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Building Osteoporosis Prevention into Dental Practice

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Abstract

Objectives: The National Report Card on Osteoporosis Care (2008) announced the need for comprehensive approaches to risk reduction and improvement in the early diagnosis of osteoporosis. Dental research has suggested that low systemic bone-mineral density also occurs in alveolar bone, and people with osteoporosis may have an increased risk of tooth loss. Whether or not a causal link exists, both conditions share similar modifiable risk factors, including a role for calcium and vitamin D. The purpose of this paper was to critically examine the role calcium and vitamin D play in the relationship between osteoporosis and the risk of tooth loss.

Methods: Scientific articles were obtained through PubMed, MEDLINE, CINAHL, AgeLine and Web of Science. Publications were restricted to those involving human subjects, and English-language articles on calcium and vitamin D. The search yielded 8 articles relating to osteoporosis and tooth loss that included calcium and vitamin D intake.

Results: Despite methodological concerns, the evidence shows a relationship between osteoporosis and tooth loss for people who have an inadequate intake of calcium and vitamin D. Adequate calcium intake positively influences optimal peak bone mass and may also assist in tooth retention in later life.

Conclusions: The dental sector can assist with national prevention strategies for osteoporosis care.

Canadian statistics indicate that 2 million people are currently diagnosed with osteoporosis.¹ Because of its impact on both people individually²⁻⁴ and the health care system,^{5,6} osteoporosis is recognized as a major public health concern.⁷ Despite the pervasiveness of osteoporosis and its consequences for the Canadian popula-

tion, statistics continually indicate long-standing difficulties with access and referral to screening for bone-mineral density.⁸ Consequently, new priorities for osteoporosis care need to be established.¹ These priorities include the improvement of early diagnosis and the development of comprehensive approaches to risk reduction.⁸

Table 1: Usual intake of calcium from food, by age and sex^a

Sex	Age category (years)	Mean intake (mg/d) ^b	Daily calcium requirement (mg/d) ^c
Male	9–13	1219	1300
	14–18	1300	1300
	19–30	1107	1000
	31–50	938	1000
	51–70	832	1200
	> 70	762	1200
Female	9–13	993	1300
	14–18	917	1300
	19–30	867	1000
	31–50	827	1000
	51–70	790	1200
	> 70	690	1200

^a Intake based on food consumption only. Intake from vitamins and mineral supplements is not included.

^b Canadian Community Health Survey.¹⁰

^c Health Canada, Updated dietary reference intakes.¹¹

Optimizing peak bone mass achieved during adolescence and young adulthood is one crucial component of reducing the risk of osteoporosis in later life.⁷ Adequate consumption of calcium and vitamin D is critical to the achievement of optimal peak bone mass.⁸ Prolonged inadequate consumption of calcium stimulates bone resorption, which leads to systemic bone fragility.⁹ Unfortunately, many Canadians are not consuming adequate amounts of calcium throughout their lifespan to achieve and maintain optimal peak bone mass.

As **Table 1** shows, women's mean calcium intake from food is considerably lower than the recommended intake across all ages.^{10,11} Although younger men tend to consume adequate amounts of calcium to achieve optimal peak bone mass, as they age, fewer consume the recommended amount of calcium to maintain their bone-mineral density. Consequently, interventions for osteoporosis prevention have included improving calcium intake throughout the lifespan.⁷

Relationship between Osteoporosis and Tooth Loss

The dental sector has a potential role in the early detection of osteoporosis.¹² Early research¹⁴

suggested that low systemic bone-mineral density also occurs in alveolar bone¹³ and hypothesized the risk of tooth loss. However, a causal association between these 2 conditions may never be established. Both osteoporosis and tooth loss are multifactorial conditions (**Table 2**) that have many unique and shared risk factors.^{7,11,15,16} Many of these shared risk factors are modifiable, including the adequate intake of calcium and vitamin D.^{7,11}

Further, the literature describes many factors that may play mediating roles between oral health and systemic diseases. Ritchie and colleagues¹⁷ discussed how oral health can affect nutritional intake and, in turn, how poor nutrition can play a role in systemic disease. The supportive role calcium and vitamin D play in bone resorption could explain the link between osteoporosis and the risk of tooth loss. Traditional interventions for tooth retention (e.g., dental hygiene) might not be sufficient for people with a diagnosis of osteoporosis.¹⁸ Additional interventions for the maintenance of optimal peak bone mass, including calcium and vitamin D supplementation, may also be beneficial for tooth retention. Evaluating the role of calcium and vitamin D in this relationship may provide insight into the development of early interventions.

Table 2: Comparison of the risk factors associated with osteoporosis and tooth loss

Risk factors	Osteoporosis ^a	Tooth loss ^b
Personal	Increased age	Older cohorts
	Menopause	Menopause ^c
	Early menopause	No insurance
	Low peak bone mass	No routine dental visits
	Female sex	Low income/low education
	Never having children	
	Caucasian ethnicity	
	Family history of osteoporosis	
	Low body weight and size	
	Low percentage of body fat	
	Low body mass index	
Clinical	Estrogen deficiency	Estrogen deficiency ^c
	Gastrointestinal diseases	Periodontal diseases
	Hypogonadal disorders	Dental decay
	Endocrine diseases affecting remodeling of bone	
	Metabolic disorders affecting calcium absorption or bone formation	
	Medications affecting calcium absorption or bone formation (e.g., corticosteroids)	
Behavioural	Smoking	Smoking
	High alcohol consumption	Facial trauma
	Physical inactivity	Poor dental hygiene
Nutritional	Low calcium intake	Low calcium intake ^d
	Low vitamin D intake	Low vitamin D intake ^d
	High protein intake	
	Low phosphorus intake	
	Low vitamin K intake	
	Overall dietary quality	Overall dietary quality
	Low fruit and vegetable intake	Low fruit and vegetable intake
	High cola intake	High cola intake
	Low/high fluoride intake	Low fluoride intake
	Low vitamin C intake	
	Low vitamin A intake	
	High iron intake	

^a World Health Organization, *Prevention and management of osteoporosis*.⁷

^b World Health Organization, *Oral health*.¹⁵

^c Accumulating evidence suggests postmenopausal women and estrogen deficiency increases risk of tooth loss.¹⁶

^d Health Canada, *Updated dietary reference intakes*.¹¹

The purpose of this literature review was to examine the role of calcium and vitamin D intake in the relationship between osteoporosis and tooth loss, and to provide an evidence base for the role dental professionals should play in supporting strategies for preventing osteoporosis in clinical practice.

Methods

Scientific articles were obtained through PubMed, MEDLINE, CINAHL, AgeLine and Web of Science. The following Medical Subject Headings were used: “osteoporosis,” “tooth loss” and “edentulous.” Publications were restricted to those about human subjects and English-language articles. All articles obtained covered the publication period from 1983 to 2011. Review articles and reference lists were examined for relevance to the topic. All articles were then reviewed for their consideration of calcium and vitamin D intake.

Eight studies that considered the role of calcium or vitamin D, or both, in the relationship between osteoporosis and tooth loss were identified. An appraisal of all 8 studies was subsequently completed. The strength of the evidence in the studies was evaluated based on sample size and representativeness, confounding factors, and methods of data collection and analyses. Evaluation of the plausibility of findings was based on the evaluations or pilot testing of the calcium and vitamin D measures. Both strength of evidence and plausibility were used to identify studies as weak, moderate or strong.¹⁹ An overview these 8 studies is presented in **Table 3**.

Results

Of the 8 studies, 3 were cohort studies^{20,22,26} and the remaining 5 were cross-sectional.^{18,21,23-25} All 8 studies used techniques to measure low systemic bone-mineral density. Five studies^{18,21,22,24,26} used dual-energy x-ray absorptiometry, widely accepted as the gold standard technique for measuring bone-mineral density.⁷ Hence, the majority of these studies used actual measures of bone-mineral density to ascertain a diagnosis of osteoporosis.

Tooth loss was measured by denture status,²⁰ tooth counts during examinations,^{21,25} dental

no trauma) is necessary to rule out tooth loss that is not likely related to resorption from supporting bone. Although radiographs and tooth counts done during dental examinations likely take into account the reasons for tooth loss (e.g., progressive alveolar bone loss, periodontal diseases) the underlying reasons for tooth loss were unknown in all studies. These methods of ascertaining tooth loss cannot, therefore, fully support or refute a hypothesis that tooth loss was the result of alveolar-bone resorption caused by low systemic bone-mineral density.

Sample Representativeness

All of the study samples included older postmenopausal women. Only 1 study²⁵ included a sample of both older women and men. This suggests that these findings can be generalized only to older postmenopausal women. Indeed, Earnshaw and colleagues²⁷ found no association between tooth loss and low systemic bone-mineral density in younger early menopausal age groups (e.g., women < 50 years of age). Older-age cohorts have higher rates of tooth loss¹⁵ because of early dental treatment procedures as children (e.g., tooth extractions), which may partially explain tooth loss in older cohorts when reasons are unknown. However, given the importance of the estrogen hormone to the balance between bone resorption and formation,²⁸ these findings may have additional implications for preventive interventions for women, which are discussed later in this paper.

Calcium and Vitamin D Intake

Consistent with Canadian population data, a trend toward low calcium intake was noted in all studies reviewed. All 8 studies reported mean calcium intakes ranging from 500 to 1000 mg per day. The recommended average intake of calcium for women \geq 51 years of age is 1200 mg daily.¹¹ Only 2 identified studies^{21,22} considered vitamin D intake. Again, participants in these studies consumed less than recommended dietary intakes for vitamin D (111–700 IU/day versus adequate intakes of 600–800 IU/day). This suggests that, on average, participants were not consuming adequate amounts of calcium to ensure optimal bone and dental health.

Measurement of Calcium and Vitamin D Intake

Measurement of calcium intake included food frequency questionnaires,^{20,21,24} dietary recall,²³ recent dietary intakes,¹⁸ serum calcium levels,²⁵ supplementation^{21,22} and diet history questionnaires.²⁶ Only 2 studies assessed vitamin D and tooth loss, both with supplementation.^{21,22} However, Krall and colleagues²¹ supplemented these data with information about habitual vitamin D intake obtained from food-frequency questionnaires.

Although these assessments provide an estimate of current dietary intake, they may not accurately represent intake across the lifespan. Studies that record daily intake of calcium based on 24-hour recalls are not likely sufficient to describe participants' usual intake of calcium.²⁹ Although food-frequency questionnaires are considered sufficient for approximating the usual dietary intake of populations over the period in question, multiple dietary-intake measures to support the validity of the dietary information are needed.²⁹ Also, not all of these studies indicated whether participants were taking supplements in addition to current dietary intake of vitamin D or calcium, an important factor to assess when considering intake. These studies did not use robust measures or multiple measures to provide a more complete picture of current and habitual intake of vitamin D and calcium.

Analyses and Confounding Variables

Famili and colleagues²⁶ found a significant relationship ($p = 0.002$) between dietary history of calcium intake and edentate postmenopausal women. The finding of the cohort study of Krall and colleagues²² that postmenopausal women in the placebo group had more tooth loss than those taking calcium supplementation over a 2-year period approached significance ($p = 0.05$). No significant association was found between vitamin D supplementation and tooth retention.^{21,22} The measure used to estimate calcium intake likely explains these findings. Nevertheless, since vitamin D is essential to bone health,⁷ ensuring that participants consume adequate amounts of both calcium and vitamin D across the lifespan is prudent.

Overall, all 8 studies reported low calcium or vitamin D intake, and all but 2 studies found an association between osteoporosis and tooth

loss.^{21,22} In their cross-sectional study, Hildebolt and colleagues²³ reported nonsignificant findings; however they acknowledged that their participants were in good dental and overall health, which may have influenced their ability to detect an association. Moreover, despite reporting low calcium intake, all their postmenopausal study participants were taking estrogen replacement therapy, which, given the significant effect of the estrogen hormone on bone,²⁸ may have affected the ability to detect a significant association.

The strongest evidence in the studies that included a measure of effect of calcium and vitamin D intake on the relationship between osteoporosis and tooth loss came from 3 cohort study designs^{20,22,26} (Table 3). Only 2 of these studies^{20,22} found a relationship between osteoporosis and tooth loss. The retrospective study by Daniell²⁰ suggested an association between osteoporosis and the need for full dentures 5 years later in a sample of postmenopausal women. Although these findings are statistically significant, denture status cannot be used to indicate that patients with osteoporosis also had an increased risk of tooth loss.

The remaining 2 cohort studies^{22,26} included calcium intake as a confounding variable and measured calcium intake differently.

Krall and colleagues²² investigated tooth retention and low systemic bone-mineral density in a cohort study of postmenopausal women who were receiving calcium and vitamin D supplementation. Despite good adherence, postmenopausal women who lost teeth had consistently unfavourable patterns of systemic bone-mineral density change compared with women who retained their teeth. The authors observed that women who were taking the placebo lost more teeth than those women taking calcium supplementation. This study found no significant association between vitamin D intake and tooth loss.

In their cohort study, Famili and colleagues²⁶ found no significant differences in age-adjusted bone-mineral density and absolute rates or percentages of bone loss between dentate and edentate participants after adjusting for a history of dietary calcium intake. Dentate participants had a higher intake of calcium and a higher bone-mineral density than edentate participants.

Table 3: An appraisal of the literature about the effect of calcium and vitamin D intake on osteoporosis and tooth loss

Study	Purpose	Study design/control for bias	Confounding variables	Data collection/methods	Analyses	Plausibility	Results	Overall score/rating
Daniell (1983) ²⁰	Percent cortical area and dentures	STRONG Retrospective cohort n = 208 Postmenopausal women 60–69 y	Smoking	Food frequency questionnaire	APPROPRIATE	WEAK No reliability or validity reported	<p>Dietary intake of patients with dentures was no different than that of those with natural teeth ($p = 0.05$)</p> <p>Of patients (55–59 y), 2% without osteoporosis required full dentures over next 5 y, vs 32% with osteoporosis ($p < 0.001$)</p> <p>Of patients (50 y) with natural teeth, 44% with osteoporosis required full dentures by 60 y, vs 15% without osteoporosis ($p < 0.05$)</p>	STRONG–MODERATE
Krall et al. (1994) ²¹	BMD and tooth number, denture use	MODERATE Cross-sectional n = 329 Postmenopausal women 41–71 y	Years since menopause Smoking status Education BMI	Food frequency questionnaires and supplements	APPROPRIATE	STRONG FFQ validated	<p>Total mean intake of calcium was 510 mg/d; vitamin D intake was 111 IU/d; intake not associated with tooth status ($p < 0.01$)</p> <p>Increased number of teeth associated with increased lumbar spine density ($p < 0.05$) and radial density ($p < 0.01$)^a</p> <p>No relationship between denture/nondenture status and BMD ($p = 0.05$)</p> <p>For women > 40 y with dentures, the mean spinal and radius BMD was lower than in women who required dentures early in life ($p < 0.05$)^a</p>	MODERATE
Krall et al. (1996) ²²	BMD and tooth loss	STRONG Cohort n = 197 Postmenopausal women 54–66 y	Years since menopause BMI Smoking Baseline number of teeth Calcium and vitamin D supplements	Random assignment Study 1 (2 y): 500 mg/d calcium or placebo Study 2 (1 y): 400 IU/d vitamin D or placebo; all received calcium supplements (mean, 377 mg/d) Study 3 (2 y): 100 IU/d or 700 IU/d vitamin D; all received 500 mg/d calcium supplements	APPROPRIATE	STRONG Adherence to supplements	<p>Over the 7 y, 24% of women lost ≥ 1 teeth</p> <p>Study 1: placebo group had more tooth loss (11%) than those taking calcium supplements (4%; $p = 0.054$); no significant association with vitamin D during studies 2 & 3 ($p = 0.05$)</p> <p>Over 7 y, women who lost teeth (≥ 1) also lost whole body BMD ($p < 0.01$), and femoral neck BMD ($p < 0.05$)</p> <p>Risk of tooth loss increased for each 1%/y decrement for the whole body (RR = 4.83, 95% CI = 1.72–13.52), femoral neck (RR = 1.50, 95% CI = 1.02–2.22), spine (RR = 1.45, 95% CI = 1.00–2.11)^a</p>	STRONG

Hidebolt et al. (1997) ²³	BMD and tooth loss	MODERATE Cross-sectional n = 135 Postmenopausal women 41–70 y	No diseases or history of fractures	Dietary recall in past 24 h	APPROPRIATE	WEAK No reliability or validity reported	Mean calcium intake was 404 mg/d Calcium intake was not correlated with tooth loss (p = 0.05) BMD was not correlated with tooth loss (p = 0.05)	MODERATE
Bando et al. (1998) ²⁴	BMD and tooth loss	WEAK Cross-sectional n = 26 Postmenopausal women 57–74 y	No hormone supplements Hysterectomy or oophorectomy	Dietary survey (frequency of daily calcium intake from milk, fish, or calcium tablet ingested)	APPROPRIATE	WEAK No reliability or validity reported	50% of women with teeth reported “making daily effort” to ensure calcium intake vs 25% without any teeth for 15 y BMD was significantly higher in women with teeth than in women without any teeth for 15 y (p < 0.05)	WEAK
Gur et al. (2003) ¹⁸	BMD, BMC and tooth loss	MODERATE Cross-sectional n = 1171 Postmenopausal women 40–86 y	No medications Medical diseases affect BMD or fracture history	Recent dietary intake (past 12 mo) Used standard food models to estimate portion sizes	APPROPRIATE	WEAK No reliability or validity reported	The number of women who took adequate calcium (500–1000 mg/d) was significantly lower in the group with no teeth than in that with < 10 teeth or 10–20 teeth (p < 0.001) BMD of women with no teeth was significantly lower than that of women with < 10 teeth or 10–20 teeth (p < 0.001) BMC of women with no teeth was significantly lower than that of women with < 10 teeth or 10–20 teeth (p < 0.001)	MODERATE
Yoshihara et al. (2005) ²⁵	BMD and tooth counts	MODERATE Cross-sectional n = 460 Men and women 70 y	Percentage of body fat Serum vitamin E concentration Sex Serum IgG concentration	Calcium serum levels (mg/dL)	APPROPRIATE	WEAK No reliability or validity reported	Mean serum calcium levels in the osteopenia group were lower than those of healthy group (p = 0.05) Mean number ± SD of remaining teeth for women in osteopenia group was 15.97 ± 8.06; for men, 16.32 ± 9.93; for women in non-osteopenia group, 16.32 ± 9.93; for men, 18.12 ± 9.33 (p = 0.047) Bone stiffness was associated with remaining teeth (p = 0.005) ^a	MODERATE–WEAK
Famili et al. (2005) ²⁶	BMD and tooth loss	STRONG Cohort n = 398 Postmenopausal women ≥ 65+ y	Age Weight Education Dietary calcium intake Alcohol use Walking for exercise	Diet history questionnaire	APPROPRIATE	WEAK No reliability or validity reported	Mean intake of calcium for women with teeth was 500 mg/d; for women without teeth, 411 mg/d (p = 0.002) No differences in absolute rate of BMD change (mg/cm ² /y), absolute rate of bone loss, or percentage of bone loss for dentate and edentate women ^b	STRONG–MODERATE

BMC = bone mineral content; BMD = bone mineral density; BMI = Body Mass Index; CI = confidence interval; FFQ = food frequency questionnaire; IgG = immunoglobulin G; RR = relative risk; SD = standard deviation

^a Authors controlled for confounding variables in analyses.

^b p values not reported for these adjustments.

Table 4: Canadian health care use by age

Age category (y)	Visits to medical professional in last year (%)	Visits to dental professional in last year (%)
12–14	66.7	82.4
15–17	70.1	79.0
18–19	71.2	69.9
20–24	72.0	57.7
25–29	74.1	58.8
30–34	75.0	62.8
35–39	73.8	65.2
40–44	74.8	64.0
45–49	76.9	63.1
50–54	79.1	61.8
55–59	82.4	57.8
60–64	84.1	53.1
65–69	85.5	46.0
70–74	87.9	42.7
75–79	89.0	39.6
≥ 80	89.8	35.3

Source: Canadian Community Health Survey, 2005.

These last 2 studies^{22,26} together support a hypothesis that an inadequate intake of calcium plays some role in causing osteoporosis and tooth loss. This suggests a possible mediating role for adequate lifetime calcium or vitamin D intake in the prevention of osteoporosis and tooth loss. An imbalance in bone resorption may also increase the risk of tooth loss when people do not consume adequate amounts of calcium throughout their lifespan. Ensuring that people with low systemic bone-mineral density have adequate amounts of calcium also may improve tooth retention.¹⁴

Discussion

Relevance to Dental Practice

This literature review critically examined the role calcium and vitamin D intake plays in the relationship between osteoporosis and tooth loss. Regardless of the true causal association, the studies reviewed suggest that ensuring a lifelong adequate dietary intake of calcium and vitamin D

would help to support good bone and dental health. Dental professionals should, therefore, assist in the achievement and maintenance of optimal peak bone-mineral density in their clinical practices.

Data from the Canadian Community Health Survey, 2005 indicates that children and young adults are likely to visit dental professionals more frequently than medical physicians (**Table 4**). Consequently, optimal peak bone-mineral density is achieved during the time when Canadians are likely regularly attending dental offices. Given this trend, dental professionals have an opportunity to regularly discuss osteoporosis prevention with their patients. Creating an awareness of the importance of achieving and maintaining optimal peak bone mass during regular scheduled dental appointments could help prevent osteoporosis and ensure overall dental health. **Table 5** provides the recommended dietary intake of calcium and vitamin D^{11,30-33} and **Table 6**, examples of dietary sources that dental professionals can discuss with their patients.

Early evidence from randomized control trials indicates that calcium and vitamin D supplementation may aid in tooth retention in early menopausal women.³⁰ Given the association between menopause and tooth loss, dental professionals should regularly discuss the importance of adequate dietary calcium and vitamin D consumption (e.g., the need for supplementation) throughout their patients' lifecycle.

Finally, Osteoporosis Canada¹ recommends that all postmenopausal women and men ≥ 65 years of age be tested for osteoporosis. Edwards and Migliorati¹² suggested that medical and dental professionals could collaborate in the early detection of osteoporosis. Since osteoporosis may first occur in alveolar bone,¹³ dental professionals may be able to provide early detection of low systemic bone-mineral density and assist medical professionals in identifying people at risk for osteoporosis. One method identified is to increase the number of discussions of these risks with patients during scheduled dental radiographs and examinations. Dental patients who have reduced alveolar bone but good dental hygiene may need further screening for systemic bone-mineral density.¹⁸ Referrals to their medical professionals to

Table 5: Recommended dietary intake for calcium and vitamin D

Dietary intake	Recommendation by age (y) and sex									
	4–8		9–13		14–18		19–50		≥ 51	
	M	F	M	F	M	F	M	F	M	F
Canada’s Food Guide^a Milk and alternatives (servings/d)	2	2	3–4	3–4	3–4	3–4	2	2	3 > 10 µg (400 IU) supplemental vitamin D	3 > 10 µg (400 IU) supplemental vitamin D
Calcium estimated average req’t for healthy populations ^b (mg/d)	800	800	1100	1100	1100	1100	800	800	1000	1000
Calcium recommended dietary allowance for healthy people ^b (mg/d)	1000	1000	1300	1300	1300	1300	1000	1000	1000 (1200 > 70 y)	1200
Calcium recommended upper limit for healthy people ^b (mg/d)	2500	2500	3000	3000	3000	3000	2500	2500	2500	2500
Vitamin D estimated average req’t for healthy populations ^b (µg/d)	10	10	10	10	10	10	10	10	10	10
Vitamin D recommended dietary allowance for healthy people ^{b,d} (µg/d)	15	15	15	15	15	15	15	15	15 (20 > 70 y)	15 (20 > 70 y)
Vitamin D recommended upper limit for healthy people ^{b,d} (µg/d)	75	75	100	100	100	100	100	100	100	100
Calcium recommendations, Osteoporosis Canada ^c	800	800	1300	1300	1300	1300	1000	1000	1200	1200
Vitamin D recommendations, Osteoporosis Canada ^c							10–25	10–25	20–25	20–25

^aEating well with Canada’s Food Guide.³⁰

^bDietary reference intakes, The National Academies Press. Note: Vitamin D recommendations are as cholecalciferol: 1 mg cholecalciferol = 40 IU vitamin D¹¹

^cOsteoporosis Canada recommends supplements of 20–50 mg vitamin D/day (800–2000 IU) for people with osteoporosis.^{1,12,32}

^dU.S. Endocrine Society’s recommendations for clinical populations at risk of vitamin D deficiency include supplementation needed to achieve blood 25(OH) D levels of 30 ng/mL: 15–25 mg (600–1000 IU) for children and 15–50 mg (600–2000 IU) for those > 19 years of age.³³

discuss these findings may further identify those people with low systemic bone-mineral density. Collaboration between professions may help increase the number of people who receive an early diagnosis of osteoporosis.

Conclusions

This review of the literature highlights the role of calcium and vitamin D intake in, and the similar risk factors for, osteoporosis and tooth loss, regardless of their cause. Dental professionals

Table 6: Sample dietary sources of calcium and vitamin D^a

Nutrient	Approximate serving	Sample dietary sources
Calcium	< 149 mg/standard serving	Beans (e.g., baked beans, pinto beans), broccoli, baked goods (e.g., biscuits, muffins, waffles, pancakes, bread)
Calcium	150–249 mg/serving	1.5 oz, (50 g) cheese (hard cheeses, mozzarella) 200 mL yogurt drink or kefir 1 cup cottage cheese or frozen yogurt ½ can salmon (105 g) or sardines with bones (55 g) ½ cup almonds or tofu 1 cup soybeans or white beans Dishes made with these ingredients
Calcium	250–300 mg/serving	1 cup (250 mL) milk (whole, 2%, 1%, skim, chocolate, reconstituted from powder), buttermilk, fortified soy or rice beverage, or fortified orange juice ¾ cup (175 g) yogurt (plain, 1%, 2%) Dishes made with these ingredients
Vitamin D	1–2 µg / 40–79 IU/ serving	2 tsp margarine, fortified 2–3 oz (75 g) tuna, Atlantic sardines
	> 2 µg / 80 IU/ serving	1 cup (250 mL) milk, fortified soy or rice beverage, or fortified orange juice 2–3 oz (75 g) fatty fish (herring, trout, mackerel, salmon, Pacific sardines)

^aEating well with Canada’s Food Guide.³⁰

could help patients achieve and maintain optimal peak bone mass while promoting good dental health. Dental professionals should support national strategies for the prevention of osteoporosis by having regular discussions about the topic with their patients. Dental professionals should, therefore, introduce screening and primary risk-reduction strategies for both osteoporosis and tooth loss into their clinical practice, and increase their patients’ awareness that a reduction of alveolar bone in the absence of poor dental hygiene may indicate the need for further systemic bone-mineral density screening. ♦

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