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Removable dental prostheses and cardiovascular survival: A 15-year follow-up study☆

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ARTICLE INFO

Article history:
Received 1 February 2013
Received in revised form
16 April 2013
Accepted 16 May 2013

Keywords:
Dental prostheses
Number of teeth
Oral care
Inflammation
Cardiovascular mortality

ABSTRACT

Objectives: In previous studies, increasing number of teeth predicted better survival and the acute needs for dental treatment predicted mortality. We sought to investigate whether restored dentitions by various removable dental prostheses impact cardiovascular (CVD) longevity.

Methods: Kuopio Oral Health and Heart study was initiated as a cross-sectional investigation with 256 subjects with diagnosed coronary artery disease [CAD] and 250 age- and sex-matched controls without CAD in 1995–1996. The mean age of both groups was 61, 30% were females. We appended mortality follow-up records to the baseline data and formulated this 15-year follow-up study. We examined the relationship between various types of dental prostheses and cardiovascular mortality by proportional hazard regression analyses. We also explored their correlation to oral and systemic inflammatory markers such as asymptotic dental score and C-reactive protein.

Results: In a model adjusted for age, sex and smoking, groups having only natural teeth (NT), removable partial denture(s) [PD] and NT, a PD and a full denture [FD], and FD/FD or FD/NT demonstrated the following hazard ratios for mortality (95% confidence interval). NT both arches: 1.00 [reference]; PD and NT: 0.75 [0.22–2.56]; PD and FD: 1.99 [1.05–3.81]; and FD opposed by FD or NT: 1.71 [0.93–3.13], respectively [p for trend = 0.05]. Although statistically not significant, those with PD and NT with mean a number of teeth [N_{teeth}] of 15.4 had better survival compared with those who had all NT [N_{teeth} = 22.5]; while those who had FD and PD [N_{teeth} = 6.5] had shorter longevity than those with FD/FD or FD/NT [N_{teeth} = 3.5].

Conclusions: Although not all subgroups of dental prostheses reached significant relationship with CVD mortality, our study suggests that not only the number [quantity] of remaining teeth but their maintenance [quality] removing potential inflammatory foci, such as pericoronitis or retained root tips, may positively impact on cardiovascular survival.

☆ This abstract was presented at the International Association for Dental Research Conference (IADR) at Iguacu Falls, Brazil in 2012.

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0300-5712/$ – see front matter
http://dx.doi.org/10.1016/j.jdent.2013.05.009

1. Introduction

The number of teeth was reported to predict mortality in several studies[1–4] and two pathways have been suggested as the mechanism. One pathway is via confounding through behavioural factors such as smoking or socioeconomic status, which parallels poor oral health,[5] and the other is through inflammation, where oral infections may contribute to endothelial inflammation and dysfunction.[6,7] Several *in vitro* studies demonstrated invasion of endothelial cells by oral pathogens,[8,9] however the establishment of causality between oral infection and CVD requires a longitudinal assessment of the relationship where the predictor, oral infection, should precede the outcome, CVD. Even when a longitudinal study was conducted, inadequate adjustment of confounding made it difficult to affirm true causality. So far, causality establishment in oral and cardiac health relationship is still uncertain as the medical community has noted.[10] Only recently, longitudinal data in addition to the current study begins to emerge suggesting a potential causal relationship.[11]

Systemic inflammation, assessed by plasma C-reactive protein [CRP] levels was highly predictive of mortality[12–14] and acute need for dental treatment was significantly associated with mortality.[15] However, notwithstanding their methodological inadequacy as we pointed out,[16] there is limited evidence of both increased risk of cardiac events and a short-term elevation of CRP following invasive dental procedures.[17,18] The equivocal evidence led to the recent American Heart Association's statement, which did not support the use of invasive periodontal treatments in an attempt to improve cardiac health.[19]

However, whether non-invasive dental treatments such as the use of various types of removable dental prostheses can affect cardiovascular survival to different extents is not known.[20] Non-use of removable dental prostheses by subjects with limited oral function was associated with reduced intake of fruits and vegetables that may lead to increase in mortality.[21] In addition, removable dental prostheses may be associated with other oral infections such as candidiasis, dental caries and gingivitis.[22]

The aims of the current study were to investigate:

1. whether the various removable dental prostheses offer different relationship with CVD mortality;
2. whether removable dental prostheses are correlated with a variety of inflammatory foci in the oral cavity;
3. whether removable dental prostheses accompany candida or streptococcal infections.

We categorized the cohort into four mutually exclusive groups to address these objectives: Having only natural teeth (NT) including the fixed dental prostheses[21]; having removable partial denture [PD] and NT (PD/PD is a form of PD/NT); having a combination of PD and a full denture [FD]; and having full dentures [FD] on both arches or FD opposed by a limited number of natural teeth. Since fixed partial dentures (i.e., bridges) that provided comparable functionality to natural teeth were included in the natural teeth group, PD from here on refers to removable partial dentures. We, then, compared the cardiovascular survival among these four groups with various combinations of natural and removable prosthetic dentitions. As more remaining teeth were associated with better survival,[23] we hypothesized a decreasing CVD survival gradient from natural teeth, to tooth-born and tissue-born dental prostheses.

2. Materials and methods

2.1. Ethical and human subjects' protection

This study was approved by the Joint Ethical Committee of the Kuopio University Hospital and the University of Kuopio and written informed consent was obtained from all participants. The longitudinal portion of the study was approved by the Boston University Institutional Review Board. This project adhered to the guidelines set forth by the Declaration of Helsinki and the Belmont Accord to assure the safety of human research subjects.

2.2. Study population

Kuopio Oral Health and Heart [KOHH] study was initiated as a cross-sectional study in 1995–1996, to investigate the association between oral health and coronary artery disease [CAD] in Kuopio, Finland. For the current study, we merged mortality outcomes over a 15-year follow-up period to the baseline data consisting of 256 CAD patients and 250 age and sex matched controls with a mean age of 60 and created a prospective follow-up study.

At baseline, 256 consecutive patients at Kuopio University Hospital who were referred for coronary angiography and confirmed as having CAD were invited to participate in the KOHH study. The CAD diagnosis was made by the presence of at least 50% stenosis in one of the epicardial arteries. Potential subjects were excluded if they had taken antibiotics during the previous 30 days or had chronic infection other than dental disease. Also, 250 age- and gender-matched controls were recruited from subjects admitted to the general surgery or otorhino-laryngology [ORL] departments at the same hospital for elective surgery. They were considered as not having heart disease based on their medical history and electrocardiogram [ECG] taken during the pre-admission tests. The controls were representative of the population of the same catchment area where the cases arose. The same exclusion and inclusion criteria were applied to the control subjects. Additional exclusion criteria for the CAD group were[1]: those who needed emergency coronary by-pass surgery or valvular replacement surgery[2]; those whose disease status was so grave that a dental examination or dental X-ray could not be performed safely[3]; those who required antibiotic prophylaxis prior to periodontal probing. Further details regarding this cohort have been published elsewhere.[7,24–26] http://www.ncbi.nlm.nih.gov/pubmed/14967717; http://www.ncbi.nlm.nih.gov/pubmed/20666873; http://www.ncbi.nlm.nih.gov/pubmed/20177131.

2.3. Predictor assessment

At the beginning of the study [1995, 1996], a single examiner [MS] performed all clinical dental examinations and