Relationship between Metabolic Syndrome and Periodontal Disease in Korean Adults

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Abstract

The purpose of this study was to analyze the effects of metabolic syndrome on Korean adult periodontal disease and was to investigate the relationship between metabolic syndrome, social factors and periodontal disease and to utilize it as a basis for the effective and systematic prevention and management of oral health policy project. The data of the study were analyzed using the data of the National Health and Nutrition Survey of the 6th year of 2015, which is representative of the national sample survey, and those who are over 19 years old who have completed the metabolic syndrome survey and oral examination The main results of metabolic syndrome's factor of judgment, prevalence of periodontal disease was higher in the order of metabolic syndrome, risk group, and normal group. Metabolic syndrome factors have shown that the distribution of periodontal disease prevalence rate was different.

In conclusion, this study suggests that the results of this study can be used as basic data for comprehensive and preventive policy formulation for the development of programs for the improvement of metabolic syndrome, periodontal disease and reduction of social problems caused by chronic diseases.

Keywords: metabolic syndrome, periodontal disease, social factors, Korean adults,

Introduction

Due to high level of medical development and improved standard of living in modern society, average life expectancy has been prolonged and the society is aging. Based on Statistics Korea data, geriatric population in Korea will increase from 14.3% in 2018 to 20.8% in 2026 [1]. Aging can cause weakness of all body functions as well as oral health and there is a rising interest on this [2]. In particular, periodontal disease, a representative oral disease, can cause loss of the teeth and complex health problems if not treated in timely manner [3].

Prevalence rate of periodontal disease in Korean adults has been increased since 2013 [4], has had the highest prevalence rate until 2016 [5], and it has been reported that one in three adults has periodontal disease [6]. Based on these results, periodontal disease should be recognized as a very important disease as its financial burden to both individuals and nation is high.

It has been known that periodontal disease is closely related to metabolic syndrome [7], and it was shown that periodontal disease greatly affects fasting blood glucose, triglyceride, HDL-cholesterol, hypertension, and abdominal obesity [8]. It has been reported that high fasting blood glucose can act as a risk factor causing periodontal disease [9], and there is a significant correlation between dyslipidemia and periodontal disease [10]. In a study on the association between periodontal disease and health status in adults aged between 23 and 83, the association between low HDL cholesterol and periodontal disease was reported [11], and it was confirmed that hypertension patients had a higher prevalence of periodontal disease [12]. In addition, for the abdominal obesity factor, overweight or obese adults had a higher risk of having periodontal disease compared to adults with normal BMI, and periodontal disease prevalence was higher in adults with a larger waist circumference [13]. Periodontal disease risk was about 20% higher in subjects with higher BMI and 3 or more metabolic syndrome factors [14]. For the criteria of metabolic syndrome diagnosis, subjects with metabolic syndrome had a higher risk of periodontal disease than normal group [15], and it showed significantly higher effects on periodontal disease.

Many studies on metabolic syndrome and periodontal disease have been reported continuously and prevalence rate has been increased nationally as well as globally. Although many studies have been continuously conducted on effects of metabolic syndrome and sociodemographic factors on periodontal disease internationally, there are very limited studies on a nationally representative large population in Korea. Therefore, this study used the 6th Korea National Health and Nutrition Examination Survey (2015), a representative study with confirmed reliability, to analyze effects of metabolic syndrome in Korean adults and sociodemographic factors on periodontal disease and to investigate their associations.

Methods

1. Subject selection

The subjects of this study were 5,945 male and female adults aged 19 or older who received health examination, oral examination and periodontal disease examination, and they were categorized into three age groups: young adults (aged 19-29), middle aged adults (aged 30-64), and elderly (aged 65 or older).

2. Data collection and analysis

This study was conducted using the 6th Korea National Health and Nutrition Examination Survey (KNHANES) (2015). KHANES is conducted based on the Article 16 of the National Health Promotion Act proclaimed in 1995 and composed of a health behavior survey, a health interview survey, chronic disease conditions, oral examination, and nutrition survey.

KHANES is a combined form of "Korea National Health Survey" and "Korea National Nutrition Survey" and reliable government accredited statistics based on Article 17 of the Statistics Act, and it is a nationally representative health and nutrition surveillance study. This study selected sociodemographic characteristics, factors consisting metabolic syndrome and their diagnostic criteria, and periodontal disease variables from KHNAES and used according to the study purposes. Statistical analysis of this study was conducted using SPSS 22 (IBM SPSS Statistics 22.0, Chicago, Illinois, USA).

Results

1. Periodontal disease prevalence rates by metabolic syndrome factors

Periodontal disease prevalence rates by metabolic syndrome factors are shown in Table 1. Subjects with hypertension had the highest prevalence rate followed by fast blood glucose, hypertriglyceridemia, abdominal obesity, and low HDL cholesterol in order. Out of 710 subjects with hypertension, 343 (48.3%) had periodontal disease, while 719 (44.1%) of 1,631 subjects with high fasting blood glucose, 562 (42.4%) of 1,326 subjects with hypertriglyceridemia, 690 (40.6%) of 1,698 subjects with abdominal obesity, and 772 (38.6%) of 2,002 subjects with low HDL cholesterol. Periodontal disease prevalence rates by metabolic syndrome factors showed a difference of distribution.

Table 1. Periodontal disease prevalence rates by metabolic syndrome factors

Item	Classification	Frequency	Periodontal disease		χ^2
			Yes (%)	No (%)	
Metabolic syndrome factors	Fast blood glucose (n=4,576) Normal	2,945	833 (28.3)	2,112 (71.7)	116.887***
	Fast blood glucose (n=4,576) Abnormal	1,631	719 (44.1)	912 (55.9)	
	Hypertrigly-ceridemia (n=4,576) Normal	3,205	990 (30.5)	2,260 (69.5)	59.718***
	Hypertrigly-ceridemia (n=4,576) Abnormal	1,326	562 (42.4)	764 (57.6)	
	Low HDL cholesterol (n=4,432) Normal	2,430	725 (29.8)	1,705 (70.2)	37.366***
	Low HDL cholesterol (n=4,432) Abnormal	2,002	772 (38.6)	1,230 (61.4)	
	Hypertension Normal	4,097	1,294 (31.6)	2,803 (68.4)	75.381***
	Hypertension Abnormal	710	343 (48.3)	367 (51.7)	
	Abdominal obesity (n=4,827) Normal	3,129	950 (30.4)	2,179 (45.1)	51.802***
	Abdominal obesity (n=4,827) Abnormal	1,698	690 (40.6)	1,008 (59.4)	

***p<.001

2. Periodontal disease prevalence rates by metabolic syndrome diagnostic criteria

Periodontal disease prevalence rates by metabolic syndrome diagnostic criteria are shown in Table 2. Periodontal disease prevalence rates by metabolic syndrome (n=4,836) diagnostic criteria were shown in order of metabolic syndrome group, risk group, and normal group. Five hundred-thirty-seven (46.3%) of metabolic syndrome group (n=1,159), 853 (35.9%) of risk group (n=2,374), and 251 of normal group (n=1,303) had periodontal disease. Periodontal disease prevalence rate by metabolic syndrome showed a difference of distribution.

Table 2. Periodontal disease prevalence rates by metabolic syndrome diagnostic criteria

Item	Classification	Frequency	Periodontal disease		χ^2
			Yes (%)	No (%)	
Metabolic syndrome (n=4,836)	Normal group	1,303	251 (19.3)	1,052 (80.7)	208.798***
	Risk group	2,374	853 (35.9)	1,521 (64.1)	
	Metabolic syndrome group	1,159	537 (46.3)	622 (53.7)	

***p<.001

Discussion

Periodontal disease is the most common oral disease in Korean adults. While dental caries among oral disease are decreasing, periodontal disease has been increasing [16]. In modern society, what needs our attention as much as periodontal disease is metabolic syndrome accompanying diseases related to 5 consisting factors (glucose, lipid, HDL-C, hypertension, and obesity). Prevalence of metabolic syndrome based on the NCEP-ATP III definition is about 19.8-30.9% worldwide, and prevalence rate increases as age increases [17]. Metabolic syndrome prevalence rate in the US was increased from 23.7% in 1998-1994 [18], to 34.3% in 2003-2006, based on National Health Examination and Nutrition Survey data [19]. Compared to the normal group, group with 3 or more metabolic syndrome factors had a higher risk of periodontal disease, and a group with 4-5 metabolic syndrome factors had a higher risk ratio of paradental pocket depth to clinical bonding loss [20], which was consistent with this study data.

In addition to periodontal disease, it is known that metabolic syndrome increases a risk of cardiovascular disease [21], type 2 diabetes [22], and can cause other chronic diseases [23, 24]. It is known that periodontal disease and loos of teeth are complications of diabetes and insulin resistance, and periodontitis can aggravate blood glucose [25] which can cause diabetes [26]. Therefore, periodontal disease causes diabetes and results in aggravation of blood glucose. Furthermore, hypertriglyceridemia can result in aggravation of periodontal disease, and high blood glucose interrupt inflammation response through deposition of glycosylated product in the tissue including periodontal tissue and stimulation of inflammatory cytokine [27]. Based on this mechanism, periodontal pathogenic bacterial infection can damage periodontal tissue and inflammation-induced cytokine and hormones produced in abundance by hypertriglyceridemia can increase periodontal infection. Furthermore, accumulation of cholesterol and lipid in atrial wall or immune cells causes inflammatory response due to decreased HDL-C level, which eliminate lipid of arterial walls. Therefore, inflammatory

cytokine potentially contributes to insulin resistance and cause periodontal disease [27, 28]. In addition, it was reported that obesity index can be utilized as an index predicting progress of periodontal disease [29, 30]. As such, metabolic syndrome factors (blood glucose, triglyceride, HDL-C, blood pressure, and obesity) affect periodontal disease both directly and indirectly. When the number of factors of metabolic syndrome increases, the effects on periodontal disease risk increased.

Also, chronic diseases of adults cause inflammation to periodontal tissue and lead to disease.

Metabolic syndrome has been increased worldwide. Preventing metabolic syndrome and reduce periodontal disease by managing risk factors of metabolic syndrome, such as lack of exercise, irregular eating habits, smoking, drinking, and stress, are urgent tasks.

This study is meaningful as it reported associations between metabolic syndrome and periodontal disease using a nationally representative and reliable data, KNHANES.

Conclusion

Periodontal disease prevalence rates by metabolic syndrome diagnostic criteria were higher in metabolic syndrome group, risk group, and normal group, in order. It was shown that as the number of metabolic syndrome factors increased, the prevalence rate increased as well. Although there were some differences in periodontal disease rates between metabolic syndrome factors, all of them showed effects. In particular, initial development of periodontal disease can be predicted by metabolic syndrome using human blood index (blood glucose, triglyceride, and HDL-C), blood pressure, and obesity index, which showed an importance of management and prevention.

Overall, it is recommended to focus Korean oral health program on prevention and motivating appropriate oral health management for periodontal disease to be done in daily life using continuous education media is necessary.

Furthermore, systemic oral health education should be given to metabolic syndrome patient with periodontal disease, and oral health policy project and program development through connected projects between government and community along with individual oral health management is urgently needed. In addition, cohort analyzing using big data on the whole nation must conducted to identify causal relationship to apply specific index of oral health by metabolic syndrome to periodontal disease, which will lead to finding scientific treatment methods for patients.

Conflicts of Interest: The authors declare no conflict of interest.

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