

# PERIODONTITIS AND OSTEOPOROSIS: ASSOCIATION AND MECHANISMS



Dr. Hayder A. Alwaeli

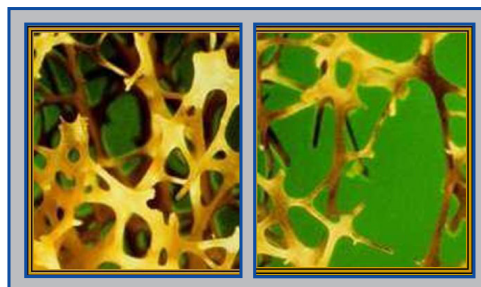
Osteoporosis and periodontitis are diseases that affect a wide range of men and women in the worldwide, with incidence increasing with advancing age. Osteoporosis is a skeletal disorder characterized by compromising bone strength predisposing to increased risk of fracture, with bone strength characterized by bone density and bone quality.

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 in adults (Fig.1).

Periodontal diseases are associated with a number of chronic diseases including Osteoporosis.



(Figure 1)▶



(Figure 2)▶

Osteopenia and osteoporosis are systemic skeletal diseases characterized by low bone mass and micro-architectural deterioration with a consequent increase in bone fragility and susceptibility to fracture (Fig 2).

According to the World Health Organization, osteoporosis is considered to be present when bone mineral density (BMD) is 2.5 standard deviations (SD) below the young normal. Osteopenia is defined as bone density levels between 1 SD and 2.5 SD below normal BMD.

In the 3rd National Health and Nutrition Examination Survey (NHANES III) the prevalence of osteoporosis when assessed at the femoral neck was 20% of postmenopausal white women.

The risk factors for osteoporosis can be divided into non-modifiable and modifiable risk factors,

The non-modifiable include sex, age, 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 (corticosteroid or anticonvulsant), propensity to fall, and systemic diseases such as hyperparathyroidism are modifiable to some extent (Fig.3). The risk factors for osteoporosis include many risk factors associated with advanced periodontal disease. Since both osteoporosis and

periodontal diseases are bone resorptive diseases, it has been hypothesized that osteoporosis could be a risk factor for the progression of periodontal disease. The data gathered on the mostly cross-sectional studies appears to indicate a relationship between systemic BMD and oral BMD. Additional data from ongoing longitudinal studies will further elaborate this relationship.

**Menopause, osteoporosis and periodontal diseases**

Female life expectancy to 80 years old, 40 % of her life in menopause which is associated with decline in the hormonal levels due to decrease in the ovarian functions. All these hormonal changes will lead to psychological, oral and systemic health changes. Oral changes that can be seen may include: thinning of oral mucosa, desquamation of gingival epithelium, burning mouth, gingival recession, xerostomia and alveolar bone loss & ridge resorption (Fig 4).

Bone loss in women occurs most rapidly in the years immediately following menopause when natural levels of estrogen are greatly reduced. In most women, bone mass reach its peak level at third decade of life and decline thereafter. This decline accelerate with the onset of menopause. While estimates the rate of menopausal bone loss may differ by population and measurement technology a rate on the order of 0.5% to 1.0% per year has been reported.

**Association between Osteoporosis and periodontal diseases**

A growing body of literature has accumulated regarding the role of osteoporosis in the onset and progression of periodontal disease and tooth loss. The association between these two diseases is biologically plausible as well. However, most studies are crossectional uncontrolled, consist of small samples, and are largely restricted to postmenopausal women. Cross-sectional studies have an inherent limitation in establishing causation, since bias, confounding, and temporality are difficult to establish and control. Loss of alveolar bone as a feature of periodontal disease may be easily confounded by other factors such as gender, hormone intake,

**Risk Factors for Osteoporosis**

Risk Factor	Modifiable	Non Modifiable
Gender	No	
Age	No	
Early Menopause	No	
Low Bone Mass	Yes	Treatment of osteoporosis or osteopenia
Thin small-framed body	No	
Race	No	
Lack of calcium	Yes	Diet high in calcium or Vitamin D
Lack of exercise	Yes	Weight-bearing exercise
Smoking	Yes	Smoking cessation
Alcohol	Yes	Decreased alcohol consumption
Heredity	No	
Diseases (e.g. hyperparathyroidism)	To some extent	Treatment
Certain medications (e.g. steroids)	To some extent	After treatment if feasible
Propensity to falling	To some extent	physical therapy, neurological treatment if possible

<(Figure 3)



<(Figure 4)

smoking, race, age, stress and distress, diet, body mass, and exercise. Many of the studies to date inadequately address these issues. Most studies are relatively small and make control of confounding and assessment of effect modification difficult.

**Potential mechanisms and biological aspects**

Based upon our knowledge of osteopenia and periodontal disease and the risk factors that affect both, it is reasonable to propose the following hypothesis: periodontitis results from bacteria that produce factors which cause loss of collagenous support of the tooth, as well as loss of alveolar bone. Osteopenia results in loss of BMD throughout the body, including loss in the maxilla and mandible. The resulting local reduction of BMD in the jawbones would set the stage for more rapid alveolar crestal height loss since a comparable challenge of bacterial bone-resorbing factors could be expected to result in greater alveolar crestal loss than

in a non-osteopenic individual. There are, in addition, systemic risk factors such as smoking, diabetes, diet, and hormone levels that affect systemic bone loss and may also affect periodontitis.

Although periodontal disease has historically been thought to be the result of an infectious process, others have suggested that periodontal disease may be an early manifestation of generalized osteopenia. Evidence in support of this concept is limited and evaluation of the independent role of generalized osteopenia on periodontal disease requires further study. Bone loss associated with osteoporosis occurs when there is an imbalance between bone resorption and formation, favoring resorption. Calcium balance, vitamin D metabolism, estrogens, and aging are interrelated factors in the causation of osteoporosis. Chronic negative calcium balance reduces bone mineral content. Decrease in calcium intake and decrease in intestinal calcium absorption with age contribute to a negative calcium balance in older women. Both estrogen and vitamin D are known to affect intestinal calcium absorption. Vitamin D3 supplementation has been shown to reduce new vertebral fractures in postmenopausal women compared to women supplemented with calcium

that contribute to bone loss include suboptimal skeletal development in early adulthood and age-related bone loss. Hormone dependent increases in bone resorption and accelerated loss of bone within 10 years after menopause have been reported to be the main pathogenic factors in primary osteoporosis in women. Estrogen deficiency appears to play a major role in osteopenia and accelerated bone loss, a concept which is supported by the higher prevalence of osteopenia in women than men. Also, a meta-analysis of the effect of estrogen replacement therapy on reduction of osteoporotic hip fractures in postmenopausal women estimated a 25% reduction in hip fracture in estrogen users compared to non-users, supporting a major role of estrogen in hip fracture and presumably osteoporosis prevention.

**Treatment of osteoporosis and periodontitis**

Regarding the treatment of osteoporosis include decrease the risk factors through many treatment options such as adding protective factors of a Ca & vit. D rich diet + supplementation, weight bearing exercises, hormonal replacement therapy (HRT)-(ERT), drug therapy such as: alendronate (Fosamax®), calcitonin, selective estrogen receptor modulators and parathyroid hormone.

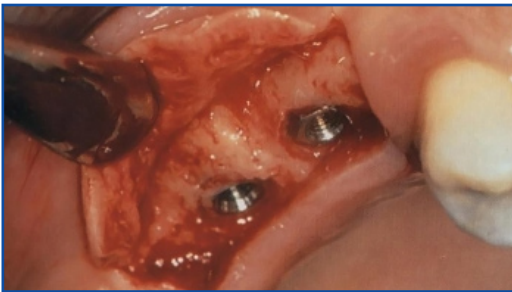
HRT as one of the treatment modalities for osteoporosis had been showed that patient on HRT show regaining bone mass to pre menopause level & in preventing / reversing postmenopausal osteoporotic changes in long bones & spine and has a beneficial effect on tooth loss, mandibular bone density & gingival bleeding.

**Clinical consideration and management of periodontal disease for an osteoporosis patient**

If the patient is osteoporosis susceptible and due to the changes in alveolar bone level or oral manifestation for a menopause woman; close monitoring of periodontal maintenance, informing the patient regarding the potential risks of hormone depleting on the oral tissue and consulting the patient's physician about the current medication & the replacements to treat osteoporosis.



(Figure 5)»



(Figure 6)»

alone. However, characteristics of the subjects enrolled may explain inconsistent results across studies. Additional factors



Every treatment modality in periodontal therapy can be done for osteoporotic patient from scaling and root planing, different periodontal and implant surgery so we can say from the scientific evidences that osteoporosis is not a contraindication for different periodontal surgery (guided tissue regeneration and implant) in spite of the lack for more controlled prolonged studies in that field (Fig.5)

Regarding dental Implant osteoporosis is not likely a risk factor for failure of osseointegrated implants, dental implant placement in edentulous area aid in maintaining the height & density of alveolar bone. osteoporotic bone does not heal differently than more dense bone and the prognosis of osseointegrated implants can be improved in O.P patient who received treatment such as (Fosamax®) (Fig.6)

### New evidences and precautions for osteoporotic patient who are on certain medication and need a huge periodontal and implant's surgical intervention

Ruggiero and colleagues reported in the August 2004 issue of the Journal of Oral and Maxillofacial Surgery the observation of an osteonecrosis syndrome reminiscent of osteoradionecrosis in certain patients taking bisphosphonate drugs.

Patients developed osteoradionecrosis-like lesions soon after extraction of teeth for periodontal, endodontic, or prosthetic reasons; from 2001 to 2003, they saw 63 cases, of which approximately two-thirds of the osteonecrosis cases occurred in the mandible. All patients had been receiving various forms of bisphosphonate therapy (primarily zoledronic acid and pamidronate) for a variety of metastatic cancers. Also in CHICAGO – April 11, 2006 – The patient of a periodontist in private practice in New Orleans, LA, developed osteonecrosis of the jaw (ONJ), a condition that can cause severe, often irreversible and debilitating damage to the jaw, following periodontal surgical therapy. Two years prior to surgery, the patient had started receiving IV

bisphosphonate therapy, or bone-sparing drugs commonly used in the treatment of osteoporosis and metastatic bone cancer to help decrease associated pain and fractures, following treatment for breast carcinoma (Fig.7).

So it will be wise enough after all these continuous observation to start with a small periodontal surgical intervention for those patient who are osteoporotic on intravenous bisphosphonate therapy or bone spring drugs and see the prognosis and the healing before we go for more advances and complicated surgical interventions).

### Conclusion

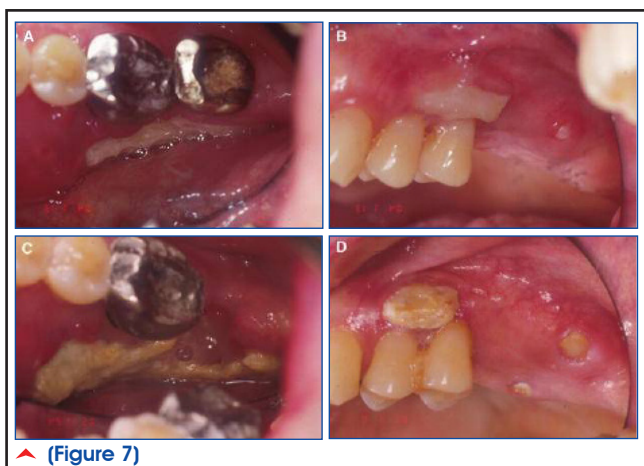
From the literature we had, it appeared that there is an association of osteoporosis with onset and progression of periodontal diseases in humans, also the studies revealed that Low bone mass independently associated with loss of alveolar crest height & tooth loss.

- 1.The limitations of the studies that investigate the aspects of the relation between osteoporosis and periodontal diseases include: small sample size
- 2.Limited control of other profounding factors
- 3.Varying definitions of periodontal diseases & O.P.

Finally there is a demanding issue to better understanding and investigation for the potential mechanisms between periodontal diseases and systemic problems including osteoporosis.

### References

1. Nico C. Geurs, Cora Elizabeth Lewis & Marjorie K. Jeffcoat. Osteoporosis and periodontal disease progression. Periodontology 2000, Vol. 32, 2003, 105–110.
2. Marjorie Jeffcoat. The Association Between Osteoporosis and Oral Bone Loss. J Periodontol 2005;76:2125-2132.
3. Jean Wactawski-Wende. Periodontal Diseases and Osteoporosis: Association and Mechanisms. Ann Periodontol 2001;6:197-208.
4. Kristi M. Solaeli. Case report: Oral post surgical complication following the administration of Biphosphonates given for osteopenia related to malignancy. J.Periodontol 2006;77:738-743.
5. Stephen J. Meraw\* and Charles M. Reeve. Qualitative Analysis of Peripheral Peri-Implant Bone and Influence of Alendronate Sodium on Early Bone Regeneration. J Periodontol 1999;70:1228-1233.



▲ (Figure 7)

### Author: Dr. Hayder A. Alwaeli

B.D.S., M.Sc, Jordanian Board Certificate in Periodontology.  
Periodontist & Lecturer, Jordan University of Science & Technology.

Member International Congress of Oral Implantologist (ICOI).

Member DGZI German Implant Society.

Member & Treasurer IADR / Jordan section