International Poster Journal IPJ of Dentistry and Oral Medicine

Int Poster J Dent Oral Med , Vol No , Poster 319

Relationship between systemic osteoporosis and periodontal disease

Language: English

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Date/Event/Venue:
July 16th-18th 2005
National Congress of the French Society of Periodontology and Implantology (SFPIO)
Bordeaux, France

Introduction

Osteoporosis and osteopenia are characterized by reductions in bone mass and may lead to skeletal fragility and fracture. Periodontitis is an inflammatory disease characterized by loss of connective tissue and alveolar bone. Like osteoporosis, it is a silent disease, not causing symptoms until late in the disease process when mobile teeth, abscesses and tooth loss may occur. While the etiologic agent in periodontitis is a pathogenic bacterial plaque in a susceptible patient, periodontitis and osteoporosis have several risk factors in common. They include an increased prevalence with increasing age, smoking and influence of disease or medications that may interfere with healing. In addition, the pathophysiology of both diseases appears to have hereditary or, at least, familial component (Reddy, 2001). It is unknown whether the rate of progression of periodontitis is related to systemic osteopenia (Jeffcoat, 1998).

Objectives

This poster reviews the current evidence on the association between periodontal disease and osteoporosis.

Material and Methods

1. Methods for assessing bone mass and density
a) Radiographs
- panoramic radiographs (Figure 1a, b)
- periapical radiographs
b) Dual energy X-ray absorption (DXA)
- uses an X-ray source
- measurements of bone mass as 'areal density' in units of grams/cm2
c) Absorptiometry
- utilizes a gamma source
- measure bone mass in grams (approximate ash weight) per cm along the axis of the bone.
Single photon absorptiometry uses gamma source such as I125
Dual photon absorptiometry uses isotopes with 2 gamma ray energies such as gadolinium153
d) Quantitative computed tomography (QCT)
- permits direct measurement of either trabecular or total bone density
- provides measures of bone 'apparent' density in units of grams/cm3

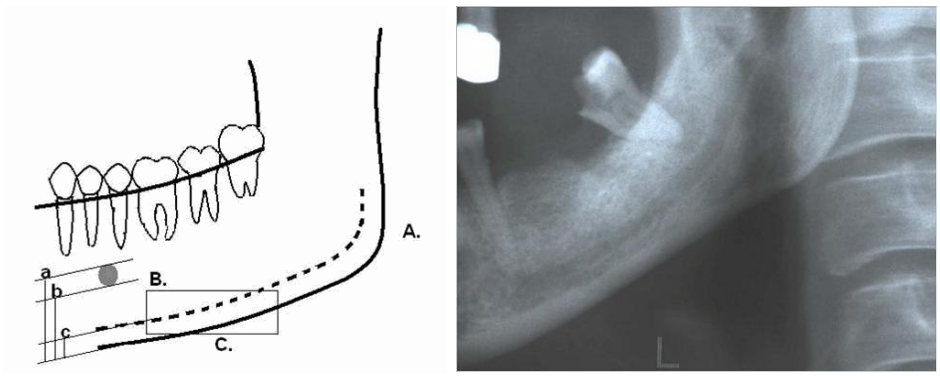

Figure 1. Regions for measuring mandibular bone changes in vivo on panoramic radiographs
A. Thickness of the mandibular angular cortex with a marking gauge (GO) (Bras et al., 1982)
B. Calculation of PMI (PMI superior margin= c / a; PMI superior margin= c / b) (Benson et al., 1991)
C. Changes in inferior cortex (C1-C3) detected on both sides of mandible, distally from the mental foramen (Klemetti et al., 1994)

2. Techniques used to assess periodontitis and oral bone loss (Figure 2 and 3)
- Radiographic measures of alveolar crestal height and residual ridge resorption
- Probing measures to assess clinical attachment level
- Measures of tooth loss

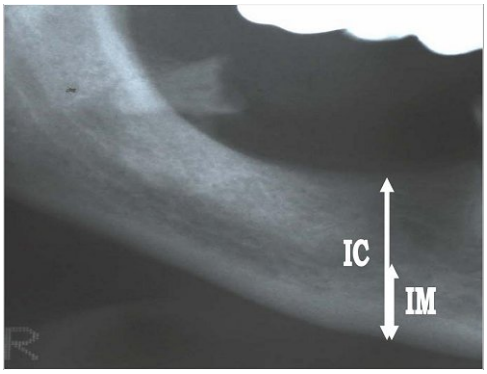

Figure 2. Measuring method for the height of ridge on panoramic radiograph - from the inferior border to the superior edge of the alveolar crest in the region of the mental foramen (IC), divided by the distance from the inferior border to the lower edge of the mental foramen (IM) to calculate the percent of bone remaining (Kribbs, 1990)

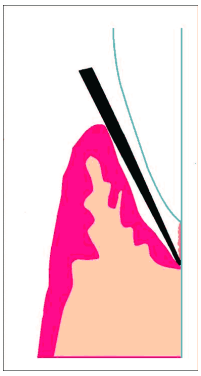

Figure 3 A. Diagrammatic representation of Periodontal Probing

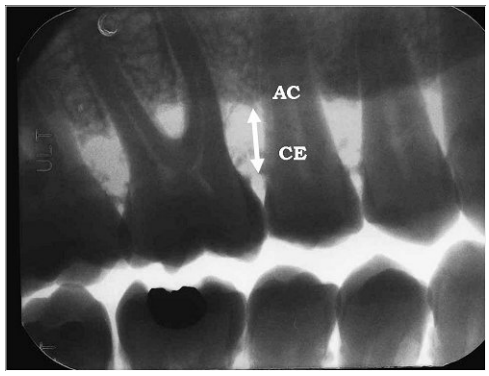

Figure 3 B. The measurement of the mean alveolar bone loss (mm) on bitewing radiographs, between the bone level of the alveolar crest (AC) and the cemento-enamel junction (CEJ), perpendicular to the occlusal surface of the tooth (Elders et al., 1992)

Results

Cross-sectional studies correlating bone mineral density with tooth count have not shown similar results and are not likely in themselves to provide a definitive answer to the temporal relationship between the onset of loss of bone mineral density and teeth (Table 1 and Table 2).

Table 1: Studies on the relationship of tooth loss and osteoporosis

Authors	Type of study	Population	Association
Kribbs (1990b)	Cross-sectional	85 women with osteoporosis;27 normal women	S
Elders et al. (1992)	Cross-sectional	286 women	NS
Klemetti et al. (1994)	Cross-sectional	355 postmenopausal women	NS
Taguchi et al. (1995a)	Cross-sectional	64 women	S
Taguchi et al. (1995b)	Cross-sectional	269 healthy patients	S
Krall et al. (1996)	Longitudinal 7 years	189 healthy, white, dentate, postmenopausal women	S
Mohammad et al. (1997)	Cross-sectional	44 non white women	NS
Hidebolt et al. (1997)	Cross-sectional	135 postmenopausal women	NS
Bando et al. (1998)	Cross-sectional	14 periodontally healthy women; 12 edentulous women	S
Taguchi et al. (1999)	Cross-sectional	90 Japanese women	S

Table 2: Studies on the relationship of periodontal disease and osteoporosis

Authors	Type of study	Population	Osteoporosis assessment	Periodontitis evaluation	Oral hygiene monitoring	Association
Kribbs et al. (1989)	CS	85 edentulous postmenopausal women	Total body calcium; SPA of the radius; DPA of the vertebrae; Cortical thickness at the gonion	PD, GR, BOP	-	S
Kribbs (1990a)	CS	50 normal women 20-90 yrs	SPA of the radius; DPA of the vertebrae; Mandibular bone mass on radiographs made distal to the mental foramen; Cortical thickness at the gonion	PD, GR, BOP	-	S
Kribbs (1990b)	CS	85 women with osteoporosis(50-84 yrs); 27 normal women	Cortical thickness at the gonion; Radiographic evidence of vertebral compression fractures; Mandibular bone mass and density	PD, GR, BOP	-	NS
Elders et al. (1992)	CS	286 women (46-55 yrs)	Lumbar BMD; MCT	Alveolar bone loss, PD, BOP	Oral cleaning	NS
Von Wowern et al. (1992)	L	17 acute nephritic dentate patients undergoing intensive long-term high- dose steroid treatment	DPA measurements of BMC of mandible and forearm	BOP, CAL on 6 selected teeth	Visible plaque (Oil)	NS
Von Wowern et al. (1994)	CS	12 women with osteoporotic fractures; 14 normal women	BMC of the mandible at the standard site (DPA); BMC of the forearm (DPA)	Same as above	Visible plaque (Oil)	S
Mohammad et al. (1996)	CS	22 women with low mean spine bone density; 20 normal women	Spine bone mineral density (DPA)	PD, GR, CAL	Plaque Index	S
Wactawski - Wende et al. (1996)	CS	70 post-menopausal women (51-78yrs)	DXA of the lumbar spine and femur	CAL, Alveolar bone loss	-	S
Hildebolt (1997)	CS	135 postmenopausal women (41-71 yr)	DXA of postcranial (vertebral and proximal femur) BMD	CAL, PD, GR	-	NS
Payne et al. (1999)	L	17 women with osteoporosis of the lumbar spine; 21 control	DXA of the lumbar spine	Alveolar bone height loss	Plaque Index	S
Payne et at. (2000)	L	59 postemenopausal women as subjects: 38 non-smokers, 21 smokers	BMD of the lumbar spine (L2-L4) (DXA)	Alveolar bone height loss	Plaque Index	S
Weyant et at. (1999)	CS	292 dentate women (average age 75.5 yrs)	Systemic BMD at 8 anatomic sites (hip, radius, spine, calcaneus) by SPA, DPA	BOP, CAL, PD	Calculus	NS
Tezal et al. (2000)	CS	70 postmenopausal (51- 78yrs)	BMD at lumbar spine and femur (DXA)	BOP, PD, CAL, Alveolar bone loss on Rx	Plaque, calculus	S
Ronderos et al. (2000)	CS	11655 adults (5733 males, 5922 females)	BMD of the proximal femur (DXA)	PD,CAL, BOP	Calculus index	NS
Von Wowern et al. (2001)	L	24 young patients with severe periodontitis (22- 42yrs)	BMC or BMD at the standard site of the mandible (DPA), lumbar spine and the left femoral neck (DXA)	PD, CAL, Alveolar bone loss	-	S
Persson et al. (2002)	CS	1084 subjects 60-75 yrs	Self reported history of osteoporosis	Alveolar bone loss	-	S
Mohammad et al. (1997)	CS	44 non Hispanic white women (aged 50 to 75 yrs)	Mandibular cortex index on panoramic Rx; self reported history of osteoporosis; DXA	GI, CAL, PD, GR	PI	S

Discussion

Cross-sectional studies correlating bone mineral density with tooth count have not shown similar results and are not likely in themselves to provide a definitive answer to the temporal relationship between the onset of loss of bone mineral density and teeth.
1. It is impossible to determine the cause of a lost tooth from a single examination. Teeth may be lost for many reasons other than decreased bone support including, but not limited to caries, endodontic involvement, fractures, trauma and restorative considerations;
2. Few teeth actually exfoliate, rather dentists extract them for a variety of sound diagnostic, prognostic, esthetic, patient preference and financial reasons;
3. Patient recall of reasons for extraction is not always reliable, and if records of treatment are secured, they do not uniformly contain the information required to determine the reason for extraction

A positive association between osteoporosis and loss of alveolar crestal height was showed in the limited number of published studies presented. Large scale and long-term studies are needed.

Literature

1. Bando K, Nitta H, Matsubara M, Ishikawa I. - Bone mineral density in periodontally healthy and edentulous postmenopausal women. Ann Periodontol 1998, 3, 322-6
2. Benson BW, Prihoda TJ, Glass BJ. - Variations in adult cortical bone mass as measured by a panoramic mandibular index. Oral Surg Oral Med Oral Pathol 1991, 71, 349-56

3. Bras J, van Ooij CP, Abraham-Inpijn L, Kusen GJ, Wilmink JM. - Radiographic interpretation of the mandibular angular cortex: A diagnostic tool in metabolic bone loss. Part I. Normal state. Oral Surg Oral Med Oral Pathol 1982, 53, 541-5
4. Elders PJ, Habets LL, Netelenbos JC, van der Linden LW, van der Stelt PF. - The relation between periodontitis and systemic bone mass in women between 46 and 55 years of age. J Clin Periodontol 1992, 19, 492-6
5. Hildebolt CF, Pilgram TK, Dotson M, Yokoyama-Crothers N, Muckerman J, Hauser J, Cohen S, Kardaris E, Vannier MW, Hanes P, Shrout MK, Civitelli R. - Attachment loss with postmenopausal age and smoking. J Periodontal Res 1997, 32, 619-25
6. Jeffcoat MK. - Osteoporosis: a possible modifying factor in oral bone loss. Ann Periodontol 1998, 3, 312-21
7. Klemetti E, Kolmakov S, Kroger H. - Pantomography in assessment of the osteoporosis risk group. Scand J Dent Res 1994, 102, 68-72
8. Krall EA, Garcia RI, Dawson-Hughes B - Increased Risk of Tooth Loss is Related to Bone Loss at the Whole Body, Hip, and Spine. Calcif Tissue Int 1996, 59, 433-437
9. Kribbs PJ, Chesnut CH 3rd, Ott SM, Kilcoyne RF. - Relationships between mandibular and skeletal bone in a population of normal women. J Prosthet Dent 1990, 63, 86-9
10. Kribbs PJ, Chesnut CH 3rd, Ott SM, Kilcoyne RF. - Relationships between mandibular and skeletal bone in an osteoporotic population. J Prosthet Dent 1989, 62, 703-7
11. Kribbs PJ. - Comparison of mandibular bone in normal and osteoporotic women. J Prosthet Dent 1990b, 63, 218-22
12. Mohammad AR, Bauer RL, Yeh CK. - Spinal bone density and tooth loss in a cohort of postmenopausal women. Int J Prosthodont 1997, 10, 381-5
13. Mohammad AR, Brunsvold M, Bauer R. - The strength of association between systemic postmenopausal osteoporosis and periodontal disease. Int J Prosthodont 1996, 9, 479-83
14. Payne JB, Reinhardt RA, Nummikoski PV, Dunning DG, Patil KD. - The association of cigarette smoking with alveolar bone loss in postmenopausal females. J Clin Periodontol 2000, 27, 658-64
15. Payne JB, Reinhardt RA, Nummikoski PV, Patil KD. - Longitudinal alveolar bone loss in postmenopausal osteoporotic/osteopenic women. Osteoporos Int 1999, 10, 34-40
16. Persson RE, Hollender LG, Powell LV, MacEntee MI, Wyatt CC, Kiyak HA, Persson GR. - Assessment of periodontal conditions and systemic disease in older subjects. I. Focus on osteoporosis. J Clin Periodontol. 2002, 29, 796-802
17. Reddy MS. - Osteoporosis and periodontitis: discussion, conclusions, and recommendations. Ann Periodontol 2001, 6, 214-7
18. Ronderos M, Jacobs DR, Himes JH, Pihlstrom BL. - Associations of periodontal disease with femoral bone mineral density and estrogen replacement therapy: cross-sectional evaluation of US adults from NHANES III. J Clin Periodontol 2000, 27, 778-86
19. Taguchi A, Suei Y, Ohtsuka M, Otani K, Tanimoto K, Hollender LG. - Relationship between bone mineral density and tooth loss in elderly Japanese women. Dentomaxillofac Radiol 1999, 28, 219-23
20. Taguchi A, Tanimoto K, Suei Y, Otani K, Wada T. - Oral signs as indicators of possible osteoporosis in elderly women. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995a, 80, 612-6
21. Taguchi A, Tanimoto K, Suei Y, Wada T. - Tooth loss and mandibular osteopenia. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995b, 79, 127-32
22. Tezal M, Wactawski-Wende J, Grossi SG, Ho AW, Dunford R, Genco RJ. - The relationship between bone mineral density and periodontitis in postmenopausal women. J Periodontol 2000, 71, 1492-8
23. von Wowern N, Klausen B, Kollerup G. - Osteoporosis: a risk factor in periodontal disease. J Periodontol 1994, 65, 1134-8
24. von Wowern N, Klausen B, Olgaard K. - Steroid-induced mandibular bone loss in relation to marginal periodontal changes. J Clin Periodontol 1992, 19, 182-6
25. von Wowern N, Westergaard J, Kollerup G. - Bone mineral content and bone metabolism in young adults with severe periodontitis. J Clin Periodontol 2001, 28, 583-8
26. Wactawski-Wende J, Grossi SG, Trevisan M, Genco RJ, Tezal M, Dunford RG, Ho AW, Hausmann E, Hreshchyshyn MM. - The role of osteopenia in oral bone loss and periodontal disease. J Periodontol 1996, 67, 1076-84
27. Weyant RJ, Pearlstein ME, Churak AP, Forrest K, Famili P, Cauley JA. - The association between osteopenia and periodontal attachment loss in older women. J Periodontol 1999, 70, 982-91

Abbreviations

AC - alveolar bone crest
BMD - bone mineral density
BOP- bleeding after probing
CAL - clinical periodontal attachment loss
CEJ - cemento-enamel junction
CS - Cross-sectional
DPA - dual-photon absorptiometry
DXA - dual energy X ray absorptiometer
GI - Gingival Index
GR - gingival recession
L - Longitudinal
MCT - Metacarpal cortical thickness
PD - pockets depths
PI - Plaque Index
Rx - Radiographs

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Poster Faksimile:

Relationship between systemic osteoporosis and periodontal disease

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INTRODUCTION

Osteoporosis and osteopenia are characterized by reductions in bone mass and may lead to skeletal fragility and fracture. Periodontitis is an inflammatory disease characterized by loss of connective tissue and alveolar bone. Like osteoporosis, it is a silent disease, not causing symptoms until late in the disease process when mobile teeth, abscesses and tooth loss may occur. While the etiologic agent in periodontitis is a pathogenic bacterial plaque in a susceptible patient, periodontitis and osteoporosis have several risk factors in common. They include an increased prevalence with increasing age, smoking and influence of disease or medications that may interfere with healing. In addition, the pathophysiology of both diseases appears to have hereditary or, at least, familial component (Reddy, 2001), it is unknown whether the rate of progression of periodontitis is related to systemic osteopenia (Jeffcoat, 1998).

This poster reviews the current evidence on the association between periodontal disease and osteoporosis.

1. Methods for assessing bone mass and density

Radiographs	- panoramic radiographs - periapical radiographs
Dual energy X-ray absorption (DXA)	- uses an X-ray source - measurements of bone mass as "areal density" in units of grams/cm²
Absorptiometry	- utilizes a gamma source - measure bone mass in grams (approximate ash weight) per cm along the axis of the bone. Single photon absorptiometry uses gamma source such as ^{125}I Dual photon absorptiometry uses isotopes with 2 gamma ray energies such as gadolinium^{153}
Quantitative computed tomography (QCT)	- permits direct measurement of either trabecular or total bone density - provides measures of bone "apparent" density in units of gram/cm³

Fig 1: Regions for measuring mandibular bone changes in vivo on panoramic radiographs
A. Thickness of the mandibular angular cortex with a marking gauge (GC) (Bras et al., 1982)
B. Calculation of PMI (PMI superior margins c / a; PMI superior margins c / b) (Benson et al., 1991)
C. Changes in inferior cortex (C1-C2) detected on both sides of mandible, distally from the mental foramen (Klemetti et al., 1994)

2. Techniques used to assess periodontitis and oral bone loss

- Radiographic measures of alveolar crestal height and residual ridge resorption
- Probing measures to assess clinical attachment level
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Fig 2: Measuring method for the height of ridge on panoramic radiograph – from the inferior border to the superior edge of the alveolar crest in the region of the mental foramen (IC), divided by the distance from the inferior border to the lower edge of the mental foramen (IM) to calculate the percent of bone remaining (Kribbs, 1990)

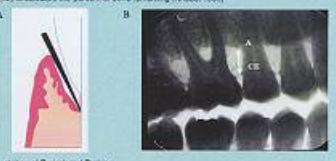

Fig 3A. Diagrammatic representation of Periodontal Probing
Fig. 3B. The measurement of the mean alveolar bone loss (mm) on bitewing radiographs, between the bone level of the alveolar crest (AC) and the cemento-enamel junction (CEJ), perpendicular to the occlusal surface of the tooth (Elders et al., 1992)

RESULTS

◆ Cross-sectional studies correlating bone mineral density with tooth count have not shown similar results and are not likely in themselves to provide a definitive answer to the temporal relationship between the onset of loss of bone mineral density and teeth.

Table 1. Studies on the relationship of tooth loss and osteoporosis

Authors	Type of study	Population	Association
Kribbs (1990b)	Cross-sectional	85 women with osteoporosis;27 normal women	S
Elders et al. (1992)	Cross-sectional	296 women	NS
Klemetti et al. (1994)	Cross-sectional	355 postmenopausal women	NS
Taguchi et al. (1995a)	Cross-sectional	64 women	S
Taguchi et al. (1995b)	Cross-sectional	269 healthy patients	S
Krall et al. (1996)	Longitudinal 7 years	189 healthy, white, dentate, postmenopausal women	S
Mohammad et al. (1997)	Cross-sectional	44 non white women	NS
Hildebolt et al. (1997)	Cross-sectional1	135 postmenopausal women	NS
Rando et al. (1998)	Cross-sectional	14 periodontally healthy women; 12 edentulous women	S
Taguchi et al. (1999)	Cross-sectional	90 Japanese women	S

SUMMARY OF RESULTS

Osteoporosis, which is a metabolic bone disorder, presents a major public health problem, particularly for postmenopausal women. When defining the relationship between osteoporosis and periodontitis several issues should be considered:

- **most published studies support a positive association between these common diseases;**
- **many studies cross-sectional in nature, include relatively small sample sizes and have inadequate control of potential confounding factors;**
- **varying methods to assess both osteoporosis and periodontitis are used;**
- **varying definitions of both osteoporosis and periodontal disease when presenting the outcomes of interest were used. Not all studies rely on some measures of bone density. Many studies rely on clinical observations of events such as bone fracture;**
- **the demographic makeup of the population under study (age, gender, race) and control of potential confounding variables (smoking, oral hygiene status) differs markedly across studies.**

As a result, interferences on the association between osteoporosis and periodontal disease require careful considerations. The findings indicate that osteoporosis may produce a risk for alveolar bone loss in cases of periodontitis.

Table 2. Studies on the relationship of periodontal disease and osteoporosis

Authors	Type of study	Population	Osteoporosis assessment	Periodontitis evaluation	Oral hygiene monitoring	Association
Kribbs et al. (1989)	CS	66 edentulous postmenopausal women	Total body calcium; SPA of the radius; DPA of the vertebrae; Cortical thickness at the gonion	PD, GR, BOP	-	S
Kribbs (1990a)	CS	50 normal women 20-80 yrs	SPA of the radius; DPA of the vertebrae; Mandibular bone mass on radiographs made distal to the mental foramen; Cortical thickness at the gonion	PD, GR, BOP	-	S
Kribbs (1990b)	CS	85 women with osteoporosis(50-84 yrs); 27 normal women	Cortical thickness at the gonion; Radiographic evidence of vertebral compression fractures; Mandibular bone mass and density	PD, GR, BOP	-	NS
Elders et al. (1992)	CS	296 women (46-55 yrs)	Lumbar BMD; MCT	Alveolar bone loss, PD, BOP	Oral cleaning	NS
Von Wowern et al. (1992)	L	17 acute nephritic dentate patients undergoing intensive long-term high-dose steroid treatment	DPA measurements of BMC of mandible and forearm	BOP, CAL on 6 selected teeth	Visible plaque (VI)	NS
Von Wowern et al. (1994)	CS	12 women with osteoporotic fractures; 14 normal women	BMC of the mandible at the standard site (DPA); BMC of the forearm (DPA)	Same as above	Visible plaque (VI)	S
Mohammad et al. (1996)	CS	22 women with low mean spine bone density; 20 normal women	Spine bone mineral density (DPA)	PD, GR, CAL	Plaque index	S
Wactawski-Wende et al. (1996)	CS	70 post-menopausal women (51-79yrs)	DXA of the lumber spine and femur	CAL, Alveolar bone loss	-	S
Hildebolt (1997)	CS	135 postmenopausal women (45-71 yr)	DXA of proximal (vertebral and proximal femur) BMD	CAL, PD, GR	-	NS
Payne et al. (1998)	L	17 women with osteoporosis of the lumber spine; 21 controls	DXA of the lumber spine	Alveolar bone height loss	Plaque index	S
Payne et al. (2000)	L	59 postmenopausal women as subjects; 38 non-smokers, 21 smokers	BMD of the lumbar spine (L3-L4) (DXA)	Alveolar bone height loss	Plaque index	S
Weyant et al. (1998)	CS	262 dentate women (average age 76.8 yrs)	Systemic BMD at 9 anatomic sites (hip, radius, spine, calcaneus) by SPA, DPA	BOP, CAL, PD	Calculus	NS
Tezal et al. (2000)	CS	70 postmenopausal (51-79yrs)	BMD at lumbar spine and femur (DXA)	BOP, PD, CAL, Alveolar bone loss on Rx	Plaque, calculus	S
Ronderos et al. (2000)	CS	11855 adults [5733 males, 5922 females]	BMD of the proximal femur (DXA)	PD,CAL, BOP	Calculus index	NS
Von Wowern et al. (2001)	L	24 young patients with severe periodontitis (22-42yrs)	BMC or BMD at the standard site of the mandible (DPA), lumber spine and the left femoral neck (DXA)	PD, CAL, Alveolar bone loss	-	S
Persson et al. (2002)	CS	1084 subjects 60-75 yrs	Self reported history of osteoporosis	Alveolar bone loss	-	S
Mohammad et al. (1997)	CS	44 non Hispanic white women [aged 50 to 75 yrs)	Mandibular cortex index on panoramic Rx; self reported history of osteoporosis; DXA	GI, CAL, PD, GR	PI	S

Legend: CS = Cross-sectional; L = Longitudinal; BMD = bone mineral density; MCT = Metacarpal cortical thickness; PD = pockets depths; GR = gingival recession; CAL = clinical periodontal attachment loss; BOP= bleeding after probing; DXA = dual energy X ray absorptiometer; DPA = dual-photon absorptiometry; PI =Plaque index; GI = Gingival Index; Rx = Radiographs

DISCUSSION

◆ Cross-sectional studies correlating bone mineral density with tooth count have not shown similar results and are not likely in themselves to provide a definitive answer to the temporal relationship between the onset of loss of bone mineral density and teeth.

1. **It is impossible to determine the cause of a lost tooth from a single examination. Teeth may be lost for many reasons other than decreased bone support including, but not limited to caries, endodontic involvement, fractures, trauma and restorative considerations;**
2. **Few teeth actually exfoliate, rather dentists extract them for a variety of sound diagnostic, prognostic, esthetic, patient preference and financial reasons;**
3. **Patient recall of reasons for extraction is not always reliable, and if records of treatment are secured, they do not uniformly contain the information required to determine the reason for extraction**

◆ A positive association between osteoporosis and loss of alveolar crestal height was showed in the limited number of published studies presented. Large scale and long-term studies are needed.

References

Rando et al. (1998) Ann Periodontol 3, 111-9
Reddy (2001) Oral Surg Oral Med Oral Pathol 73,248-56
Rees et al. (1993) Oral Surg Oral Med Oral Pathol 75, 343-7
Elders et al. (1992) J Clin Periodontol 19, 451-6
Hildebolt et al. (1997) J Periodontol 68, 641-51
Hillman (1994) Ann Periodontol 3, 312-5
Hildebolt et al. (1994) Scand J Dent Res 102, 68-72
Krall et al. (1996) Calcif Tissue Int 59, 439-7
Kribbs et al. (1989) J Prosthet Dent 62, 703-7
Kribbs (1990a) J Prosthet Dent 63, 90-6
Kribbs (1990b) J Prosthet Dent 64, 218-22
Mohammad et al. (1997) Int J Prosthodont 10, 541-5
Mohammad et al. (1996) Int J Prosthodont 9, 429-33
Payne et al. (1998) J Clin Periodontol 27, 658-64
Payne et al. (1999) Osteoporos Int 10, 34-40
Persson et al. (2002) J Clin Periodontol 29, 756-761
Reddy (2001) Ann Periodontol 6, 73-7
Ronderos et al. (2000) J Clin Periodontol 27, 178-86
Taguchi et al. (1995) Int J Prosthodont 8, 115-19
Taguchi et al. (1995a) 90, 423-8
Taguchi et al. (1995b) 78, 127-32
Tezal et al. (2000) J Periodontol 71, 1492-8
von Wowern et al. (1992) J Clin Periodontol 19, 801-6
von Wowern et al. (1994) J Periodontol 65, 1224-8
von Wowern et al. (2001) J Clin Periodontol 28, 262-9
Wactawski-Wende et al. (1996) J Periodontol 67, 1076-84
Weyant et al. (1998) J Periodontol 69, 741-50