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Review Article

Post Menopausal Osteoporosis and Periodontal Disease

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ABSTRACT

Osteoporosis is a disorder of the skeletal system characterized by weakened bone strength, which results in an increased risk of fracture. Osteoporosis integrates two main features: bone density

(usually expressed as grams of mineral per area or volume) and bone quality (architecture, damage accumulation, and mineralization of the bone). Although osteoporosis is more prevalent in postmenopausal women, it can strike at any age and affects both men and women. Periodontitis is an inflammatory disease caused by bacterial plaque which destroys the bone supporting the teeth. Currently, there seems to be a positive correlation between osteoporosis and thinning of the jaw bone. However, further investigation is warranted to better understand the exact nature of the link between osteoporosis and oral health.

Key Words: Osteoporosis, post-menopausal, periodontitis.

INTRODUCTION

Both osteoporosis and periodontal diseases are bone-resorptive diseases. Osteoporosis and osteopenia are characterized by reductions in bone mass and may lead to skeletal fragility and fracture. In most women, bone mass reaches its peak in the third decade of life (age 20 to 30) and declines thereafter. This decline in bone mass is accelerated with the onset of menopause, and oral symptoms are also found in addition to the systemic manifestations of menopause. An increased incidence is observed of oral discomfort, including pain, a burning sensation, dryness, and altered taste perception, as well as a debated rise in the prevalence of periodontal disease.

Periodontitis, an inflammatory disease characterized by resorption of the alveolar bone as well as loss of the soft tissue

attachment to the tooth, is a major cause of tooth loss in adults. Since loss of alveolar bone is a prominent feature of periodontal disease, severe osteoporosis could be suspected of being an aggravating factor in the case of periodontal destruction. In recent years, there has been increasing interest in the interrelationship between systemic osteoporosis, oral bone loss, tooth loss, and periodontal disease. Bone loss is a central, common feature of both periodontal disease and osteoporosis. O*steopenia*, or low bone mineral density (BMD), results when bone metabolism becomes unbalanced, with bone resorption by osteoclast cells occurring at a faster rate than bone production by osteoblast cells.[1] A woman with a BMD 2.5 standard deviations below the mean peak density for young women has osteoporosis, according to the definition of the World Health Organization.[2] Prevalence is higher in women than men and increases with age. About 35% of post-menopausal white women have osteoporosis of the hip, spine, or distal forearm; prevalence in Asian women is similar.[3] In periodontal disease, oral inflammation due to chronic infection of the tissue around the teeth results in destruction of oral bone and periodontal ligament, ultimately leading to tooth loss. Oral inflammation increases production of cytokines, such as interleukin-6, that stimulate osteoclast activity and promote bone resorption.[4]

A similar mechanism may contribute to osteoporosis, raising the question of whether people with low skeletal BMD are at increased risk of oral osteopenia. Several lines of evidence indicate that there is an association between osteoporosis and periodontal disease.

Risk Factors

There are risk factors common to both osteoporosis and periodontal disease. Both osteoporosis and periodontal disease become more prevalent with advancing age, and individuals with a family history are at higher risk.[4] In women, estrogen deficiency increases the risk of both oral and systemic osteopenia.[5] Smoking is a risk factor for, and hastens progression of, both conditions.[4,5]

Cross-Sectional and Longitudinal Studies

Many studies have reported an association between systemic BMD and periodontal disease, regardless of whether the measure of periodontal status is clinical (*e.g.*, attachment loss, probing pocket depth), or radiographic (alveolar crestal height loss).[4] A number of studies have investigated a possible relationship between periodontitis and osteoporosis, and although the literature supports such association, its extent remains unclear, due to small sample sizes, no-comparable study populations and different study methods used to assess periodontitis and osteoporosis. Although studies of osteoporosis and clinical attachment level have produced mixed results, larger cross-sectional studies and at least two prospective studies support an association.[4] For example, in a three-year longitudinal study, 70- year-old subjects were divided into osteopenic and non-osteopenic groups based on BMD of the heel at baseline.[6] The number of sites with at least 3 mm of additional attachment loss after three years was significantly higher in the osteopenic group ($p = 0.043$).[7] This study indicates that, in this older population, systemic BMD may be one factor in predicting periodontal disease progression.[6] A positive association between low BMD and tooth loss has also been reported in many studies, and studies that found no association have generally been in younger populations.[4] The relationship is not firmly established, however, because some studies report no association, and of those that do, most are cross-sectional, many have small sample sizes, and most do not control adequately for possible confounding factors, such as smoking status, postmenopausal hormone use, or treatment for periodontal disease.[4]

Therapies Affecting Both Osteoporosis and Periodontal Disease

Some interventions that improve systemic BMD also improve measures of periodontal disease.[7] Improvement of the two conditions by the same therapies suggests an underlying connection. The three classes of therapy that have been implicated in this regard are

1) Hormone replacement therapy (HRT),

2) Diet supplementation with calcium and vitamin D, and

3) Bisphosphonates.

HRT appears to improve oral bone density, and also leads to less bleeding on probing, less frequent clinical attachment loss, and less tooth loss.[7] These effects are consistent with the benefit of HRT for systemic BMD. Sufficient dietary calcium is essential for maintaining BMD, and low calcium intake may increase the risk of periodontal disease or hasten disease progression.[7] Vitamin D aids calcium absorption from the intestine and regulates calcium metabolism. A three-year prospective, placebo-controlled trial of calcium and vitamin D supplementation in men and women over age 65 found that fewer subjects who received supplements lost at least one tooth.[8] In a two-year follow-up period, fewer subjects consuming at least 1000 mg of calcium per day lost one or more teeth than those who consumed less calcium.[8] These results support a potential benefit of calcium and vitamin D for improving periodontal disease. Few studies have examined the impact of bisphosphonate therapy on periodontal outcomes. One prospective, double-blind trial in women aged 55–65 years who were not receiving HRT found greater improvement in probing depth and gingival bleeding in subjects receiving bisphosphonate alendronate than in those receiving placebo.[9] Systemic BMD and alveolar crestal height increased in the alendronate group but worsened in the placebo group.[9] More studies of bisphosphonates are needed to confirm their impact on periodontal disease.

Possible Mechanisms

The above evidence supports an association between systemic BMD and periodontal disease. The mechanisms underlying this association, however, are unknown. Patients with low systemic BMD may also have low oral BMD, allowing periodontal disease to progress more rapidly because there is simply less oral bone present.[4] A second possibility is that osteoporosis and bone loss due to periodontal disease both proceed by the same cellular mechanism, namely increased production of cytokines, such as interleukin-6, that stimulate osteoclast activity.[1] Genetics may also play a role, in that patients predisposed to BMD loss may also be more likely to suffer periodontal damage.[4] Finally, certain lifestyle factors may increase a patient's risk of bone loss and periodontal disease.[4] There are systemic risk factors such as smoking, diabetes, diet and hormone levels that affect systemic bone loss and may also affect periodontitis.

Relationship between systemic and mandibular bone mineral density

In a study by Kribbs et al, total body calcium as assessed by neutron activation analysis was found to be associated with mandibular density as measured by quantitative analysis of intraoral radiographs.[10] In another study, a comparison of 85 osteoporotic women with 27 normal women showed less mandibular bone mass and density and a thinner cortex at the gonion in osteoporotic women compared to non-osteoporotic women.[11] Similarly, von Wowern et al reported that 12 osteoporotic women with a history of fractures had less mandibular bone density as measured by dual photon absorptiometry than 14 normal women.[12] However, Mohajery and Brooks found that there was no correlation between skeletal and mandibular bone measurements.[13]

Relationship between tooth loss and bone mineral density

Krall and others studied tooth loss and skeletal bone density in 329 post-menopausal women who were participating in a study of calcium supplementation and found that the BMD of the lumbar spine and radius correlated well with the number of remaining teeth.[14] Tooth loss is highly influenced not only by periodontal disease, but also by local practices of the dental community as well as other factors related to oral health.

Implant dentistry in osteoporosis

The use of dental implants in patients with osteoporosis, whether being treated for it or not, is a controversial topic. Osseointegration, which is measured by the percentage of contact between the surface of the implant and the bone, can be affected not only by the characteristics of the implant and surgical procedure, but also by patient-dependent variables that can affect the quantity and quality of bone. Thus,

osteoporosis, characterized by bone loss, alteration of the microstructure and the reduction in the regenerative capacity of bone, has been considered a possible contraindication or a risk factor for dental implant placement. It has been established the hypothesis that osteoporosis affects the jaws in the same manner as other bones of the skeleton, and also that altered bone metabolism may reduce the scarring around the implants. Duarte et al evaluated the influence of estrogen deficiency in bone around implants placed in ovariectomized rats. They analyzed the bone-implant contact and also the area and the density of bone around the implants, distinguishing the cortical region of the spongy region. The authors found significant differences between the study group and the control group, with lower values in the spongy region of the group with induced osteoporosis.[15] Shibili et al performed a comparative histological analysis between implants with load removed in patients with and without osteoporosis. The percentages of bone implant contact did not show differences between both groups. The histomorphometric results were not different either between groups once the osseointegration was established. These data suggest that osteoporosis cannot be considered a contraindication to placement of implants in patients with osteoporosis.[16] In a study to evaluate osseointegration in postmenopausal women aged between 48 and 70, 19 of them with a densitometric diagnosis of osteoporosis and 20 whose diagnosis was normal, 82 mandibular implants were placed (39 in the osteoporosis group and 43 in the control group) and osseointegration was analysed after 9 months. Results determined by panoramic x-rays showed no significant differences between the group of osteoporosis and the control group. Also histological analysis of jaw biopsies showed no differences in bone formation and bone resorption between the two groups. The failure rate of 1.2% (only one implant lost) is compatible with the literature and cannot be attributed to osteoporosis.[17] In another retrospective study with a follow up to 3 years and 4 months for 70 implants placed in patients diagnosed with osteoporosis at lumbar level of the spine and hip, there was a success rate of 97% for the maxilla and 97.3% for jaw.[18]The results of the reviewed studies show that it is feasible to place implants in subjects with osteoporosis, with success rates similar to those obtained in healthy subjects, even in cases in which there was poor quality of bone during or placement. Although the risk of osteonecrosis of the jaw in subjects treated with bisphosphonates is very low, patients should be informed and must sign consent with the inclusion of this specific point.

CONCLUSION

Periodontitis and osteoporosis, as two most widely spread diseases worldwide; have a lot in common, the fact that needs further study. In osteoporotic people, a greater loss of teeth is evident, which in turn leads to the onset of edentulism. The cause of tooth loss is difficult to determine, since it is not clear whether it is due to osteoporosis or some forms of periodontitis. Further studies will help in better understanding the role of osteoporosis and other risk factors in the onset and progression of periodontitis and its effects on periodontal therapy. The importance of cooperation between rheumatologists and dentists should be emphasized due to a new concept of bone resorption by inflammation mediators both during osteoporosis and periodontitis.

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