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Management of atrophic maxilla in severe osteoporosis treated with bisphosphonates: a case report

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Studies investigating whether osteoporosis is a risk factor for using implants have revealed no correlation between possible implant failure and the severity of osteoporosis. However, osteoporotic patients frequently require bone regeneration techniques, because they do not fulfil optimum conditions for implant placement owing to the diminished bone structure and rapid resorption of the alveolar bone. We present a successful case of advanced implant therapy using platelet-rich plasma in a patient with severe osteoporosis who had been previously treated with bisphosphonates. We are not aware that this technique has been previously described in literature. (**Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2008;xx:xxx**)

The use of osseointegrated implants has high rates of long-term success in rehabilitation of fully edentulous, partially edentulous, and single tooth replacement.¹⁻³ Osseointegration success depends on the host bone bed and its healing capacity and can be expected when implants are placed in bone with good quality and quantity. The influence of the bone quality on the outcome of dental implant has been discussed in several studies. A higher failure rate in patients with low bone quality, sometimes associated with small and inadequate bone volumes, has been reported.⁴⁻⁶

Osteoporosis is characterized by a loss of bone mass with brittle bone tissue which increases susceptibility to fractures. This age-related disease is mainly seen among postmenopausal women⁷ and may have a relationship with periodontal attachment and oral bone loss.⁸⁻¹⁰ However, other authors suggest that the presence of osteoporosis in one site, such as the vertebrae, is not necessarily accompanied by a similar status of the bone of the maxilla and mandible.¹¹ To reduce post-

menopausal bone loss and fractures, estrogen hormone supplementation and administration of bisphosphonates (BPs) as a strong suppressor of bone absorption have been advocated.^{7,12}

The presumption that osteoporosis represents a risk factor for osseointegration may be derived from the association of the disease with a deficiency in bone formation. This deficiency would compromise the healing capacity and the apposition of bone at the bone-implant interface. To understand the influence of osteoporosis on fracture healing, osteoporosis was induced in rats by ovariectomy and maintaining the animals on a low-calcium diet. After 6 weeks, healing was similar in test and control groups, whereas after 12 weeks newly generated bone in ovariectomized rats was osteoporotic and had low mineral density.¹³ This finding may have wound healing implications for bone healing adjacent to dental implants, so the criteria for treatment using implants in patient with osteoporosis has been established to some extent by prolongation of the healing time.^{14,15}

Moreover, several studies have revealed no correlation between possible implant failure and the severity of osteoporosis.¹¹ Some authors have described implant failures¹⁶ and others have reported success^{14,17,18} in patients with osteoporosis. However, because of the diminished bone structure and rapid resorption of the alveolar process^{8,19} such patients do not fulfil optimum conditions for implant placement, and in some cases they require bone regeneration techniques.

One of the least favorable regions for dental implants is the posterior atrophic maxilla, where the bone is largely cancellous with a low level of mineralization, the cortical bone is thin or absent, and its height is usually limited by the extended maxillary sinus. In this case various surgical techniques are used with good

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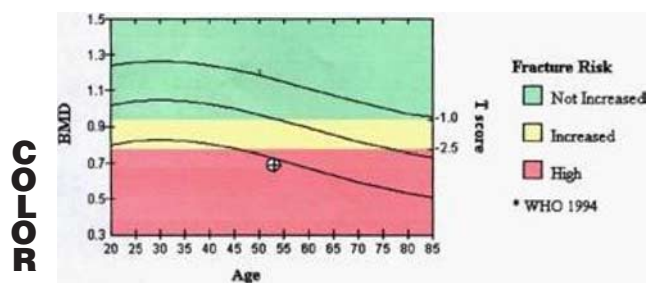


Fig. 1. Patient's densitometry analysis chart showing a bone mineral density (BMD) T-score (L1-L4) of 3.3, indicating a high risk of vertebral fracture and severe osteoporosis.

results, such as the sinus augmentation technique and autogenous onlay block bone grafts for horizontal ridge augmentation.^{20,21}

Several studies have reported the predictability of the sinus augmentation technique with average implant success rates around 92%.^{22,23} When using autogenous block graft approaches for bone augmentation, a considerable amount of horizontal augmentation can be added to the defect area, and a variety of autogenous onlay bone graft techniques have been used for the entire severely resorbed edentulous maxilla²⁴

Bisphosphonates have transformed our ability to treat osteoporosis and hypercalcaemia. This drug is assumed to be well tolerated by most patients,⁷ although there are some important caveats to this assumption. One is the risk of osteonecrosis of the jaw (ONJ) in oral surgery procedures. Although ONJ has been associated with the prolonged use of BPs, there is limited information about the risk of ONJ among users of oral BPs or about the magnitude of the risk among users of intravenous BPs.²⁵⁻²⁷

Recently the potential benefits of using platelet-rich plasma (PRP) in optimal osseous wound repair have been reported.^{28,29} Platelet-rich plasma is a fibrin adhesive with a higher platelet concentration, easily obtained from whole blood centrifugation, and contains angiogenic and mitogenic growth factors derived from the platelets' alpha granules.³⁰ Platelet-rich plasma is inexpensive and its surgical use in clinical studies has shown some positive results.^{31,32}

It has been reported that the combination of anorganic bovine bone with PRP improves the quality and quantity of bone regeneration.³³ We hypothesized that this combination could improve the healing of osteoporotic bone. The present report describes the use of PRP in sinus floor elevation and the onlay autogenous grafting for treatment with dental implants in a patient with severe osteoporosis taking oral BPs. To our knowledge, this technique has not been described previously in osteoporotic patients.



Fig. 2. Autologous bone block graft obtained from the mandible ramus fixed on the atrophic maxilla and sinus floor augmentation using platelet-rich plasma + Bio-Oss.

CASE REPORT

A 64-year-old Spanish white woman was referred to Alcalá Dental Clinic for dental mobility evaluation and implant treatment. She had suffered from severe osteoporosis since early 1997, with high risk of fracture (Fig. 1). Since then she had been receiving alendronate 70 mg/week (Fosamax; MS&D Pharmaceuticals), and tricalcium phosphate 1200 mg/day with vitamin D₃ U/I 800 mg/day (Osteomerk; Merck Pharmaceuticals). The patient was taking no other drugs or hormones and had been undergoing regular examinations. We told her to cancel the treatment with BPs 3 months before the surgical procedures. Clinical exploration, panoramic radiograph, and computerized tomographic (CT) imaging revealed a severe periodontitis in posterior maxilla with a diminished alveolar process and low bone density, which do not fulfil optimum conditions for implant placement and require bone regeneration techniques. Atrophic posterior maxilla was augmented by means of mandibular block bone grafts and the sinus floor augmentation technique, using as bone graft PRP mixture with an inorganic bovine hydroxyapatite (80%) and autogenous bone (20%) harvested from the lateral wall of the maxilla and from the tuberosity (Fig. 2). Four months after surgery, no complications were observed and CT revealed that new regenerated bone was obtained (Fig. 3) allowing stabilization of 6 implants (4 F1 100 101 102 103 104 105 106 107 108

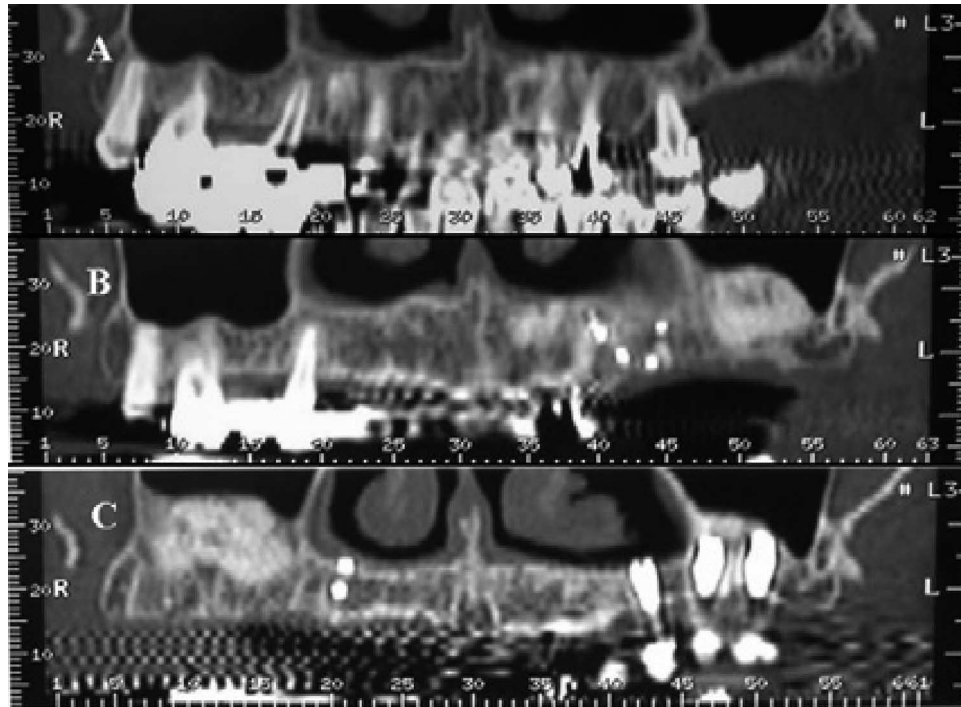


Fig. 3. Dental computerized tomographic scan at: **A**, first visit before the regeneration treatment; **B**, 2 months after treatment of the left side; **C**, 2 months after treating the right side and implant placement on the left side. Note the augmenting bone regeneration in the posterior areas.



Fig. 4. Implant-supported fixed prosthesis in posterior maxilla providing aesthetics and function to the patient 3 years after the treatment was started.



Fig. 5. Orthopantomogram 3 years after the treatment was started, showing successful implant osteointegration.

DISCUSSION

Postmenopausal osteoporosis is a contributing factor to alveolar bone atrophy associated with tooth loss in the elderly, however, dental titanium implants has been increasingly adapted to treat these edentulous patients. The situation in which the host bed for an implant appears to be of bone quality type IV, as classified by Lekholm and Zarb,³⁴ is analogous of an osteoporotic bone. The implant failure rate in such sites has been reported to be greater than in bone qualities type I to III.^{4,5,34,35} Therefore, more

complications and failures are expected when inserting implants in patients with osteoporotic bone.³⁶ However, studies investigating whether osteoporosis is a risk factor for using implants in humans have revealed no correlation between possible implant failure and the severity of osteoporosis.^{11,14,15}

Moreover, dental implant osseointegration may be obtained even in osteoporotic bone. The disease may nega-

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tively interfere with the early implant-tissue integration, affecting the healing period of bone tissue after the insertion of dental implants and delaying the osteointegration.^{37,38} These changes have been observed in different animal studies by a decrease of trabecular bone volume as well as bone-to-implant contact around implants.^{39,40}

Bone regeneration techniques such sinus augmentation and autogenous onlay bone blocks have been reported to be a predictable treatment for the management of the atrophic maxilla, however, this anatomic challenge could be even more difficult in osteoporotic patients who need implant therapy. Moreover, bone healing in osteoporotic patients taking oral BPs is unknown.

However, it is important to draw attention to a worrying correlation which has emerged in the last 3-4 years between ONJ and the systemic administration of BPs. For instance, several cases of ONJ have been reported in patients treated with BPs after oral surgery procedures,^{25,26} as well as the antiangiogenic and ONJ effect of BPs.⁴¹⁻⁴³ Current theory suggests that the mechanism of bisphosphonate ONJ is related to the high metabolic biology of the jawbones, which leads to enhanced concentration of the agents there. Reduction of osteoclastic remodeling promotes acellular bone formation and subsequent necrosis with the inability to heal.⁴²

Little is known of the risks associated with long-term use of oral BPs despite their use for more than 10 years as an oral mode of delivery for the treatment of osteopenia, osteoporosis, and Paget disease of bone. Some authors reported in a controlled study that problems with implants in patients taking oral BPs are relatively rare.²⁷ Furthermore, BPs demonstrate the potential to oversuppress bone turnover rates and inhibit angiogenesis, thus impairing the reparative properties of bone,^{42,44,45} which is why the angiogenic properties of PRP could be beneficial for bone healing in such patients.^{46,47}

Recently Fugazzotto et al. reported that after a mean period of 3.3 years (range 1-5 years) of oral BP use, no correlation was found with the development of osteonecrosis after implant placement.⁴⁸ Cartos et al. claimed that the mode of BP use results in different risk profiles for developing ONJ. They reviewed the use of BPs in the literature and reported an increased risk of inflammatory conditions and surgical procedures of the jaw for users of IV BPs, whereas they did not find this risk for users of oral BPs.⁴⁹

In the present case, no complications were observed after canceling the treatment with oral BPs 3 months before the surgical procedures. Besides, we consider that careful handling of the closure of the wounds may be a relevant factor to reduce the effect of BPs on the emergence of osteonecrosis.

Although a conclusion should not be drawn based on a single case, the result of the present case is in accor-

dance with the findings of other authors.^{11-14,17,18,48,50} These results suggest that severe osteoporosis is probably not a contraindication to dental implant treatment and had no effect on the prognosis of the implants even in advanced implant therapy techniques. Furthermore the use of PRP in augmenting the severely atrophic posterior maxilla may have clinical benefits in terms of angiogenic properties and reducing the healing period of bone maturation, even in severe osteoporosis, accelerating the time of insertion of the implants.

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