



## The relationship between metabolic conditions and prevalence of periodontal disease in rural Korean elderly



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### ABSTRACT

The aim of this study was to investigate the relationship between the duration and number of components of metabolic syndrome and periodontal disease among rural elderly in Korea over 60 years old. This longitudinal study consisted of 399 participants who underwent regular health examinations at Seongju-gun Public Health Center from 2000 to 2007. The components of metabolic syndrome (diabetes mellitus, hypertension, obesity, and hypercholesterolemia) were evaluated from clinical records of Seongju-gun Public Health Center, which were recorded from 2000 to 2007, and periodontal examination by Community Periodontal Index, recorded from 2006 to 2007. Participants suffering from longer durations of diabetes mellitus, hypertension, and obesity were more likely to have periodontal disease. Individuals with a greater number of metabolic syndrome components were more likely to have periodontal disease. Older rural Koreans with components of metabolic syndrome have unmet periodontal treatment needs. Medical and dental professionals need to coordinated systemic and oral care for these people.

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### 1. Introduction

Life expectancy of the Korean population has increased due to improvements in public health, sanitation, access to medical services, and the decrease of infant mortality rate, contributed by the rapid economic development (Korea National Statistical Office, 2006). The Korea Institute for Health and Social Affairs (2000) has reported that Korean people value oral health as they get older. Approximately 65% of people over 60 years old consider oral health to be more important than any other health problem.

Studies on the association between oral disease and systemic health have increased. In particular, interest in metabolic syndrome and oral health, such as periodontitis and missing teeth, has been growing.

Periodontitis, which reduces the masticatory function, is the main cause of tooth loss in adults. In terms of severity or association with systemic disease, it is recognized as a significant oral disease that requires prevention and management (Korea

Centers for Disease Control and Prevention, 2009a). By raising attention to systemic health and oral disease, some researchers have suggested that chronic oral inflammatory conditions, such as dental caries, periodontal disease, and loss of teeth, can accelerate atherosclerosis and increase the risk of cardiovascular diseases (Scannapieco, 1998).

Periodontitis is the result of infections caused by various pathogens and eventually leads to teeth loss, which is a possible source of low-grade infections (Moutsopoulos & Madianos, 2006). Low-grade inflammation increases the levels of C-reactive protein, fibrinogen, and white blood cell counts in blood circulation and these inflammatory markers are related to increased risks of coronary heart disease and hypertension (HBP) (Holmlund, Holm, & Lind, 2006; Saito et al., 2003). Periodontal disease can be associated with various systemic diseases such as coronary heart disease, diabetes mellitus (DM), HBP (Buhlin, Gustafsson, Hakansson, & Klinge, 2002; Holmlund et al., 2006; Kweider, Lowe, Murray, Kinane, & McGowan, 1993; Mattila, 1993; Thorstensson & Johansson, 2009). Furthermore, several studies suggest that systemic diseases can also cause periodontal disease (American Academy of Periodontology, 2000; Joshipura et al., 1996; Shay, 2002).

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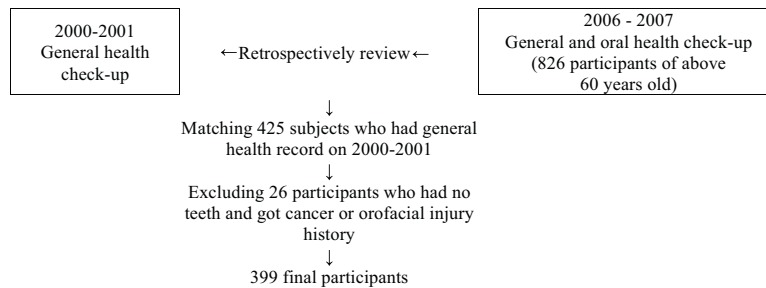


Fig. 1. Flow diagram of the process of choosing the subjects.

Recently, interest in the association of systemic disease with periodontitis is growing in Korea. Some studies using cross-sectional survey data, such as Korean National Health and Nutrition Examination Survey (KNHANES), have been conducted, but studies using longitudinal surveys taken from communities have rarely been conducted. Therefore, the goal of this study was to analyze the association of community periodontal index on the basis of morbidity duration and comorbidity with metabolic syndrome components (from 2000 to 2007).

The specific purposes of this study are as follows: The first aim of this study was to investigate the association between metabolic syndrome components (MSCs), such as DM, HBP, obesity (OB), and hypercholesterolemia (HC) and the degrees of periodontal diseases; by examining longitudinal clinical records. The second was to analyze the influence of metabolic syndromes on periodontal diseases through close examinations on the duration and the number of component of the elderly over 60 years old that reside in provinces of South Korea.

## 2. Materials and methods

### 2.1. Study participants

Seongju-gun Public Health Center, located in the Gyeongsangbuk-do province of Korea, had conducted health screenings in 2000 and 2006 on residents who were born in even number years. The same tests were done to those who were born in odd number years in 2001 and 2007. The 826 subjects over 60 years old who received the exam in 2006 and 2007 were conducted periodontal examination by Community Periodontal Index. Among them, 425 had received the exam repeatedly in the years 2000, 2006 or 2001, 2007. Of the 425 subjects, 399 subjects with no other systemic diseases, injuries, or orofacial injury histories that could affect general health, were chosen and analyzed. Fig. 1 shows the selection process of the sample.

### 2.2. Measurements

#### 2.2.1. Metabolic conditions

We considered the following MSC in these analyses: overweight and obesity, DM, HBP and HC. Body mass index (BMI) was computed from height and weight recordings in the medical records by dividing the weight, in kilograms, by the height, in meters squared. Individuals with BMI  $\geq 25.0$  kg/m<sup>2</sup> were classified as overweight or obese (OB) (Steering Committee of International Diabetes Institute, 2000). Systolic/diastolic blood pressure, recorded after a 5 minute rest, was measured by mercury-gravity sphygmomanometers; individuals were classified as having HBP, if either systolic BP was  $\geq 140$  mm Hg or diastolic BP was  $\geq 90$  mm Hg, or if they had been taking medications to control hypertension (Christgau, Palitzsch, Schmalz, Kreiner, & Frenzel, 1998). DM was defined as fasting glucose  $\geq 126$  mg/dl, and HC as blood cholesterol  $\geq 240$  mg/dl (HC) (National Cholesterol Education Program/

National Heart Lung and Blood Institute/National Institute of Health, 2002).

Individuals were grouped by the number of MSCs present. The number of MSCs was classified as 0 (individual was not overweight or OB, did not have DM, HBP, or HC), 1 (at least one of the MSCs was present), or 2 (more than 1 MSCs were present).

#### 2.2.2. Periodontal measurement

Public Health dentists attending an examiner calibration programs performed oral health examinations. Clinical periodontal health was assessed under artificial and natural lighting using a dental mirror, explorer and periodontal probe (PCP-UNC15 Color-Coded probe) by measuring the codes of Community Periodontal Index (CPI) (Ainamo et al., 1982). The CPI system has representative teeth numbered 17, 16, 11, 26, 27, 37, 36, 31, 46, and 47 from each sextant and has four code values from 0 to 4, given as: 0 = no sign of periodontal disease, 1 = bleeding, 2 = calculus formation, 3 = pocket depth 4–5 mm, 4 = pocket depth over 6 mm. Probing depth was measured at the whole pocket base per index tooth. The maximum code value was recorded as the level of that sextant. Subjects with complete dentures were excluded. Individuals were classified as having periodontal disease (CPI score  $\geq 3$ ), or not having periodontal disease (CPI score  $\leq 2$ ).

#### 2.2.3. Statistical analysis

Bivariate analyses of the association between MSCs and CPI were performed using Chi-square test. Logistic regression analysis was applied after adjusting the age and sex, and the odds ratio was then calculated in order to investigate the prevalence of periodontal disease. SPSS for Windows 19.0 was used for statistical analysis.

## 3. Results

### 3.1. Demographic characteristics of subjects

The study sample included 399 subjects, and demographic characteristics are shown in Table 1. The mean age of subjects was 72.3 years and all of them were aged 60 years or older. The percentage of male subjects was 42.9% (171 subjects). The number of people with one or more remaining teeth was 313 persons. Measurement of CPI was performed in this group. 15 subjects (4.8%) had the score of '0', 52 (16.6%) had '1', 164 (52.4%) had '2', 62 (19.8%) had '3', and 20 (6.4%) had '4' in their CPIs.

### 3.2. CPI according to metabolic syndrome components

#### 3.2.1. CPI according to duration and number of metabolic syndrome components

In DM patients with six years or more, 84.3% had a CPI score of '3' or '4'. In DM patients with less than six years, 50% had a score of '3' or '4'. However, only 17.1% of people without DM had a score of

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