Elderly Canadians Residing in Long-term Care Hospitals: Part II. Dental Caries Status

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Abstract

Background: *Dental caries has been identified as a significant problem for elderly residents of long-term care (LTC) hospitals in developed countries, yet little recent information is available for the Canadian population.*

Objective: *To document the caries status of elderly dentate residents of intermediate and extended LTC hospitals in Vancouver and surrounding communities.*

Methods: *A dentist examined the teeth of 369 elderly dentate hospital residents (coronal and root surfaces) for caries. The medical, dietary, oral microbial, oral hygiene and dental status of the same subjects are documented and discussed in a companion article.*

Results: *Two hundred and ninety (78.6%) of the subjects had at least one carious lesion; 186 (50.4%) had coronal caries and 254 (68.8%) had root caries. On average, each subject had 3.8 carious teeth. The residents of extended LTC hospitals had significantly more carious coronal surfaces.* Lactobacillus *scores were correlated with the DMFS (decayed, missing, filled surfaces), the number of carious coronal lesions, the number of carious surfaces and the plaque index, but* Streptococcus *mutans scores were correlated only with DMFT (decayed, missing, filled teeth).*

Conclusions: *Overall, the prevalence of dental caries among the elderly residents of LTC hospitals in this study was high, although almost half of the subjects had visited community dentists within the previous 5 years. Caries prevention strategies (specifically diet, oral hygiene and antimicrobial agents) rather than treatment alone may be needed to control caries in this susceptible population.*

MeSH Key Words: *Canada; dental care for aged; dental caries/epidemiology*

© J Can Dent Assoc 2002; 68(6):359-63
This article has been peer reviewed.

The elderly population includes increasing proportions of dentate and partially dentate people.[1,2] With improved tooth retention, the number of carious lesions has also increased, as indicated by increases in the numbers of restored coronal and root surfaces and of active carious lesions.[3,4]

Xerostomia as a result of a direct physiological change or as a side effect of medications has been associated with increased prevalence of caries in the elderly population.[5-7] In addition, a diet high in refined carbohydrates and poor oral hygiene place elderly people living in institutions at considerable risk of caries.[8] Despite this high risk, this population faces greater barriers to receiving dental care than their independent counterparts.[9,10] In addition, low socioeconomic standing, common among the elderly, has been strongly associated with high caries levels.[11] In particular, elderly hospitalized residents in poor health have a higher prevalence of dental caries than those in better health.[12]

This paper documents the caries status of elderly dentate residents of intermediate and extended long-term care (LTC) hospitals in Vancouver and surrounding communities.

Materials and Methods

The baseline oral status of 369 elderly dentate subjects enrolled in a longitudinal clinical trial testing the effectiveness of antimicrobial mouth rinses (0.2% fluoride and 0.12% chlorhexidine) in protecting teeth from caries was

used in this study. A total of 39 LTC hospitals in the Vancouver area (5 extended care facilities accounting for a total of 59 [16%] subjects and 34 intermediate care facilities accounting for a total of 310 [84%] subjects) participated in this study, which took place from 1998 to 2000. Medical, nutritional, oral microbial, oral hygiene and dental status were documented and discussed in a companion paper (see Wyatt, p. 353).

An experienced dentist, calibrated to National Institute of Dental Research (NIDR)[13] criteria, examined all subjects for caries after cleaning the teeth (by means of scaling and rotary instrument prophylaxis) to remove soft and hard deposits, as recommended by Mojon and others.[14] Examinations were performed in a quiet room within the institution, with a portable fibre optic halogen light and chair, as well as a compressor to provide air, water and suction. The examiner used a visual and tactile approach to diagnose coronal and root caries with a front surface mirror and no. 5 caries explorer. The single examiner was also calibrated against the author, who was also trained in NIDR caries examination protocol. Training sessions involved the recorder (a certified dental assistant), who was responsible for verbally confirming the examiner's scores.

The dentist scored all exposed coronal and root surfaces as absent, sound, restored or decayed. For each intact tooth, a total of 9 surfaces were scored; teeth missing all of their coronal surfaces were scored as fractured, and 5 root surfaces (mesial, buccal, distal, lingual and occlusal) were scored. The calculation of decayed and filled teeth (DFT), decayed, missing and filled teeth (DMFT), decayed, missing and filled surfaces (DMFS), and decayed and filled surfaces (DFS) was based on the 9 surfaces for intact and fractured teeth (excluding the occlusal root surface). The root caries index (i.e., the percentage of carious exposed root surfaces) was determined according to the calculation described by Katz.[15]

The Statistical Package for the Social Sciences (SPSS) (SPSS Inc., Chicago, Ill.) was used to analyze the data. Paired 2-tailed *t*-tests were used to verify the examiner's reliability in assessing tooth scores and plaque indices. The results are presented as means and standard deviations (SDs). A paired *t*-test was used to test for significant differences between mean values. Pearson chi-square and Pearson correlation coefficients were used to test for significant relationships between continuous variables. Probability of 5% was defined as significant for all statistical tests in this study.

A random sample of 10 subjects was re-examined after one week to determine the examiner's repeatability in scoring tooth surfaces for coronal and root caries. Upon re-examination there were no significant differences in scores for individual carious coronal surfaces (t = 0.452, df = 9, p [2-tailed] = 0.662) or carious root surfaces (t = 0.165, df = 9, p [2-tailed] = 0.872). In addition, the author examined the teeth of 10 subjects for caries; there were no significant differences in individual carious coronal surfaces

Table 1 **Numbers of teeth present and carious teeth, and percentages of subjects with teeth present and carious teeth (including third molars)**

	Maxilla				Mandible			
	Teeth present		Carious teeth		Teeth present		Carious teeth	
Teeth	Mean no.	% of subjects	Mean no.	% of subjects	Mean no.	% of subjects	Mean no.	% of subjects
Incisors and canines	3.6	72.6	0.9	38.8	5.3	97.8	1.1	39.8
Premolars	1.7	62.9	0.4	24.7	2.6	88.3	0.6	40.4
Molars	1.7	62.3	0.3	22.5	1.5	63.1	0.5	30.6
Total	7.0	74.5	1.6	47.7	9.4	98.4	2.2	66.7

Table 2 **Caries scores and percentage of subjects with carious teeth, carious coronal surfaces and carious root surfaces by sex**

	Men (n = 88)		Women (n = 281)		Total (n = 369)	
Variable	Mean ± SD	% of subjects	Mean ± SD	% of subjects	Mean ± SD	% of subjects
Carious teeth[a]	4.9 ± 5.1	87.5	3.5 ± 3.9	77.2	3.8 ± 4.2	78.6
Carious coronal or root surfaces	9.0 ± 12.8		6.3 ± 8.8		6.9 ± 9.8	
Carious coronal surfaces	2.9 ± 4.8	62.1	1.7 ± 3.3	46.6	2.0 ± 3.8	50.4
Carious root surfaces[a]	6.1 ± 9.4	74.7	4.6 ± 7.4	66.9	4.9 ± 7.9	68.8
DMFS (coronal)	111.6 ± 29.3	NA	112.6 ± 25.8	NA	112.3 ± 26.6	NA
DMFS (coronal or root)	234.9 ± 32.0	NA	233.2 ± 29.5	NA	233.6 ± 30.1	NA
Root caries index	34.1 ± 29.9	NA	29.2 ± 24.8	NA	30.3 ± 26.1	NA

SD = standard deviation, DMFS = decayed, missing, and filled surfaces, NA = not applicable
[a]Statistically significant difference in scores between men and women

Table 3 **Caries scores and percentage of subjects with carious teeth, coronal carious surfaces and carious root surfaces by hospital type**

	Intermediate care (*n* = 310)		Extended care (*n* = 59)	
Variable	**Mean ± SD**	**% of subjects**	**Mean ± SD**	**% of subjects**
Carious teeth	3.73 ± 4.28	78.7	4.14 ± 3.91	84.7
Carious coronal surfaces[a]	1.73 ± 3.51	47.4	3.27 ± 4.55	66.1
Carious root surfaces	4.82 ± 7.40	71.0	5.56 ± 10.30	57.6

SD = standard deviation
[a]Statistically significant difference in scores

Table 4 **Summary and comparison of caries data in various studies**

Variable	This study	Other studies
Mean no. of carious teeth	3.79	2.6 (Hawkins and others[21])
% of subjects with caries	78.6	76 (Galan and others[18])
% of subjects with coronal caries	50.4	68 (Guivante-Nabet and others[16]) 59 (Hawkins[17]) 41 (Galan and others[18])
% of subjects with root caries	68.8	88 (Guivante-Nabet and others[16]) 63 (Frenkel and others[19]) 46 (Hawkins[17]) 22 (Galan and others[18])
Mean no. of carious coronal (root) surfaces	1.98 (4.93)	3.72 (7.96) (Guivante-Nabet and others[16])
Mean DMFT	26.6	25.1 (Galan and others[18]) 25.6 (Guivante-Nabet and others[16]) 22.9 (Altieri and others[20])

DMFT = decayed, missing and filled teeth

(t = 1.246, df = 9, p [2-tailed] = 0.244) or carious root surfaces (t = 1.937, df = 9, p [2-tailed] = 0.085) determined by the author and the examining dentist.

Results

On average, 23% of residents' remaining teeth were affected by caries, with few differences between tooth types or between the jaws (Table 1). Two hundred and ninety (78.6%) of the subjects had at least one carious lesion; 186 (50.4%) had coronal caries and 254 (68.8%) had root caries (Table 2). There was a significant positive correlation between the number of carious coronal surface lesions and carious root surface lesions (Pearson chi-square = 22.27, $p < 0.001$) and teeth remaining (Pearson chi-square = 22.42, $p < 0.001$) per subject. Men had more carious teeth (t = –9.874, p = 0.000) and carious root surfaces (t = –7.645, $p < 0.001$) (Table 2).

Although there were no differences in the number of remaining teeth between residents of extended care hospitals and those living in intermediate care facilities, the extended care residents had significantly more carious coronal surfaces (t = 2.94, p = 0.003) (Table 3). *Lactobacillus* scores were correlated with the number of carious coronal lesions (R = 0.205, $p < 0.01$), the number of carious surfaces (coronal and root) (R = 0.120, $p < 0.05$) and the plaque index (R = 0.191, $p < 0.01$). No associations were found between coronal and root caries and the number of medications or the number of medications with xerostomic side effects.

The mean DMFT was 26.6 (SD 4.3, range 7–32), and the mean number of decayed, filled teeth (DFT) was 11.0 (SD 6.1, range 0–26). The mean coronal DFS per subject was 30.9 (SD 23.8, range 0–99) and the mean root DFS was 7.4 (SD 8.1, range 0–56). There was no significant correlation between the root caries index (mean 30.3, SD 26.0) and the bacterial scores. However, *Lactobacillus* scores were correlated with coronal and root DMFS (R = 0.111, $p < 0.05$), and *S. mutans* scores were correlated with coronal and root DMFT (R = 0.111, $p < 0.05$). As a result of this study, a total of 253 residents (68.6%) were referred to a dentist, mostly for treatment of dental caries (244 subjects or 96.4%).

Discussion

A high percentage of older adults living in institutions suffer from caries, yet considerable variability exists between published data for populations within and outside of Canada (Table 4). The mean number of decayed teeth in this study was greater than that reported for LTC residents in Toronto,[21] however, the mean number of carious coronal and root surfaces was approximately half that reported by Guivante-Nabet and others.[16] Guivante-Nabet and others[16] admitted that their population had strikingly higher percentages of root caries and lower filled root surfaces than other published studies. They recorded twice as many carious root lesions as carious coronal lesions, as was the case for 120 hospitalized older adults in Switzerland.[22]

In our study, there was a strong association between the number of root surface lesions and the number of carious coronal lesions. Fure and Zickert[4] also found that the

number of root surface lesions was positively correlated with the frequency of coronal decay and negatively correlated with the number of remaining teeth and exposed root surfaces.

Weak positive correlations between bacterial and caries scores were evident, but no correlation was evident between caries and plaque indices. The incidence of root caries has been correlated with high salivary levels of *S. mutans* and *Lactobacillus*, plaque levels and frequency of carbohydrate intake.[4] In addition, Budt-Jorgensen and others[22] found correlations between caries and plaque scores and frequency of tooth brushing.

The DMFT of 26.6 was similar to those reported by Galan and others[18] and by Guivante-Nabet and others,[16] but higher than that reported by Altieri and others[20] (Table 4). Similarly, the coronal DMFS of 112.3 was also higher than the 97.0 value reported by Altieri and others.[20] The mean DFT (10.97) and DFS 30.8 (SD 23.8) were higher than the mean DFT of 6.1 (SD 7.0) and mean DFS of 18.8 (SD 23.4) determined by McGuire and others[23] for 1,151 independent New England elders aged 70 years and older. The coronal DFS of 30.8 and root DFS of 7.4 were higher than those reported by Locker and Leake[24] (23.9 and 3.6 respectively). Degree of dependence and inclusion of root surfaces in the DFT in this study may explain these differences. The root caries index for 170 LTC residents in Winnipeg (38%)[18] was similar to the root caries index observed in the extended care population in this study, but higher than that for the intermediate care population.

Conclusions

Residents of LTC hospitals have inadequate daily oral hygiene, high sugar intake, high levels of caries bacteria and a propensity for xerostomia, all of which result in moderately high plaque and extremely high risk of caries. In addition, hospitalized elderly people experience barriers to receiving dental care, including cost, lack of perceived need for care, transportation problems and fear.[9] Prevention of oral disease in the elderly requires early intervention, education of health professionals in the identification of patients at risk, and implementation of preventive programs.[25,26] Caries prevention regimens have been recommended for the elderly institutionalized population,[18,27-30] but have not been tested.

Overall, the prevalence of dental caries was high among the elderly residents of LTC hospitals in this study, although almost half had visited community dentists within the previous 5 years. The distribution of both coronal and root caries was similar to that for other populations of older adults in Canada and other countries. The high level of caries may be due to a combination of lack of assistance in oral hygiene, high risk of xerostomia induced by medication and consumption of a diet high in sugar. Barriers to professional care must be removed and prevention strategies formulated to reduce the risk of oral diseases, including caries. In fact, prevention strategies may offer the most cost-effective means of controlling caries in this population. ◆

Acknowledgments: The author wishes to express thanks to Mrs. Judy Laird (clinical research manager) and Dr. Rand Barker (research dentist) for their help in performing this research project. Supported by BCHRF Institutional Program Grant #212 (97-2).

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The author has no declared financial interests.

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