



Research Paper

Association between Osteoporosis and Periodontal Disease – An Update

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ABSTRACT

Osteoporosis and periodontitis affect a large number of men and women worldwide with increase in incidence with advancing age. Periodontitis has long been defined as an infection mediated destruction of the alveolar bone and soft tissue attachment of the tooth, responsible for tooth loss among adult populations. Several studies support an association of osteoporosis with the onset and progression of periodontal disease in humans. Systemic loss of bone density in osteoporosis including that of the oral cavity may provide a host system that is increasingly susceptible to infectious destruction of periodontal tissue. Understanding the association between these common diseases and the mechanisms underlying these associations will aid health professionals to provide improved means to prevent, diagnose and treat these very common diseases.

KEY WORDS

Osteoporosis, Osteopenia, Bone Mineral Density, Periodontitis.

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I. INTRODUCTION

Osteoporosis is an aging-associated bone disease hallmarked by deterioration of bone mass, mineral density, and architecture, thereby increasing the risk of bone fracture.¹ Afflicting over 200 million worldwide,² it is the most common metabolic bone disease, which places 1 in 3 women and 1 in 5 men over 50 at risk for fracture.³ Periodontitis is an exemplar of a microbe-driven chronic inflammatory disease that persists in susceptible individuals, in part due to reciprocally reinforced interactions between the dysbiotic microbiome and the host inflammatory response.^{4,5} In its severe form, periodontitis is the sixth most prevalent condition in the world and afflicts about 10% of the adult population.^{6,7} Both periodontitis and OPR are multifactorial in nature and share some common risk factors and risk indicators. This makes Periodontitis and osteoporosis, the two prevalent inflammation-associated skeletal disorders posing significant public health challenges to our aging population.

CLASSIFICATION OF OSTEOPOROSIS

•Based on the confinement to a particular bone or group of bones.

- a. Regional Osteoporosis.
- b. Generalized osteoporosis.

•Based on the causative factor:

- a. Primary osteoporosis
- b. Secondary osteoporosis

Primary osteoporosis is associated with menopause, advancing age, and idiopathic osteoporosis that may be seen in premenopausal women and middle aged men. Primary osteoporosis is further divided into three types- postmenopausal osteoporosis (Type I), age-related osteoporosis (Type II), and

idiopathic osteoporosis. Postmenopausal (Type I) osteoporosis develops in women who have estrogen deficiency, whereas age-related (Type II) osteoporosis occurs in men and women as their bone density decreases with aging.

Secondary osteoporosis is commonly associated with endocrine disorders (Cushing syndrome, hyperparathyroidism, IDDM, adrenal insufficiency), rheumatoid arthritis, hematologic disorders and malignancies (leukemia, lymphoma), immobilization, pregnancy, lactation, environmental factors including cigarette smoking, sedentary life style and probably alcoholism.

RISK FACTORS

The risk factors for osteoporosis can be divided into non-modifiable and modifiable risk factors. The non-modifiable risk factors include age, gender, early menopause, thin or small body frame, race, and heredity. Lack of calcium intake, lack of exercise, smoking, and alcohol are modifiable risk factors. Low bone mass, certain medications, propensity to fall, and systemic diseases such as hyperparathyroidism can be considered modifiable to some extent.

Table 1- Risk factors for osteoporosis and periodontitis

OSTEOPOROSIS	COMMON RISK FACTORS	PERIODONTITIS
Female gender	Smoking	Plaque
Caucasian/ Asian race	Nutritional deficiency	Stress
Heredity	Increasing age	Diabetes
Menopause, Amenorrhoea	Use of corticosteroids	Hormonal changes
High intake of caffeine, salt, protein	Immune dysfunction	
Low intake of calcium, vitamin D		
Excessive alcohol		
Physical inactivity		
Low skeletal mass		

DIAGNOSIS

Diagnosis of osteoporosis can be done by clinical features like neck and shoulder pain, lumbar and back pain, pain or numbness of extremities, fracture of fore arm, fracture on routine activities and also by using plain radiographs, dual energy x - ray absorptiometry (DXA), vertebral fracture assessment, quantitative CT, quantitative ultrasound, single energy x - ray absorptiometry.⁷ DXA is considered to be the gold standard for diagnosis.

The primary method for diagnosing osteoporosis and associated fracture risk relies on bone densitometry to measure bone mass. The bone densitometry reports are expressed as a T score (the number of SD above or below the mean bone mineral density for sex and race matched to young controls).

Table 2 - Diagnostic levels of bone mineral density established by WHO

	T score (No. of SD 's)
Normal	Equal to -1.0 or higher
Osteopenia	Between -1.0 and -2.5
Osteoporosis	Equal to -2.5 or lower
Severe osteoporosis	Equal to -2.5 or lower with fracture

POTENTIAL MECHANISMS OF ASSOCIATION BETWEEN PERIODONTITIS AND OSTEOPOROSIS

Several potential mechanisms by which osteoporosis or systemic bone loss may be associated with periodontal attachment loss, loss of alveolar bone height and tooth loss have been proposed⁸:

1. Low bone density in the oral bone associated with low systemic bone density:

This may lead to more rapid resorption of alveolar bone following insult by periodontal bacteria.

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 (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 osteoclastic activity resulting in increased bone resorption.

3. Genetic factors:

Genetic factors that predispose a person to systemic bone loss also influence or predispose an individual to periodontal destruction.

4. Environmental factors:

Smoking and sub optimal calcium intake, among others, may put individuals at risk for development of both low bone mass and periodontal disease.

Table 3 - Important studies assessing the relationship between osteoporosis and periodontitis

Author	Subjects And Study Setting	Type Of Study	BMD Assessment	Periodontal Parameters	Major Results
Mashalkar et al. ⁹ (2018)	94 post menopausal women in Maharashtra	Cross sectional	DXA	OHI,PI,CAL	A statistically significant correlation was found between periodontitis and BMD
Silveria et al. ¹⁰ (2016)	4,678 subjects in Pomerania	Cross sectional	Quantitative ultrasound of heel	CAL, tooth loss	Reduced bone stiffness was associated with CAL and tooth loss in women but not in men
Richa et al. ¹¹ (2016)	Post menopausal women (aged 45 – 65 years) in Bangalore	Cross sectional	Quantitative ultrasound	CAL, BOP, gingivitis	Skeletal BMD is related to CAL, BOP, gingivitis
Ignasiak et al. ¹² (2016)	91 post menopausal women	Cross sectional	DXA of radial bone	Tooth number, PPD, gingival bleeding	BMD not significantly correlated with tooth number and gingival bleeding
Juluri et al. ¹³ (2015)	50 osteoporotic and 50 non osteoporotic women (aged 50 – 65 years)	Case control	DXA	PPD, ABL, CAL,	Osteoporotic women had significantly greater PPD, CAL, ABL
Darcey et al. ¹⁴ (2013)	395 post menopausal women (aged 45–70 years), Greater Manchester	Cross sectional	DXA	PPD, PI, GI	No significant association between osteoporosis status and moderate to severe periodontitis
Gondim et al. ¹⁵ (2013)	148 women	Cross sectional	DXA lumbar spine, femoral neck	PPD, BOP, CAL, tooth loss	Inverse relationship of severe CAL with BMD of the femoral neck, positive association of severe CAL with tooth loss
Bertulucci et al. ¹⁶ (2012)	99 post menopausal women	Case control	DXA lumbar spine	PPD, PI, GI, CAL	Significant difference in periodontal status between normal and osteoporosis group and between osteoporosis and osteopenia group
Gomes- Filho et al. ¹⁷ (2007)	139 postmenopausal women in Brazil:	Case control	DXA of femur and/or lumbar column	PD, GR, CAL	Postmenopausal women with osteoporosis and low educational levels have a greater chance of having periodontal disease than do those without osteoporosis.
Wactawski-Wende	1341 post	Cohort	DXA	Alveolar crestal	Strong and

et al. ¹⁸ (2005)	menopausal women (aged 53 – 85), New York			height(ACH)	consistent association between ACH and T score in post menopausal women
Yoshihara et al. ¹⁹ (2004)	600 subjects aged 70 years, Japan	Longitudinal	Ultrasound of heel bone	Probing attachment level(PAL)	Significant association between BMD and PAL

DXA - dual-energy X-ray absorptiometry, OHI – oral hygiene index, GI – gingival index, PI – plaque index, BMD – bone mineral density, ABL – alveolar bone loss, PD – probing depth, CAL – clinical attachment loss, GR – gingival recession.

II. Conclusion

Osteoporosis is a silent disease, reflected only in a low bone density, till a fracture occurs and so is periodontal disease. As the older adults in the Indian population is increasing establishing the association between osteoporosis and periodontitis will help motivate the general population to institute preventive measures so that we can reduce the burden of two chronic diseases thereby improving quality of life. It should be advisable for the dentists to identify patients with multiple shared risk factors, such as aging and smoking, and based on the periodontal status, recommend these patients to perform fracture risk assessment with their primary care physicians. Well-controlled longitudinal studies are needed to examine the interdisciplinary management and potential therapeutic modalities to address both these diseases.

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