

# IMPLICATIONS OF OSTEOPOROSIS IN IMPLANTOLOGY: CLINICAL CHALLENGES AND TREATMENT

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Research Article

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**Abstract.** Osteoporosis is an osteometabolic pathology whose characteristic is a decrease in bone density and wear and tear of the tissue microstructure, resulting in bone fragility and predisposition to fractures. It can manifest itself through the resorption of the alveolar bone, tooth loss, and periodontal disease, making rehabilitation treatments such as prostheses and implants difficult. Osteoporosis affects bone quality and quantity, so implant placement can be risky. Studies link dental implant loss and osteoporosis directly, although they are not statistically significant. Despite the fact that osteoporosis the quantity and quality of the bones are affected, adequate bone formation around the implant and with a similar percentage of bone contact with the implant surface has been demonstrated in healthy individuals versus individuals with osteoporosis. Searches were carried out in online databases, such as Bireme, PubMed, Science Direct, Web of Science, Scielo and Google Scholar, in English and Portuguese, using terms such as “oral health”, “osteoporosis”, and “implantology”. The present study aims to analyze the effects of osteoporosis on oral health and its relationship with dental practices, through a literature review.

**Keywords** — Oral Health. Osteoporosis. Implantology.

## 1 Introduction

According to studies, osteoporosis will become a health problem on a global scale and is associated with aging and, particularly, the hormonal changes associated with menopause. Therefore, it is particularly prevalent in postmenopausal women, although it can also affect adult men and, in exceptional cases, children [1].

Osteoporosis is related to an imbalance of bone remodeling, i.e., more bone is resorbed than formed, which can easily lead to fractures [2]. It can be considered a risk factor for obtaining osseointegration of dental implants, as it is a disease that has the characteristics of decreased bone mass and its impact on bone remodeling properties in skeletal physiology, accompanied by malnutrition, lack of skeletal stress and decreased bone mass. Estrogen is the most common cause of this disorder [3].

According to the Brazilian Society of Rheumatology [4], osteoporosis is a disease that can affect all bones in the body, causing them to become weak, and can break at the slightest effort. In this way, it is considered an asymptomatic and silent pathology in the early stages and, according to some experts, one of the facts that contributes to this is the lack of adequate investigation of the disease, both by patients and doctors.

Although often associated with long bones and vertebrae, osteoporosis also affects the maxillary bones, directly influencing oral health and dental procedures [5]. The decrease in bone density can affect the stability of dental implants, healing after tooth extractions, and periodontal integrity [6, 7].

Early diagnosis of osteoporosis can reduce the risk of fractures and improve the quality of life of individuals, and it should be noted that when referring to the diagnosis, the clinical suspicion should be investigated through Bone Mineral Density, in addition to laboratory tests that include complete blood count, calcium, phosphorus, among others [8].

The Dental Surgeon has several alternatives to detect osteoporosis in advance and thus determine the best therapy, that is, the best way to deal with osteoporosis is through preventive treatment that minimizes damage, with early diagnosis playing a fundamental role, including in the dental field, because osteoporosis when it is detected early can be treated, focusing on limiting their development [9].

The treatment of osteoporosis has a direct and indirect impact on oral health, generally people with osteoporosis tend to agree to a combination drug treatment of bisphosphonates, which is very effective in increasing bone mineral density and reduces the risk of bone resorption. One of the main side effects is osteonecrosis of the jaw, which causes degradation of the jaw, especially after dental surgeries. In implant dentistry, the acquisition of new bone around the implant surface is directly dependent on an active and balanced population of osteoblasts and osteoclasts. Any disruption of this cellular relationship can alter the quantity or quality of the bone formed, leading to a bone deficit [10].

The present study aimed to understand how osteoporosis affects oral health, as well as to identify the best treatment approaches for patients with this condition, especially in implant dentistry..

## 2 Materials and Methods

The research used in this work can be classified as a qualitative and descriptive literature review inherent to the theme proposed for the study. Searches were carried out in online databases, such as Bireme, PubMed, Science Direct, Web of Science, Scielo and Google Scholar, in English and Portuguese, using terms such as “oral health”, “osteoporosis”, and “implantology”. To aid in the search, the keywords used were: osteoporosis, dental implants, risk factors, bone resorption.

### 2.1 Implications of Osteoporosis in Implant Dentistry

Osteoporosis is a systemic metabolic pathology that results in loss of bone mass and defects in bone microarchitecture. Bone density analysis (bone densitometry) is the recognized test to detect this condition, but a recent study in women with osteoporosis showed that this pathology can be identified by panoramic dental imaging using radiomorphometric indices such as the Mandibular Cortical Index (BMI), and allows patients to be divided into three groups: healthy, osteopenic, and osteoporotic [11].

In previous studies, a significant correlation between osteoporosis and the BMI index has been suggested, however, there are also studies that show that osteoporosis, assessed by the Mandibular Cortical Index, does not seem to be correlated with the risk of marginal bone loss. This marginal bone loss appears to be related to periodontitis and the placement of implants in a site of regenerated bone [11].

In osteoporosis, osteoblasts and osteoclasts are disproportionately active, with a predominance of osteoclasts. In Brazil, 10 million people suffer from osteoporosis and 24 million fractures each year – and 200,000 die each year, with the disease affecting approximately 30% of women and 13% of men over 50 years of age [12]. It is believed that one of the main factors for this higher incidence is due to the hormonal changes that women experience during menopause. This causes a sudden drop in estrogen (the female sex hormone) [13].

Treatments to combat osteoporosis have direct and indirect implications for oral health, since patients with osteoporosis are most commonly treated with bisphosphonates in combination with medications, which are very effective in increasing bone mineral density and reducing the risk of bone absorbing spheres and agents that inhibit the phenomenon of bone resorption. The main side effect of bisphosphonates is osteonecrosis of the jaw, as it causes degeneration of the jaw, especially after dental surgery. In dental offices, relative percentages of osteonecrosis of the jaw develop in patients treated with bisphosphonates for the prevention of osteoporosis [10].

Bisphosphonates, compounds similar to pyrophosphate, were first synthesized in 1865 and used in industry as anticorrosive agents. Its application in the treatment of bone diseases began after research was carried out that confirmed its effectiveness in controlling *in vitro* and *in vivo* phosphate formation in bone mining and resorption [14].

It is worth noting that bisphosphonates are drugs used in the treatment of different bone diseases, such as osteoporosis, metastatic bone malignancy, malignant hypercalcemia, and multiple myeloma [14]. Bisphosphonates are drugs that alter bone metabolism, increase bone mass and reduce the risk of fracture, act especially on osteoclasts, inhibit the

development of their precursor cells, increase their rate of apoptosis, boost their inhibitory factors, and reduce their activity [15]. It is clear that the decision of whether or not to place dental implants in patients using bisphosphonates is controversial, depending on the route of administration that can be administered orally or intravenously and the duration of the drug [16].

Bisphosphonate-related osteonecrosis occurs exclusively in the maxillary bones, with the mandible being the most affected, since this type of necrosis is commonly associated with nitrogenous bisphosphonates administered intravenously [17].

The inhibition of osteoclast activity results in a decrease in the capacity for bone remodeling, leading to necrosis in case of trauma to the bone region [14]. Therefore, patients who use bisphosphonate are at risk of developing osteonecrosis when undergoing invasive dental procedures, such as surgeries [18]. There is no fully effective treatment for the pathology and the emphasis is on preventive measures for the disease [3].

Studies indicate that the use of bisphosphonates should not be performed chronically, nor simultaneously with more aggressive dental procedures, such as: tooth extractions, implant installation, periodontal surgery and placement of bone grafts. These procedures should be avoided in osteoporotic patients who use bisphosphonates as a medication for this disease [6].

It is inappropriate to use these drugs in patients who will undergo treatments that involve the performance of osseointegrated dental implants, since they can later interfere with the osseointegration of the implants in the bone tissue of the patients and the development of osteonecrosis of the jaws induced by medication may occur, causing the explantation of the implant. This condition compromises not only oral health, but also the quality of life of these patients [19].

Treatment with intravenous bisphosphonates is contraindicated for the placement of dental implants, and the patient should be informed about the risks, contraindications, and other therapeutic alternatives to implant placement. He should receive oral follow-up performed every 4 months. This follow-up should be done in collaboration with the oncologist [20].

In the case of patients who use oral bisphosphonates, the placement of implants may be indicated, however, it is advisable to interrupt the treatment at least 2 to 3 months before surgery. In view of this, the question then arises to answer that it is possible for patients with osteoporosis, treated with bisphosphonates and who request the placement of dental implants. However, vitamin D verification and supplementation should be carried out, always with caution, with a prescription of chlorhexidine mouthwash and antibiotics until complete healing, prolonged monitoring and regular follow-up to detect any peri-pathology. It is contraindicated in patients treated with intravenous bisphosphonates for a malignant pathology [21]. The treatment of osteonecrosis will initially be preventive with the elimination of all dental infectious foci. When osteonecrosis is established, continuous antibiotic therapy, mouthwash, and possibly surgery with removal of bone sequestrations should be prescribed [10].

Regardless of the type of treatment, the dentist must be correctly informed of the use of osteoporosis medications so that he can offer the most appropriate treatments for each situation. In addition, it is advisable to perform the necessary dental treatment before starting bisphosphonate treatment, except when the risk of fracture is such that it is not

possible to delay the start of treatment [10].

It is important to note that dental implants for patients with osteoporosis are highly recommended under certain conditions, and the dentist needs to pay special attention and dedication to the patient, especially those who have been using bisphosphonates for a long time, which are the drugs commonly prescribed by the doctor to combat losses. Surgical interventions should be restricted [21].

Analyzing information from studies carried out, it was possible to verify that the general rate of implant failures is around 10.9%, a rate that was also verified in previous studies carried out in individuals without osteopenia/osteoporosis, a similar prevalence in cases of peri-implantitis, which suggests that metabolic diseases may or may not have a minimal impact on the pathogenesis of peri-implantitis, unlike periodontal diseases [21]. As described so far, it is emphasized that the premise that the insertion of dental implants is contraindicated in patients with osteoporosis or osteopenia is only mediated by assumptions that these pathologies affect the mandible to the same extent as they affect other parts of the human body, it is also a fact that there are differences in the kinetics of healing and in the path of bone consolidation and remodeling [1].

The maxilla and mandible can be affected by osteoporosis, influencing several dental procedures such as: integrated bone implants, tooth extraction, periodontal problems, etc. As an example of implantology, obtaining new bone around the surface of the implant depends directly on this cellular ratio, and any change can lead to bone mass deficits. Under these conditions, the osseointegration process would be impaired in osteoporotic bones [22].

The association between osteoporosis and higher rates of dental implant loss, however, the relationship between the impact of osteoporosis on bone-implant contact, has little evidence that can support or contest the premise that osteoporosis can offer detrimental effects on bone concretion, which makes it difficult to present decisive conclusions about this impact of osteoporosis on implant-supported restoration. A balance is needed to understand this issue, emphasizing that adequate information for patients about the risks involved remains paramount; as well as cooperation between the dentist and the prescribing physician, will allow effective care [10].

Restorations performed on dental implants in the mandibles usually have a multi-factorial influence, that is, they are influenced by systemic factors, local factors, occlusal factors, periodontal conditions, number and distribution of dental implants in the arch and bite forces. Another factor to be analyzed is that even though there are studies that show long-term success in local and systemic factors, little is known about the factors that end up influencing the stability of dental implants after the connection of the abutment and occlusal load, so endogenous factors in cell renewal and differentiation are scarce. It is then suggested that the systemic conditions that are associated with patients with osteoporosis or osteopenia end up contributing to the worsening of alveolar bone loss [23].

It is essential that the necessary precautions must be taken when intervening when the patient suffers from certain diseases and additional complications: diabetes, drug allergies or intolerances, blood clotting problems, cardiopulmonary or kidney diseases, pacemakers, among others. These are frequent precautions in surgical practice, so they do not represent major challenges if they are properly adopted [21]

### 3 Discussion

As described by [11], through Bone Densitometry it is possible to detect osteoporosis that results in loss of bone mass and defects in bone microarchitecture. Some studies suggest a significant correlation between osteoporosis and the MCI index, while others clarify that it may be related to periodontitis and the placement of implants in a site of regenerated bone.

According to [12], statistics suggest that millions of people suffer from osteoporosis that causes fractures and even deaths, and the disease mainly affects women over 50 years old. It corroborates [13] that one of the main factors for this higher incidence is due to the hormonal changes that women experience during menopause.

It describes [10], that patients with osteoporosis are most usually treated with bisphosphonates in combination with medications, which are very effective in increasing bone mineral density and reducing the risk of bone absorbing spheres and agents that inhibit the phenomenon of bone resorption. The main side effect of bisphosphonates is osteonecrosis of the jaw.

Contribute [6, 15], that bisphosphonates are drugs that alter bone metabolism, increase bone mass and reduce the risk of fracture, act especially on osteoclasts, inhibit the development of their precursor cells, increase their rate of apoptosis, boost their inhibitory factors, and reduce their activity. The use of bisphosphonates should not be performed chronically, nor simultaneously with more aggressive dental procedures, they should be avoided in osteoporotic patients who use bisphosphonates as a medication for this disease.

They clarify [16], the decision to place or not dental implants in patients who use bisphosphonates is controversial, depending on the route of administration that can be administered orally or intravenously and the duration of the drug.

In accordance with research [10], indicate that the relationship between the impact of osteoporosis on bone-implant contact has little evidence that can support or contest the premise that osteoporosis can offer detrimental effects on bone achievement, which makes it difficult to present decisive conclusions about this impact of osteoporosis on implant-supported restoration. Thus, adequate information for patients about the risks involved remains paramount; as well as cooperation between the dentist and the prescribing physician, will allow for effective care.

It highlights [23], that restorations performed on dental implants in the mandibles are usually influenced by systemic factors, local factors, occlusal factors, periodontal conditions, number and distribution of dental implants in the arch and bite forces. Even though there are studies that show long-term success in local and systemic factors, little is known about the factors that ultimately influence the stability of dental implants.

They argue [21], that the necessary precautions should be taken when intervening when the patient suffers from certain diseases and additional complications: diabetes, drug allergies or intolerances, blood clotting problems, cardiopulmonary or kidney diseases, pacemakers, among others.

## 4 Conclusion

Osteoporosis is a systemic pathology that is differentiated by the reduction of bone density, increasing the danger of fractures and impairing the quality of life of patients. It mainly affects elderly people who are the most prone to tooth loss, so when they undergo dental implant treatments, professionals should do a detailed study of these patients before proceeding with treatment. The connection between osteoporosis and implant dentistry is extremely important, as bone weakening can affect the oral cavity, especially in procedures that require manipulation of the alveolar bone, such as tooth extractions and implants. The use of bisphosphonates to treat osteoporosis, despite being efficient in reducing bone resorption and preventing fractures, provides significant clinical challenges for the dentist, especially in relation to the risk of osteonecrosis of the jaws. There is well-founded research demonstrating the influence of osteoporosis on oral health, but others indicate that changes in oral bone mass do not influence the success or failure of dental implants. By weakening the bone structure and reducing its mass, osteoporosis can lead to tooth loosening and complicate the placement of implants and prostheses. Likewise, it tends to worsen periodontal disease and increase the risk of tooth loss. Prevention is the solution to protect yourself from this disease and its unfortunate consequences for your teeth. Osteoporotic individuals had higher rates of implant loss, however, there is less evidence to strengthen or refute the hypothesis that osteoporosis can have detrimental effects on bone healing.

## Author Contributions (CRediT)

Conceptualization: A1; Methodology: A1; Software: A2; Writing—original draft: A1; Writing—review & editing: A1, A2; Supervision: A1.

## Competing Interests

The authors declare no competing interests.

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