Improvement of Oral Environment Indices of Oral Preventive Care Program, and Change in Oral Health-related Behaviors based on Dental Hygiene Process

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Abstract

This study aims to ensure the autonomy of dental hygienists through an oral preventive care program based on the dental hygiene process, and to provide basic data to support systematic and professional oral care. It was intended to determine changes in patients' oral-related knowledge, awareness, practice, OHB and other various oral hygiene care indices through the dental hygiene process. Data analysis was performed using IBM SPSS Statistics (version 21.0), and statistical significance level was set at $p<0.05$. Frequency analysis was performed for general characteristics and two-way repeated measures ANOVA was performed to compare changes in the oral health care indices of the dental hygiene process. In addition, paired t-test was performed to compare differences in oral health knowledge, awareness, practice and OHB, and bivariate correlation analysis was performed to determine correlations between them. In the results of this study, it was found that there were significant decreases in S-0HI, PSR Score and BOP, O' Leary through the dental hygiene process, showing that the oral preventive care program was effective ($p<.001$). Oral health knowledge, awareness, practice and OHB were also found to be significantly increased, revealing that there were positive changes ($p<.001$). It is expected that the clinical application of this dental hygiene program would be established as an effective manual to improve the oral environment.

Keywords: Oral Hygiene Care Indices, Dental Hygiene Process, Oral Preventive Care Program

1. Introduction

As education and income levels become higher, the interest in oral health and the demand for medical care through clinic visits are gradually increasing. This interest requires skillful medical and health personnel, including professional medical care and high-level medical services. In particular, expertise and autonomy are required for dental hygienists, who are in full charge of the prevention, education and management of oral diseases [1]. Dental hygienists are described as the personnel who are engaged in oral disease prevention and oral hygiene [2], and these responsibilities should be sufficiently performed at dental clinical sites. Actually, there is an urgent need for the jobs of dental hygienists to shift toward more effectively improving the public's oral health [3]. The jobs of dental hygienists are legally prescribed as teeth plaque removal, preventive treatments and oral hygiene. However, the work of cooperation for medical treatment is largely performed in clinical practices. There is a need for a paradigm shift toward the performance of the jobs based on the dental hygienists' job autonomy together with the job of cooperation for medical care. Dental hygienists should acquire technologies including scientific and professional knowledge related to oral disease prevention

and oral health improvement in order to secure their own jobs [4]. To secure the expertise and identity of dental hygienists, they should be able to carry out the work of oral health improvement with some job autonomy.

The dental hygiene process is a systematic approach to satisfy patients' needs. This process helps to manage actual and potential oral health problems by figuring out an individual's health behavior and solving the problems affecting his oral health [5]. This process is also a mechanism of clinical judgment and decision-making that provides a framework with which dental hygienists can identify and satisfy the individual needs of patients through a systematic approach within the scope of their jobs [6]. Dental hygienists should acquire the comprehensive and systematic capability to perform dental hygienist jobs through active job development and education, so that they can play the role of a clinician aiming at oral disease prevention and oral health improvement in clinics [7]. The dental hygiene process is a series of processes of assessing patients through data collation, conducting dental hygiene diagnosis by identifying problems based on the literature, planning and implementing the treatment and finally evaluating it[1]. This dental hygiene process will enable the performance of oral disease prevention and oral health improvement work by professional dental hygienists [8].

To prevent and cure periodontal disease and dental caries, scientific evidence and knowledge need to be provided to patients. In addition, dental disease prevention programs that can change the behaviors and attitudes of patients are needed. In particular, it is very important to establish oral preventive care programs to present clinical decision-making and evidence judgment based on the dental hygiene process.

This research intends to identify the changes in patients' various oral hygiene care indices before, during and after the application of the dental hygiene process through the application of this process to the operations in disease-preventive and medical offices of Busan-based dental clinics. The ultimate aim is to secure the job autonomy of dental hygienists, to develop and implement oral health improvement programs and thus to provide basic data on systematic and professional oral management.

2. Method

This research conducted an investigation from May to September 2014 after receiving an approval (IRB No. 201406-HR-001) from the Bioethics Committee of Silla University. Targeting patients that applied to some Busan-based dental clinics for oral disease preventive care programs, pre-education about different examination methods and patient educations were provided to one dentist and two dental hygienists in charge of preventive care who were sufficiently trained in the dental hygiene process. Sufficient explanations about the purpose of this research were given to patients, and consents for the survey were obtained from the patients. Of the 100 patients who consented to participate in the questionnaire survey, only 53 patients, who were free from systemic disease and were appropriate subjects for data collection, were investigated. A questionnaire survey and oral preventive care program were conducted through interviews.

2.1. Oral Preventive Care Program based on Dental Hygiene Process

This research was conducted in a number of phases, which included systematically collecting all information about a patient and assessing the patient. By identifying the cause of dental problems found based on the literature, a process that included the dental hygiene diagnosis, planning, implementation and evaluation

was conducted. All processes were carried out by one dentist and two skillful dental hygienists in charge of oral disease prevention.

Table 1. Oral Preventive Care Program based on Dental Hygiene Process

		Dental Hygiene Process
1st	Dental Hygiene Assessment	① Subjective data collection (questionnaire) ② Objective data collection (oral examination)
	Documentation	All processes recorded via electronic documents, Patient's signature to help address legal problems
2nd	Dental Hygiene Diagnosis	Dental hygiene diagnosis based on dental hygiene assessment data at the 1st visit to dental clinic (Systemic, Dental, Oral hygiene, Extra/intra-oral, Periodontal, Behavioral)
	Dental Hygiene Planning	Treatment planning necessary to improve oral hygiene care indices
	Goal setting	Determination of target values of oral hygiene care indices to solve problems according to diagnosis results
	Dental Hygiene Implementation	Implementation of preventive care program according to patient-tailored priorities (including treatment and education)
	Documentation	All processes recorded via electronic documents, Patient's signature to help address legal problems
3rd	Dental Hygiene Assessment	① Subjective data collection (questionnaire) ② Objective data collection (oral examination)
	Dental Hygiene Evaluation	Checking whether oral hygiene care indices are improved ①Improved: Termination after implementing education for continuous management (continuous education-implementation for customers who want to receive further education) ②Not improved: Returning to the 2nd goal setting (recall unit, preventive treatment, etc)
	Dental Hygiene Implementation	Implementation of preventive care program according to patient-tailored priorities (including treatment and education)
	Documentation	All processes recorded via electronic documents, Patient's signature provided to ensure there are no legal issues

2.2. Oral Hygiene Care Indices

Dental plaque examination (O'Leary Index) [9], Simplified oral hygiene index (S-OHI) [9], Bleeding on probing (BOP) [10] and Periodontal Screening and Recording (PSR) [11] were conducted for oral hygiene care indices. After all teeth in the mouth were stained using disclosing solutions, O'Leary Index was calculated at one point for the case in which dental plaque was attached to four tooth surfaces (mesial, distal, buccal and lingual surface) and zero point for the case in which dental plaque was not attached. O'Leary Index was calculated using the dental plaque control score table [9]. For S-OHI [9], examinations were conducted on the buccal surfaces of the first molar teeth at the left and right sides of maxilla, the labial surfaces of maxillary and mandibular central incisors, and the lingual surfaces of the first molar teeth at the left and right sides of mandible. An examination was conducted on the food residue and dental plaque on one tooth surface. Based on the above results, scores were given, with 0.0 to 1.2 indicating an excellent oral environment, 1.3 to 3.0 a good oral environment and 3.1 to 6.0 a bad oral environment. For BOP [10], one point was given in the event that bleeding occurred, and zero was given in the event that bleeding did not occur, about 30

seconds after measuring periodontal pocket. The sum of the overall bleedings was calculated based on a percentage.

For PSR [11], which is a variation of the Community Periodontal Index (CPI) used in the WHO's epidemiological survey, periodontal status was examined on six areas such as the mesial buccal side, central buccal side, distal buccal side, distal lingual side, central lingual side and mesial lingual side of the designated teeth (#17, #16, #11, #26, #27, #31, #36, #37, #46, #47), identically to the community periodontal index. For all examination results, a smaller measurement value indicates better dental health.

2.3. Oral Health Knowledge, Awareness and Practice

An investigation on oral health knowledge, awareness and practice was conducted using an amended and supplemented version of Kim's questionnaire [12]. Using a 5 point Likert scale, each item was scored as follows: 'Strongly Agree' 5 points, 'Agree' 4 point, 'Neutral' 3 points, 'Disagree' 2 points, and 'Strongly Disagree' 1 point. Total scores ranged from a minimum of 0 to a maximum of 100 points. Higher scores indicated higher oral health knowledge, awareness and practice.

2.4. Oral Health Behavior (OHB) Questionnaires

Oral Health Behavior (OHB) [13] Questionnaires include items such as the frequency, time, extent, duration, use of toothbrush, fluoride toothpaste, interdental cleansing and tongue cleaning in tooth brushing, and all the items were scored. Higher scores indicate more positive oral health behavior.

2.5. Statistical Analysis

IBM SPSS Statistics (version 21.0) was used for data analysis, which was verified on the basis of a significance level of $p<.05$. Two-way repeated measures ANOVA was conducted to compare the changes in oral hygiene care indices before, during and after the application of the dental hygiene process according to general features. A paired t-test was conducted to compare the differences in oral health knowledge, awareness and practice, and OHB before and after the test.

3. Results

3.1. General Characteristics of Human Subjects

Table 2 presents the general characteristics of human subjects. The male to female ratio is 60.4% to 39.6%. The ratio of people under age 25 to people aged 25 and over is 45.3% to 54.7%. The ratio of unmarried people to married people is 81.1% to 18.9%. The ratio of people with a monthly income of less than 2 million won to people with a monthly income of 2 million won or higher is 77.4% to 22.6%. The ratio of graduates of three-year vocational colleges to those of four-year universities is 41.5% to 58.5%. The ratio of jobless people to jobholders is 58.5% to 41.5%. The ratio of non-smokers to smokers is 75.5% to 24.5%. The ratio of non-drinkers to drinkers is 13.2% to 86.8%.

Table 2. General Characteristics of Human Subjects

	Category	N	%
Gender	Male	32	60.4
	Female	21	39.6
Age	<25	24	45.3

	≧25		29	54.7
Marital Status	Single		43	81.1
	Married		10	18.9
Income/month	<200		41	77.4
	≧200		12	22.6
Education level	<Junior college		22	41.5
	≧4-year college		31	58.5
Job	No		31	58.5
	Yes		22	41.5
Smoking	No		40	75.5
	Yes		13	24.5
Drinking	No		7	13.2
	Yes		46	86.8
Total			53	100.0

3.2. Change in S-0HI According to Application of the Dental Hygiene Process

Table 3 presents the changes in S-0HI before and after applying the dental hygiene process. By verifying the difference in the dental hygiene process of S-0HI, what showed a difference in terms of point of time (before, during and after) was gender (F=91.676, p<.001), age (F=80.984, p<.001), marital status (F=49.123, p<.001), income (F=78.389, p<.001), education status (F=77.373, p<.001), employment status (F=79.653, p<.001), smoking status (F=54.019, p<.001), and drinking status (F=62.414, p<.001). These showed a statistically significant decrease after the application of the dental hygiene process.

Table 3. Changes in S-0HI before and after Applying Dental Hygiene Process

		Before	After	Source	F
Sex	Male	2.24±1.07	1.30±1.06	Sex	1.107
				period	91.676***
	Female	2.78±1.18	1.34±1.02	Sex *period	4.133*
Age	<25	2.85±1.23	1.70±1.29	Age	8.166**
				period	80.984***
	≧25	2.10±.94	1.01±1.14	Age *period	.107
Marital Status	Single	2.55±1.17	1.41±1.10	Marital	2.216
				period	49.123***
	Married	2.04±.93	.92±.56	Marital*period	.003
Income /month	<200	2.42±1.15	1.42±1.12	Income	.222
				period	78.389***
	≧200	2.55±1.14	.98±.61	Income *period	3.702
Education level	<Junior <college	2.69±1.28	1.65±1.35	Education	3.258
				period	77.373***
	≧4-year college	2.28±1.02	1.08±.66	Education* period	.390
Job	No	2.69±1.22	1.58±1.19	Job	5.151*
				period	79.653***
	Yes	2.12±.94	.95±.63	Job*period	.084
Smoking	No	2.49±1.19	1.30±1.12	Smoke	.027

				period	54.019***
	Yes	2.29±.98	1.38±.73	Smoke*period	.794
Drinking	No	3.51±1.56	1.73±1.48	Alcohol	4.788*
				period	62.414***
	Yes	2.32±.98	1.26±.96	Alcohol * period	4.424*

*p<.05,**p<.01,***p<.001
F-values in Two-way repeated measures ANOVA

3.3. Change in PSR Score According to Application of Dental Hygiene Process

Table 4 presents the changes in PSR Score before and after applying the dental hygiene process. Through verifying the difference in the dental hygiene process of PSR Score, the differences that were shown based on a point of time (before, during and after) were in gender (F=18.611, p<.001), age (F=18.236, p<.001), marital status (F=10.924, p<.01), income (F=8.059, p<.01), education status (F=20.555, p<.001), employment status (F=15.534, p<.001), and smoking status (F=10.265, p<.01). These showed a statistically significant decrease after the application of the dental hygiene process.

Table 4. Changes in PSR Score before and after Applying Dental Hygiene Process

		Before	After	Source	F
Sex	Male	2.03±.47	1.53±.80	Sex	1.070
				period	18.236***
	Female	2.29±.64	1.57±.93	Sex *period	.568
Age	<25	2.21±.66	1.46±.78	Age	.007
				period	18.611***
	≧25	2.07±.46	1.62±.90	Age *period	1.180
Marital Status	Single	2.12±.49	1.54±.85	Marital	.172
				period	10.924**
	Married	2.20±.78	1.60±.84	Marital * period	.003
Income /month	<200	2.17±.63	1.49±.87	Income	.074
				period	8.059**
	≧200	2.00±.00	1.75±.75	Income *period	1.736
Education level	<Junior college	2.27±.70	1.41±.85	Education	.000
				period	20.555***
	≧4-year college	2.03±.41	1.65±.84	Education* period	.984
Job	No	2.19±.60	1.39±.84	Job	.701
				period	15.534***
	Yes	2.05±.49	1.77±.81	Job*period	3.800*
Smoking	No	2.18±.59	1.53±.88	Smoke	.067
				period	10.265**
	Yes	2.00±.41	1.62±.77	Smoke*period	.675
Drinking	No	2.00±.00	1.85±.37	Alcohol	.244
				period	3.818*
	Yes	2.15±.59	1.50±.89	Alcohol * period	1.567

*p<.05,**p<.01,***p<.001
F-values in Two-way repeated measures ANOVA
Code 0; Preventive treatment, No calculus,
Code 1,2; Oral hygiene care, The removal of plaque and biofilm,
Code 3; Code 2 is similar, If necessary, consult an specialist,
Code 4; Code 2,3 is similar, If necessary, consult an specialist

3.4. Change in BOP According to the Application of the Dental Hygiene Process

Table 5 presents the change in BOP according to the Application of the Dental Hygiene Process. Through verifying the difference in the dental hygiene process of BOP, what showed differences based on point of time (before, during and after) were gender (F=16.455, p<.001), age (F=17.248, p<.001), marital status (F=7.875, p<.01), education status (F=15.914, p<.001), employment status (F=14.342, p<.001), smoking status (F=7.963, p<.01), and drinking status (F=11.955, p<.01). These showed a statistically significant decrease after the application of the dental hygiene process.

Table 5. Changes in BOP before and after Applying Dental Hygiene Process

		Before	After	Source	F
Sex	Male	24.53±22.59	14.81±16.08	Sex	.096
				Period	16.455***
	Female	24.85±25.74	11.52±12.21	Sex *period	.405
Age	<25	30.21±25.54	15.33±17.83	Age	2.133
				Period	17.248***
	≧25	20.07±21.32	12.00±11.45	Age *period	1.518
Marital Status	Single	25.49±24.39	13.63±15.61	Marital	.176
				period	7.875**
	Married	21.10±20.89	13.00±9.97	Marital * period	.280
Income /month	<200	27.46±25.51	13.37±15.53	Income	1.124
				period	5.602*
	≧200	15.08±12.17	14.00±11.62	Income *period	4.117*
Education level	<Junior college	24.46±23.09	12.36±14.80	Education	.059
				period	15.914***
	≧4-year college	24.81±24.41	14.32±14.69	Education* period	.081
Job	No	27.84±26.29	13.84±16.56	Job	.802
				period	14.342***
	Yes	20.18±19.01	13.05±11.74	Job*period	1.512
Smoking	No	26.85±24.60	13.62±15.40	Smoke	.755
				period	7.963**
	Yes	17.92±19.76	13.15±12.51	Smoke*period	1.758
Drinking	No	28.00±17.05	9.85±12.40	Alcohol	.001
				period	11.955**
	Yes	24.15±24.60	14.06±14.98	Alcohol * period	.974

*p<.05,**p<.01,***p<.001
F-values in Two-way repeated measures ANOVA

3.5. Change in O'Leary Index According to the Application of the Dental Hygiene Process

Table 6 presents the change in the O'Leary index according to the Application of the Dental Hygiene Process. Through verifying the difference in the dental hygiene process via the O'Leary index, the factors that showed a difference based on point of time (before, during and after) were gender (F=84.067, p<.001), age (F=74.445, p<.001), marital status (F=54.057, p<.01), income (F=63.558, p<.001), education status (F=71.618, p<.001), employment status (F=82.216, p<.001), and drinking status (F=41.420, p<.01). These showed a statistically significant decrease after the application of the dental hygiene process.

Table 6. Changes in O'Leary Index Score before and after Applying Dental Hygiene Process

		Before	After	Source	F
Sex	Male	52.34±19.98	33.12±18.98	Sex	1.982
				period	84.067***
	Female	63.95±18.74	34.71±18.54	Sex *period	3.594
Age	<25	59.33±21.54	39.29±20.43	Age	2.497
				period	74.445***
	≧25	54.96±19.08	29.17±15.96	Age *period	1.172
Marital Status	Single	56.40±21.22	34.27±19.58	Marital	.000
				period	54.057***
	Married	59.30±15.39	31.50±14.56	Marital * period	.701
Income /month	<200	57.75±.20.78	36.19±19.49	Income	1.711
				period	63.558***
	≧200	54.16±18.39	25.41±12.80	Income *period	1.298
Education level	<Junior college	60.36±22.59	41.41±20.96	Education	4.557*
				period	71.618***
	≧4-year college	54.32±18.14	28.32±14.88	Education* period	1.606
Job	No	57.81±21.57	38.32±19.45	Job	1.976
				period	82.216***
	Yes	55.72±18.37	27.31±15.68	Job*period	2.855
Smoking	No	60.00±20.58	33.40±20.04	Smoke	1.049
				period	44.305***
	Yes	47.53±15.98	34.84±14.08	Smoke*period	5.551*
Drinking	No	66.28±27.35	38.14±22.40	Alcohol	1.348
				period	41.420***
	Yes	55.52±18.81	33.08±18.20	Alcohol * period	.528

*p<.05, **p<.01, ***p<.001
F-values in Two-way repeated measures ANOVA

3.6. Changes in Oral Health Knowledge, Awareness and Practice and OHB According to the Application of the Dental Hygiene Process

A program applying the dental hygiene process was implemented targeting patients who saw dentists for oral health management, and oral health knowledge, awareness and practice and OHB were reviewed. The results are shown in Table 7. Oral health knowledge after the application of the dental hygiene process (M=90.19) was statistically significantly higher (t=-5.188, p=.000) compared to before its application (M=74.71). The awareness of oral health after the application of the dental hygiene process (M=89.15) was also statistically significantly higher (t=-6.164, p=.000) compared to before its application (M=74.05). The practice of the oral health program after the application of the dental hygiene process (M=76.60) was statistically significantly higher (t=-9.823, p=.000) compared to before its application (M=50.38). OHB after the application of the dental hygiene process (M=10.15) was statistically significantly higher (t=-8.938, p=.000) compared to before its application (M=12.66).

Table 7. Changes in Oral Health Knowledge, Awareness, Practice and OHB According to Application of Dental Hygiene Process

	Before	After	t	p
Knowledge	74.71±20.15	90.19± 9.30	-5.188	.000[***]
Awareness	74.05±15.81	89.15±12.11	-6.164	.000[***]
Practice	50.38±15.69	76.60±16.83	-9.823	.000[***]
OHB	10.15±2.45	12.66±1.78	-8.938	.000[***]

[*]p<.05,[**]p<.01,[***]p<.001
T-values by t-test

4. Discussion

The dental hygiene process is a mechanism of clinical judgment and decision-making in which dental hygienists work to solve human subjects' oral health problems within the scope of the dental hygienists' job [6]. Through this dental hygiene process, dental hygienists can perform activities related to oral disease prevention and treatment and relevant education, and can reflect a new concept of the role of the dental hygienist [14]. This dental hygiene process can provide a useful framework that can systematically integrate dental hygienists' oral hygiene jobs in current dental clinics demanding fragmented clinical techniques [6]. In dental hygiene education, Korea has long handled dental hygiene at the level of the auxiliary role of dental care. There are limits to conduct dental hygienists' leading education about the implementation of professional oral hygiene management. This has led to job dissatisfaction and resignation of dental hygienists, causing a shortage of dental personnel. The goal of this research is to identify oral environment improvement effects through the application of an oral preventive care program based on the dental hygiene process, centered on dental hygienists that take a dental hygiene education course.

The characteristics of research subjects are as follows: The male to female ratio is 60.4% to 39.6%; the ratio of people under age 25 to people aged 25 and over is 45.3% to 54.7%; the ratio of unmarried people to married people is 81.1% to 18.9%; the ratio of people with monthly incomes of less than 2 million won to people with incomes of 2 million won or more is 77.4% to 22.6%; the ratio of graduates of three-year vocational colleges to those of four-year universities is 41.5% to 58.5%; the ratio of jobless people to jobholders is 58.5% to 41.5%; the ratio of non-smokers

to smokers is 75.5% to 24.5%. The ratio of non-drinkers to drinkers is 13.2% to 86.8%.

Clinic locations are thought to have affected unmarried state and income. The change in S-0HI before and after the application of the dental hygiene process was reviewed using Repeated Measures ANOVA, and the results are as follows: All S-0HI showed statistically significant decreases in gender (F=91.676, p<.001), age (F=80.984, p<.001), marital status (F=49.123, p<.001), income (F=78.389, p<.001), education status (F=77.373, p<.001), employment status (F=79.653, p<.001), smoking status (F=54.019, p<.001), and drinking status (F=62.414, p<.001) after the application of the dental hygiene process compared to before its application. Oral environment was significantly improved due to the prevention, treatment and education through the dental hygiene process, and S-0HI was significantly improved, which were identical to the results of Lee and Lee's study[15]. As the time of test increased and age was lower, S-0HI became lower and indices showed significant changes. However, in this research, S-0HI of the higher age group decreased, and consequently, the opposite result occurred. There was a significant interaction between gender and time (F=4.133, p<.05) and between drinking and time (F=4.424, p<.05). This means that there is a difference in the effect of the dental hygiene process. The change in PSR Score before and after the application of the dental hygiene process was reviewed using Repeated Measures ANOVA, and the results are as follows: PSR Score showed statistically significant decreases in gender (F=18.611, p<.001), age (F=18.236, p<.001), marital status (F=10.924, p<.01), income (F=8.059, p<.01), education status (F=20.555, p<.001), employment status (F=15.534, p<.001), smoking status (F=10.265, p<.01), and drinking status (F=3.818, p<.05) after the application of the dental hygiene process compared to before its application.

It can be shown that the oral environment was significantly improved due to the prevention, treatment and education provided through the dental hygiene process. However, there was no difference in the improvement of the oral environment according to general characteristics. There was a significant interaction between employment status and time. This means that there is a difference in the effect of employment status and dental hygiene process (F=3.800, p<.05). The phase before dental hygiene process largely fell under Code 2 in need of oral hygiene improvement, and was partly improved to Code 1 in age, monthly income, education status and employment status. However, it is found that there was still a need to improve oral hygiene. The change in BOP before and after the application of the dental hygiene process was reviewed using Repeated Measures ANOVA, and the results are as follows: BOP showed statistically significant decreases in gender (F=16.455, p<.001), age (F=17.248, p<.001), marital status (F=7.875, p<.01), education status (F=15.914, p<.001), employment status (F=14.342, p<.001), smoking status (F=7.963, p<.01), and drinking status (F=11.955, p<.01) after the application of the dental hygiene process compared to before its application. There was a significant interaction between monthly income and time. This means that there is a difference in the effect of monthly income and the dental hygiene process (F=4.177, p<.05).

The results of a study conducted by Oh et al [16] show that BOP of the non-smoking group decreased significantly and that BOP of the human subjects group with high cooperation decreased significantly. This finding is similar to the findings of this research. The change in O'Leary index before and after the application of the dental hygiene process was reviewed using Repeated Measures ANOVA, and the results are as follows: O'Leary index showed statistically significant decreases in gender (F=84.067, p<.001), age (F=74.445, p<.001), marital status (F=54.057, p<.01), income

(F=63.558, p<.001), education status (F=71.618, p<.001), employment status (F=82.216, p<.001), and drinking status (F=41.420, p<.01) after the application of the dental hygiene process compared to before its application. There was a significant interaction between smoking status and time. This means that there is a difference in the effect of smoking status and the dental hygiene process (F=5.551, p<.05).

Based on identification of the numbers of colored plaque surfaces left after tooth surfaces were discolored largely using disclosing solution, the O' Leary index is used in various applications such as dental health education or preventive treatment record. According to the results of studies conducted by Oh et al [16], Park et al [4], and Lee and Lee [15] using O' Leary index conducive to motivation of human subjects, O' Leary index was decreased due to oral disease prevention, treatment and education, particularly dental plaque control education, and these results are the same as the results of this research. In short, to reduce dental plaque, the dental hygienist plays the most important role. Dental hygienists should teach human subjects what toothbrush and toothpaste are suitable for them and how they should brush their teeth. Then, dental hygienists should be continuously engaged in the management process. By doing this, the oral care environment will be improved. An investigation of human subjects' oral health knowledge, awareness, practice and OHB showed that there was a significant positive increase after the application of the dental hygiene process compared to before its application. This means that the application of the dental hygiene process has an effect not only on the oral environment but also on human subjects' oral health knowledge, awareness, practice and OHB (p<.001).

This research has some limitations. The results of this research were derived from a dental hygiene process applied by some dental clinics, but a generalization of the results requires a certain degree of circumspection, because the period of time for the research was too short and not many human subjects were used. Nevertheless, it would be meaningful in future research to apply this dental hygiene process not yet applied by many dentists to many dental clinics, and subsequently derive the result.

5. Conclusion

If dental clinics and hospitals intending to apply prevention-centered care based on the results of this research acknowledge dental hygienists' job autonomy and carry out preventive care, it will trigger an improvement in the public's oral environment. Hopefully, the clinical application of this dental hygiene process to improve the oral environment will be established based on effective manuals.

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