experienced failure of a single implant. Four of these patients received multiple implants at the time of surgery, but none experienced failure of more than 1 implant. All 5 later had the implant successfully replaced.

Of these 5 patients, 1 had been on BP medication for 6 months, did not smoke, and received no bone grafting. The implant failed after 3 months. Another patient had been taking BPs for 3 years before implant surgery, smoked a pack of cigarettes a day, and re-

ceived socket bone grafts. The implant failed within 2 months. The third patient had taken BPs for 2 years before surgery, did not smoke, and received a closed sinus lift. The implant and bone graft failed after 5 months. The fourth patient had been on BPs for 5 years before surgery, did not smoke, received a sinus lift, and the implant had limited stability at the time of placement. The implant failed after 3 weeks. The fifth patient had been on BPs for 3 years, did not smoke, and had a closed sinus lift. The implant failed within 2 months. There was no evidence of exposed bone or ONJ in any of these patients.

Three of the 5 failed implants were in the posterior maxilla. Of these 3, 1 was in the site of a sinus lift and 2 were in the sites of closed sinus lifts. The other 2 failed implants were placed in the upper lateral incisor and lower cuspid areas. The lateral incisor implant was placed immediately after extraction and the patient had a history of smoking. The patient with the lower cuspid implant wore an over denture during healing, which may have prematurely loaded the implant.

No patient examined showed signs of ONJ. One patient experienced 2 mm of vertical bone loss. She had stopped using BPs 1 year before her follow-up appointment, but 2 years after her surgery. No other patients had clinical or radiographic signs of bone loss. There was no bleeding on probing around any of the implants, and pocket depths remained unchanged from the 2 month follow-up visit to the final evaluation.

## Discussion

The reasons for implant failure did not seem to be related to BP treatment. Sixty percent of the failed implants were in the posterior maxilla, compared to 23% of the total implants placed in the same area. One implant failed in a patient who smokes cigarettes. These data are consistent with the higher risk of implant failure in the posterior maxilla and in patients who smoke.

The results of this retrospective analysis show no causal relationship between oral medications containing BPs and implant failure. The 95% success rate of implants for patients in this study is comparable to the 96.5% success rate in 2006 for the same operator. Furthermore, there was no evidence of ONJ or any other related complication in any of the patients in this study.

Bone graft procedures in these patients were very successful. Only 1 case of bone graft failure was observed. This is of interest, as osteoclasts are critical in the resorbative phase of graft healing. Nevertheless, sinus lifts, guided tissue regeneration, socket grafting, and tunnel grafts were preformed without complica-

tion. Grafting materials included autogenous bone harvested from intraoral sites, xenograft (biooss), and resorbable collagen membrane (bioguide). No areas of dehiscence, infection, or loss of graft occurred. No complications including no cases of ONJ arose at the intraoral donor sites.

In this limited study of 42 patients, implant placement and oral bone grafting appear to be safe and successful procedures in patients taking oral BPs for osteoporosis. Considering the number of patients taking oral bisphosphonates who have already received dental implants, further retrospective studies of this nature as well as prospective studies will be helpful in clarifying this issue.

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