

Study on the Relationship Trend between Chronic Diseases and Oral Health according to Diabetes Treatment: Focusing on the Local Health Survey for 2015, 2016 and 2017

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Abstract

Background/Objectives: This study intended to examine the needs of oral care and to provide the basic data required to develop related products through the trend analysis on the relation between the chronic disease and the oral health according to the diabetes treatment.

Methods/Statistical analysis: 458,301 research subjects older than 45 years were selected by requesting the raw data of 2015, 2016 and 2017 local community health survey. For the data analysis, the statistical software R program was used, and the significant level was less than 0.05.

Findings: In case of having diabetes, it was shown that the hypertension, arthritis, depression etc. were significantly high out of the chronic disease and the subjective health level was also poor ($p < 0.001$). In the oral health, in case of having diabetes, as the subjective oral health level was poor such as subjective periodontal tissue health level was poor and the mastication was inconvenient and the subjective oral health level was poor.

Improvements/Applications: For the patient with diabetes, diverse measures for the management of complications of the chronic disease and oral health care should be prepared at national level for the systematic oral health care.

Keywords: Diabetes, Oral health, Chronic diseases, Trend analysis, Local community health survey.

Introduction

Diabetes is the metabolic disease having characteristics of high blood sugar and occurs by the lack of the insulin resistance and the insufficient insulin secretion [1]. Diabetes occurs in about 9 million people around the world every year and as a result, it is estimated that 80% of the patients die [2]. Diabetes causes the chronic complications such as atherosclerosis, stroke, renal diseases, retinopathy, oral diseases, etc. As the chronic disease such as diabetes, hypertension, cardiovascular disease, etc. occurs in the adult, the

research on the relation with periodontal disease is being increased [3, 4]. The preceding researches reported that the periodontal disease has relation with cardiovascular disease and osteoporosis [5], and the blood pressure is high when having periodontal diseases than when does not having periodontal disease [6]. In addition, it was reported that the prevalence of the periodontal disease was higher in the people having diabetes [7], and the people having chronic diseases have poor periodontal condition compared to the normal people [8]. Through diverse epidemiological researches, it is known that the longer the diabetes is the possibility of the periodontal disease occurrence is high and the destruction of periodontal tissue is severe in the patient with diabetes after 30 years of age [9]. The inflammation by the diabetes accelerates the damage to the tissues

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in the surrounding area of tooth [10] and the high blood sugar increases the inflammation of periodontal tissue by changing the capillaries in the whole body and the gingiva [11]. As recently, the chronic diseases such as diabetes, metabolic syndrome, cardiovascular disease, hypertension, etc. which occur commonly in the adults of middle age and old age, are increased, the research on the relation with periodontal disease is being increased but the research at the national level is not sufficient. Therefore, this study intended to examine the needs of oral care and to provide the basic data required to develop related products through the trend analysis on the relation between the chronic disease and the oral health according to the diabetes treatment.

Method

458,301 research subjects older than 45 years were selected by requesting the raw data of 2015, 2016 and 2017 local community health survey. For the data analysis, the statistical software R program was used, and the significant level was less than 0.05. For the general characteristics of the research subjects, chi-square test was performed for the age, education level,

marital status and the income according to the gender and the trend analysis by year was analyzed with linear by linear association. The logistic regression analysis for the chronic disease and oral health was performed by taking the diabetes treatment as dependent variable.

Result and Discussion

1. General Characteristics

In the results of analyzing the general characteristics by gender, for the age, the male was 121,281 persons (60.1%) occupying the highest proportion (p<0.001). In the education level, the male graduated the college or higher was 128190 persons (41.7%) occupying the highest proportion (p<0.001). In the marital status, the male having spouse was 171,709 persons (85.4%) the most and the female having spouse, divorced, widow and separate woman in order were shown significantly (p<0.001). In the household income, the male and female from 1 million won to 3 million won were 75,178 persons (37.6%) and 88,178 persons (34.6%), the most, followed by the female and the male with less than 1 million and the male from 3 million won to 5 million won, in order (p<0.001) [Table 1].

Table 1. General Characteristics

Variable	Categories	Gender		Unit: N(%)
		Male	Female	
Age	45 ~ 64 years old	121281	60.1	141522
	65 ~74 years old	47598	23.6	60452
	75 years old or older	32835	16.3	55102
Education	uneducated	6951	2.3	40360
	elementary school	41371	13.4	80565
	middle school	35529	11.5	40782
	high school,	95585	31.1	96948
	college or higher	128190	41.7	117099
Marital status	single	6959	3.5	3392
	have spouse	171709	85.4	166456
	divorced, separated, widow	22380	11.1	86030
Household income	ess than 1 million won	47343	23.7	85110
	1 million to less than 3 million won	75178	37.6	88178
	3 million to less than 5 million won	47043	23.5	49538
	more than 5 million won	30226	15.1	31806
Occupation	administrative management job	21050	10.4	14735
	office job	13339	6.6	7875
	sales and service job	16420	8.2	37342
	agriculture and fisheries	41847	20.8	36855
	simple technical job	54386	27.0	33141
	homemaker or unemployed, others.	54000	26.8	126856
	etc.	399	0.2	56
Total		201441	44.0	256860

2. Chronic Disease according to Diabetes

The case that does not have hypertension in the group without diabetes was 273,487 persons (69.2%), showing significantly high and the case having hypertension in the group having diabetes was 38,887 persons (61.9%) showing significantly high. For the arthritis, the subject having arthritis in the group without having diabetes was 348,725 persons (88.2%) showing significantly high and the subject having arthritis in the group having diabetes was 10,921 persons (17.3%) (p<0.001). For the depression, the case that does not have depression in

the group without having diabetes was 348,725 persons (88.2%) showing significantly high and the subject who receives the psychological counseling in the group having diabetes was 1,015 persons (1.6%) (p<0.001). For the stress psychological counseling, the subject who does not have diabetes and does not receive the psychological counseling was 388,000 persons (98.3%) showing significantly high and the subject who is receiving the psychological counseling without having diabetes was 6,714 persons (1.7%) the lowest (p<0.001) [Table 2].

Table 2. Chronic Disease according to Diabetes

Variable	Categories	Diabetes Treatment				Total		Unit: N(%)
		Treatment		Not Treatment				
Hypertension Treatment								p=0.000
	Yes	38887	61.9	121668	30.8	160555	35.1	
	No	23947	38.1	273487	69.2	297434	64.9	
Arthritis Treatment								p=0.000
	Yes	10921	17.3	46540	11.8	57461	12.5	
	No	52281	82.7	348725	88.2	401006	87.5	
Psychological counseling due to depression								p=0.000
	Yes	1015	1.6	4323	1.1	5338	1.2	
	No	62176	98.4	390802	86.3	452978	98.8	
Psychological counseling by the stress								
	Yes	1404	2.2	6714	1.7	8118	1.8	
	No	61607	97.8	388000	98.3	449607	98.2	
Total		63011	13.8	394714	86.2	457725	100.0	

3. Oral Health and Oral Health Practice Trend of Person having Diabetes by Year

In the subjective oral health level, the proportion of the subject having diabetes who answered “Poor” was high but showed the decreasing trend (p<0.001). For the experience of mastication inconvenience, the proportion of “Inconvenient” was shown decreasing trend (p<0.001). For the form of using prosthesis, the proportion “I have both upper and lower prosthesis” showed the decreasing trend (p<0.001). toothbrushing showed the decreasing trend (p<0.001). In the tooth brushing after breakfast, the trend not having breakfast was increased and toothbrushing showed the decreasing trend (p<0.001). The toothbrushing after lunch showed the increasing trend (p<0.001). Toothbrushing after dinner and before sleep showed the increasing trend

(p<0.001) [Table 3].

4. Annual Trend of Reason Not Receiving Annual Oral Examination and Required Dental Treatment of Person having Diabetes

For the annual oral examination, the subject without having diabetes who did not receive examination was 317,425 persons (80.3%) the most (p<0.001). For the reason not receiving required dental examination excluding the case of not avoiding the examination, the subject having diabetes who did not receive examination by the economical reason was 5,110 persons (8.1%) showing significantly high (p<0.001). In the trend by year, the proportion of the subject who does not receive the examination while having diabetes showed the significantly increasing trend (p<0.001). Although the

reason of not receiving required dental treatment was economical but it showed the decreasing trend ($p < 0.001$) [Table 4].

Table 3. Oral Health and Oral Health Practice Trend of Person having Diabetes by Year Unit: N(%)

Variable	Categories	Diabetes				Trend of Subject having Diabetes by Year					
		Yes		No		2015		2016		2017	
Subjective Oral Health Level				p=0.000							p=0.000
	Good	8890	14.1	77580	19.6	3020	14.6	2906	13.4	3512	15.0
	Fair	17331	27.4	141049	35.7	5531	26.8	6040	27.9	6839	29.3
	Poor	37007	58.5	176788	44.7	12109	58.6	12721	58.7	13027	55.7
Experience of mastication inconvenience				p=0.000							p=0.000
	Inconvenient	26326	41.6	118338	29.9	8795	42.6	2721	42.0	8812	37.7
	No so much	8633	13.7	52872	13.4	2913	14.1	9845	12.6	3301	14.1
	Not inconvenient	28271	44.7	224218	56.7	8954	43.3	21667	45.4	11265	48.2
Form of using Prosthesis				p=0.000							p=0.008
	Have both upper and lower	15952	24.3	62238	14.8	5152	24.9	5246	24.2	5554	23.8
	Have only upper	4913	7.5	18185	5.2	1588	7.7	1687	7.8	1638	7.0
	Have only lower	2681	4.1	11189	3.0	842	4.1	938	4.3	901	3.9
	No	39682	56.1	303802	50.9	11396	55.2	12059	55.7	13407	57.4
	Not applicable(Less than 50 years old)	5297	8.1	2280	26.1	1682	8.1	1738	8.0	1877	8.0
Tooth brushing after breakfast yesterday				p=0.000							p=0.005
	Yes	55169	87.2	337122	85.3	18000	87.1	18693	86.3	20226	86.5
	No	5524	8.7	28935	7.3	1749	8.5	2038	9.4	1948	8.3
	Did not have breakfast yesterday	2537	4.1	29318	7.4	909	4.4	930	4.3	1197	5.1
Toothbrushing after lunch yesterday				p=0.000							p=0.000
	Yes	23519	37.2	177806	45.0	7558	36.6	7791	36.0	9329	39.9
	No	39179	62.0	214704	54.3	12934	62.6	13687	63.2	13839	59.2
	Did not have lunch yesterday	533	0.8	2874	0.7	168	0.8	183	0.8	204	0.9
Toothbrushing after dinner yesterday				p=0.000							p=0.000
	Yes	42924	67.9	279420	70.7	13830	66.9	14503	67.0	16137	69.0
	No	20143	31.9	114942	29.1	6771	32.8	7110	32.8	7173	30.7
	Did not have dinner yesterday	164	0.2	1027	0.3	58	0.3	49	0.2	62	0.3
Toothbrushing before sleep yesterday				p=0.000							p=0.000
	Yes	24902	39.4	178697	45.2	8017	38.8	8401	38.8	9839	42.1
	No	38217	60.4	216123	54.7	12596	61.0	13232	61.1	13503	57.8
	Did not sleep yesterday	98	0.2	569	0.1	44	0.2	30	0.1	32	0.1

Table 4. Annual Trend of Reason Not Receiving Annual Oral Examination and Dental Treatment

Unit: N(%)

Variable	Categories	Diabetes				Trend of Subject having Diabetes by Year					
		Yes		No		2015		2016		2017	
Recently received the annual oral examination					p=0.000						p=0.000
	Yes	12627	20.0	77967	19.7	4447	21.5	4573	21.1	4282	18.3
	No	50594	80.0	317425	80.3	16213	78.5	17092	78.9	19091	81.7
Reason of not receiving dental treatment					p=0.000						p=0.000
	Economical	5110	8.1	24718	6.3	1913	9.4	1762	8.3	1591	6.9
	Distance	657	1.0	3613	0.9	215	1.1	264	1.2	195	0.8
	Lack of time	2035	3.2	21381	5.4	720	3.5	784	3.7	743	3.2
	Difficulty of movement	1425	2.3	4354	1.1	455	2.2	509	2.4	481	2.1
	Low importance	1526	2.4	12201	3.1	17	0.1	13	0.1	14	0.1
	Fear for treatment	963	1.5	7096	1.8	506	2.5	568	2.7	547	2.4
	Others	907	1.4	4578	1.2	284	1.4	319	1.5	373	1.6
	Never avoided the examination	50594	80.0	317425	80.3	16213	79.8	17092	80.2	19091	82.9
Total		63217	100.0	395366	100.0	3,049			100%		

Table 5. Multiple Logistic Regression Analysis on Chronic Disease according to Diabetes

	B	S.E.	Wald	df	Significance level	Exp(B)	95% C.I of EXP(B)	
							Lower Limit	Upper Limit
Hypertension(ref: No) Yes	1.761	.009	39899.214	1	.000	5.817	5.717	5.918
Arthritis(ref: No) Yes	.292	.012	551.198	1	.000	1.340	1.307	1.373
Depression(ref: No) Yes	.280	.040	48.584	1	.000	1.323	1.223	1.431
Stress(ref: No) Yes	.049	.033	2.231	1	.135	1.051	.985	1.121
Constant	.598	.039	238.536	1	.000	1.819		

5. Multiple Logistic Regression Analysis on Chronic Disease and Oral Health according to Diabetes

In the results of performing multiple logistic regression analysis on the chronic disease according to diabetes, the hypertension, arthritis, depression were

shown as influencing factor ($p < 0.001$) [Table 5]. In the results of performing multiple logistic regression analysis on the oral health according to diabetes, subjective oral health level, mastication inconvenience, not receiving annual dental examination, toothbrushing after breakfast, lunch and dinner, toothbrushing before sleep, etc. were shown as the influencing factor ($p < 0.001$) [Table 6].

Table 6. Multiple Logistic Regression Analysis on Oral Health according to Diabetes

	B	S.E.	Wald	df	Significance level	Exp(B)	95% C.I of EXP(B)	
							Lower Limit	Upper Limit
Subjective Oral Health level (ref: Good)			46.497	2	.000			
Fair	-.033	.039	.704	1	.401	.968	.897	1.045
Poor	.178	.041	18.515	1	.000	1.195	1.102	1.296
Mastication Inconvenience(ref: Not inconvenient)			35.397	2	.000			
Inconvenient	.197	.033	35.215	1	.000	1.217	1.141	1.299
Fair	.075	.039	3.660	1	.056	1.078	.998	1.164
Toothbrushing after breakfast (ref: Yes) No	-.151	.043	12.524	1	.000	.860	.790	.935
Toothbrushing after lunch (ref: Yes) No	.164	.027	37.571	1	.000	1.178	1.118	1.242
Toothbrushing after dinner (ref: Yes) No	.134	.030	19.832	1	.000	1.144	1.078	1.213
Toothbrushing before sleep (ref: Yes) No	.208	.027	61.545	1	.000	1.232	1.169	1.298
Constant	1.866	.037	2521.457	1	.000	6.466		

Conclusion

This study analyzed the 2015, 2016 and 2017 local community health survey results of 458,301 persons having 45 years or more to verify the oral care needs of the patients with diabetes and to provide the basic data required for development of related products through the trend analysis on the relation between the chronic disease and the oral health according to the diabetes treatment. In the analysis results, in case of having diabetes, it was shown that the hypertension, arthritis, depression etc. were significantly high out of the chronic disease and the subjective health level was also poor ($p < 0.001$). In the oral health, in case of having diabetes, as the subjective oral health level was poor such as subjective periodontal tissue health level was poor and the mastication was inconvenient and the subjective oral health level was poor, it was observed that there is problem in oral health case. In the degree of oral health practice, it was shown that the people do not receive the annual oral examination well and particularly, the toothbrushing, which is the basic for oral health care, is not performed well when mastication is inconvenient, after the dinner and before sleep ($p < 0.001$). In conclusion, for the patient with diabetes, diverse measures for the management of complications of the chronic disease and oral health care should be prepared at national level for the systematic oral health care.

Ethical Clearance: Not required

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