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<Original Article>

Association of Erectile Dysfunction with Chronic Periodontal Disease

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Running title. ED and Chronic Periodontal Disease

Abstract

To examine the relationship between chronic periodontal disease (CPD) and erectile dysfunction (ED), the interview sheet including the CPD self-checklist (CPD score) and the 5-item version of the International Index of Erectile Function (IIEF-5) was distributed to 300 adult men who received a comprehensive dental examination. Statistical analyses were performed by the Spearman's rank correlation coefficient and other methods. Statistical significance was accepted at the level of $P<0.05$. The interview sheets were collected from 88 men (response rate 29.3%, 50.9 ± 16.6 years old). There was a statistically significant correlation between the CPD score and the presence of ED ($P=0.0415$). The results in the present study suggest that ED is related to the damage caused by endothelial dysfunction and the systematic inflammatory changes associated with CPD. The present study also suggests that dental health is important as a preventive medicine for ED.

Introduction

The metabolic syndrome (MetS) describes the combination, or clustering of several metabolic abnormalities or risk factors, including central obesity, dyslipidemia, hypertension, insulin resistance with compensatory hyperinsulinemia and glucose intolerance. The linkage between MetS and erectile dysfunction (ED) has been highlighted by many studies.[1-3] MetS and ED are suggested to share common pathophysiological factors including insulin-resistance, endothelial dysfunction and systemic inflammatory disease.

Chronic periodontal disease (CPD), also called *chronic periodontitis* or *chronic periodontal inflammation*, is a common bacterial-induced inflammatory disease, resulting in resorption of the tooth-bearing alveolar bone and eventually shedding of the involved teeth.[4] It has been discovered that CPD is associated with systemic diseases, such as MetS,[5-7] coronary heart disease,[8,9] and CPD is associated with endothelial dysfunction.[10] Because CPD and ED share common risk factors, the epidemiological and pathophysiological linkage between CPD and ED is quite possible. However, there have been only a few reports that suggest the association between CPD and ED.[11,12] Therefore, the aim of the present study was to further examine the relationship between CPD and ED.

MATERIALS AND METHODS

The interview sheet for CPD and ED was distributed to 300 adult men who received a comprehensive dental examination and had ability to answer the interview sheet at our hospital and dental clinics in Asahikawa city, Japan. The interview sheets were collected by the mail. Included were all men who filled the

interview questionnaire. Excluded were men who did not fill the interview questionnaire. This study was approved by Asahikawa Medical University Ethical Committee and carried out in accordance with the principles of the Declaration of Helsinki.

Chronic Periodontal Disease self-check sheet (APPEDIX)[13]

CPD self-check sheet was used to detect CPD and assess its severity. The questionnaire consists of 15 questions (Q) on symptoms. If the answer to each question is *yes*, Q1 is multiplied by 5, Q2 and Q3 are multiplied by 6, Q4 to Q6 are multiplied by 7, Q7 to Q9 are multiplied by 8, and Q10 to Q15 are multiplied by 10. CPD severity is classified into four categories based on the total score of CPD self-check sheet, namely 0 to 9; little possibility of periodontitis, 10 to 30; a possibility of periodontitis, 31 to 70; necessary to check it in dentist's office, 71 and more; considerably advanced symptoms and treatment is necessary.

International Index of Erectile Function (IIEF) 5 Questionnaire[14]

The IIEF-5 questionnaire was used to detect ED and assess its severity. This questionnaire consists of five items, each rated on a 6-point scale from 0 to 5, except for one item which is rated on a 5-point scale from 1 to 5. The final score, ranging from 1 to 25, is calculated by summing up individual scores. Scores above 21 represent normal erectile function and scores at or below this cutoff represent ED. ED severity is classified into four categories based on the IIEF-5 scores, namely 1 to 7; severe ED, 8 to 11; moderate ED, 12 to 16; moderate to mild ED, 17 to 21; mild ED, 22 and above; no ED.

Statistical Analysis

Continuous variables were expressed by mean +/- standard deviation (SD). Statistical analyses were performed by the Spearman's rank correlation coefficient method, Cochran-Armitage test, and Jonckheere-Terpstra trend test. Statistical significance was accepted at the level of $p<0.05$. Data were analyzed by SPSS 15.0 (SPSS, Inc., Chicago, IL, USA).

RESULTS

The interview sheet was collected from 88 men (response rate 29.3%, age 50.9 ± 16.6 years old ranging from 20 to 85).

Correlation of age with CPD score and ED domains.

There was no statistically significant correlation between the age and CPD score (P=0.0581). However, there was a statistically significant correlation between the age and ED domains (each domain and total score of IIEF-5) (all; $p<0.0001$). (Data not shown).

Relationship between CPD score and ED domains (IIEF-5) (Table 1).

Statistically significant correlation was only noted between the CPD score and the ability to keep an erection (Q1 of IIEF-5) ($p=0.0223$).

Relationship between CPD and ED (Table 2).

There was no statistically significant correlation between the CPD score and the severity of ED ($p=0.1114$) **(Table 2A)**. However, there was a statistically significant correlation between the CPD score and the presence of ED ($p=0.0415$) **(Table 2B)**.

DISCUSSION

We examined the relationship between CPD and ED using outpatient interview sheets at dental clinics in Asahikawa city, Japan. The risk of ED is related to many factors, including age, smoking, diabetes, heart disease, depression, and hypertension.[15] Periodontal medicine is an emerging concept which deals with the association between CPD and systemic diseases, such as coronary heart disease, cerebrovascular disease, diabetes, smoking, and chronic obstructive pulmonary disease.[4] Recently, a few studies reported possible association of ED with CPD.[11,12] ED and CPD share risk factors and are associated systemic conditions encompassing systemic inflammation, endothelial dysfunction, and atherosclerosis such as MetS.[1-8] Maekawa et al reported that periodontal infection itself does not cause atherosclerosis, but accelerates it by inducing systemic inflammation and deteriorating lipid metabolism and might contribute to the development of coronary heart disease.[16] Billups suggests that ED is an early sign of coronary heart disease.[17] Taken together, it is reasonable to believe that systemic inflammation induced by periodontal pathogens might be associated with endothelial dysfunction and atherosclerosis first in the small vessels such as the penile vasculature, and later in larger arteries such as the coronaries. Interestingly, 6 months after intensive periodontal treatment, the improved oral health was associated with improvement of endothelial function.[18] Thus dental health seems to be important as a preventive medicine for ED.

In the present study, the CPD score was associated with the presence of ED. Among ED domains, statistically significant correlation was only noted

between the CPD score and the ability to keep an erection (Q1 of IIEF-5). The CPD self-check sheet used is Japanese, because the subjects of this study were Japanese men, and the original is in Japanese.[13] CPD self-check sheet [Appendix] is an English translation of the original content of the CPD self-check, and is not validated. The international validated CPD self-check does not exist, so we accepted the questionnaire generally used in Japan. Due to the small number of patients and the fact that data was gathered only by interview sheets, it is not clear whether this association is independent of risk factors, such as MetS. We assume that CPD is associated with ED just as it is associated with MetS, and that CPD might be an implication of possible ED in men. We believe that chronic inflammation and endothelial dysfunction create a linkage between CPD and ED. This is a preliminary study to show whether Japanese men show similar results as other reference literature.[11,12] And, these results showed that there was comparable result by the Japanese men. A large-scale study with confounder analysis and a longitudinal follow-up is warranted.

In conclusion, there is a statistically significantly correlation between CPD and ED. The present study suggests that ED is related to the damage caused by endothelial dysfunction and the systematic inflammatory changes associated with CPD.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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APPENDIX

CPD self-check sheet[13]

Did you have any artificial tooth treatment after tooth extraction?	[5]	yes/no
When you drink water, do you feel the pain in teeth and gums?	[6]	yes/no
When getting up in the morning, is it sticky in the mouth?	[6]	yes/no
Do you feel gums itchy?	[6]	yes/no
Are you anxious about foul breath?	[7]	yes/no
Is food got in easily to interdental spaces?	[7]	yes/no
Is the gum swollen in red?	[8]	yes/no
Are the dental plaque and tartar attached to teeth?	[8]	yes/no
Does blood attach to the tooth brush when the tooth polish is done?	[8]	yes/no
Do your teeth seem to have become long than before?	[9]	yes/no
Does blood go out of the gum naturally?	[10]	yes/no
Is there continued pain in the gum?	[10]	yes/no
Does the pus come out when the gum is pushed?	[10]	yes/no
Do you feel that teeth shake or the spaces of teeth extended?	[10]	yes/no
Do you feel that food cannot be bitten well because teeth move?	[10]	yes/no

Judgment standard

- *0-9 point: There is little possibility of periodontitis.*

- *10-30 point: There is a possibility of periodontitis.*

- *31-70 point: It is necessary to check it in the dentist's office.*

- *71 points or more: The symptom has advanced considerably. Treatment necessary.*

TABLE LEGENDS

Table 1. Relationship between CPD score and ED domains (IIEF-5), analyzed Correlation coefficient Spearman's methods. ED domains were questionnaire with IIEF-5.

Table 2. Relationship between CPD score and ED. **(A)** between the CPD score and the severity of ED by Jonckheere-Terpstra trend test, **(B)** between the CPD score and the presence of ED by Cochran-Armitage test.

Table 1.

	Spearman's method	
	Correlation coefficient	**_p_-value**
IIEF-5	1. Erectile function	-0.24346	0.0223*
	2. Orgasm function	-0.1676	0.1186
	3. Sexual desire	-0.13828	0.1989
	4. Intercourse satisfaction	-0.13603	0.2063
	5. Overall satisfaction	-0.07236	0.5029
	total score	-0.19208	0.0730

*; _p_<0.05

Table 2.

A

CPD	complete ED		moderately ED		mild - mod. ED		mild ED		ED (-)		Total	Jonckheere-Terpstra method
	N	%	N	%	N	%	N	%	N	%	N	
little possibility of CPD	1	5.9	1	5.9	1	5.9	5	29.4	9	52.9	17	
a possibility of CPD	2	4.8	5	11.9	4	9.5	12	28.6	19	45.2	42	*p*=0.1114
necessary to check CPD in the dentist's office	1	4	1	4	4	16	10	40	9	36	25	
advanced considerably. Treatment necessary	0	0	2	50	1	25	1	25	0	0	4	

B

CPD	ED (+)		ED (-)		Total	Cochran-Armitage method
	N	%	N	%	N	
little possibility of CPD	8	47.1	9	52.9	17	
a possibility of CPD	23	54.8	19	45.2	42	*p*=0.0415*
necessary to check CPD in the dentist's office	16	64	9	36	25	
advanced considerably. Treatment necessary	4	100	0	0	4	

*; $p < 0.05$