

Review

Osteoporosis: A silent oral health deterrent

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Accepted 10 April, 2013

Osteoporosis is a multifactorial degenerative condition of the bone characterized by leaching out of mineral content resulting in more porous and fragile bone vulnerable for fractures and infections, which seems to be affecting more in elderly. Fracture of bones in the elderly is really a social and economic burden on the country. Osteoporosis may accentuate the already existing periodontal diseases which are more prevalent in many developing and developed countries leading to early loss of teeth and have a great impact on the quality of life. The present prevalence of osteoporosis is about 10% and with the growing proportion of elderly population worldwide, this could become a major public health problem. However, the condition can be successfully prevented by eliminating risk factors. A thorough knowledge of its etiology, risk factors and management is of significant importance to health professionals.

Key words: Periodontitis, resorption of bone tissue, osteoporosis, bone mineral density, aging.

INTRODUCTION

According to World Health Organization (WHO), osteoporosis is next to cardiovascular disease. The prevalence of osteoporosis is increasing with increasing age and has a female preponderance (WHO, 2003). Osteoporosis is a serious threat in India as well (Osteoporosis Society of India, 2003). India is home to a very large population of osteoporosis patients (Gupta, 1996). More than 20 crores women worldwide have osteoporosis which is predominantly a disease of the women. One in 3 women over 50 years will suffer a fracture due to osteoporosis that increases to 1 in 2 over 60 years (Melton, 1995). One in 5 men over 50 years will suffer a fracture due to osteoporosis that increases to 1 in 3 over 60 years (WHO, 2003). The burden of morbidity from osteoporosis has significant medical, social and financial implications (International Osteoporosis Foundation, 2002). According to WHO, osteoporosis is defined "as a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture" (WHO, 2003).

There is evidence that osteoporosis affects the craniofacial and oral structures, although the contribution of osteoporosis in the loss of periodontal attachments, teeth, and height of the residual ridge has not been clearly elucidated (Dervis, 2005). Hence, the relationship between systemic osteoporosis and oral health is still a complex problem of great interest to a large number of researchers and clinicians. The purpose of this article is to review and summarize published literature concerning possible associations between osteoporosis and various oral conditions such as bone loss in the jaws, periodontal diseases, and tooth loss.

OSTEOPOROSIS AND ORAL HEALTH

Periodontitis and osteoporosis are two diseases found in both male and female population worldwide. Bone loss is a central, common feature of both periodontal disease and osteoporosis (Pejicic et al., 2005). Periodontitis is an inflammation of the supporting tissue of the teeth, usually

leading to loss of bone and periodontal ligament and is a major cause of tooth loss and edentulousness. Periodontal diseases are associated with a number of chronic diseases including osteoporosis (Alwaeli, 2008).

Osteoporosis has the highest degree of osteopenia, characterized by bone loss leading to structural bone transformation. A number of studies have been presented and have generally suggested that osteopenia does play a role in the establishment of periodontal disease. The etiology of periodontal disease as a bacterial infection is well established. However, loss of alveolar bone as a result of osteopenia is probably important in the creation of a susceptible host. In addition, osteopenia and periodontal disease may share common etiologic agents which may either directly influence or modulate both disease processes. Mechanisms by which osteoporosis bone loss may be associated with periodontal attachment loss, loss of alveolar bone height and tooth loss have been proposed by Bartold et al. (2000) as follows:

(1) Low bone density in the oral bone associated with low systemic bone: This low bone density or loss of bone density may lead to more rapid resorption of alveolar bone following insult by periodontal bacteria (Jeffcoat, 2005).

(2) Modification of local tissue response to periodontal infections due to systemic factors affecting the bone remodeling: Persons with systemic bone loss are known to have increased systemic production of cytokines (interleukins (IL) 1 and 6 that may have effect on the bone throughout the body including bone of oral cavity. Periodontal infections have been shown to increase local cytokine production that in turn increases local osteoclast activity resulting in increased bone resorption (Jeffcoat, 2000).

(3) There are also certain genetic factors that predispose a person to systemic bone loss resulting in periodontal destruction (Shum et al., 2010).

(4) Other factors such as cigarette smoking and sub optimal calcium intake may put individuals at higher risk for development of both osteopenia and periodontal disease (Passos et al., 2010).

These conditions share some common pathways in their pathogenesis. For example, systemic up-regulation and increased production of IL-1, tumor necrosis factor- α , and IL-6 induce osteoclastic activity and increase bone turnover rates that lead to loss of bone mass and osteoporosis. It is possible that patients who are at risk for osteoporosis because of a systemically up-regulated cytokine response may also be more susceptible to periodontitis in the presence of local irritants.

The aforementioned evidence supports an association between systemic bone mineral density (BMD) and periodontal disease. The mechanisms underlying this association, however, are unknown. Patients with low systemic BMD may also have low oral BMD, thereby

increasing susceptibility to periodontal disease to progress more rapidly because there is simply less oral bone present. There are some risk factors common to both conditions (Table 1) (Gomes-Filho et al., 2007).

The changes seen in jaw bones are decreased bone mineral content and density, microarchitectural deterioration of trabeculae, increased osteoblastic activity, reduced remodeling rate, reduction in volume of the residual ridge, and decrease in the cortical thickness. Although, changes in maxilla are more evident, because of its high vascularity and its spongy nature, however, the mandible is also affected. Severity of changes is also related to local factors such as the number of existing teeth, similarity of biological events in response to implanted biomaterials (implants or graft materials) in jaws that may or may not be consistent as seen in the spine, hip, or long bones, where osteoporosis is rather much more common. However, patients with osteoporosis have no contraindications to dental implant placement and steps undertaken to insert a surgical implant in these patients will not be different from people without osteoporosis (Mellado-Valero et al., 2010).

There are very few studies in the literature suggesting a relationship between these diseases; hence, further studies regarding the relationship between osteoporosis, oral bone loss and periodontal disease are needed.

DIAGNOSIS

Increasing awareness of osteoporosis and the development of treatments of proven efficacy is likely to increase the demand for the diagnosis of patients with this condition.

History and physical examination

The history and physical examination are insufficient for diagnosis of osteoporosis. However, they can be important in the screening process for osteoporosis and in directing the evaluation. The medical history will provide valuable information about factors that could influence bone mineral density, such as chronic conditions, behaviours, physical fitness, and the long term use of medications. The history should focus on the likelihood of fractures. The physical examination should be used to aid in the screening for osteoporosis. Fractures are generally a late physical manifestation of osteoporosis (Kanis and Glüer, 2000).

The most straightforward approach to the diagnosis of osteoporosis by bone density measurements is to define a threshold, namely, a cut-off point for BMD that will encompass most patients with osteoporotic fractures. Bone density measurements are, however, also used to assess future risk of fracture, so that more than one threshold will be needed.

Table 1. Risk factors for osteoporosis and periodontitis and common risk factors (Gomes-Filho et al., 2007).

Risk factor (Osteoporosis)	Common risk factor	Risk factors (Periodontitis)
Female gender	Cigarette smoking	Plaque
Caucasian or Asian race	Nutritional deficiency	Diabetes
Hereditary	Increased age	Hormone changes
Menopause or amenorrhea	Corticosteroid use	Medical disorder
High intake of protein, caffeine, salt	Immune dysfunction	Osteoporosis
Low intake of calcium and vitamin D	-	-
Excessive alcohol	-	-
Physical inactivity	-	-
Low skeletal mass	-	-
Medical disorder	-	-

Radiographs

Osteoporosis can often be diagnosed by visual inspection of plain radiographs. Panoramic radiographs reveal cortical thickness whereas the intraoral films can be used to measure ridge/bone height, apparent bone density, change in bone height (mm) or density (mg/mm^2), fracture dimension along with the cortical thickness (Devlin and Horner, 2008).

More recent method for the diagnosis of osteoporosis include

Single- and dual-energy X-ray absorptiometry

Single and dual X-ray absorptiometry (SXA and DXA) are methods of assessing the mineral content of the whole skeleton, as well as of specific sites, including those most vulnerable to fracture (WHO, 2003; Gupta, 1996; Bartold et al., 2000). The term "bone mineral content" describes the amount of mineral in the specific bone site scanned, from which a value for BMD can be derived by dividing the bone mineral content by the area or volume measured. With both SXA and DXA, this is an areal density rather than a true volumetric density, since the scan is two-dimensional (WHO, 2003).

Of the many techniques developed to assess bone mass, bone mineral or other related aspects of skeletal mass or structure, the most highly developed, technically and the most thoroughly validated, biologically is DXA, which is regarded as the "gold standard", with which the performance characteristics of less well-established techniques can be compared.

As far as the public health aspect of osteoporosis is concerned, as such there is no screening test to diagnose the osteoporosis and the existing clinical diagnosis is very costly. Hence, public health approach of osteoporosis is limited to health education, to promote good nutrition, physical activity habits and to de-addict them from smoking.

TREATMENT

Ignorance about osteoporosis is still common among health professionals, patients and the public, therefore the education of all of these groups is necessary. The aim should be to increase knowledge of bone physiology and osteoporosis, raise the awareness of major risk factors, and provide information on possibilities of primary and secondary prevention and the management of the disease. Patient compliance can be increased by using effective methods of patient education and individualizing education in a stepwise manner (De Villers, 2003).

Treatment may be aimed at maintaining bone mass or rectifying skeletal deficits and architectural abnormalities, though in practice, the latter remains experimental. A large number of bone-active agents have been used to treat osteoporosis. The management of osteoporosis is intended to prevent either the first or any subsequent fracture by maximizing skeletal strength and/or minimizing skeletal trauma. Changes in lifestyle, e.g. in nutrition, exercise and avoidance of immobility, are helpful, but individuals at high fracture risk will often also require pharmacological interventions (WHO, 2003).

CONCLUSION

Periodontitis and osteoporosis, as two most widely spread diseases worldwide; have a lot in common, a 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.

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