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Associations between the number of natural teeth in postmenopausal women and hormone replacement therapy

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ABSTRACT

Objectives: Increasing research suggests that periodontal status is associated with hormone replacement therapy in postmenopausal women. This study was performed to assess the relationship between the number of natural teeth and ever use of hormone replacement therapy in postmenopausal women using nationally representative Korean data.
Methods: Data from the Korea National Health and Nutrition Examination Survey between 2010 and 2012 were used, and the analysis in this study was confined to a total of 4869 respondents over 19 years old who had gone through menopause and who had no missing data for the reproductive factors and outcome variables in that study. The total number of natural teeth was then calculated after excluding third molars. The time of day when tooth brushing was done was recorded as representative oral health behavior. Multiple logistic regression analyses were used to assess association between the number of natural teeth and the use of hormone replacement therapy.
Results: Among participants who had ever used hormone replacement therapy, the proportions (percentage and standard error) with no teeth, 1–9 teeth, 10–19 teeth, 20–27 teeth, and 28 teeth were $5.0 \pm 2.4\%$, $6.7 \pm 1.4\%$, $12.5 \pm 1.7\%$, $18.9 \pm 1.0\%$, and $20.7 \pm 1.6\%$, respectively ($P < 0.05$). The adjusted odds ratio and 95% confidence interval for having fewer than 20 teeth <20 was 0.624 [0.464–0.840] for the individuals using hormone replacement therapy, after adjustments.
Conclusions: The analysis revealed that the use of hormone replacement therapy by postmenopausal women showed positive effects for retention of natural teeth. Lack of hormone replacement therapy may be considered to be an independent risk indicator for tooth loss in Korean postmenopausal women.

1. Introduction

Menopause is the permanent cessation of menstrual cycle after 12 consecutive months of amenorrhea due to loss of ovarian follicular function, and it usually takes place between 45 and 55 years of age [1,2]. Menopause is a particularly influential period during which women have to adapt to a new biological transition [3]. Menopause also is associated with significant adverse changes in the orofacial complex such as decreased unstimulated and stimulated submandibular and sublingual salivary gland flow [4]. Moreover, postmenopausal women with osteoporosis and concurrent periodontitis also are likely to exhibit an exaggerated response to dental plaque, as evidenced by increased bleeding on probing, loss of dentoalveolar bone height, and decreased bone mineral density of the alveolar crestal and subcrestal bone [4,5].

Menopause is also characterized by decreased levels of estradiol as the principal circulating estrogen [1]. Hormone replacement therapy has been applied to treat menopausal symptoms and to reduce the risk for osteoporosis [2]. Increasing research suggests that the better periodontal status is associated with hormone replacement therapy in postmenopausal women [6]. It was reported that hormone replacement therapy was associated with reduced gingival inflammation and a reduced frequency of clinical attachment loss in osteopenic/osteoporotic women in early menopause [6], and the risk for attachment loss may be attenuated by the use of hormone replacement therapy [7]. Moreover, hormone replacement therapy is reported to protect against tooth loss and to reduce the risk of edentulism, and the association of estro-

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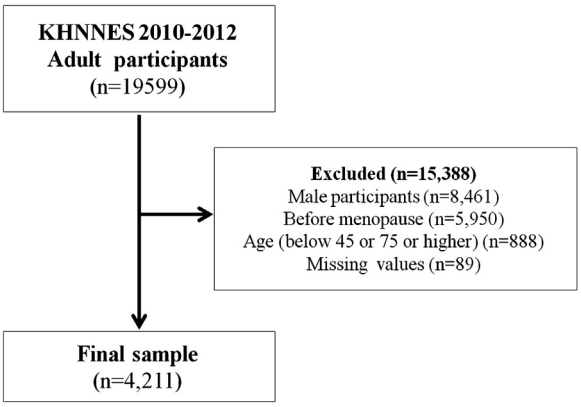

Fig. 1. Participant flow chart.

gen use and tooth retention in incisors, canines, and premolars have been revealed [8]. However, one report showed that long-term hormone replacement therapy was not associated with relevant effects on periodontal status and clinical measures of periodontal disease, thus suggesting that hormone replacement therapy may not confer protection against periodontitis in postmenopausal women [9].

Thus, this study was performed to assess the relationship between the number of natural teeth and ever use of hormone replacement therapy in postmenopausal women using nationally representative data.

2. Material and methods

2.1. Overview of the survey and participants

The data used in this study were derived from the Korea National Health and Nutrition Examination Survey (KNHANES), which was conducted between 2010 and 2012 by the Division of Chronic Disease Surveillance under the Korea Centers for Disease Control and Prevention (KCDC) and the Korean Ministry of Health and Welfare [10]. The KNHANES is a nationwide survey of non-institutionalized civilians that uses a stratified and multi-stage probability-sampling design with a rolling survey-sampling model. The sampling units were based on the population and housing consensus from the 2005 National Census Registry in Korea, which includes age, gender, and geographic area. The sample weights were used to calculate all statistics of this survey. To represent the Korean population with sample participants, sample weights were created, considering survey non-response, complex survey design and post-stratification.

2.2. Menopause and hormone replacement therapy

Initially, a total of 19,599 participated in the KNHANES survey. The number of survey was reduced to 11,138 excluding male participants. The analysis in this study was confined to a total of 4211 respondents aged 46–74 years who had gone through menopause and had no missing values for the reproductive factors and outcome variables (Fig. 1). Ever use of hormone replacement therapy was noted. All participants in the survey signed an informed consent form prior to participation. This survey was reviewed and approved by the Institutional Review Board of the Korea Centers for Disease Control and Prevention.

2.3. Sociodemographic and lifestyle variables

All participants were asked about sociodemographic and lifestyle variables by trained interviewers. Education level was categorized into two groups using the criteria as high school graduate or higher. Monthly household income was divided into quartiles after adjusting for the number of family members. The first-lowest quartile included households with a monthly income <1092.4 USD. Participants were categorized into two groups using the criteria of ≥15 g/day, depending on the amount of alcohol consumed per day for a month before the interview [11]. Smoking status was categorized into two groups in accordance with respondents' answers on the self-report questionnaire: non-smokers and those who had ever smoked. Based on responses to the modified form of the International Physical Activity Questionnaire for Koreans, individuals were regarded as regular physical exercisers if they performed moderate exercise more than 5 times per week for over 30 min per session or performed vigorous exercise more than 3 times per week for over 20 min per session [12].

2.4. Measurements and definition of obesity

Anthropometric measurements were performed by trained staff members. Body weight and height were measured to the nearest 0.1 kg and 0.1 cm, respectively, with participants in light indoor clothing without shoes. Body mass index was calculated as body weight (kg) divided by the squared height (m^2). Waist circumference was measured at the narrowest point between the lower border of the rib cage and the iliac crest in standing position. A body mass index ≥25 kg/m^2 was defined as the presence of obesity [13,14].

2.5. Biochemical measurements

The physical measurements of the participants were taken by trained staff members in the Division of Chronic Disease Surveillance under the Korea Centers for Disease Control and Prevention and the Korean Ministry of Health and Welfare.

A standard mercury sphygmomanometer (Baumanometer; W.A. Baum Co., Inc., Copiague, NY) was used for blood pressure measurement. Systolic blood pressure and diastolic blood pressure were measured twice at 5-min intervals, and the average values were used for the analysis.

To measure concentrations of serum-fasting plasma glucose, total cholesterol, triglycerides and high-density lipoprotein-cholesterol, a blood sample was collected from the antecubital vein of each participant after fasting for >8 h. Blood samples were analyzed within 24 h of transportation. Levels of serum-fasting plasma glucose, total cholesterol, triglycerides and high-density lipoprotein-cholesterol were measured with a Hitachi Automatic Analyzer 7600 (Hitachi, Tokyo, Japan) by enzymatic methods using commercially available kits (Daiichi, Tokyo, Japan) [15].

2.6. Description of metabolic syndrome, diabetes, hypertension and coronary heart disease

Metabolic syndrome was defined according to the American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement criteria for Asians [16]. According to these criteria, three or more of the following criteria must be fulfilled to be diagnosed with metabolic syndrome: waist circumference ≥90 cm in men and ≥80 cm in women; fasting triglycerides ≥150 mg/dL or use of lipid-lowering medication; high-density lipoprotein-cholesterol <40 mg/dL in men and <50 mg/dL in women or use of medication; blood pressure ≥130/85 mm Hg or use of antihypertensive medication; and fasting blood glucose ≥100 mg/dL or current use of anti-diabetes medication [17]. Diabetes was diagnosed when fasting blood sugar was > 126 mg/dL or when the individual was currently using anti-diabetic medications [18]. Hypertension was defined as a systolic blood pressure of >160 mm Hg, a diastolic blood pressure of >90 mm Hg or the current use of systemic antihyper-