



Research Paper

Linkage of Chronic Periodontal Disease to Sexual Function among Middle-Aged Men

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ABSTRACT: The purpose of this study investigated the linkage of chronic periodontal disease to sexual function among middle-aged men in Korea. Chronic periodontal disease is the most common chronic inflammatory disease involving gingival inflammation and the destruction of periodontal tissue. Erectile dysfunction is characterized by the regular or repeated inability to obtain or maintain an erection and also described as a persistent or recurrent inability to have sufficient erection for satisfactory sexual performance. The participants included 500 men aged 30 to 59 living in Daegu, and Gyeongbuk province. All the participants were surveyed on their socio-demographic characteristics, chronic periodontal disease, and international index of erectile function (IIEF) using a self-administered questionnaire. Univariate and multivariate analyses were used to assess the crude and adjusted associations between chronic periodontal disease and sexual function using PASW Statistics 20. In the univariate analysis, the IIEF for the group with chronic periodontal disease (47.28) was significantly lower than that for the group without chronic periodontal disease (52.41) ($p=0.004$). In the multivariate analysis, chronic periodontal disease was also significantly associated with the IIEF ($b=-3.786$, $p=0.039$) and erectile function ($b=-1.672$, $p=0.047$) after adjusting for the socio-demographic characteristics. In this study, chronic periodontal disease was found to have an influence on the sexual function in adult men. This study concludes that chronic periodontal disease influenced on sexual function and associated with erectile function in adult men. Moreover, it is suggested that an effective oral health care program on periodontal treatment would be helpful to improve sexual function among middle-aged men.

KEYWORDS: Chronic periodontal disease, Erectile dysfunction, Questionnaire, Sexual function

I. INTRODUCTION

Chronic periodontal disease is a major oral health problem, which affects a considerable proportion of the adult population. It is a common bacterial-induced inflammatory disease, resulting in resorption of the alveolar bone and eventually alveolar bone destruction¹. Chronic periodontal disease has also been described as inflammation of the periodontium that causes endothelial dysfunction in different organs². Plus, Pizzo et al.³ reported that periodontal pathogens and their products, as well as inflammatory mediators produced in periodontal tissues, can enter the bloodstream, causing systemic effects to systemic diseases⁴. Based on this mechanism, chronic periodontal disease has been suggested as a risk factor for cardiovascular diseases associated with atherosclerosis, bacterial endocarditis, diabetes, respiratory disease, preterm delivery, rheumatoid arthritis, and metabolic^{5,6}.

Erectile dysfunction, a male systemic disease, is estimated to affect at least 150 million people worldwide, and this number is likely to increase to 300 million by 2025⁷. In Korea, it is also expected that the number of erectile dysfunction patients will continue to increase due to physical fatigue and psychological stress from the complex modern life after industrialization⁸. As of 2010, an estimated 1.2 million patients are suffering from erectile dysfunction in Korea⁹.

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As chronic periodontal disease and erectile dysfunction have common risk factors, an epidemiological and pathophysiological association between chronic periodontal disease and erectile dysfunction has already been hypothesized¹⁰. Furthermore, it is widely understood that periodontal disease is a chronic infectious disease caused by bacterial biofilm, and associated with erectile dysfunction as well as endothelial disorder¹¹. However, the relation of oral health to sexual function has not been extensively investigated with epidemiological study data¹². In particular, as Korea is a conservative society, studies dealing with issues related to personal sexuality have been rarely investigated.

Accordingly, this study investigated the linkage of chronic periodontal disease to sexual function including erectile dysfunction among middle-aged men in Korea. Plus, this study provides evidence that an appropriate oral health care program could be helpful for sexual function in adult men.

II. MATERIALS AND METHODS

2.1 Subjects

Five hundred men aged 30 to 59 were recruited and interviewed using self-administrated questionnaires. Written consent was obtained from all the survey participants, and the study protocol approved by the Ethical Committee of Daegu Oriental Hospital, Daegu Haany University (IRB NO: DHUMC-D-14009-PRO-01).

2.2 Survey instruments

The questionnaire consisted of 34 questions divided into 3 sections and surveyed information on chronic periodontal disease (13 questions), sexual function (15 questions), and socio-demographic characteristics (5 questions).

2.2.1 Chronic periodontal diseases

The self-administered chronic periodontal disease questions covered symptoms, signs of periodontal status, and oral health behavior¹³. A multiple logistic regression analysis was then performed to identify the questions that were potential predictors of chronic periodontal disease. Those variables that met a $p < 0.10$ criterion were included in a subsequent logistic regression. Finally, a logistic equation was created to predict the possibility of chronic periodontal disease using the evaluation dataset previously reported by Jin et al¹³. The probability calculated for each survey participant using the equation in the final logistic model was then used to determine the presence or absence of chronic periodontal disease.

2.2.2 Erectile dysfunction

Sexual function is normally assessed using the International Index of Erectile Function (IIEF) questionnaire¹⁴. This study used a Korean version of the IIEF questionnaire modified by Choe et al.¹⁵ for Korean adult men. Consisting of 15 questions (Q1~Q15), the participants were asked about the effects of erection problems on their sex life with their partner during the prior four weeks. The total IIEF score for each survey participant was calculated by summing up all the responses (Q1~Q15), where the scores ranged from 5 to 75. As an IIEF subscale, the erectile function was calculated by summing up the responses for questions Q1~Q5 and Q15, where the scores ranged between 1 and 30. As a result, higher IIEF and erectile function scores indicated a lower level of sexual function. Cronbach's alpha was 0.967 for the IIEF score and 0.936 for the erectile function score.

2.2.3 Socio-demographic characteristics

The participants' socio-demographic characteristics were considered as covariates, including age, years of schooling, monthly household income, systemic disease, and intake of health supplement food.

2.3 Statistical analysis

The prevalence of chronic periodontal disease according to the socio-demographics characteristics was tested using a chi-squared test and the mean difference of sexual function was confirmed using a t-test procedure for with/without chronic periodontal disease. A multiple regression analysis was also used to assess the association between chronic periodontal disease and sexual function after adjusting for the socio-demographics characteristics. The statistical analyses were performed using PASW Statistics 20.0 (IBM Co., Armonk, NY, USA), and a p -value < 0.05 was considered statistically significant.

III. RESULTS

3.1 Socio-demographic characteristics of the respondents

Table 1 summarizes the socio-demographic characteristics of the respondents. The age distribution was 29.4% (147/500) in their 30s, 36.8% (184/500) in their 40s, and 33.8% (169/500) in their 50s. For the years of schooling distribution, 28.6% (143/500) had equal or less than 12 years, 22.4% (112/500) had 13~15 years, and 19.0% (245/500) had equal or more than 16 years. The monthly household income distribution was 8.8% (44/500) earned less than 2,000 thousand Korean won, 21.4% (107/500) earned 2,000~2,999 thousand won, 31.0% (155/500) earned 3,000~3,999 thousand won, and 38.8% (194/500) earned equal or more than 4,000

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thousand won. Plus, 32.2% (161/500) had a systemic disease, and 29.0% (145/500) took health supplement foods.

Table 1. Socio-demographic characteristics of survey participants

Characteristics	N (%)
Total	500(100.0)
Age (years)	
30~39	147(29.4)
40~49	184(36.8)
50~59	169(33.8)
Years of schooling (years)	
≤12	143(28.6)
13~15	112(22.4)
≥16	245(49.0)
Household income (1,000 won/month)	
< 2,000	44(8.8)
2,000~2,999	107(21.4)
3,000~3,999	155(31.0)
≥4,000	194(38.8)
Systemic disease	
Yes	161(32.2)
No	339(67.8)
Health supplement foods	
Yes	145(29.0)
No	355(71.0)

2. Mean scores and distribution of sexual function

Table 2 presents the mean scores and distribution of sexual function. The IIEF and erectile function means were 50.70 (SD 18.86) and 21.95 (SD 8.69), respectively. Moreover, 65.4% (327/500) had no erectile dysfunction. The severity of erectile dysfunction was distributed as follows: severe 11.4%, moderate 5.6%, moderate to mild 5.4%, mild 12.2%, and normal 65.4%, respectively.

Table 2. Scores and distribution of erectile dysfunction

	Scores*	Distribution**				
		Severe	Moderate	Moderate to mild	Mild	Normal
IIEF	50.70±18.86	-	-	-	-	-
Erectile function	21.95± 8.69	57(11.4)	28(5.6)	27(5.4)	61(12.2)	327(65.4)

IIEF: International Index of Erectile Function
 * Mean standard deviation of IIEF (min=5, max=75) and erectile function (min=1, max=30)
 ** N(%), respondents were categorized as severe (erectile function≤7), moderate (8≤erectile function≤11), moderate to mild (12≤erectile function≤16), mild (17≤erectile function≤21), and normal (erectile function≥22) (Rosen et al, 1999)

3. Prevalence of chronic periodontal disease according to the socio-demographic characteristics

Table 3 shows the prevalence of chronic periodontal disease according to the socio-demographic characteristics. In total, the prevalence of chronic periodontal disease was 33.4% (167/500). The prevalence of chronic periodontal disease according to age was 16.3%, 29.9%, and 52.1% in their 30s, 40s, and 50s, respectively. The prevalence of chronic periodontal disease showed an increasing tendency with age that was statistically significant (p<0.001). For the years of schooling, the prevalence of chronic periodontal disease was 44.1% for

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equal or less than 12 years, 34.8% for 13~15 years, and 26.5% for equal or more than 16 years. Thus, the prevalence of chronic periodontal disease showed a decreasing tendency according to the years of schooling that was statistically significant ($p=0.002$). Notwithstanding, the prevalence of chronic periodontal disease did not show any significant difference according to the household income ($p=0.379$), systemic disease ($p=0.095$), and the intake of health supplement foods ($p=0.987$).

Table 3. Prevalence of chronic periodontal disease according to socio- demographic characteristics

	Chronic periodontal disease		p-value
	Yes	No	
Total	167 (33.4)	333(66.6)	
Age (years)			
30~39	24(16.3)	123(83.7)	<0.001
40~49	55(29.9)	129(70.1)	
50-59	88(52.1)	81(47.9)	
Years of schooling (years)			
≤ 12	63(44.1)	80(55.9)	0.002
13~15	39(34.8)	73(65.2)	
≥ 16	65(26.5)	180(73.5)	
Household income(1,000 won/month)			
< 2,000	18(40.9)	26(59.1)	0.366
2,000~2,999	37(34.6)	70(65.4)	
3,000~3,999	44(28.4)	111(71.6)	
$\geq 4,000$	68(35.1)	126(64.9)	
Systemic disease			
Yes	62(38.5)	99(61.5)	0.095
No	105(31.0)	234(69.0)	
Health supplement foods			
Yes	45(31.0)	100(69.0)	0.474
No	122(34.4)	233(65.6)	

Values are presented as N(%)

p-values determined by chi-square test

4. Mean differences of IIEF and erectile function according to chronic periodontal disease

Table 4 shows the mean differences of sexual function according to chronic periodontal disease. The IIEF score for the group with chronic periodontal disease (47.28) was significantly lower than that for the group without chronic periodontal disease (52.41) ($p=0.004$). Moreover, the erectile function score for the group with chronic periodontal disease (20.40) was also significantly lower than that for the group without chronic periodontal disease (22.73) ($p=0.005$).

Table 4. Mean differences of IIEF and erectile function according to chronic periodontal disease

	Chronic periodontal disease		p-value
	Yes	No	
IIEF	47.28 \pm 19.03	52.41 \pm 18.57	0.004
Erectile function	20.40 \pm 8.90	22.73 \pm 8.49	0.005

IIEF: International Index of Erectile Function

Values are mean \pm standard deviation

p-values were determined by t-test procedure

5. Association between chronic periodontal disease and sexual function A multiple regression analysis was carried out to examine the association between chronic periodontal disease and sexual function after adjusting for the socio-demographic characteristics, and the results are summarized in Table 5. For IIEF, the fitted regression model was statistically significant ($F=4.565$, $p<0.001$), and accounted for 6.7% of the total variation in IIEF (Adjusted $R^2=0.067$). Moreover, chronic periodontal disease was significantly associated with IIEF after adjusting for the socio-demographic characteristics. The IIEF for an individual with chronic periodontal disease was on average 3.786 points lower when compared to an individual without chronic periodontal disease ($b=-3.786$, $p=0.039$). For erectile function, the fitted regression model was statistically significant ($F=4.810$, $p<0.001$), and accounted for 9.0% of the total variation in erectile function (Adjusted $R^2=0.090$). Moreover,

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chronic periodontal disease was significantly associated with erectile function after adjusting for the socio-demographic characteristics. The erectile function of an individual with chronic periodontal disease was on average 1.672 points lower than that of an individual without chronic periodontal disease ($b=-1.672$, $p=0.047$).

Table 5. Association between chronic periodontal disease and sexual function

	IIEF			Erectile function		
	b	SE	p-value	b	SE	p-value
Chronic periodontal disease						
No	Ref.			Ref.		
Yes	-3.786	1.826	0.039	-1.672	0.840	0.047
Age (years)						
30~39	Ref.			Ref.		
40~49	2.394	2.149	0.266	0.820	0.988	0.407
50~59	-1.821	2.400	0.448	-1.056	1.104	0.339
Years of schooling (years)						
≤12	Ref.			Ref.		
13~15	2.885	2.389	0.228	1.142	1.098	0.299
≥16	1.804	2.116	0.394	0.767	0.973	0.431
Household income(1,000 won/month)						
< 2,000	Ref.			Ref.		
2,000~2,999	5.323	3.296	0.107	2.631	1.515	0.083
3,000~3,999	9.583	3.196	0.003	4.355	1.470	0.003
≥4,000	11.417	3.198	<0.001	5.724	1.470	<0.001
Systemic disease						
No	Ref.			Ref.		
Yes	-1.007	1.837	0.584	-0.597	0.844	0.480
Health supplement foods						
No	Ref.			Ref.		
Yes	3.507	1.845	0.058	1.721	0.848	0.043

IIEF: International Index of Erectile Function

b: Estimated coefficient, SE: Standard error

Ref: reference category

IV. DISCUSSION

One serious health problem encountered by middle-aged adult males is erectile dysfunction, leading to an unsatisfactory sex life¹⁶. As a result of studies on the association of male sexual function and hormonal change¹⁷, it has been identified that hormonal change has an important relationship with systemic diseases, as well as erectile function¹⁸.

Erectile dysfunction and chronic periodontal disease have similar risk factors, such as aging, smoking, diabetes, and cardiovascular diseases¹⁹. Plus, Zadiket al.²⁰ previously reported that adult males with chronic periodontal disease showed a higher prevalence of erectile dysfunction, and that chronic periodontal disease and erectile function were connected to each other.

According to Zadiket al.²⁰, chronic periodontal disease with an alveolar bone loss of 6 mm or more was significantly more prevalent among young men with milder erectile dysfunction. While alveolar bone loss was not radiographed in the current study, our findings also showed an association of chronic periodontal disease and erectile dysfunction after adjusting for age, years of schooling, household income, systemic disease, and health supplement foods. Consequently, these results indicate that the two diseases would seem to have common risk factors, along with similar symptoms, and may act as markers of disease progression^{21, 22}.

According to the IIEF criteria, a score above 22 represents a normal erectile function. In this study, the mean erectile function score was 21.95 ± 8.69 points, indicating that the majority of the respondents had a normal erectile function. Notwithstanding, despite the selection bias by convenient sampling, the association between erectile function and chronic periodontal disease showed significant differences according to age, years of schooling, household income, and health supplement foods.

Zadiket al.²⁰ also reported that chronic periodontal disease and erectile dysfunction could be the first symptom of atherosclerosis and endothelial dysfunction, as patients with chronic periodontal disease also showed an increased inflammatory level. Furthermore, since the pathogens and their related products involved in periodontal disease can directly affect endothelium function²³, an association was already suggested between erectile dysfunction and periodontal disease variables²⁴. In a study by Eltas, A et al.²⁵ treatment of periodontal disease was found to reduce the risk of erectile dysfunction associated with endothelial dysfunction, plus Oguz, F et al.²⁶ reported that 53% of male adults with erectile dysfunction developed inflammation in their periodontium, while only 23% of male adults without erectile dysfunction developed periodontitis. In the current study that was adjusted for confounding variables, including age, body mass index (BMI), household income, and years of schooling, it was found that male adults with severe periodontal disease had a 3-fold higher risk of erectile dysfunction than male adults with a healthy periodontium²⁷. Plus, after adjusting for socio-demographic characteristics, including age, years of schooling, household income, systemic disease, and health supplement foods, it was found that chronic periodontal disease worsened by 1 unit, while erectile function decreased by 1.672 points. These results are consistent with the results of previous studies.

However, the present study has various limitations for generalizing the association between chronic periodontal disease and the sexual function of Korean male adults. No pathophysiological association between the two diseases was identified in this study, and an evidence base is needed to investigate the relationship between the two diseases. Plus, while chronic periodontal disease is known to cause erectile dysfunction through endothelial dysfunction²⁹, this study did not evaluate the degree of endothelial dysfunction or accurately determine the case severity of the periodontal disease. Furthermore, as most respondents reflected high-level socio-demographic characteristics, this may have caused selection bias, leading to underestimation in the analysis. Moreover, since the association between chronic periodontal disease and sexual function involves sensitive questions, the respondents may have been unwilling to answer about their private life or reported an exaggerated sexual life. Thus, further studies are needed where the degree of erectile dysfunction is measured by urologists, while chronic periodontal disease is measured using objective methods, such as a dental plaque index, bleeding, the depth of the pocket depth, and loss of clinical attached gingiva. Yet, despite these limitations, the current study is still meaningful, suggesting an association between chronic periodontal disease and sexual function that has not been previously studied in Korea.

V. CONCLUSIONS

The results of this study revealed that chronic periodontal disease is independently associated with sexual function in Korean adult men. Thus, an effective oral health care program for periodontal treatment may be helpful for improving sexual function in men, while maintaining good oral health can be an important preventive medicine for erectile dysfunction.

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