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Assessment of periodontal conditions and systemic disease in older subjects

II. Focus on cardiovascular diseases

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Abstract

Background: Panoramic radiographs (PMX)s may provide information about systemic health conditions.

Aims: i) To study clinical periodontal conditions and collect self-reported health status in a cohort of 1084 older subjects; ii) to study signs of alveolar bone loss and carotid calcification from panoramic radiographs obtained from these subjects; and iii) to study associations between study parameters.

Material and methods: PMXs from 1064 adults aged 60–75 (mean age 67.6, SD ± 4.7) were studied. Signs of alveolar bone loss, vertical defects, and molar furcation radiolucencies defined periodontal status. Medical health histories were obtained via self-reports. Signs of carotid calcification were identified from panoramic radiographs.

Results: The PMX allowed assessment of 53% of the films (Seattle 64.5% and Vancouver 48.4%). A self-reported history of a stroke was reported by 8.1% of men in Seattle and 2.9% of men in Vancouver ($P < 0.01$). Heart attacks were reported by 12% of men in Seattle and 7.2% in Vancouver (N.S.). PMX evidence of periodontitis was found in 48.5% of the subjects, with carotid calcification in 18.6%. The intraclass correlation score for PMX findings of carotid calcification and stroke was 0.24 (95% CI: 0.10–0.35, $P < 0.001$). The odds ratio for PMX carotid calcification and periodontitis was 2.1 (95% CI: 1.3–3.2, $P < 0.001$), and for PMX carotid calcification and stroke 4.2 (95% CI: 1.9–9.1, $P < 0.001$). The associations disappeared when smoking was accounted for. A history of a heart attack was associated with stroke, gender, age, and PMX scores of alveolar bone loss.

Conclusions: PMXs may provide valuable information about both oral conditions and signs of carotid calcification, data that are consistent with self-reported health conditions. Alveolar bone loss as assessed from PMXs is associated with cardiovascular diseases.

Atherosclerosis is a progressive disease and the leading cause of death in most Western countries and may affect 50% or more of the older population. Conventional cardiovascular risk factors, however, have failed to explain the observed variations in the prevalence and severity of coronary heart disease (Kuller & Tracey 2000). A link between infection and atherosclerotic disease including both myocardial and cerebral infarction has been advocated. Many different bacteria and viruses have been suggested as etiological factors (Valtonen 1991, Ellis 1997, Carlisle & Nahata 1999, Coombes & Mahony 1999, de Boer et al. 2000).

Associations between cardiovascular

diseases (CVD), specifically atherosclerosis, and periodontitis have been suggested (i.e. DeStefano et al. 1993, Mattila 1993, Beck et al. 1996, Loesche et al. 1998, Mattila et al. 2000). The 'response to the injury' hypothesis includes a perception that hyperlipidemia, and especially oxidized low-density lipoproteins, can cause endothelial cell injury. Lipopolysaccharide (LPS) from, for example, *Chlamydia pneumoniae* can then induce macrophage foam cell formation, which will result in accumulation of excess cholesterol, contributing to the development of vascular atheroma (Kalayoglu & Byrne 1998). Periodontal pathogens such as *Actinobacillus actinomycetemcomitans*, and *Porphyromonas gingivalis* also have characteristic LPS cell-wall capsules (Genco et al. 1998). An association between elevated serum IgG titers to *P. gingivalis* and elevated serum cholesterol values has been demonstrated (Cutler et al. 1999). Furthermore both *P. gingivialis* and *S. sanguis* can be found in atherosclerotic plaque (Chiu 1999, Dorn et al. 1999). Thus, it appears that the putative infectious etiology in CVD and periodontitis share immuno-potent factors and that *P. gingivalis* may also induce macrophage foam cell formation and act similar to *C. pneumoniae.*

Cerebrovascular disease and coronary artery disease often coexist and have similar risk factors. The incidence of asymptomatic carotid artery disease increases with age and approximately 30% of people age 50 and older have some evidence of this disease (Barnett et al. 1995). Studies have shown that the highest odds ratio of an association between periodontitis and cardiovascular diseases is for non-hemorrhagic stroke (Wu et al. 2000).

Duplex ultrasonography is the most frequently used non-invasive method for assessing carotid artery stenosis. It provides both anatomical imaging of the vessel and flow velocity information. Widely used duplex velocity criteria for carotid artery stenosis are based on correlations between duplex-derived pulsed Doppler waveform analysis, and measurements of angiographic stenosis (Roederer et al. 1982, 1984).

Morphological and morphometrical analysis including radiographic classification of different degrees of calcification on post mortem carotid arteries have shown that the most common localization of radiographically iden-tified calcified deposits is the carotid bulb (Deneke et al. 2000). A radiopaque nodular mass appearing adjacent to the cervical vertebrae at or below intervertebral space C3–C4 can be identified as a sign of carotid arterial calcifications from panoramic radiographs (Friedlander et al. 1994, Friedlander & Gratt 1994, Lewis & Brooks 1999, Friedlander & Maeder 2000; Freymiller et al. 2000).

Studies comparing panoramic radiographs and intraoral radiographs, which are generally preferred in clinical practice, have demonstrated that they are almost equally useful for determining alveolar bone conditions or the frequency of non-interpretable or measurable sites (Åkesson et al. 1989, Åkesson 1991). The distribution of intrabony lesions and furcation defects has been assessed from panoramic radiographs. Based on analysis of panoramic radiographs the prevalence of bone pockets (3 mm or deeper) was 51% and furcation lesions 28% in a Finnish study population (Ainamo et al. 1994). Therefore, access to panoramic radiographs could provide simultaneous information about both oral (periodontal alveolar bone conditions) and potentially signs of carotid calcification.

The objectives of the present study were as follows:

- to study clinical periodontal conditions and collect self-reported health status in a cohort of 1084 older subjects;
- to study signs of alveolar bone loss and carotid calcification from panoramic radiographs obtained from these subjects;
- to study the association between study parameters.

Material and methods

The present study was approved by the IRBs (Institutional Review Boards) at the University of Washington and at the University of British Columbia. Adults between the ages of 60 and 75 years who had at least four remaining teeth were recruited from the Seattle and Vancouver metropolitan areas (Chinese, African-American, and Hispanic in Seattle; Chinese and East Indians in Vancouver) (Kiyak et al. 2000). A total of 1084 subjects were enrolled. Efforts were made to study a regionally representative ethnic distribution of older subjects. Each subject was asked to complete a comprehensive health questionnaire. Medication data were obtained directly from the containers brought in by study subjects and compared with self-reported health histories. All interviews with non-English speakers were conducted in their native language by a translator who was a native speaker of each language.

Each subject underwent a comprehensive dental examination by calibrated examiners and had a panoramic radiograph (PMX) taken. At the University of Washington, all PMXs were taken at the Division of Oral Radiology, Department of Oral Medicine (Orthophos Plus, Siemens AG, Bensheim, Germany). Subjects at the Vancouver BC study site had their panoramic radiographs taken at different locations using different equipment (Planmeca, Panelipse, Orthophos, Helsinki, Finland). A vertically aligned radiopaque nodular structure appearing adjacent to the cervical vertebrae at or below intervertebral space C3–C4 was identified as a sign of carotid arterial calcifications (Friedlander & Gratt 1994, Friedlander 1995, Lewis & Brooks 1999, Freymiller et al. 2000). The frequencies of mesial and distal vertical bone defects ≥ 3 mm around remaining teeth were counted and the number of molars with identifiable interterradicular marginal radiolucency was accounted for. The extent of alveolar (horizontal) bone height was assessed using an index system (0–3) (for details see Persson et al. 2002). Two examiners (L.G.H. and R.E.P.) jointly analyzed all PMX films and reached consensus agreement regarding both alveolar bone conditions and signs of carotid calcification. Only in the presence of a radiopaque mass or two radiopaque vertical lines at the level of the lower margin of the third cervical vertebra (C3) was the lesion identified as a radiographic indication of a carotid calcification. These opacities are separate and distinct from the hyoid bone and variably appear above or below it. In addition, systolic and diastolic blood pressures were measured in Seattle subjects, the subject sitting in a dental chair using automatic blood pressure equipment (Omron HEM-720 C, Kyoto, Japan).

Data analysis

Descriptive statistics were used to present information about the prevalence of

systemic diseases and PMX findings. To test the null hypothesis of no difference between grouping variables, either parametric independent *t*-tests or non-parametric χ^2 or Mann–Whitney U-tests were used. The level of agreement between PMX findings and systemic conditions was assessed by intraclass correlation. The Mantel–Haentszel common odds ratio estimate was used to assess the odds of agreement between observations. Logistic linear regression analysis was used to study explanatory models of a history of heart attack.

Results

Panoramic radiographs were available for analysis from 1064 of the enrolled subjects, of whom 485 (46.3%) were men and 579 women. The mean age of these subjects was 67.2 years (SD ± 4.7). The overall ethnic distribution was as follows; Caucasian (47%), Asian (31.4%), East Indian (10.4%), African-American (7.8%), and others (3.4%). All East Indians were recruited from the Vancouver study site.

Characteristics of self-reported health conditions are presented in Table 1. Among all participants, 4.2% reported that they had had a by-pass heart surgery performed. The prevalence of a history of a heart attack was significantly higher among men, whereas osteoarthritis, chronic pain and depression were significantly more common among women ($P < 0.001$,

Mann–Whitney n-par test). Subjects at the Seattle study site more frequently reported a history of heart murmur, high blood pressure, depression, chronic pain ($P < 0.001$ Mann–Whitney n-par test), and stroke, cancer, gastric-intestinal diseases, and alcoholic problems ($P < 0.05$). Among those reporting a history of a heart attack, 10 subjects (14.3%) also reported a history of a stroke. Smoking habits did not differ between Seattle and Vancouver study subjects (Table 1).

The distribution of a history of a heart attack or a stroke by ethnicity is illustrated in Fig. 1. The prevalence of heart attacks and strokes was significantly higher in the Caucasian than in the Chinese group ($P < 0.05$, and $P < 0.01$, respectively, Mann–Whitney U-test). The Caucasians also had a higher prevalence of stroke than the East Indians ($P < 0.05$). No other ethnic differences were found for the prevalence of self-reported cardiovascular diseases.

Clinical assessments of systolic and diastolic blood pressures were only performed at the Seattle study site ($n = 701$). The mean systolic blood pressure for women was 135.8 mmHg (SD ± 20.9) and for men 135.1 mmHg (SD ± 18.1). The corresponding values for diastolic blood pressure were 77.6 (SD ± 12.1) and 79.2 (SD ± 11.5), respectively, with no statistically significant differences by gender or ethnicity. The highest systolic blood pressure measured was 242 mmHg, and 22.7% of the

subjects had a systolic blood pressure ≥ 150 mmHg. The highest diastolic blood pressure was 121 mmHg with 15% of the subjects having diastolic pressure ≥ 90 mmHg. At the Seattle study site, medications against high cholesterol were taken by 18.6% of the subjects and 43.3% of the subjects used medication against high blood pressure.

Figure 2 presents the percentages of subjects with a positive PMX finding of carotid calcification, and a positive self-reported history of cardiovascular diseases studied (heart attack, stroke, and combined all forms of cardiovascular and cerebrovascular diseases) and periodontitis among those with readable PMX films. The proportion of subjects with positive PMX findings of carotid calcification was significantly higher in the Seattle group ($\chi^2 = 17.3$, $P < 0.001$). The difference remained statistically significant ($\chi^2 = 17.3$, $P < 0.001$) when signs of carotid calcification were studied only among Caucasians in Seattle ($n = 236$) and Vancouver ($n = 56$).

Details of periodontal conditions by study location and ethnicity are presented elsewhere (Persson et al. 2002). Evidence of alveolar bone loss based on the composite analysis of the panoramic radiographs was found in 48.5% of the subjects (score 1 = 34.6%, score 2 = 9.6%, score 3 = 3.9% and score 4 = 0.4%). Clinical assessments of probing depths and attachment levels suggested that about 45% of the subjects had no evidence of teeth with PD ≥ 5 mm. However, 93.3% had at least one tooth with CAL ≥ 4 mm and 69.9% had at least 10 teeth with one or more sites with a CAL ≥ 4 mm. Radiographic evidence of alveolar bone loss was significantly greater among men than women ($\chi^2 = 5.7$, $P < 0.017$).

The PMX films allowed assessment of carotid calcification in 51.3% of the films (64% in Seattle and 33% in Vancouver BC), and slightly more frequently on the right side (51.6%) vs. the left side (50.3%) of the subjects. PMX findings of carotid calcification were found in 17.1% of those PMX films of subjects where one or the other side was deemed interpretable. Signs of carotid calcification on both sides were found in 8.6% of PMX films that were interpretable on both left and right sides. The proportion of subjects with positive PMX findings of carotid calcification was significantly higher in the Seattle group ($P < 0.001$, Mann–Whitney U-test).

Table 1. The proportional distribution of self-reported diseases by gender and study location

	Seattle study site		Vancouver study site	
	Male	Female	Male	Female
Study Variable	($n = 283$)	($n = 418$)	($n = 211$)	($n = 161$)
Heart attack	12.0%	5.5%	7.2%	3.1%
Stroke	8.1	4.1	2.9	2.5
Heart murmur	8.1	9.6	2.4	3.8
High blood pressure	41.3	42.3	30.0	29.2
All subjects with diabetes	8.1	8.6	7.7	8.9
Insulin dependent	3.2	1.9	0.5	1.3
Cancer	12.4	9.3	5.3	8.1
Osteoarthritis	27.6	46.2	24.4	34.2
Chronic pain	13.5	20.0	3.8	12.4
Hypothyroidism	4.2	14.6	2.4	12.7
Kidney disease	3.5	4.3	4.8	2.5
Gastrointestinal disease	15.5	18.4	11.5	13.1
Depression	14.9	23.4	6.8	16.3
Alcohol problems	5.7	2.4	2.4	2.3
Smoking status				
Never smoked	50.4	68.0	52.6	69.0
Quit smoking	39.9	25.3	41.6	23.2
Current smoker	9.7	6.7	5.8	7.8

Reliability analysis demonstrated significant intraclass correlation (ICC) between a self-reported history of a stroke and PMX findings of carotid calcification, and between a self-reported history of a heart attack and PMX findings of carotid calcification (Table 3).

The odds ratio of agreements between PMX signs of carotid calcification and self-reported history of heart attack or stroke, or the composite of stroke/heart attack are presented in Table 4. However, when only subjects who never smoked and who had a read-able PMX for carotid calcification were included, the odds ratios were reduced to ≤ 1.2 and were then not statistically significant. The sample was also reduced by 53%. Among those who had never smoked, 6.1% reported that they had had a heart attack, 3.6% reported that they had a history of a stroke, and 7.7% had evidence of PMX carotid calcification. In the group of current or past smokers, 9.9% reported a history of a heart attack, 6.8% a history of a stroke, and 15.1% had evidence of PMX carotid calcification.

In the non-smoking group, 56.7% had no evidence of PMX signs of alveolar bone loss compared to 44.7% of the subjects who had a history of smoking. Spearman rank correlation demonstrated weak associations between smoking status and PMX evidence of bone loss ($r = 0.12$, $P < 0.001$), stroke ($r = 0.07$, $P < 0.05$), and heart attack ($r = 0.07$, $P < 0.05$). The number of remaining teeth differed for subjects with a composite history of cardiovascular disease (heart attack, stroke, high blood pressure), such that those with a positive finding of cardiovascular disease had fewer remaining teeth (23 teeth vs. 20 teeth) ($t = 3.8$, $P < 0.001$).

Factors associated with a history of a heart attack were studied by logistical linear regression analysis. Among 110 variables studied, only four could be associated with a history of a heart attack; stroke, PMX composite score, gender, and age ($P < 0.01$) (Table 5). Among the periodontal parameters studied, only the PMX composite score of overall alveolar bone loss was significantly associated with a history of a heart attack.

Discussion

The prevalence of periodontitis based on evaluation of panoramic radiographs in these subjects age 60–75 is very high, and reached 51% in the Seattle population. In fact, periodontitis appears to be more prevalent than high blood pressure and osteoarthritis. Clinical measurements of probing depths and clinical attachment levels also revealed a high prevalence and severity of periodontitis. The findings are remarkable in that approximately 50% of the subjects in the present study reported that they had never smoked.

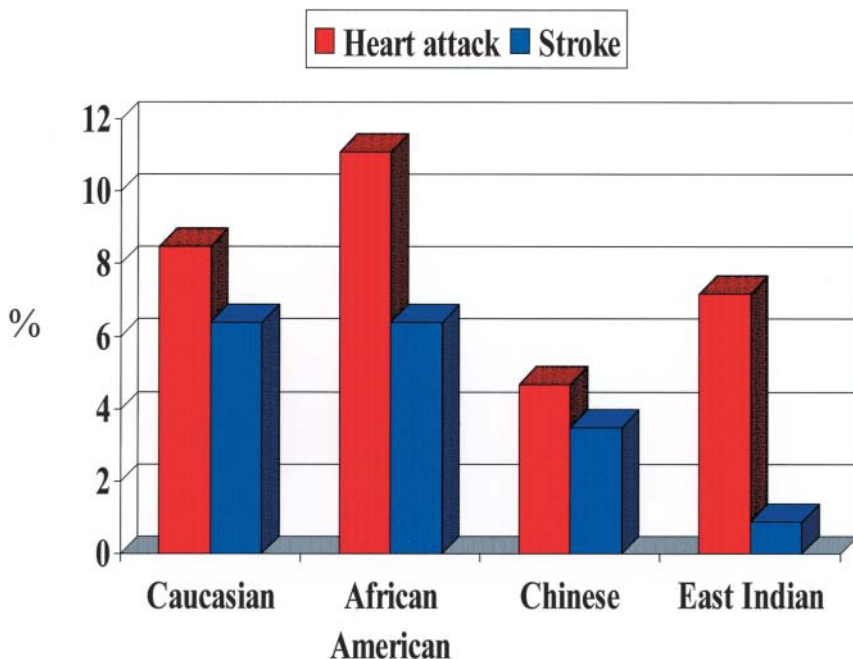Several epidemiological studies have suggested associations between heart diseases and periodontitis (DeStefano

Fig. 1. Proportions of subjects with a self-reported history of a heart attack or stroke by ethnicity.
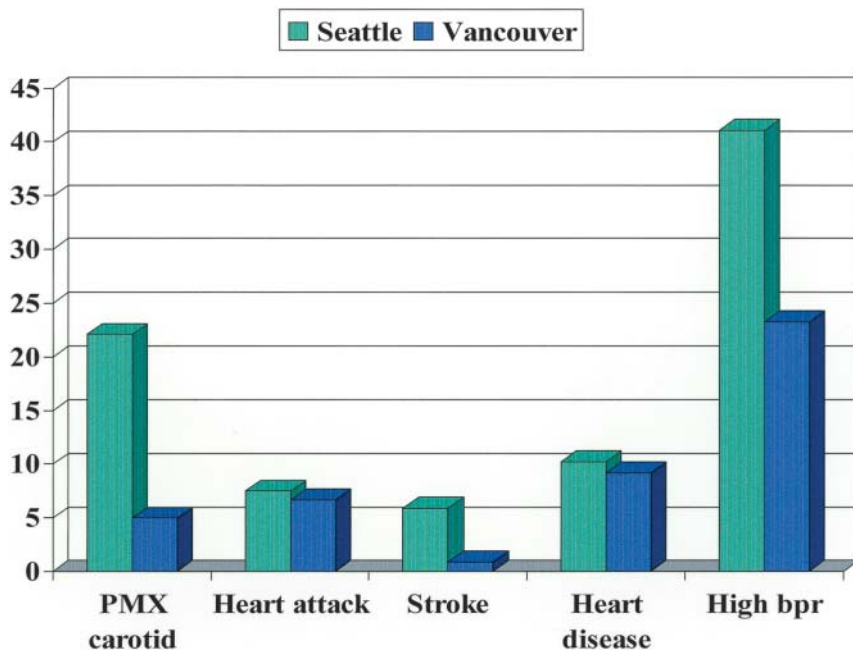

Fig. 2. Proportions of subjects with a positive panoramic (PMX) finding suggestive of carotid calcification, self-reported history of heart attack, stroke, overall cardiovascular diseases, high blood pressure, and periodontitis.

et al. 1993, Mattila 1993, Beck et al. 1996, Joshipura et al. 1996, Loesche et al. 1998, Mattila et al. 2000). The findings from the present study are in agreement with one longitudinal study of older subjects which concluded that after controlling for age and gender, vertical alveolar bone loss in older subjects judged from panoramic radiographs was associated with a 4-year all-cause mortality risk (Soikkonen et al. 2000). However, the reported associations between cardiovascular diseases and periodontitis may depend on several confounding factors (Hujoel et al. 2001). In the present study the association between CVD and periodontitis was significant when smoking was not accounted for. However, when smoking was included in the analysis, this association disappeared. This may be the result of decreased statistical power and of smoking being a significant factor for both CVD and periodontitis. A history of smoking may in fact be the most important link between the simultaneous occurrence of both conditions.

The appreciation that atherosclerosis is an immune-mediated inflammatory disease has renewed interest in the potential role of infectious agents in initiating or modulating atherosclerosis (de Boer et al. 2000, Valtonen et al. 1991). A positive association between elevated serum titers to different pathogens and having previously suffered acute myocardial infarction provide further support for the hypothesis that there is a causal association between chronic infections and the development of coronary heart disease (Kahan et al. 2000, Shimada et al. 2000). In the present study, the microflora associated with periodontitis or antibody titers to such pathogens were not studied. The likelihood that such pathogens were present in a majority of the subjects is, however, high (Schlegel-Bregenzer et al. 1998).

Patients seeking dental care may be unaware of their medical health status (Thompson et al. 1999). Other studies have shown that approximately 75% of a self-reported history of a myocardial infarct or a stroke is accurate but also that underreporting occurs (Psaty et al. 1995). Nevertheless, others have demonstrated that a self-administered questionnaire can be used to assess accurately the prevalence of stroke in epidemiological research (Engstad et al. 2000). In the present study, self-reported history of either a heart attack or a stroke or both was 16.9% and consistent with prevalence rates of definite myocardial infarction and angina in a cardiovascular health study of men aged 65–69 years (Mittelmark et al. 1993). The overall findings form the self-reported medical histories are consistent with perceived disease prevalence in older subjects, suggesting that the self-reported histories are generally accurate. This was further ascertained by the review of subjects' medication lists and confirmation from primary care providers when necessary.

In the present study the prevalence of a positive finding of carotid calcification was 18.6%, somewhat lower than found by others who used the same methodology for older subjects with diabetes mellitus or other high risk subjects (Friedlander et al. 1994, Friedlander & Maeder 2000). Although many of the subjects in the present study could be categorized as low income and ethnically diverse, they were not identified as high risk subjects for cardiovascular disease. This may be illustrated by the large proportion of East Indian participants of Sikh de-

Table 3. Intra-class correlation coefficients (ICC), 95% confidence intervals and P-values between panoramic findings of carotid calcification (PMX CC) and self-reported information of stroke and heart attack

Variables	ICC coefficient	95% CI	*P*-value
PMX CC − Stroke	0.24	0.10–0.36	0.001
PMX CC − Heart attack	0.25	0.10–0.36	0.001
PMX CC − CVD	0.27	0.10–0.40	0.001
PMX CC − Periodontitis	0.24	0.10–0.35	0.001

Table 4. Odds ratios and 95% confidence intervals between stroke, heart attack and PMX assessments of periodontal conditions

Condition	Odds ratio	95% CI		Significance
Stroke and PMX signs of carotid calcifications	4.2	1.9	9.1	*P* < 0.001
Heart attack and PMX signs of carotid calcifications	3.2	2.4	7.9	*P* < 0.001
Composite variable heart attack and/or stroke and PMX signs of carotid calcification	4.3	2.4	7.9	*P* < 0.001
Carotid calcification as assessed by PMX and the composite PMX evidence of alveolar bone loss	2.1	1.3	3.2	*P* < 0.001

Table 5. Binary logistic forward stepwise regression analysis of models of factors for heart attack

		B	SE	Wald	df	Significance	Exp (B)
Step 1[a]	STROKE	1.909	0.339	31.674	1	0.000	6.746
	Constant	−4.606	0.411	125.329	1	0.000	0.010
Step 2[b]	PMX composite score	0.420	0.128	10.785	1	0.001	1.521
	STROKE	1.902	0.345	30.433	1	0.000	6.698
	Constant	−4.939	0.438	127.452	1	0.000	0.007
Step 3[c]	PMX composite score	0.381	0.129	8.717	1	0.003	1.464
	Gender	−0.737	0.259	8.066	1	0.005	0.479
	STROKE	1.815	0.350	26.881	1	0.000	6.141
	Constant	−3.736	0.590	40.153	1	0.000	0.024
Step 4[d]	PMX composite score	0.345	0.130	7.069	1	0.008	1.412
	Gender	−0.736	0.261	7.980	1	0.005	0.479
	STROKE	1.763	0.352	25.098	1	0.000	5.827
	Age	0.072	0.027	7.054	1	0.008	1.075
	Constant	−8.578	1.944	19.463	1	0.000	0.000

[a]Variable(s) entered on step 1: STROKE.
[b]Variable(s) entered on step 2: PMX composite score.
[c]Variable(s) entered on step 3: Gender.
[d]Variable(s) entered on step 1: Age.

nomination, who do not use tobacco products, drink alcoholic beverages or consume meat products, which are considered risk factors in many studies. The prevalence of positive signs of carotid calcification in this subgroup was 7.1% compared with 22.9% in the Caucasian group.

The purpose of the present study was limited to assessing the benefit of panoramic radiographs to determine signs of CVD (cerebrovascular disease) and periodontitis. This would be important as other studies have suggested a strong association between periodontitis and stroke (Loesche et al. 1998). In the present study, only PMX assessment of the extent of alveolar bone loss could be associated with CVD. The complexity of gingival recession, loss of periodontal attachment and probing depths in older subjects may make it difficult to use such parameters in assessing associations to other systemic diseases. The PMX score of alveolar bone loss constitutes the consequences of past and recent events of periodontal disease activity, and may therefore be the best variable for studies of associations. It is noteworthy that epidemiological studies either suggesting (DeStefano et al. 1993, Mattila 1993, Beck et al. 1996, Loesche et al. 1998, Mattila et al. 2000) or rejecting (Hujoel et al. 2001) associations between CVD and periodontitis are based on clinical measures of periodontitis using various clinical indices and have not assessed radiographs.

The PMXs taken at the Seattle study site allowed assessment for carotid calcification more frequently than at the Vancouver study site. The reason for this might be that all PMXs in Seattle were taken by trained radiology assistants. Other studies have identified that standardization of the equipment and quality differ from study sites (Ahlqwist et al. 1986, Åkesson et al. 1989, Åkesson 1991). To assess signs of carotid calcification, it may be necessary to adjust the position of the subject to obtain views of the area of interest on the film. It is noteworthy that the right side of the subject is more often readable for signs of carotid calcification. This may be the result of the specifics of a certain panoramic equipment. If the intent of the analysis is to assess for carotid calcification, then adjusting the position of the subject may create better images, but this may then also limit visibility of other areas of interest for the radiographic analysis. In most cases an adjustment of either the equipment or patient positioning to allow assessment of the area of interest for carotid calcification would not compromise the ability to assess radiographic evidence of pathology as compared with routine PMX films (i.e. temporomandibular joints).

The panoramic radiograph has many advantages in that the effective body dose is very low and similar to a few single intraoral films. It provides information useful for the assessment of not only systemic disease but also oral conditions, including periodontitis, sinus affection, and temporomandibular joint conditions as well as other pathological conditions that affect the facial region.

In conclusion, the present study has demonstrated that panoramic radiographs can provide valuable information about both oral conditions and potential signs of carotid calcification that corroborate with self-reported health conditions. The present study results also confirm that alveolar bone loss as assessed from panoramic radiographs can be associated with cardiovascular diseases and that ethnicity and regional differences may be confounding factors. The study demonstrated that a history of a previous stroke, gender, age and extent of horizontal alveolar bone loss were the best predictors of a history of heart attack in older persons.

Acknowledgements

Zusammenfassung

Bestimmung parodontaler Bedingungen und systemischer Erkrankungen bei älteren Patienten. II. Fokus auf kardovaskuläre Erkrankungen

Hintergründe: Panorama-Röntgenaufnahmen (PMX; panoramic radiography) können Informationen zu systemischen gesundheitlichen Bedingungen liefern.

Zielsetzung: Ziel der vorliegenden Studie waren (1) die Untersuchung klinischer parodontaler Zustände und Erhebung des selbst berichteten Gesundheitsstatus in einer Kohorte von 1084 älteren Patienten, (2) die Untersuchung von Anzeichen eines alveolären Knochenverlusts und einer Verkalkung der *A. carotis* durch Panorama-Röntgenaufnahmen von diesen Patienten, und (3) die Untersuchung der Beziehungen zwischen den Untersuchungsparametern.

Material und Methodik: Untersucht wurden PMX von 1064 Erwachsenen im Alter von 60 – 75 Jahren (durchschnittliches Alter 67,6, SA ± 4,7 Jahre). Der parodontale Status der Patienten wurde durch Anzeichen von alveolärem Knochenverlust, vertikalen Knochentaschen und Röntgenstrahlendurchlässigkeit der Molarfurchen definiert. Die medizinische Anamnese wurde durch Eigenberichte erhoben. Anzeichen einer Verkalkung der *A. carotis* wurden durch Panorama-Röntgenaufnahmen identifiziert.

Ergebnisse: Eine selbst berichtete Anamnese mit Schlaganfall wurde von 8,1 % der Männer in Seattle und 2,9 % der Männer in Vancouver berichtet (p < 0.01). Herzinfarkte wurden von 12 % der Männer in Seattle und 7,2 % der Männer in Vancouver (nicht signifikant) berichtet. Die PMX gestatteten eine Beurteilung von 53 % der Aufnahmen (Seattle 64,5 % und Vancouver 48,4 %) Nachweise durch PMX einer Parodontitis wurden bei 48,5 % der Patienten, mit gleichzeitigen Anzeichen einer Verkalkung der *A. carotis* bei 18,6 % beobachtet. Der ICC-Score für PMX-Ergebnisse einer Verkalkung der *A. carotis* und Schlaganfall lag bei 0,24 (95 % CI: 0,10 – 0,35, p < 0.001). Die Odds Ratio einer durch PMX nachgewiesenen Verkalkung der *A. carotis* und Parodontitis lag bei 2,1 (95 % CI: 1,3 – 3,2, p < 0.001) und einer durch PMX dargestellten Verkalkung der *A. carotis* und Gehirnschlag bei 4,2 (95 % CI: 1,9 – 9,1, p < 0.001). Die Beziehungen verschwanden, wenn Rauchen mit eingearbeitet wurde. Eine Herzinfarkt-Krankengeschichte war mit Schlaganfall, Geschlecht, Alter und PMX-Scores für alveolären Knochenverlust verbunden.

Schlussfolgerung: PMX kann wertvolle Informationen zu oralem Zustand und Anzeichen einer Verkalkung der *A. carotis* liefern. Unsere Ergebnisse stimmen mit dem selbst berichteten Gesundheitszustand überein. Ein durch PMX bestimmter alveolärer Knochenverlust ist mit kardiovaskulären Erkrankungen verbunden.

Résumé

Evaluation des conditions parodontales et de la maladie systémique chez les sujets âgés. II. Maladies cardiovasculaires

Des radiographies panoramiques (PMX) peuvent apporter une information concernant les conditions de santé systémique. Les buts de cette étude ont été 1) d'analyser les conditions parodontales cliniques et l'état de santé déclaré par le patient chez 1 084 sujets âgés, 2) d'étudier les pertes osseuses alvéolaires et une calcification carotidienne à partir de radiographies panoramiques obtenues de ces sujets et 3) d'étudier les associations entre les paramètres étudiés. Des PMX de 1 064

adultes âgés de 60 à 75 ans (moyenne 67,6± 4,7) ont été étudiés. Des signes de perte osseuse alvéolaire, de lésions verticales et de radioclarté au niveau des bifurcations des molaires définissaient l'état parodontal. Les historiques de la santé médicale ont été obtenus verbalement. Des signes de calcification carotidienne ont été identifiés à partir des radiographies panoramiques. La PMX permettait l'évaluation de 53% des films (65% à Seattle et 48% à Vancouver). Un passé d'attaque cardiaque a été rapporté par 8,1% des hommes de Seattle et 2,9% de ceux de Vancouver (p<0,01). Des crises cardiaques étaient citées par 12% des hommes de Seattle et 7,2% de ceux de Vancouver (N.S.). Une évidence de parodontite par PMX a été notée chez 48,5% des sujets, et avec une calcification carotidienne chez 18,6%. La relation intraclasse du score pour les découvertes PMX de calcification carotidienne et d'attaque étaient de 0,24 (95% CI: 0,10 à 0,35, P<0,001). Les facteurs de risque pour une calcification carotidienne PMX et parodontite étaient de 2,1 (95% CI :1,3 à 3,2, p<0,001) et pour la calcification carotidienne par PMX et l'attaque de 4,2 (95% CI : 1,9 à 9,1, P<0,001). Les associations disparaissaient lorsque le tabagisme était pris en considération. Un passé de crise cardiaque était associé à l'attaque, le sexe, l'âge et les scores PMX de perte osseuse alvéolaire. Le PMX peut apporter une information valable sur les conditions buccales et les signes de calcification carotidienne, données en accord avec les conditions de santé rapportées par les patients. Une perte osseuse alvéolaire établie par PMX est associée aux maladies cardio-vasculaires.

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