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Effect of an Oral Hygiene Care Program on Periodontal Health Status in Korean Rural Adults

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Directed by Professor Sei-Jin Chang

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ABSTRACT

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Objectives: Periodontal diseases are a leading cause of tooth mortality for adults and they are highly preventable by individuals' behaviour changes, which can be improved by supportive public programs with prevention and intervention strategies. The purpose of this study was to analyze the effects of an oral hygiene care program delivered at rural public health centers, on oral health behaviors, oral hygiene status and Bleeding on probing (BOP) score, to Korean rural residents older than 40 years.

Methods: Residents older than 40 years living in two rural areas were allocated randomly by order of visit into an intervention group (N_1=23) and control group (N_2=23). For the intervention group, a total 4 sessions of professional care were performed with 2 weeks interval and scaling was conducted after 8 weeks. For the control group, 1 session of education and scaling after 8 weeks were performed. After 16 weeks, change of oral health behaviors, plaque index, BOP score in the intervention and the control group were measured. Changes of plaque, gingivitis, daily toothbrushing frequency, and number of oral hygiene product use days between the groups were analyzed with repeated-measures ANOVA and hierarchical multiple regression. Analyses were conducted to identify factors affecting change of BOP score.

Results: It was found in the intervention group that the daily toothbrushing frequency and the number of oral hygiene product use days were improved significantly and the plaque index and the BOP score decreased also after 16 weeks from implementation of the program. It was found in the control group that the BOP score decreased. The BOP score decreased by 22.87 in the intervention group and 0.27 in the control group between the baseline and after 8 weeks, so it was identified that the oral health education and the professional care conducted before the scaling had statistically significant effect ($p<0.001$). The BOP score decreased by 3.32 in the intervention group and 7.9 in the control group ($p<0.05$) after implementing the scaling in the both group after 8 weeks. According to the results of the multiple regression model analysis, it was shown that the change of BOP score (ΔBOP score) increased significantly with increase of reduction of PHP index (ΔPHP index) ($t=-2.174$, $p<0.05$) and increased with greater significance in the intervention group than the control group ($t=2.143$, $p<0.05$).

Conclusion: Professional care and continuous oral health education for 8 weeks prior to scaling among adults older than 40 years living in rural environments resulted in a change in oral health behaviors and substantial reduction in gingival bleeding. Continuous care for adults' periodontal disease is important and it should be based on behavior change. Thus, it is considered that continuous education and incubation of self-care ability combined with scaling are important in preventing periodontal diseases. Therefore, it seems necessary for dental hygienists to expand and implement primary oral health medical services and service for prevention of periodontal disease in order to resolve regional imbalance in areas with lower dental service accessibility.

Key words: Oral hygiene care program, Periodontal health, Community health center, Plaque index, BOP score, Oral health behaviors

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Ⅰ. INTRODUCTION

1. Background

Periodontal disease, a chronic inflammatory disease in which periodontal tissue is destroyed by biofilm formed on the tooth surface in conjunction with a bacterial host response, is one of the main causes of tooth loss in individuals after middle-age (Musskopf et al., 2017). Attention to the importance of disease prevention has increased

due to the association of periodontal disease with systemic diseases including cardiovascular disease and diabetes, as well as tooth loss (Meenawat et al., 2013; Ramirez et al., 2014). However, a study in 2013 found that Korean males older than 40 years of age had a 37.9% prevalence of periodontal disease, and one of every two males older than 50 years and at least one-third of females of the same age group had periodontal disease (Ministry of Health and Welfare, 2014). Gingivitis and periodontal diseases produced the highest increase in medical cost rates among frequent outpatient diseases; medical care expenses in Korea increased by 36.7% in 2014 compared to 2013, significantly impacting health care expenses (Health Insurance Review & Assessment Service, 2014).

The increased expense was especially significant for rural residents who are more likely to have a lower socioeconomic status than residents of large urban centers. Compared to urban areas, residents of rural areas exhibit a higher obesity rate (BMI), lessened physical activity, higher risk of having chronic disease (Durazo et al., 2011), and a higher prevalence rate of periodontal disease (Ministry of Health and Welfare, 2014). The prevalence of periodontal disease in Korean adults was 21.4%, 30.0%, and 32.6% in metropolitan cities, mid-sized cities, and rural areas, respectively; the highest prevalence was found in rural areas (Chung et al., 2010). In particular, among older residents in rural areas with low health service accessibility, the high rates of tooth loss and low socioeconomic status has considerable effects on oral health-related quality of life (Park et al., 2008). Furthermore, periodontal disease in the elderly is positively correlated to metabolic syndrome risk as measured by cholesterol level, fasting plasma glucose level, and body mass index (Lee et al., 2014). The proportion of elderly residents is high in agricultural areas such as the country side compared to urban centers (Ahn & Kim, 2004).

Thus, it is essential to build a system to take care of the residents' oral health, especially for the middle-aged, living in rural areas who are at a high risk of developing periodontal disease. This would prevent various dental and health problems that they can encounter in their latter years. As masticatory movement is related to quality of life, nutritional balance, in addition to intelligence and social abilities, it may be crucial to manage oral health well into the adulthood (Porter et al., 2015). Unfortunately, a number of individuals in their adulthood do not get proper services for their oral health due to various reasons from timing problems to economical difficulties (Song et al., 2003; Yoon & Nam, 2010).

The health care system should provide essential health care services to all residents, especially vulnerable individuals. However, at least 93% of health care institutions in Korea are private institutions, most of which are located in metropolitan cities. With regard to the regional distribution of dental clinics in 2011, Seoul, a metropolitan city, housed 30.6% of all dental clinics (4,595 sites), and Gangwon, a rural province, housed only 2.1% (314 sites), illustrating unequal distribution of health care facilities (Oh, 2013).

Among 23,540 dentists at different medical institutions in 2015, 83.8% of them worked at dental clinics and 9.0% worked in the dentistry departments of large-scale hospitals. Overall, more than 90% of the dentists worked at private dental clinics or hospitals, and this number has been steadily increasing. The regional distributions of dentists show that the largest number of dentists (n = 6733, 28.6%) worked in Seoul, followed by Gangwon Province (n = 617, 2.6%), Chungbuk Province (n = 533, 2.3%), and the city of Ulsan (n = 469, 2.0%). The differences in the number of dentists in different regions were quite large (Yearbook of Korean Dentistry, 2014 & 2016). The prevalence of periodontal disease in Gangwon were found to be 42,2% in 2014, which is the second highest comes after Jeonbuk of 47.3% (Health Policy Institute, 2016) (Figure 1). Likewise, the areas'

urbanization, social location, and accessibility towards resources are highly related to the oral health of the community people (Kim et al., 2012).

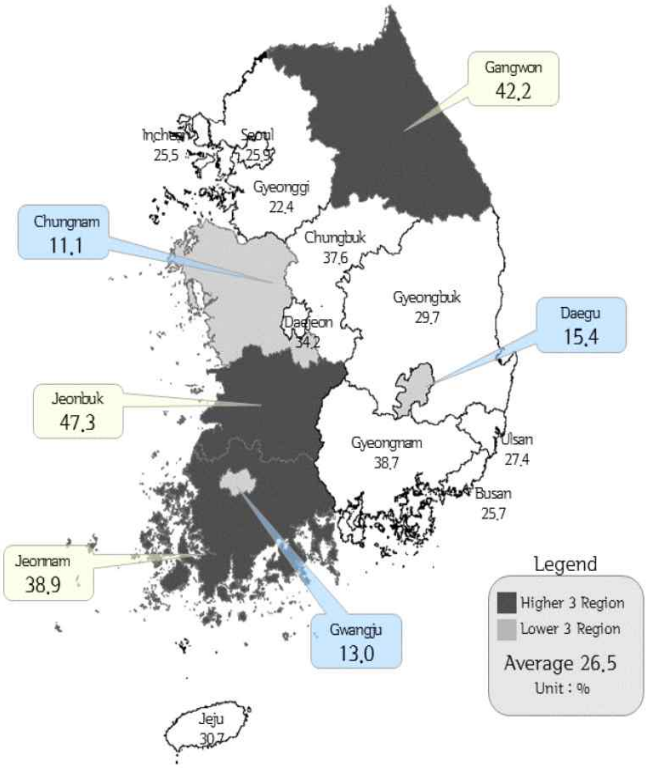

Figure 1. Regional periodontal disease prevalence in South Korea
(Over the 12 years old, 2014)

Korean community health centers and rural health sub-centers, which are representative public health settings, were founded to reinforce health service accessibility in vulnerable areas through an act in 1980 that established special measures for health services in farming and fishing communities (Ministry of Government Legislation, 2013). They have acted as primary care centers focusing on primary care in those areas to reduce inequality of healthcare. Recently, the functional focus of community health centers has gradually shifted from disease treatment to prevention and disease control and providing services

appropriate to regional conditions (Ha, 2014). Thus, it is important that oral health providers planning and conducting oral health projects in public health settings establish strategies for training and interventions to maintain and apply in clinical settings.

However, during the last six years, there has been increase in the number of areas where oral health service at health centers (and sub-centers) has been reduced or partially abolished due to a decrease in the number of public health dentists. The number of public health dentists in public health centers decreased from 310 in 2009 to 239 in 2015. This decrease was even more marked in public health sub-center and health care centers, from 550 to 150 (2009–2015) (Yearbook of Korean Dentistry, 2014 & 2016). Public health dentists work in rural areas with insufficient medical care systems to provide public health care as their obligatory military service. The number of public health dentists has decreased because of an increase in the number of male dentists who have already finished their obligatory military service before becoming a dentist since the establishment of the Graduate School of Dentistry in Korea. Moreover, the number of female students enrolling in this school increased.

Accordingly, the number of dental hygienists increased from 658 to 860 in public health centers (2009–2015), but it decreased from 587 to 404 at public health sub-centers (Yearbook of Korean Dentistry, 2014 & 2016). The reduced number of public health dentists at public health sub-centers with relatively vulnerable medical services has resulted in an increased number of rotating check-ups and decreased number of check-ups per public health sub-center; even the number of areas that shut down such centers has begun to increase (Kim, 2014). Furthermore, staff reductions and shut downs of dental clinics within public health sub-center have caused dental hygienists to work in areas other than public dental health services. Therefore the imbalance in the number of dentists or oral

care human resources may affect the regional difference in unmet oral care needs (Kim et al., 2012), and it is therefore necessary to prepare for this.

In primary care or public health settings, effective and non-invasive interventions to reduce gingivitis are low-cost preventive measures for improving oral health (Geisinger et al., 2014). The most basic and widely known procedure to prevent periodontal disease is to remove biofilm on the gingival margin through mechanical plaque control (Van der Weijden & Slot, 2011). Gingivitis is a significant risk factor in the clinical progression of chronic periodontitis (Schatzle et al., 2004). Although gingivitis does not necessarily progress to periodontitis, it always precedes periodontitis (Mizutani et al., 2012). Symptoms of gingivitis include swelling, redness and gingival bleeding. It is possible to restore the gingiva to a healthy state through proper self-oral hygiene behaviors such as tooth-brushing and application of oral hygiene products and professional oral health care (Sambunjak et al., 2011).

A recent study found periodontal health improvements in plaque index, calculus index, and gingivitis index after an average of three sessions of education and professional care among the elderly, mental patients, and patients hospitalized in an intensive care unit (Choi et al., 2013; Mun et al., 2014). Another recent effort toward behavior change and periodontal health promotion in the form of a personalized education program targeted adults older than 20 years (Jonsson et al., 2010; Kapellas et al., 2013).

The bleeding on probing (BOP) score has been widely used as a tool for determining gingival inflammation and periodontal health stability (Lang et al., 1990). The BOP score is an early and more sensitive indicator than probing pocket depth and visual signs of inflammation (redness and swelling) (Greenstein, 1984). In order to promote oral health and prevent oral diseases, primary health care and public health interventions should be

provided (Petersen, 2014). However, previous studies have been mainly performed with patients visiting dental clinics. Also, government-led oral health projects have mainly targeted children and the elderly, neglecting adults in rural areas with low medical service accessibility. Therefore, it is necessary for the community to reinforce health promotion capacity through improvement of oral health practices in adulthood such as prevention, education, and oral hygiene care. This should be carryed out commitment of the oral health professionals in the community.

Table 1. Effectiveness of domestic and international preventive periodontal care program

Author(s) (Year)	Target population	follow-up period	Methods	Outcome measures	Results
Lee et al. (2009)	· Type 2 Diabetic patients in hospital - Intervention: N = 40 - Control: N = 35 Mean age:52.2	6 months	**-Baseline:** Oral Health Education (OHE), received educational brochures and Supra-gingival scaling in two groups **-Intervention:** All the procedures (oral examination, x-ray taking, education, and supra-gingival scaling) were repeatedly conducted every month for 6 months **-Control:** All the procedures were conducted twice at baseline and at 6 months	-Plaque index -PHP index -Calculus index -Bleeding index -Community periodontal index (CPI) -Russel's periodontal index, -Tooth mobility	- There were significant differences in the groups after 6 Months ($p<0.001$). ·**plaque index:** (intervention: 1.83±0.90, control: 9,83±4.05) ·**dental calculus index:** (intervention: 1.35±0.74, control: 8.06±2.83) ·**bleeding index:** (intervention: 0.32±0.33, control: 1.92±0.68) ·**PHP index:** (intervention: 1.46±0.45 , control: 3.96±0.85) ·**Russel's periodontal index.** - However, tooth mobility and CPI did not show any significant differences between the two groups.
Jonsson et al. (2010)	·Patients with chronic periodontitis -Intervention: = 57 -Control= 56 mean age= 51.2	12 months	**-Intervention:** ITOHEP based on cognitive behavioural perspective and Motivational Interviewing with scaling **-Control:** Standard OHE with scaling	-Plaque index (PlI) -Bleeding on probing (BOP) -Pocket depth (PD)	- Between baseline and the 12-month follow-up, the experimental group improved both in BOP and PlI more than the control group. - No difference between the two groups was observed for ‘pocket closure’and reduction of periodontal pock depth.

Author(s) (Year)	Target population	follow-up period	Methods	Outcome measures	Results
Kang et al. (2012)	·Diabetics youth in hospital -Diabetic group = 31 -Control = 87 (Students)	6 months	**-Baseline:** Tooth brushing method, oral prophylaxis, scaling, and dental auxiliary education in two groups **-Intervention:** follow-up after 2 weeks and 3 months **-Control:** follow-up after 6 months	-Gingival index (GI) - Plaque index (PI)	- Both GI and PI were significantly decreased in the treatment group of the 31 diabetic youth in comparison to the controls (P<0.001). - In the control group, PI increased on all tooth positions, and GI increased on some tooth positions.
Cho et al. (2013)	·Dental patients on elderly older than 65 N = 87 Control: none	4 weeks	**-Implementation:** 1 week interval 4 times :watanabe toothbrushing method and interdental brushing education	-PHP index -Gingival Bleeding Index (GBI)	- The average gingival bleeding index was 1.65 at the commencement of the study and 1.25, 0.88, and 0.65, after the first, second and third trial. - The PHP index of dental plaque was 2.90 prior to commencement of the study, 2.79, 2.77, and 2.76 after the first, second, and third trials.
Choi et al. (2013)	·Intensive care unit (ICU)patients with stroke -Intervention: N = 22 -Control: 21	1-5 weeks	**-Intervention:** At least 5 times per day: professional oral hygienic care (toothbrush, tongue cleaner, chlorohexidine) **-Control:** No treatment	-Plaque index -Gingival index -Clinical attachment loss (CAL)	- The plaque index and gingival index of the oral care group were significantly lower than those of the non-oral care group (p=0001). ·**Plaque index:** (intervention: 0.91±0.45, control: 1.84±0.69) ·**Gingival index:** (intervention: 0.93±0.82, control: 1.58±0.61) - **CAL:** no significant difference in CAL was observed (P=0.384)

Author(s) (Year)	Target population	follow-up period	Methods	Outcome measures	Results
Mun et al. (2013)	·Patients with mental disorders -Group A=23 -Group B=22 -Group C=28 -age range: :20-65years	12 weeks	**-Group A:** video, brochure and professional toothbrushing using the toothpick method during the second and third sessions **-Group B:** video & brochure **-Group C:** brochure -followed over 12 weeks at 4week intervals	-PHP index -Saliva stimulation -Oral dryness scores	- Dental plaque index: significantly decreased after each session (P<0.0001) in all three groups, and significant differences were found between groups (P = 0.036).
Fan et al. (2014)	·Stroke patients in hospital -Intervention N=35 -Control=31 -mean age: 58.5	About 4 weeks	**-Baseline:** Tooth Brushing Instruction (TBI), and 1 time scaling in two groups **-Intervention:** proper professional toothbrushing for 5 times every 3-4days during hospitalization **-Control:** 1 time professional toothbrushing and TBI	-O'Leary index -Plaque index -Calculus index -Bleeding index -Tooth mobility index	- The O'Leary index and plaque index of the intervention group were significantly improved than those of the control group (p<0.01). **·O'Leary index:** (baseline: 38.7±14.4, after: 57.7±7.0) **·Plaque index:** (intervention: 10.15, control: 14.03) **- Calculus index** decreased in both groups (p<0.05) - Bleeding index and tooth mobility decreased in the intervention group, but the difference was not significant (p>0.05). - The effects of repeated management were seen after the third time.

Author(s) (Year)	Target population	follow-up period	Methods	Outcome measures	Results
Geisinger et al. (2014)	·16 and 24 weeks gestation with Gingival index (GI ≥ 2 at ≥ 50% of sites) N=119	8 weeks	**-Baseline:** Educational DVD, dental prophylaxis, Individually tailored intensive one-on-one oral hygiene counselling, home-care aids provided **-Follow-up 4weeks and 8weeks:** repeated counselling and oral examination	-Plaque index (PI) -Gingival index (GI) -PD -CAL	-Statistically significant reductions in PI, GI, PD, and CAL occurred over the study period (p<0001). **·PI:** (baseline: 1.35, after 8 weeks: 0.61) **·GI:** (baseline: 1.45, after 8 weeks: 0.75) **·PD:** (baseline: 3.41mm, after 8 weeks: 2.97mm) **·CAL:** (baseline: 2.26mm, after 8 weeks: 2.02mm)
Choi et al. (2015)	·55 diabetic patients in health care center -SRP=19 -PMC=20 -CT=16 -age range: 44 to 85	12 weeks	**-SRP(Scaling and root planing)** week 1: scaling week 3: root planing week 12: oral examination **-PMC(professional maintenance care)** week 1: watanabe toothbrushing method (15-30 mins) week 2: scaling week 3 - week 5: watanabe toothbrushing week 12: oral examination **-CT(control):** none	-Bleeding on Probing (BOP) -Pocket depth (PD) -Calculus index (CI) -Quality of life (SF-36)	-Statistically significant differences between the three groups in BOP score and calculus index (p<0.05). **·BOP:** The values have decreased in the SRP group (baseline 17.05% to 10.96% at 12 weeks) and the PMC group (baseline 22.25% to 5.73% at 12 weeks), while they have increased in the CT group (baseline 20.84% to 21.24% at 12 weeks). **·CI:** The values changed in the SRP group (from 2.89 to 1.05, p<0.05), PMC group (from 1.70 to 0.60, p<0.05), CT group (from 1.94 to 2.26). - The reduction of PD in 4 mm regions was not significant in both the SRP group and PMC group, (P>0.05).

2. Objectives

This study aimed to investigate the effects of an oral hygiene care program conducted by dental hygienists on oral health behavior, oral hygiene status and periodontal health in adults aged 40 years or older at public health centers (sub-centers) in rural areas where the accessibility of the dental cere service is considered poor. Detailed objectives are as follows.

First, it analyses whether professional oral hygiene care sessions performed 4 times (45 min per session in 2-week intervals) can help improve oral hygiene status;

Second, it analyses whether professional oral hygiene care sessions performed 4 times (45 min per session in 2-week intervals) can lower bleeding on probing (BOP) score;

Third, it analyses whether professional oral hygiene care sessions performed 4 times (45 min per session in 2-week intervals) and changes number of toothbrushing and days of using oral hygiene products.

Fourth, it analyses the factors that affecting change of BOP score by conducting a hierarchical analysis on demographic characteristics, oral health behaviors, and changed oral hygiene status.

3. Definition of key variables

3.1. Gingival diseases

Gingival diseases usually involve inflammation of the gingival tissues, most often in response to bacterial plaque. Gingival diseases have been subdivided into two major categories: Dental plaque-induced gingival diseases and Nonplaque-induced gingival lesions (Armitage, 1999).

1) Plaque-induced gingival disease are periodontal diseases involving inflammation of the gingiva in response to bacteria located at the gingival margin.

2) A small percentage of nonplaque-induced gingivitis can result from such varied causes as viral infections, fungal infections, allergic reactions, or mechanical trauma.

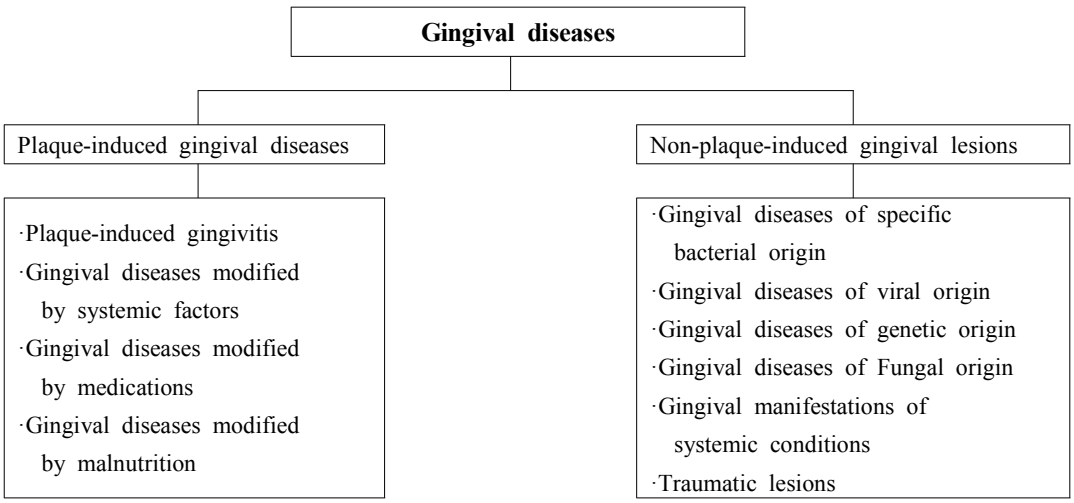

Figure 2. Two major subdivisions of gingival diseases

3.2. Periodontitis

Periodontitis is a bacterial infection that affects all parts of the periodontium including the gingiva, periodontal ligament, bone, and cementum.

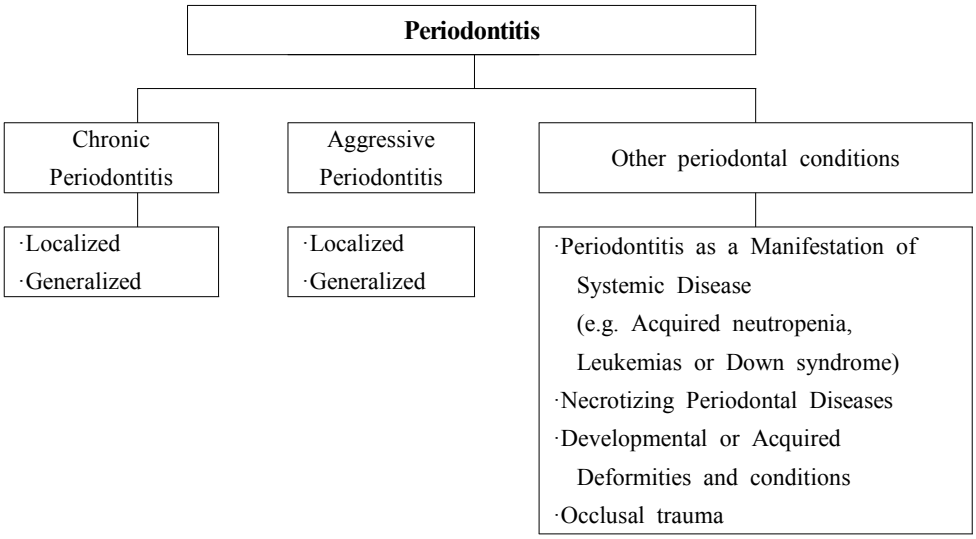

Figure 3. Categories of periodontitis

Typical nonsurgical plans such as the 5 below can be carried out for plaque-induced gingivitis patients and patients with slight to moderate chronic periodontitis patients.

1. Customized self-care instructions including patient education and motivation.
2. Periodontal instrumentation (typically a dental prophylaxis)
3. Control of local risk factors to include steps such as removal of overhanging restorations, restoration of caries, or minimizing excessive occlusal forces.
4. Correction of systemic risk factors to include steps such as smoking cessation counseling or referral for control of diabetes.
5. Reevaluation of patient's periodontal status.

Ⅱ. MATERIALS AND METHODS

1. Study design

The study design flowchart is shown in Figure 4. After selecting the subjects, they were randomly allocated into intervention and control groups according to the order of their visit.

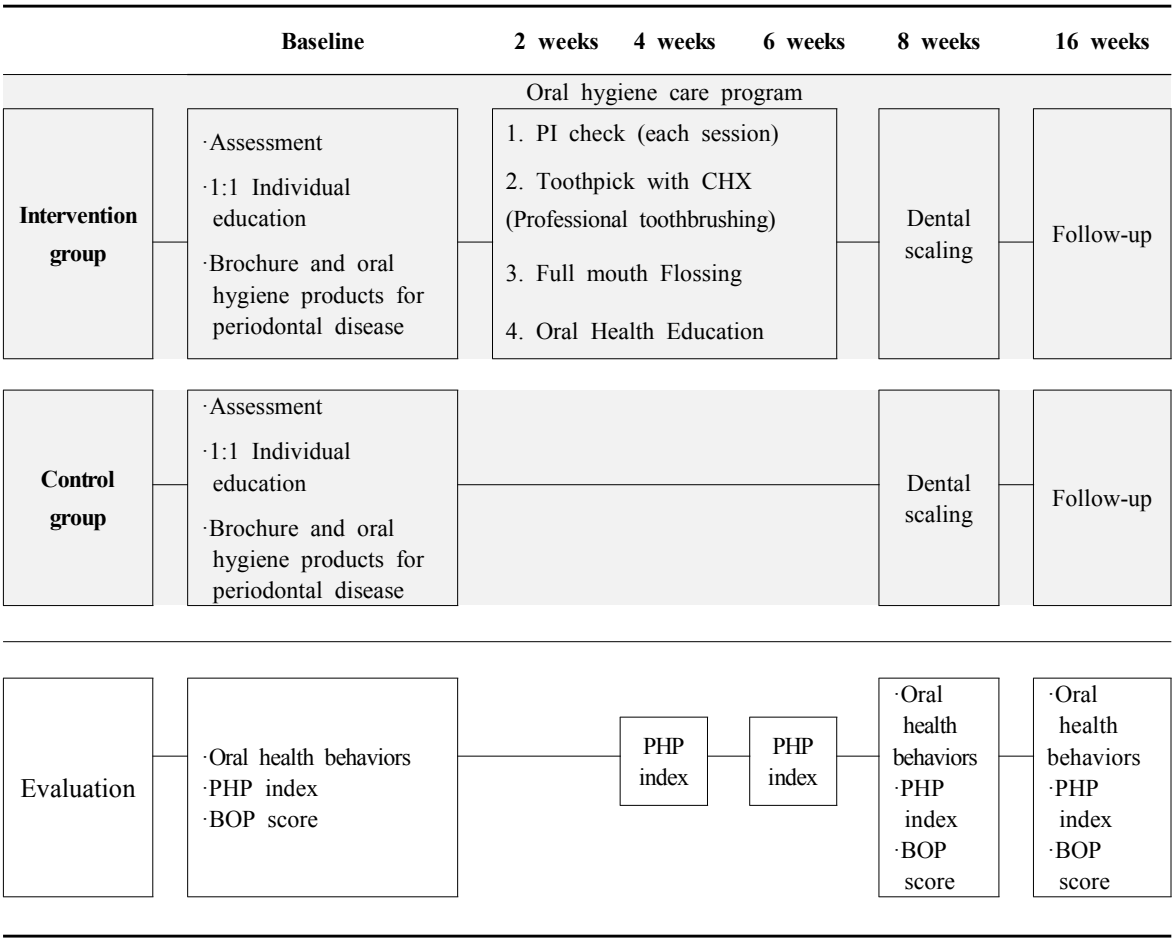

Figure 4. Study design flowchart

2. Study subjects

2.1. Samples

Study subjects included middle-aged adults older than 40 years who lived in Hongcheon-gun, Gangwon-do, or Yeoju-si, Gyeonggi-do from June, 2014 to December, 2014 (Figure 5). A total of 83 subjects participated in the program; 46 people were selected as study subjects, excluding 37 people who had a prior oral health assessment; 42 people were included in the final sample, after four subjects dropped out due to personal circumstances during the study period (Figure 6).

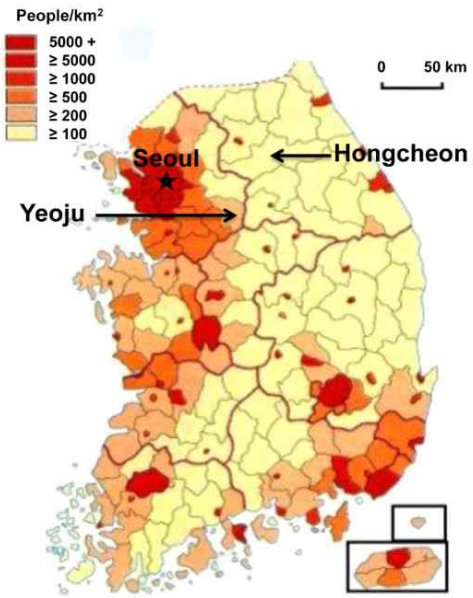

Figure 5. Study region: Hongcheon and Yeoju in South Korea

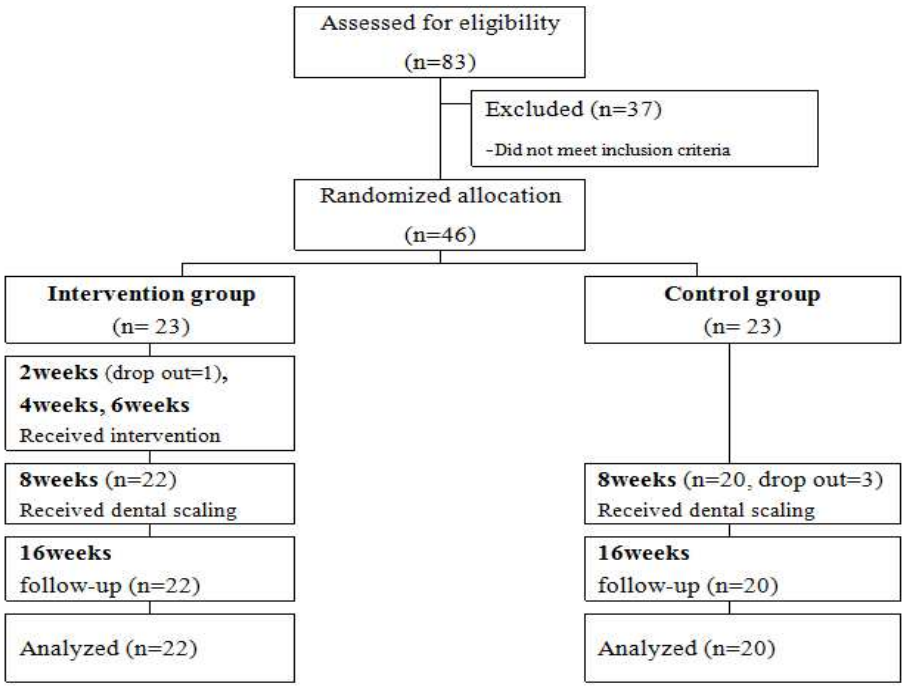

Figure 6. Flowchart for participants in this study

Table 2. Criteria of inclusion and exclusion for research participants

Inclusion criteria	Exclusion criteria
1. Voluntary participants age older than 40 years	1. Subjects who had fewer than 10 teeth
2. BOP score of at least 15%, and PHP index of at least 3.0 (Htoon et al., 2007)	2. Subjects had received periodontal treatment including scaling within the previous six months or who had normal periodontal pocket depth (within 1~3 mm) without gingival bleeding
3. Individuals taking daily medication for systemic diseases such as hypertension and diabetes	3. Infectious disease (HIV, AIDS, HEPA) or needing periodontal surgery prior to the oral hygiene care program (mob+++)

2.2. Sample size calculations [Test for equality]

The required study sample size was calculated to identify differences in plaque control effects between the intervention and control groups (Chow et al., 2007; Lee et al., 2009). The calculation of effective sample size considering a 1:1 allocation at a statistical significance level α=0.05, $Z_{\alpha/2}$=1.96, and statistical test power Z=0.84 found that 20 people were needed in each group; therefore, a total sample size of 46 people was determined to be an effective sample size for this study, considering a 10% drop-out rate.

To test whether there is a true difference between the means of the test (μ_1) and the reference value (μ_2). Let $\varepsilon = \mu_1 - \mu_2$.

Research hypothesis : $H_0 : \varepsilon = 0$ vs. $H_1 : \varepsilon \neq 0$

Sample number calculation formula :

$$n = \frac{(Z_{\alpha/2}+Z_{\beta})^2 \sigma^2 (1+1/k)}{\varepsilon^2} \qquad n = \frac{2(1.96+0.84)^2 0.7}{0.76^2} \approx 20$$

3. Procedures

3.1. Recruitment of participants and pilot test

First, the program schedule was discussed at weekly meetings with the dental hygienist of a community health center in the health sub-center. Next, voluntary participants were recruited through a community newspaper, advertisement on a health center homepage, and a notice at the health center. In order to assess the efficiency and accessibility of the oral health project, three of the recruited participants were selected for a pilot study, which was conducted once a week for four weeks.

The program was assessed by two trained dental hygienists. They performed repeated objective assessment of oral hygiene status and also received training to ensure conformity and objectivity relating to BOP score and PHP index. The reliability measurement between the investigators showed that the ICC (intra-class correlation coefficient) for BOP score was 0.903, and the Kappa coefficient measured by presence of plaque on the surfaces of five teeth was 0.755, indicating a high degree of conformity (Landis & Koch, 1977).

3.2. Process of oral hygiene care program

1) Baseline visit

At baseline, all subjects listened to an explanation of the program and provided written consent. Subjects who agreed to participate in the study answered a questionnaire assessing their general characteristics, medical history, alcohol drinking, smoking, and other oral health practices. In addition, they received a clinical evaluation including BOP score and PHP index and 1:1 individual education for prevention of periodontal diseases and a pamphlet personally produced by a educator. After selecting the subjects, they were randomly allocated into intervention and control groups according to the order of their visit.

2) Two-weeks, four-weeks, and six-weeks visit

- Professional oral hygiene care

For the intervention group, professional oral hygiene care was provided for eight weeks at two-week intervals. Each session lasted about 45 min, and a plaque check and professional cleaning for gingival health improvement were also performed. The toothpick method, where the bristle of a toothbrush is pushed into the interdental region, was used with a semi-stiff tooth brush with 2x6 lines of bristles. Chlorhexidine was applied to the toothbrush in order to procure its antiplaque and anti-gingivitis effects (Van Strydonck et al., 2012).

3) Eight-weeks visit

After eight weeks, dental scaling was performed both in the intervention and the control groups, and mouth wash was provided. Scaling was conducted on by a dentist and two dental hygienists regardless of whether the subject was in the intervention group or control group. Both an ultrasonic scaler and hand scaler were used for scaling.

4) 16-weeks visit

In order to assess the persistence of the program, gingival condition, plaque index and oral health behaviors were assessed after 16 weeks.

4. Measures

4.1. Clinical measurements

At the eighth week and the 16th week, oral health behaviors, oral hygiene status and Bleeding on probing (BOP) score were measured.

1) Plaque index (PHP index)

In order to assess the amount of plaque amount, subjects were asked to apply a disclosing solution with a cotton ball immediately prior to oral examination and then rinse three times with water. For the plaque index, the maxilla were measured in order of 16, 11, and 26, and the mandible was measured in order of 36, 31, and 46, using Podshadley and Haley's Patient Hygiene Performance Index (Podshadley & Haley, 1968), where the buccal surface of the maxilla, lingual surface of the mandible, and labial surface of the central incisor are divided into five equal parts. A score was calculated based on the presence of plaque on each of the above five tooth parts (0 = no, 1 = yes), by dividing the total score by the total number of tooth surfaces.

2) Bleeding on Probing (BOP score)

In the present study, the intervention effect was evaluated with %BOP, an early indicator of gingivitis or periodontal disease. The bleeding on probing assessment (%BOP) was performed with a mirror and a periodontal probe (PCP 11.5 WHO probe with color band (3.5-5.5 mm), ball of 0.5 mm diameter, Hu-Friedy, Chicago, IL, USA). The marginal gingiva surrounding each tooth were classified into proximal, distal, buccal and lingual,

and the amount of bleeding appearing within 15 sec after measurement of periodontal pocket depth on the four sides of the marginal gingiva was indicated as a percentage. Bleeding on probing was considered to be a continuous variable.

4.2. Oral health behaviors

Oral health behaviors was assessed through questionnaires covering oral self-care habits such as frequency of toothbrushing and auxiliary oral hygiene device usage. It was measured at the baseline, after 8 weeks, and after 16 weeks to check for any the changes. The questionnaire about the use of auxiliary oral hygiene device aside from brushing your teeth with a toothbrush was evaluated based on the number of days that a oral hygiene product was used in the last seven days, by asking the question : ‘how many times did you use dental floss or any other oral hygiene products to clean between your teeth? (Eke et al., 2013)’. Furthermore, individual oral health education was done by explaining causes of periodontal disease, ways of preventing the disease, proper ways of using oral hygiene products.

5. Statistical analysis

Shapiro-Wilk normality test was performed, and the results showed that normality was satisfied with a score of 0.094 for BOP score and 0.200 for PHP index. For general characteristics of the subjects, descriptive statistics and Chi-square tests were performed, while independent t-test and one-way ANOVA were performed for the analysis of oral health behaviors, plaque index and BOP score according to general characteristics.

Changes in oral health behaviors, plaque index and gingivitis before and after the program were analyzed with repeated-measures ANOVA. When the repeated measures ANOVA test was carried out, within-subject effects, between-subject effects, and interaction effects were considered for the analysis. Within-subject effects arise when the intervention group and control group are held constant at set points in time, according to baseline, 8 weeks and 16 weeks, the BOP score and PHP index are analysed. Between-subjects effect is when time is held constant, differences in BOP score and PHP index values between the two groups' and the differences between individual subjects are analyzed.

Finally, factors affecting BOP score change were analyzed with hierarchical multiple regression analysis. All statistical analyses were performed with PASW statistics 20.0 (SPSS Inc., Chicago, IL, USA). A two-tailed test was performed at the significance level of 0.05.

6. Ethical approval of research

The study was approved by the Yonsei University Wonju College of Medicine Institutional Research Ethics Review Board (Registration number YWDR-14-7-047, Approval date: June 5, 2014). Each subject who agreed to participate received written information about the program and gave their written consent. After the agreement, oral health related gifts were given to the participants. The gifts were toothpaste and toothbrush for the participants to the questionnaire and oral examination, and other oral hygiene products (interdental brush, dental floss) as well as mouthrinse after scaling was complete.

Ⅲ. RESULTS

1. Demographic characteristics of the study subjects

Table 3 describes the socio-demographic characteristics and oral health statuses of the subjects. Their mean age was 57.5 years, and there was no significant age difference between the two groups.

Table 3. Socio-demographic characteristics between intervention and control group

Unit: Person (%)

Characteristics	Total (N=42)		Intervention (N_1=22)		Control (N_2=20)		*P*-value
Age (years)†	57.5	±9.92	56.3	±9.61	58.9	±10.32	0.406
Gender							
Male	23	(54.8)	11	(50.0)	12	(60.0)	0.516
Female	19	(45.2)	11	(50.0)	8	(40.0)	
Education‡							
≤Elementary	5	(11.9)	2	(9.1)	3	(15.0)	0.570
Middle	8	(19.0)	3	(13.6)	5	(25.0)	
High	14	(33.3)	7	(31.8)	7	(35.0)	
≥College	15	(35.8)	10	(45.5)	5	(25.0)	
Occupation‡							
Office worker	9	(21.4)	7	(31.8)	2	(10.0)	0.244
Service and sales worker	8	(19.0)	2	(9.1)	6	(30.0)	
Agriculture, forestry, and fishery worker	14	(33.4)	7	(31.8)	7	(35.0)	
Manual worker	5	(11.9)	2	(9.1)	3	(15.0)	
Others (housewife, unemployed)	6	(14.3)	4	(18.2)	2	(10.0)	

The data were analyzed by x^2-test, P <0.05, ‡ Fisher's exact test

† Mean±standard deviation.

2. General behaviors and oral health status of the subjects

40.5% of the subjects were hypertension, 14.3% were diabetes, 23.8% were current smokers, and 45.2% were drinkers. There was no difference between the two groups (Table 4). In terms of oral health status, the subjects had 26 teeth on average and the PHP index was 2.8 points. The proportion of those having the frequency of daily tooth brushing more than 2 times was the highest (40.5%), and 28.6% of all the subjects were using oral hygiene products. At baseline, BOP score were significantly higher in the intervention group but other oral health status showed no significant differences between the two groups (Table 4).

Table 4. General behaviors and oral health status by group at the baseline

Unit: Person (%)

Characteristics	Total (N=42)		Intervention (N_1=22)		Control (N_2=20)		*P*-value
Past history							
Hypertension							
Yes	17	(40.5)	10	(45.5)	7	(35.0)	0.491
No	25	(59.5)	12	(54.5)	13	(65.0)	
Diabetes‡							
Yes	6	(14.3)	4	(18.2)	2	(10.0)	0.665
No	36	(85.7)	18	(81.8)	18	(90.0)	
General health behaviors							
Smoking‡							
Current	10	(23.8)	6	(27.3)	4	(20.0)	0.786
Past	3	(7.2)	1	(4.5)	2	(10.0)	
Never	29	(69.0)	15	(68.2)	14	(70.0)	
Drinking							
Yes	19	(45.2)	12	(54.5)	7	(35.0)	0.204
No	23	(54.8)	10	(45.5)	13	(65.0)	
Oral hygiene states							
Present teeth†	26.2	±2.25	26.3	±2.16	26.1	±2.40	0.760
PHP index (0-5)†	2.80	±0.78	2.81	±0.74	2.79	±0.84	0.928
BOP scores (0-100%)†	27.0	±15.5	32.4	±17.5	21.2	±10.4	0.018*
Oral health behaviors							
Daily toothbrushing frequency‡							
1	9	(21.4)	4	(18.2)	5	(25.0)	0.620
2	17	(40.5)	8	(36.4)	9	(45.0)	
≥3	16	(38.1)	10	(45.4)	6	(30.0)	
Auxiliary oral hygiene products							
Used	12	(28.6)	7	(31.8)	5	(25.0)	0.625
Non-used	30	(71.4)	15	(68.2)	15	(75.0)	
Previous visits to dentist							
Once a year	20	(47.6)	10	(45.5)	10	(50.0)	0.768
At irregular intervals	22	(52.4)	12	(54.5)	10	(50.0)	

The data were analyzed by x^2-test, P <0.05

† by independent t-test or one-way ANOVA, ‡ Fisher's exact test

3. Perceived oral health between group at the baseline

In terms of the perceived oral health, 57.1% reported that they had a ‘bad’ oral health. 42.9% had chewing difficulty, and about 70% experienced gingival symptoms.

In addition, 76.2% of the subjects complained of food impaction, and there was no difference between the two groups (Table 5).

Table 5. Perceived oral health between intervention and control group (baseline)

Unit: Person (%)

Characteristics	Total (n=42)		Intervention (N_1=22)		Control (N_2=20)		*P*-value
Perceived oral health status							
Good	18	(42.9)	9	(40.9)	9	(45.0)	0.789
Poor	24	(57.1)	13	(59.1)	11	(55.0)	
Chewing difficulty							
Yes	18	(42.9)	10	(45.5)	8	(40.0)	0.721
No	24	(57.1)	12	(54.5)	12	(60.0)	
Gingival health†							
Tooth mobility	10	(23.8)	6	(27.2)	4	(20.0)	0.225
Gingival swelling	5	(11.9)	4	(18.2)	1	(5.0)	
Lots of dental calculus	5	(11.9)	4	(18.2)	1	(5.0)	
Gingival Bleeding	9	(21.4)	4	(18.2)	5	(25.0)	
Normal	13	(31.0)	4	(18.2)	9	(45.0)	
Oral health symptoms							
Food impaction							
Often	32	(76.2)	16	(72.7)	16	(80.0)	0.144
Sometimes	8	(19.0)	6	(27.3)	2	(10.0)	
Never	2	(4.8)	0	(0.0)	2	(10.0)	
Mouth dryness							
Often	6	(14.3)	4	(18.2)	2	(10.0)	0.702
Sometimes	14	(33.3)	6	(27.3)	8	(40.0)	
None	22	(52.4)	12	(54.5)	10	(50.0)	
Temperature sensitivity							
Often	6	(14.3)	3	(13.6)	3	(15.0)	0.838
Sometimes	15	(35.7)	9	(40.9)	6	(30.0)	
None	21	(50.0)	10	(45.5)	11	(55.0)	
Halitosis (bad breath)							
Often	7	(16.7)	6	(17.3)	1	(5.0)	0.172
Sometimes	20	(47.6)	9	(40.9)	11	(55.0)	
None	15	(35.7)	7	(31.8)	8	(40.0)	

† Fisher's exact test

4. PHP index and BOP score according to general characteristics at the baseline

At baseline, PHP index and BOP score were compared according to general feature, general health behaviors, and oral health outcomes (Table 6). According to the results of the analysis, it was found that males with lower education level, 1 time of toothbrushing number, and no application of oral hygiene product had higher PHP index and BOP score, but it was not statistically significant. It was found that the group engaging in farming as a job had significantly higher BOP score ($p<0.05$).

Table 6. PHP index and BOP score according to general characteristics at the baseline

Unit: Person (%)

Characteristics	PHP index			BOP score		
	Mean	±SD	*P*-value	Mean	±SD	*P*-value
Gender†						
Male	2.91	± 0.84	.314	27.46	± 14.67	.858
Female	2.67	± 0.70		26.59	± 16.77	
Education‡						
≤Middle	3.01	± 0.99	.469	33.59	± 20.94	.181
High	2.63	± 0.54		25.01	± 11.82	
≥College	2.78	± 0.77		23.34	± 15.46	
Occupation‡						
Agriculture worker	3.10	±0.90	.169	35.65	± 19.89	.024
Office, service and sales worker	2.56	±0.62		20.83	± 10.87	
Manual worker and others (housewife, unemployed)	2.80	±0.78		25.78	± 10.30	
Past history						
Hypertension†						
Yes	2.57	± 0.90	.103	22.30	± 13.96	.100
No	2.97	± 0.67		30.32	± 15.86	
Diabetes†						
Yes	2.76	± 0.98	.888	24.36	± 17.22	.649
No	2.81	± 0.76		27.53	± 15.38	
General health behaviors						
Smoking†						
Yes	2.78	± 0.76	.900	20.80	± 12.74	.144
No	2.82	± 0.80		29.03	± 15.89	
Drinking†						
Yes	2.87	± 0.73	.612	27.96	± 17.60	.740
No	2.75	± 0.83		26.33	± 13.82	
Oral health behaviors						
Daily toothbrushing frequency‡						
1	3.04	± 0.61	.199	33.93	± 21.77	.330
2	2.94	± 0.84		24.85	± 12.30	
≥3	2.54	± 0.76		25.58	± 14.26	
Auxiliary oral hygiene products†						
Used	2.51	± 0.64	.131	23.67	± 13.81	.375
Non-used	2.92	± 0.81		28.43	± 16.10	
Previous visits to dentist†						
Once a year	2.83	± 0.78	.820	27.89	± 15.22	.747
At irregular intervals	2.78	± 0.80		26.32	± 16.00	

† by Independent t-test, P <0.05 , ‡ by one-way ANOVA, P <0.05

5. Changes of the Plaque index

As results of Mauchly's sphericity test, it was found that the PHP index satisfied the sphericity assumption as p-value=0.976 (p>.05). As results of the repeated measure ANOVA of the PHP index, it was identified that in the Intervention group where the professional care was performed, the plaque index decreased significantly and there was a difference between the groups at each time point. In addition, it was identified that in the changes of PHP index, there was an effect of interaction according to the groups and time (Table 7) (Figure 7).

Table 7. Changes in PHP index between intervention and control group

Time Period	Intervention (N_1=22)	Control (N_2=20)	*P*-value			
			Within	Between	Interaction	Contrast
Baseline	2.81 ± 0.74	2.79 ± 0.84				-
8 weeks	1.44 ± 0.62	2.86 ± 0.64	<0.001	<0.001	<0.001	<0.001
16 weeks	1.74 ± 0.61	2.79 ± 0.84				0.035

Repeated-measure ANOVA was used as a post hoc test

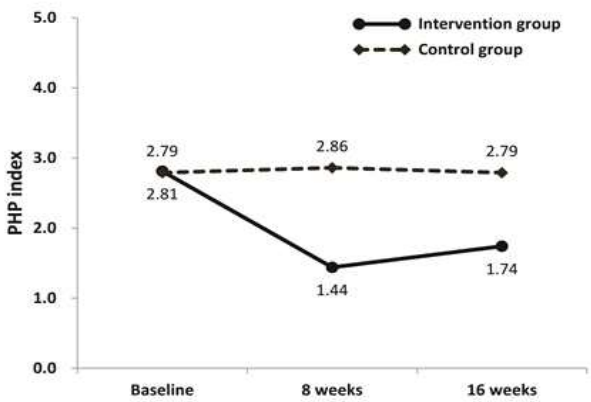

Figure 7. Changes in PHP index by group

The plaque index of the intervention group was measured at 2 weeks' time intervals (Table 8) (Figure 8) and as the result of measuring it 5 times; that there was a significant decrease from the 1st to the 4th measurement and no significance between 8 and 16 weeks.

From the perspectives of the control group, difference of PHP index was not significant.

Table 8. Changes in PHP index by measurement time point by group

	Time period	Intervention group	Within *P*-value	Contrast P-value
PHP index	Baseline	2.81 ± 0.74		-
	4 weeks	2.11 ± 0.82		<0.001
	6 weeks	1.54 ± 0.83	<0.001	<0.001
	8 weeks	1.44 ± 0.62		<0.001
	16 weeks	1.74 ± 0.61		0.083
	Time period	Control group	Within *P*-value	Contrast P-value
	Baseline	2.79 ± 0.84		-
	8 weeks	2.86 ± 0.64	0.750	0.640
	16 weeks	2.79 ± 0.84		0.624

Repeated-measure ANOVA was used as post hoc test

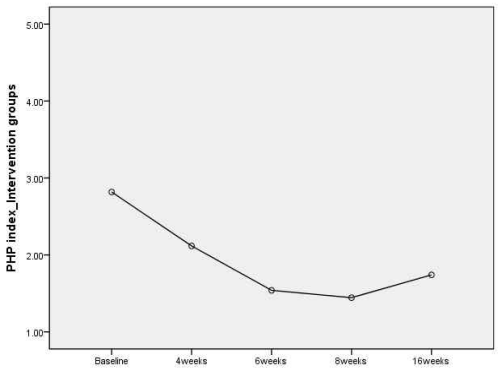

Figure 8. Change of PHP index by measurement time point in the intervention group

6. Changes of the BOP Score

For the BOP score, the repeated-measure ANOVA was conducted on the assumption that the upsilon value of Huynh-Feldt(=0.720) satisfying the sphericity assumption, approaching 1. As shown by the results of the repeated-measure ANOVA for the BOP score, it was found that within the same group, the BOP score decreased with each measurement time point ($p<0.001$). As shown by the results of the BOP score comparison between 8 week intervals for the post-hoc test, it was found that the score decreased by 22.87 in the intervention group and 0.27 in the control group between baseline and 8 weeks and the score change between 8 and 16 weeks was 3.32 in the intervention group and 7.9 in the control group. Thus, it was identified that there was a definite change in BOP score between the measurement time points between the intervention and the control group (Table 9) (Figure 9).

Table 9. Changes in BOP score between intervention and control group

Time Period	Intervention (N_1=22)	Control (N_2=20)	*P*-value			
			Within	Between	Interaction	Contrast
Baseline	32.38 ± 17.51	21.23 ± 10.42				-
8 weeks	9.51 ± 6.13	20.96 ± 10.86	<0.001	0.385	<0.001	<0.001
16 weeks	6.19 ± 6.24	13.06 ± 8.44				0.007

Repeated-measure ANOVA was used as post hoc test

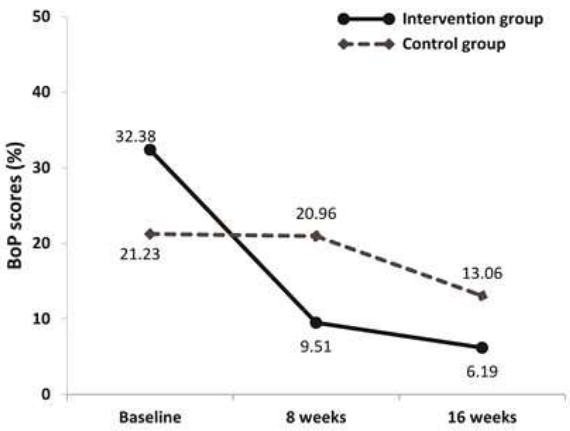

Figure 9. Changes in BOP score by group

The results of analyzing the differences within the intervention group (Table 10) showed that the BOP score in the intervention group was significantly decreased according to the measurement time point, and there were significant differences between the baseline and after 8 weeks and between after 8 and 16 weeks.

The BOP score by measurement time point within the control group was significantly decreased. These differences were between after 8 weeks and after 16 weeks (before and after scaling).

Table 10. Changes of BOP score by measurement time point by group

	Time Period	Intervention group	Within *P*-value	Contrast P-value
BOP score	Baseline	32.38 ± 17.51		-
	8 weeks	9.51 ± 6.13	<0.001	<0.001
	16 weeks	6.19 ± 6.24		<0.001
	Time Period	Control group	Within P-value	Contrast P-value
	Baseline	21.23 ± 10.42		-
	8 weeks	20.96 ± 10.86	<0.001	0.868
	16 weeks	13.06 ± 8.44		<0.001

7. Changes of the oral health behaviors

1) Change of daily toothbrushing frequency between intervention and control group

According to the results of analyzing the patients' daily toothbrushing frequency (Table 11), it was shown that the change of toothbrushing frequency (p=0.551) satisfied the sphericity assumption and the toothbrushing frequency of the intervention group showed an intragroup difference (p=0.001) increasing from 2.36 at baseline to 2.82 in 8 weeks and 2.95 in 16 weeks, but there was no change in the control group (p=0.405). It was identified that there was some difference in the toothbrushing frequency between the groups (p=0.009), but the interactive effect according to measurement time points between the group was not significant (p=0.092) (Table 11) (Figure 10).

The changes in the frequency of tooth brushing within the intervention group was significantly increased according to measurement time point and between near measurement time points, whereas there was no difference within the control group (Table 12).

Table 11. Change of daily toothbrushing frequency between intervention and control group

Time Period	Intervention (N_1=22)	Control (N_2=20)	*P*-value Within	Between	Interaction	Contrast
Baseline	2.36 ± 0.90	2.05 ± 0.76				-
8 weeks	2.82 ± 0.73	2.10 ± 0.79	=0.001	0.009	0.092	0.061
16 weeks	2.95 ± 0.72	2.25 ± 0.79				0.295

Repeated-measure ANOVA was used as post hoc test

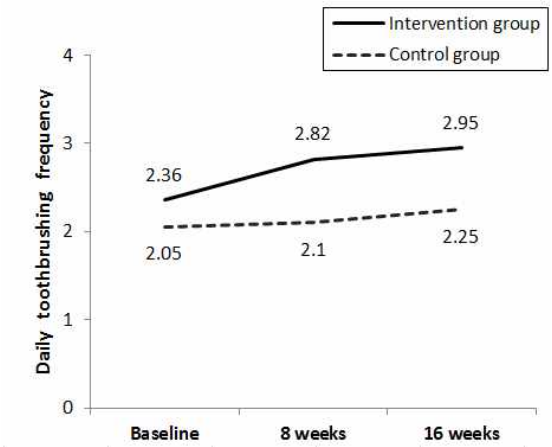

Figure 10. Change of daily toothbrushing frequency between intervention and control group

Table 12. Change of daily toothbrushing frequency by measurement time point by group

	Time Period	Mean±SD	Within P-value	Contrast P-value
Intervention	Baseline	2.36 ± 0.90		-
	8 weeks	2.82 ± 0.73	=0.001	0.015
	16 weeks	2.95 ± 0.72		<0.001
Control	Baseline	2.05 ± 0.76		-
	8 weeks	2.10 ± 0.79	0.405	0.666
	16 weeks	2.25 ± 0.79		0.286

Repeated-measure ANOVA was used as post hoc test

2) Change in use of auxiliary oral hygiene products between intervention and control group

The change in use of auxiliary oral hygiene products ($p=0.207$) also satisfied the sphericity assumption. The change in use of auxiliary oral hygiene products in the intervention group showed significant increase ($p<0.001$) by time points within the group, increasing gradually from 1.64 per day at baseline, to 3.64 per day by 8 weeks, and 3.86 per day by 16 weeks and interaction effects by groups and measurement time points was identified also (Table 13) (Figure 11).

The changes in the number of days of oral hygiene product use within the intervention group differed according to measurement time point and was significantly increased between the near measurement time points, whereas there was no difference within the control group (Table 14).

Table 13. Changes in use of auxiliary oral hygiene products between intervention and control group

Time Period	Intervention (N_1=22)	Control (N_2=20)	*P*-value Within	Between	Interaction	Contrast
Baseline	1.64 ± 2.85	1.35 ± 2.68				-
8 weeks	3.64 ± 2.85	2.15 ± 2.85	<0.001	0.095	0.044	0.102
16 weeks	3.86 ± 2.45	1.85 ± 2.60				0.060

Repeated-measure ANOVA was used as post hoc test

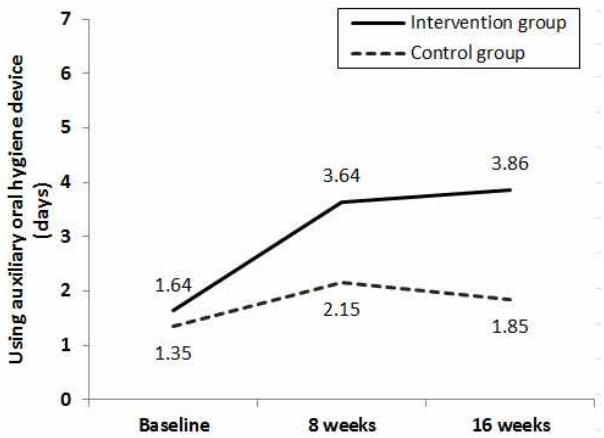

Figure 11. Change in use of auxiliary oral hygiene products between intervention and control group

Table 14. Changes of using oral hygiene products by measurement time point by group

		Mean±SD	Within P-value	Contrast P-value
Intervention	Baseline	1.64 ± 2.85		-
	8 weeks	3.64 ± 2.85	<0.001	0.002
	16 weeks	3.86 ± 2.45		0.004
Control	Baseline	1.35 ± 2.68		-
	8 weeks	2.15 ± 2.85	0.252	0.080
	16 weeks	1.85 ± 2.60		0.826

Repeated-measure ANOVA was used as post hoc test

8. Factors affecting decrease of BOP score between baseline and 16 weeks

In order to identify factors affecting change of BOP score between baseline and 16 weeks, hierarchical multiple regression analysis was performed (Table 15).

General characteristics and subjects' health practices were added to Model I, change in oral hygiene conditions was added to Model II, and presence of intervention was added to Model III. An R^2 change due to model change was determined. Based on the R^2 value, Model I explained 3% of the BOP change, while Model II explained 38.5% of the BOP change. Model III, which contained the general characteristics and the altered oral hygiene condition, explained 44.5% of the BOP change. In Model I, the changes in BOP score increased significantly in the group engaged in agriculture. In Model II calibrating the general characteristics, when the reduction in PHP index between baseline and the 16th week increased by one unit, the BOP score decreased by 11.877. In the results of the final Model III, there was a significant increase in BOP score ($t=2.143$, $p<0.05$) in the intervention group compared to that of the control group, along with an increased reduction of PHP index between baseline and the 16th week ($t=-2.174$, $p<0.05$).

Table 15. Results of hierarchical multiple regression analysis of Δ BOP score (baseline – 16 weeks)

Variables	Model Ⅰ			Model Ⅱ			Model Ⅲ		
	B	T	*P*	B	T	*P*	B	T	*P*
Gender (ref. male=1)	-2.872	-.567	.575	2.473	.598	.554	2.358	.600	.552
Age	-.403	-1.413	.167	-.100	-.432	.668	-.124	-.563	.577
Education (ref. ≥middle=1)	-2.526	-.411	.684	-.923	-.190	.851	1.989	.413	.682
Occupation (ref. agriculture=1)	13.566	2.108	.042	7.447	1.404	.170	6.968	1.382	.177
Hypertension (ref. no=1)	1.739	.332	.742	4.461	1.064	.295	4.599	1.155	.256
Diabetes (ref. no=1)	-.276	-.038	.970	.007	.001	.999	1.748	.320	.751
Δ Auxiliary oral hygiene products				-.542	-.713	.481	.019	.025	.980
Δ PHP index				11.877	4.685	.000	7.120	2.174	.037
Intervention (ref. yes=1)							11.534	2.143	.040
F	1.022			4.206*			4.656*		
Adjusted R^2	.003			.385			.445		
Adjusted R^2 change	.149			.356			.062		

* p <.001 Δ BOP score; Δ Auxiliary oral hygiene device; Δ PHP index, changes from baseline to 16 weeks
ModelⅠ: adjusted for gender, age, education, occupation, hypertension existence, diabetes existence;
ModelⅡ: adjusted for the previous list Δ Auxiliary oral hygiene device use and Δ PHP index;
Model Ⅲ: previous list plus intervention existence

IV. DISCUSSION

Although daily care for prevention of periodontal disease is important, it is likely to be neglected due to lack of education, procedural know-how, and concern. This is especially so for rural residents who have a low socioeconomic status. Such residents don't have the means, education, or incentive to engage in preventative oral hygiene practices, and the reduced availability to dental education and services in rural regions further limits their opportunities for access to quality, effective oral hygiene care. Continuous care for periodontal disease focused on behavior changes is essentially important. Also, in order to improve oral health, individuals' proper oral health behavior, relevant knowledge, and behavior change must be emphasized (Zhu et al., 2003). In the present study, the professional oral hygiene care program administered to Korean residents older than 40 years with lower accessibility to dental health services was more effective in improving oral hygiene status and reducing gingival bleeding than was conventional one-time scaling.

The duration of oral health care program implemented in previous studies ranged from about 4 to 12 weeks and the program intervals varied from 3-4 days to 1 week, 2 weeks and 4 weeks. In previous studies, the number of oral health care program sessions implemented in the intervention group varied from 2 to 5 times. However, it has been suggested across multiple studies that the number of oral health care program sessions should be more than 3 times. Fan et al. (2014) confirmed in a study that one-time scaling alone could not improve oral hygiene status in stroke patients, and described that as scaling was repeatedly administered more than 3 times, the effect was maintained and improved. A study by Kang et al. (2012) also indicated that the gingival index tended to

decrease constantly even after 3 months from the baseline, and the dental plaque index decreased greatly in the short term but tended to increase again after months over time. Woo and Kim (2010) reported that one-time education in the proper tooth-brushing method and auxiliary oral hygiene product use was insufficient to improve oral hygiene, as the education effect often regressed and disappeared within 4-6 weeks after education, suggesting the need for systematic repeated education. In this study, it was also shown that due to repeated professional education for toothbrushing and oral hygiene product use for 8 weeks at 2 weeks intervals, the plaque index decreased with increase of education number, but it increased again in the continued care period after 16 weeks. However, the degree of increase was lower than the initial plaque index, so it seemed necessary that this program should be recalled and performed regularly and continuously rather than one time for the most effective change in behavior.

Oral health education is a required course to maintain periodontal health and prevent abnormalities and it is required to select and educate oral hygiene products appropriate to the subjects. Dental floss and interdental brushes are commonly recommended oral hygiene products, which have effects on reduction of clinical parameters of gingival inflammation and are known as effective tools for adults (Jackson et al., 2006; Sambunjak et al., 2011). Originally, the interdental brush is recommended to patients with large embrasure spaces by dental professionals (Slot et al., 2008). The interdental brush is often preferred by subjects because of easier application and in this study subject to adults over 40 years old (Jonsson et al., 2006), the interdental brush was recommended due to participants' having relatively wide interdental space and the brushes can be used relatively easily. Therefore, the change in use of auxiliary oral hygiene products in the intervention group showed a significant increase ($p<0.001$) by time points within the group, increasing gradually as 1.64

per day at baseline and 3.86 per day at 16 weeks.

BOP (Bleeding on probing) score is one of the earliest clinical signs of the presence of gingival inflammation and has value in identifying patients at risk for periodontal disease progression (Lang et al., 1990). A study by Matuliene et al. (2008) reported a full-mouth bleeding score ≥30 to be a risk factor for tooth loss. The mean BOP score in the early intervention group was 32.4% in the present study, indicating unhealthy gingiva. After the study intervention, BOP decreased by 22.87% in the intervention group and 0.27% in the control group between baseline and eight weeks. In addition, the BOP decreased by 3.32% in the intervention group and 7.9% in the control group after scaling. With a decline ≥15% considered to constitute a successful non-surgical periodontal treatment (Lang & Tonetti, 2003), the present oral hygiene care program carried out in adults older than 40 years living in rural areas in Korea was considered to be effective.

It was considered that the larger decline of BOP score in the intervention group of this study was due to improvement of self-care capacity through oral health education for 8 weeks combined with professional care. The professional tooth-brushing (toothpick method) is known to improve periodontal inflammation through proper gingival stimulation and effective plaque removal (Morita et al., 1998; Horiuchi et al., 2002). This procedure helps to reduce invasion of inflammatory cells and increases fibroblasts or collagen via physical stimulation of the gingiva (Kusano et al., 2006). Choi et al. (2015) reported in a study that the BOP greatly decreased in the professional maintenance care group using the toothpick method more than 3 times compared to the root planing group, and claimed the need for continuous professional maintenance care.

The present study also showed a continuous decrease in plaque index with professional tooth-brushing combined with chlorhexidine prior to scaling. In other words, meticulous

removal of supragingival plaque, including bacteria accumulated around the gingival margin, was especially important in controlling and preventing periodontal disease (Haffajee et al., 2003). Additionally, chlorhexidine is very effective for periodontal disease treatment and maintaining good oral health, and it is the most well known antibacterial mouthwash of today. In addition to being antibacterial, antibiotic effects are also expected (Van Der Weijden et al., 2015). Choi et al. (2013) described in a study that it is helpful to perform both mechanical plaque removal such as professional toothbrushing in addition to chemical sterilization through chlorhexidine in order to minimize bacterial colonization. Therefore, it is recommended to use professional toothbrushing combined with chlorhexidine in periodontal disease prevention programs as well.

Crocombe et al. (2012) reported that everyday self-interdental cleaning was effective against dental plaque, dental calculus, and gingivitis, but had no statistical significance on clinical attachment loss. In other studies, it is also shown that no significant difference between the groups was observed for reduction of periodontal pocket depth (PD) and clinical attachment loss (CAL) (Jonsson et al., 2010; Choi et al., 2013; Choi et al., 2015). Choi et al., (2013) stated that the reason was due to the fact that periodontitis is a chronic progressive disease and that study was a short-term study conducted for 20 days on average per subject. Therefore, it can be applied to adults with gingivitis and adults with slight to moderate chronic periodontitis who are the target recipients of preventive periodontal care in the community.

Although the control group did not show early significant change, BOP score was improved after scaling was performed in the eighth week of the intervention. Routine scaling is a well-known preventive measure for periodontal disease, but it is difficult to receive regular professional scaling in areas with limited medical service accessibility. In

the areas of Gangwon-do and Gyeonggi-do, where the present study was performed, the community health sub-center was the only medical center within a 30 minutes - 1 hour drive. This seriously limited access to medical care facilities in these areas demonstrating an urgent need for active preventive education and support. In addition, Most people visit a dental clinic when they are already experiencing health problems, and they may be less motivated to visit a dental clinic to receive preventive treatment or to minimize the scope of treatment (Roberts-Thomson & Stewart, 2003).

Additionally, those who did not use dental services were found to be about 1.8-2.1 times more likely to have poor periodontal health status than those who used dental services (Park & Lee, 2010). A study by Oh (2008) reported that as the level of regional deprivation was higher, the number of one-person households in the area was higher and the number of dentists in the area was smaller, the unmet dental need in the area was higher. Therefore, in order to find ways of resolving regional disparities in medical human resources required for each individual area, it is necessary to closely examine the specific situation of individual areas and to provide services that properly reflect the needs of the local residents.

Various national policies aimed to improve access to oral hygiene care services are currently implemented, including national health insurance coverage for ‘pit and fissure sealant’ which was introduced in December 2009, health insurance coverage for ‘complete dentures’ among elderly people aged 75 years or older which was introduced in July 2012, and health insurance coverage for ‘scaling’ which was introduced in July 2013. However, most of those policies are focused on ‘economic access’ considering payment aspects, such as the ability to pay. Therefore, it is also necessary to consider ‘geographical

access' considering the availability of oral health human resources and related medical facilities.

A study by Park et al. (2014) showed that when the region was divided into city, town and district, the utilization rates of health services and oral health services in health centers were the highest in the town areas with 46.8% and 7.2%, respectively, about 2 times higher than in the district areas with the lowest utilization. By occupation, the residents engaged in agriculture, forestry or fishery were found to use the health center most frequently (56.8%) and oral health services (6.0%). However, those engaged in agriculture, forestry or fishery performed tooth brushing less than 3 times per day and had the highest risk of not taking regular oral examinations and having chewing difficulty, compared to managers, experts and related workers. Therefore, it is necessary to approach the challenge in the context of polarization of the gap between rich and poor, the aggravation of rural economy and alienation (Shin et al., 2016). Eventually, the material deprivation among those engaged in agriculture, forestry or fishery and socio-psychological changes can deteriorate their oral health through unhealthy lifestyle and life behavior, and the accumulation of such problems may lead to tooth loss, thereby resulting in a decrease in the oral health–related quality of life.

The United States is experiencing a rapidly growing shortage of dental services providers. For example, in Minnesota, 60% of dentists are expected to retire by 2,028 (Brandt & Cerra, 2008). This shortage is inconvenient for people who can afford dental services or who are covered by dental insurance, but it is catastrophic for people who live in rural areas and high-risk populations such as the poor, disabled, elderly, and minorities (Stolberg et al., 2011). This future shortage has been expected since the early 2000's, and in 2004, the national call for action put out a report outlining the need to create the

position of advanced dental hygiene practitioner (Lyle et al., 2009; Stolberg et al., 2011). ADHP is a mid-level professional position in line with other positions requiring a master's degree such as nurse practitioners, occupational therapists, physiotherapists (Lyle et al., 2009; Burgess et al., 2016). Advanced dental hygiene practitioners' role is to provide primary dental care of patients, including education, diagnostic services, prevention, therapy, such as non-surgical periodontal therapy, and minimally invasive restorative procedures such as installing dental crowns and antibiotic application. Also, advanced dental hygiene practitioners provide referral services to other specialist dental professionals when required (Stolberg et al., 2011).

In a clinical setting, advanced dental hygiene practitioners provide the role of a primary dental care giver or first point of contact with the dental care system. They can work with patients on education regarding diet and nutrition or smoking cessation. They can create an individualized treatment plan under the supervision of a collaborating dentist, provide, dispense, and administer analgesic, in amatory, or antibiotic medication, and make referrals to professionals where services beyond the scope of the ADHP are required (Stolberg et al., 2011).

At a community level, the role of the ADHP is similar to the clinical setting. The major difference between ADHPs and DHs is that the advanced practitioners can function independently of a dentist. They may provide basic services such as check-ups and periodontal cleaning with only indirect supervision as opposed to general supervision which is required for ordinary dental hygienists (Stolberg et al., 2011; Burgess et al., 2016). This aspect of their role is especially vital as the dwindling population of dentists is resulting in dentists increasingly being only available in large urban centers. A rapid increase in the number of advanced dental hygiene practitioners will mean that more practitioners will be

available in rural areas, and their availability will more closely match the distribution of the general population compared to the distribution of dentists (Fonkert, 2007). Therefore, public oral health projects and periodontal management-oriented oral health education projects for the prevention of periodontal disease, one of social diseases, should be actively implemented in the Korean society (Sheiham & Nicolau, 2005).

According to Zander et al. (2013), oral health management programs are very necessary in agricultural rural areas, and the current study under investigation also suggests the necessity to carry on oral health management sustainably for the improvement of oral health in rural areas (Parker et al., 2005). Choi et al. (2015) reported that the dropout rate was high with 20 dropouts (26.67%) out of a total of 75 middle-aged and elderly people in a 12 weeks program conducted at a public health center. Therefore, when a periodontal care program is expanded and conducted in health sub-centers in rural area in the future, it is appropriate to first establish cooperative relationships with village heads, local public health centers and local dental clinics and to conduct such a program during the unoccupied farming season rather than the farming. It is appropriate that a program is to be conducted three times at intervals of 1-2 weeks.

Furthermore, it is thought that the appropriate length of the 1st session is about 45 minutes to educate about the causes and prevention of periodontal disease and its relationship with systemic disease, and the appropriate length of the 2nd and 3rd sessions is about 30 minutes per session to provide professional care and toothbrushing as well as education about use of oral hygiene products.

It is necessary to link up to receive scaling after performing professional care and self-care at least 2-3 times in order to strengthen the oral health practice competency of residents in the community. In addition, it is judged that a combination of mechanical

removal of oral biofilm through professional toothbrushing and chemical sterilization by chlorhexidine would be helpful for periodontal health. In the future, it is necessary to develop and commercialize dental hygienist periodontal care protocols including education about smoking cessation, nutrition and systemic disease in the community, and related legal systems, facilities and resources should be secured, so that dental hygienists can act more actively as advocates of village residents, healthcare providers and educators.

Oral hygiene care projects conducted at public health centers should be continuously monitored. The BOP score and PHP index implemented in the present study may differ between studies according to inter-observer reliability, and can be more easily quantified when equipment for objective diagnosis such as electronic probe and Q-Ray™ system become commercially available in the future. Moreover, the Korea National Health and Nutritional Examination Survey (Ministry of Health and Welfare, 2015) is conducted in South Korea to build a national health evaluation system every year. In the KNHNES with respect to periodontal disease in adults, the periodontal tissue examination of the subjects is performed using the community periodontal index (CPI, Community Periodontal Index). In the Community Health Survey (Ministry of Health and Welfare, 2015), periodontal status is measured using a subjective self-report survey with items including ‘it’s normal’, ‘my gums are bleeding’, ‘I have a lot of calculus’, ‘My gums are often swollen’, ‘My teeth are loose’. Recently, self-reported questionnaires for measuring periodontal health have continuously developed in foreign countries (Eke et al., 2013; Khader et al., 2015; Abbood et al., 2016), and its validity and reliability were also assessed in South Korea (Jin et al., 2014). Therefore, when assessing the effectiveness of health projects for periodontal care in adults in the future, mid-term and long-term periodontal health monitoring will be feasible if both objective and subjective indicators

are evaluated together.

There are several limitations to the present study. First, the study sample might not be representative of the general population, as it included only subjects with relatively good periodontal health, excluding individuals with severe tooth mobility or requiring surgery. It is considered possible to manage subjects with relatively healthy gums or gingivitis with a community health care program focused on prevention services. Second, although subjects were allocated randomly in order of visit, the initial BOP score was higher in the intervention group than in the control group. This may have resulted in extending the decline in BOP score after the end of the intervention. Third, comparison with a no treatment group was not performed due to ethical reasons. However, only one subject dropped out of the oral care intervention, and subjects reported a high degree of satisfaction with professional tooth-brushing education and oral hygiene care education. In the present study, professional care and continuous oral health education for eight weeks prior to scaling among adults older than 40 years resulted in a change in oral health behaviors and substantial reduction in gingival bleeding. Therefore, the implementation and expansion of primary oral hygiene services for the prevention of periodontal disease by oral health professionals working at community health (sub-) centers could contribute towards resolving regional imbalances in areas with lower dental service accessibility. Furthermore, patients who need treatment of periodontal disease should be provided with systems to receive treatment in conjunction with dental clinics and hospitals. For alienated elderly people who have mobility difficulties, and cannot thus visit a health center, it is necessary to implement home visiting oral health services and investigate their effects.

V. CONCLUSION

This study provided a professional oral health program to prevent periodontal disease of rural residents who visited Gangwon/Gyeonggi region community health centers between June, 2014 to December, 2014, evaluated the effectiveness of the oral health behaviors, oral hygiene status and BOP score. Subjects older than 40 years were allocated randomly by order of visit into an intervention group (N_1=23) and control group (N_2=23). For the intervention group, a total of 4 sessions of professional care were performed with 2 weeks intervals and scaling was conducted after 8 weeks. For the control group, 1 session of education was given at the baseline and scaling was administered after 8 weeks. The analyses yielded the following results:

First, the Plaque index was shown to have a significant difference between the intervention group and the control group. The intervention group shows significant decrease 2 weeks before scaling for 8 weeks to be 2.81, 2.11, 1.54, 1.44 and there was no significant difference between 8 weeks and 16 weeks. The control group shows an increase from the baseline to 8th weeks from 2.79 to 2.86, and decreased to 2.79 again at 16 weeks but there was no significance.

Second, The BOP score decreased by 22.87 in the intervention group and 0.27 in the control group between the baseline and 8 weeks, so it was identified that the oral health education and the professional care conducted before the scaling had statistically significant effect. The BOP score decreased by 3.32 in the intervention group and 7.9 in the control group after implementing the scaling in both groups after 8 weeks.

Third, The daily toothbrushing frequency of the intervention group showed an intragroup difference increasing from 2.36 at baseline to 2.82 in 8 weeks and 2.95 in 16 weeks, but there was no change in the control group. The change in use of auxiliary oral hygiene products in the intervention group showed a significant increase by time points within the group, increasing gradually as 1.64 per day at baseline, 3.64 per day at 8 weeks, and 3.86 per day at 16 weeks and interaction effects by groups and measurement time points were identified also.

Fourth, As results of the multiple regression model analysis show, Model I, BOP score change increased significantly in the group engaged in agriculture. In Model II, which was calibrated For the general characteristics, when the reduction in PHP index between baseline and the 16th week increased by one unit, BOP score decreased by 11.877. In the results of the final Model III, there was a significant increase in BOP score in the intervention group compared to the control group, along with an increased reduction of PHP index between baseline and the 16th week.

In this study, a reduction effect of gingival bleeding was identified through professional care and continuous oral health education for 8 weeks prior to scaling, targeting adults over 40 years old. Therefore, the implementation and expansion of primary oral health services for the prevention of periodontal disease by oral health professionals working at community health (sub-) centers could contribute towards resolving regional imbalances in areas where the accessibility of the dental cere service is considered poor.

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APPENDICES

Appendix 1. Permission of Research Ethics Enquiry Commission

연구윤리 심사 의뢰서

접수번호	2014-05-24			접수일자	2014년 5월 26일	
연구과제명	일부 보건지소에 내원한 지역주민의 치주관리 프로그램의 효과					
연구책임자	소 속	예방의학교실	직 위	교수	성 명	장세진
신 청 자	성 명	이민영		핸드폰	010-2588-7652	
				E-mail	dud7652@yonsei.ac.kr	
연 구 기 간	*연구윤리 승인 후* - 2015년 05월 30일					
연구의 종류	☐ 환자대상 설문조사 ☐ 일반인대상 설문조사 ☐ 정상세포배양 ☐ 보관된 검체연구 ☐ 의무기록을 이용한 연구 ☐ 조직 및 혈액연구 ☑ 관찰연구 ☐ 일반인 또는 환자를 대상으로 의학적 시술이 필요한 경우 ☐ 기타 ( )					

위 연구책임자께서 제출하신 연구과제에 대하여 연구윤리심의위원회에서 검토하여 다음과 같이 결정하였음을 통지합니다.

- 다 음 -

심사일	2014. 06. 05	승인번호	YWDR-14-7-047	통보일자	2014. 06. 05
심사결과	☐ 원안승인 ■ 수정 자료 승인 ☐ 반려				
비 고					

연세대학교 원주의과대학 연구윤리심의위원장

Appendix 2. Oral examination and questionnaire

□□-□□□

연구 참여 동의서

일부 보건지소에 내원한 지역주민의 치주관리 프로그램의 효과

❑ 치위생관리(Dental Hygiene care) 내용

치과위생사가 귀하의 현재 구강상태를 파악하기 위하여,
현재 남아 있는 **치아, 잇몸상태, 치면세균막 정도**를 검사할 예정입니다.
더불어 현재 알고 있는 **구강건강관련 지식정도와 구강위생관리**를 어떻게 하고 계신지 여쭤보겠습니다.
귀하의 잇몸상태가 좋아질 수 있도록 **전문가 잇솔질을 포함한 구강위생관리**를 제공해드릴 예정입니다.

❑ 개인정보 비밀 보장

본 연구에 기록된 모든 개인정보는 연구목적으로만 사용할 것이며, 조사한 결과를 분석하기 위해 컴퓨터 프로그램에 입력할 경우 코드화함으로써 직접 참여하는 연구자 이외에는 철저하게 비밀을 보장할 것입니다.

구강검사와 설문 도중 불편하신 점이 있으시면, 언제든지 자유의사에 의해 참여를 중단하실 수 있으며, 연구 참여를 거부 또는 중단하더라도 불이익이 가해지지 않습니다.

본인_____는(은) 위 내용에 관해 충분한 설명을 듣고 확인하였습니다.

본 연구에 참여할 것을 동의합니다.

201 년 월 일 서명 : _____(인)

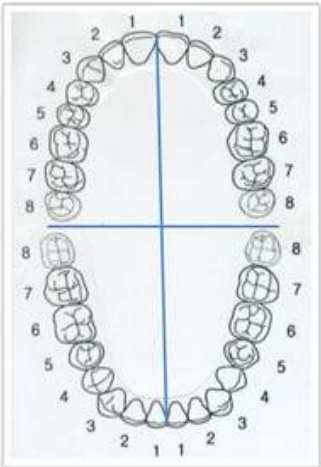
연세대학교 원주의과대학 예방의학교실

책임 연구원 이만영 : 010-2588-7652, dmd7652@yonsei.ac.kr
지도 교수 장세진 : 033-741-0347, chang0343@yonsei.ac.kr

치위생사정(Dental Hygiene Care Assessment)

이 름		성 별	□①남 □②여	주민번호	- (만 세)
주 소				전화번호	
대상자 Needs	□ 충치치료 □ 잇몸치료 □ 보철치료 □ 식편압입 □ 입마름 □ 온도민감			Scaling 필요 여부	□ 필요 □ 불필요

□1. 치아검사



구분	상악	하악
치아상태	□① 유치악 □② 무치악	□① 유치악 □② 무치악
의치장착 여부	□⑨ 해당없음 □①부분틀니 □②완전틀니	□⑨ 해당없음 □①부분틀니 □②완전틀니
잔존치아 개수	_____ 개	_____ 개

구분	측정	결과
BoP	탐침시 출혈된 부위수 / 평가 치아 수×4 ×100	_____ _____%
PHP index	각 치면 수의 점수 합 / 평가 치아 수	_____ _____

□2. 탐침 시 출혈(Bleeding on probing)

18	17	16	15	14	13	12	11	21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41	31	32	33	34	35	36	37	38

□3. 구강위생 상태 검사(PHP index)

검사대상		부 분						기타 특이사항
치아	치면	치은	중앙	절단	근심	원심	계	
16	협면							
11	순면							
26	협면							
36	설면							
31	순면							
46	설면							

☞ **전신건강에 관한 물음입니다.** 다음 설문내용 가운데 **본인의 생각과 일치하는 보기에 ☑ 표시**를 하여주십시오.

내 용	구분			
1. 전신질환	귀하는 의사로부터 다음과 같은 질환을 진단받은 적이 있습니까?			
	고혈압 □① 예 □② 아니오	□① 완치 □② 현재 치료 중 (□약물 □운동 □식이) □③ 치료 받은 적 없음(방치)	**당뇨** □① 예 □② 아니오	□① 완치 □② 현재 치료 중 (□약물 □운동 □식이) □③ 치료 받은 적 없음(방치)
	측정수치	(/)mmHg	측정수치	식전 / 식후2시간( )mg/dl
	□ 기타( )			
2. 흡연	□① 현재 흡연 (흡연기간: 년 월 / 하루 평균 흡연 양: 개비) □② 금연 중 (금연기간: 년 월) □③ 흡연경험 없음			
3. 음주	□① 예 □② 아니오 ▸음주빈도: □① 월 1회 미만 □② 월 2~4회 □③ 주 2~3회 □④ 주 4회 이상 ▸한번 음주량: 잔(술 종류: 소주 / 맥주)			

☞ **구강건강에 관한 물음입니다.** 다음 설문내용 가운데 **본인의 생각과 일치하는 보기에 ☑ 표시**를 하여주십시오.

1. **스스로 생각할 때 치아와 잇몸 등 귀하의 구강건강이 어떤 편이라고 생각합니까?**
□① 매우 좋음 □② 좋음 □③ 보통 □④ 나쁨 □⑤ 매우 나쁨

2. **현재 치아나 틀니, 잇몸 등 입안의 문제로 음식을 씹는 데 어려움이나 불편함을 느낍니까?**
(※틀니를 사용하는 경우에는 틀니를 낀 상태에서 느끼는 상태를 말씀해 주십시오.)
□① 매우 불편하다 □② 불편하다 □③ 그저 그렇다 □④ 별로 불편하지 않다 □⑤ 전혀 불편하지 않다

3. **치주조직(잇몸)의 건강은 어느 정도라고 생각합니까? (한가지만 응답)**
(※ 여러 개의 증상이 동시에 나타나는 경우, 가장 위중한 증상을 선택함. 1번으로 갈수록 위중)
□① 이가 흔들린다
□② 잇몸이 자주 붓는다
□③ 치석이 많다
□④ 잇몸에서 피가 난다
□⑤ 정상이다
□⑥ 해당없음

4. **어제 하루 동안 칫솔질을 한 시기에 모두 ☑표시해 주십시오.**
□① 아침식사 후에 □② 점심식사 후에 □③ 저녁식사 후에
□④ 잠자기 전에 □⑤ 하지 않음 □⑥ 해당없음

5. **본인의 구강건강지식과 일치하는 보기에 ☑ 표시를 하여 주십시오.**

문 항	①맞음	②틀림	③모르겠음
문5-1) 설탕이 든 음식과 음료를 많이 먹으면, 충치가 생길 가능성이 더욱 커진다.	□	□	□
문5-2) 잇몸에서 피가 나는 것은 잇몸병의 징조이다.	□	□	□
문5-3) 이를 닦는 것은 잇몸건강에 도움이 될 것이다.	□	□	□
문5-4) 치실이나 치간솔을 사용하는 것은 잇몸건강에 도움이 될 것이다.	□	□	□
문5-5) 자연치아가 전혀 없는 사람들은 문제가 있을 때에만 치과검진이 필요하다.	□	□	□

6. 본인의 구강건강증상과 일치하는 보기에 ☑ 표시를 하여 주십시오.

문 항	①없음	②가끔	③자주	④해당없음
문6-1) 음식물이 치아 사이에 끼십니까?	□	□	□	□
문6-2) 입이 마른 적이 있습니까?	□	□	□	□
문6-3) 뜨겁거나 찬 음식에 민감하십니까?	□	□	□	□
문6-4) 칫솔질 할 때 잇몸에서 피가 나십니까?	□	□	□	□
문6-5) 입에서 냄새가 나십니까?	□	□	□	□

7. 가장 최근에 구강진료기관(치과의원 종합병원치과 치과병원 보건소치과)을 방문한 때는 언제입니까?
□① 6개월 이내 □② 6개월~1년 이내 □③ 1~3년 이내 □④ 3년 이상 □⑤ 간 적이 없다

8. 구강진료기관에서 (치과의사나 치과위생사가) 귀하에게 치주질환 혹은 잇몸병이 있다고 언급한 적이 있습니까?
□① 예 □② 아니오 □③ 해당없음

9. 최근 1년 동안 스케일링(치석제거)을 받은 적이 있습니까?
□① 예 □② 아니오 □③ 해당없음

10. 최근 1주일 동안 치약과 칫솔이외에 치실 혹은 치간솔을 사용하여 치아 사이를 닦은 날은 며칠입니까?
□① 일주일에_____일 □② 사용 않함

11. 최근 1년 동안 치과진료가 필요하다고 생각하였으나 진료를 받지 못한 적이 있습니까?
□① 예(11-1질문으로) □② 아니오 □③ 해당없음

문11-1) 진료를 받지 못한 이유는 무엇입니까? (가장 중요한 한가지만 응답)

⇒ (_____)

예) 경제적 이유, 멀어서, 거동이 불편해서, 무서워서, 덜 중요해서 등

12. 귀하께서는 현재 어떤 일을 하고 계십니까?
⇒ (_____)

13. 현재 누구와 함께 사십니까?
□① 혼자산다 □② 부부만 산다 □③ 가족과 함께 산다

14. 귀하의 최종 학력은 다음 중 어디에 해당됩니까?
□① 초졸이하 □② 중졸 □③ 고졸 □④ 대졸이상

※ 끝까지 설문에 응해주셔서 감사합니다.

____회차 Dental Hygiene Care

대상자 ID		이름		성 별	□①남 □②여	날 짜	2014. .

□1. 구강위생 상태 검사(PHP index)

검사대상		부 분						측정	결과
치아	치면	치은	중앙	절단	근심	원심	계		
16	협면							각 치면 수의 점수 합 / 평가 치아 수	_____
11	순면								
26	협면								
36	설면								
31	순면								
46	설면								

□2. 치위생 관리내용

치태검사	전문가 잇솔질	구강보건교육	불소도포	스켈링

□3. 구강보건교육내용

항 목	대상자 교육 및 자가관리 내용

_4_회차 Dental Hygiene Care

대상자 ID		이름		성 별	□①남 □②여	날 짜	2014. .

□1. 탐침 시 출혈(Bleeding on probing)

18	17	16	15	14	13	12	11		21	22	23	24	25	26	27	28
48	47	46	45	44	43	42	41		31	32	33	34	35	36	37	38

□2. 구강위생 상태 검사(PHP index)

검사대상		부 분						측정	결과
치아	치면	치은	중앙	절단	근심	원심	계		
16	협면							각 치면 수의 점수 합 / 평가 치아 수	_____
11	순면								
26	협면								
36	설면								
31	순면								
46	설면								

□3. 치위생 관리내용

치태검사	전문가 잇솔질	구강보건교육	불소도포	스켈링

4. 어제 하루 동안 칫솔질을 한 시기에 모두 ☑표시해 주십시오.

□① 아침식사 후에 □② 점심식사 후에 □③ 저녁식사 후에
□④ 잠자기 전에 □⑤ 하지 않음 □⑥ 해당없음

5. 본인의 구강건강증상과 일치하는 보기에 ☑ 표시를 하여 주십시오.

문 항	①없음	②가끔	③자주	④해당없음
문7-1) 음식물이 치아 사이에 끼십니까?	□	□	□	□
문7-2) 입이 마른 적이 있습니까?	□	□	□	□
문7-3) 뜨겁거나 찬 음식에 민감하십니까?	□	□	□	□
문7-4) 칫솔질 할 때 잇몸에서 피가 나십니까?	□	□	□	□
문7-5) 입에서 냄새가 나십니까?	□	□	□	□

6. <u>최근 1주일 동안</u> 치약과 칫솔이외에 치실 혹은 치간솔을 사용하여 치아 사이를 닦은 날은 며칠입니까?

□① 일주일에_____일 □② 사용 않함

_5_회차 Dental Hygiene Care

대상자 ID		이름		성 별	□①남 □②여	날 짜	2014. .

□1. 구강위생 상태 검사(PHP index)

검사대상		부 분						측정	결과
치아	치면	치은	중앙	절단	근심	원심	계		
16	협면							각 치면 수의 점수 합 / 평가 치아 수	_____
11	순면								
26	협면								
36	설면								
31	순면								
46	설면								

□2. 치위생 관리내용

치태검사	전문가 잇솔질	구강보건교육	불소도포	스켈링

3. 치주관리 프로그램에 관한 만족도 조사입니다. 해당하는 보기에 ☑ 표시를 하여 주십시오.

문 항	①그렇다	②보통이다	③그렇지 않다
문3-1) 본 보건소의 "치주관리 프로그램" 시행에 만족하셨습니까?	□	□	□
문3-2) 이번 프로그램을 받고 현재 매 식후 잇솔질을 실천합니까?	□	□	□
문3-3) 이번 프로그램을 받고 현재 구강관리용품(치실, 치간칫솔)을 사용합니까?	□	□	□
문3-4) 본 "치주관리 프로그램"을 주위에 다른 사람에게 권유하시겠습니까?	□	□	□

4. 본 프로그램에서 좋았던 점이나, 향후 추가되었으면 하는 점이 있으시면 자유롭게 기술해주세요.

좋았던 점	
보완할 점	

본 프로그램에 참여하여 주셔서 다시 한번 감사드립니다.

치주질환 관련 간이 설문지

귀하의 구강건강에 관한 질문입니다.

1. 스스로 생각할 때 치아와 잇몸 등 귀하의 구강건강이 어떤 편이라고 생각합니까?
□① 매우 좋음 □② 좋음 □③ 보통 □④ 나쁨 □⑤ 매우 나쁨

2. 현재 치아나 틀니, 잇몸 등 입안의 문제로 음식을 씹는 데 어려움이나 불편함을 느낍니까?
(※틀니를 사용하는 경우에는 틀니를 낀 상태에서 느끼는 상태를 말씀해 주십시오.)
□① 매우 불편하다 □② 불편하다 □③ 그저 그렇다 □④ 별로 불편하지 않다 □⑤ 전혀 불편하지 않다

3. 현재 본인의 구강 상태에 무슨 치료가 필요하다고 생각하십니까? (해당 하는 모두를 선택해 주십시오)
□① 구강검사 □② 스케일링 및 잇몸치료 □③ 썩은 이 봉하기 □④ 신경치료
□⑤ 이 빼기(발치) □⑥ 보철, 틀니 해 넣기 □⑦ 없다 □⑧ 모르겠다

4. 가장 최근에 구강진료기관(치과의원, 종합병원치과, 치과병원, 보건소치과)을 방문한 때는 언제입니까?
□① 6개월 이내 □② 6개월-1년 이내 □③ 1-3년 이내 □④ 3년 이상 □⑤ 간 적이 없다

5. 어제 하루 동안 칫솔질을 한 시기에 모두 ☑표시해 주십시오.
□① 아침식사 후에 □② 점심식사 후에 □③ 저녁식사 후에
□④ 잠자기 전에 □⑤ 하지 않음

※ 다음은 현재 구강내 남아있는 치아가 10개 이상일 경우(보철물 포함)만 응답해 주십시오.

6. 치주조직(잇몸)의 건강은 어느 정도라고 생각합니까? (한가지만 응답)
(※ 여러 개의 증상이 동시에 나타나는 경우, 가장 위중한 증상을 선택함. 1번으로 갈수록 위중)
□① 이가 흔들린다
□② 잇몸이 자주 붓는다
□③ 치석이 많다
□④ 잇몸에서 피가 난다
□⑤ 정상이다

7. 본인의 구강건강증상과 일치하는 보기에 ☑ 표시를 하여 주십시오.	없음	가끔	자주
4-1) 음식물이 치아 사이에 끼십니까?	①	②	③
4-2) 입이 마른 적이 있습니까?	①	②	③
4-3) 뜨겁거나 찬 음식에 민감하십니까?	①	②	③
4-4) 칫솔질 할 때 잇몸에서 피가 나십니까?	①	②	③
4-5) 입에서 냄새가 나십니까?	①	②	③

8. 구강진료기관에서 (치과의사나 치과위생사가) 귀하에게 치주질환 혹은 잇몸병이 있다고 언급한 적이 있습니까?
□① 예 □② 아니오

9. 최근 1년 동안 스케일링(치석제거)을 받은 적이 있습니까?
□① 예 □② 아니오

10. 최근 7일 동안 치약과 칫솔이외에 치실 혹은 치간솔을 사용하여 치아 사이를 닦은 날은 며칠입니까?
□① 일주일에_____일 □② 사용 않함

<국문초록>

농촌 지역 주민을 위한 보건(지)소 치주관리사업의 효과

이 민 영

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치주질환은 치아표면에 형성되는 치면세균막과 세균에 대한 숙주반응에 의해 치주조직이 파괴되는 만성염증성 질환으로 중년층 이상에서 치아상실의 주된 원인이다. 최근에는 치아상실뿐만 아니라, 심장질환, 당뇨 등 전신질환과의 관련성에 대한 관심이 커지면서 예방의 중요성이 부각되고 있다. 특히 농촌 지역 주민은 더 많은 치주질환을 호소하며, 병의원의 진료를 대신하는 보건(지)소의 구강보건업무는 2009년부터 공중보건치과의사의 지속적인 감소로 인하여 해당 업무가 축소되거나 일부 폐지되는 지역이 늘어나고 있다. 이러한 구강진료자원의 지역 간 불균형은 구강진료 미충족률의 격차에 영향을 미칠 수 있어 이에 대한 대비가 필요하다. 따라서 본 연구는 일부 농촌지역 성인을 대상으로 치주관리 프로그램을 실시하여 구강건강행동, 구강위생상태의 변화, 치은염 지수의 효과를 평가하고자 하였다.

2014년 6월부터 동년 12월까지 강원도 내 1개 보건지소와 경기도 내 1개 보건소(community health center)를 거점으로 해당 지역에 거주하는 40세 이상의 중장년층

을 무작위로 중재군(N_1=23)과 대조군(N_2=23)으로 할당하였다. 본 연구의 취지에 동의한 자를 대상으로 중재군과 대조군 모두 처음 방문 시 구강위생교육과 치주질환 예방책자를 제공하였고, 구강관련 설문과 구강검사를 시행하였다. 중재군은 2주 간격으로 8주 동안 치주질환의 원인이 되는 치면세균막 검사, 치은출혈 감소를 위한 전문가 칫솔질, 구강위생용품 실천교육을 포함한 치주관리 프로그램을 제공하였다. 8주 후 두 군 모두 스케일링을 시행하였다. 보건지소에서 시행된 스케일링은 보건소로부터 협조받은 이동진료차량과 구강보건실 유니트체어에서 치과공중보건의 1인과 치과위생사 2인이 수행하였다. 두 그룹 간 프로그램 횟수별 치면세균막 및 치은염 변화, 칫솔질 횟수 및 구강위생용품 사용 일수의 변화는 반복측정 분산분석을 이용하여 분석하였고, 치은출혈 지수(BOP score) 감소에 영향을 주는 요인을 파악하기 위해 위계적 다중회귀분석을 시행하였다.

분석결과, 프로그램 시행 16주 후 중재군은 칫솔질 횟수, 구강위생용품 사용 일수가 유의하게 개선되었고 치면세균막 지수, 치은출혈 지수 또한 감소하였다. 처음과 8주 후 치은출혈 지수는 중재군에서 22.87, 대조군에서 0.27 감소하여 스케일링을 받기 전에 수행한 구강보건교육과 전문가관리의 효과를 확인하였다($p<0.001$). 8주 후 두 그룹 모두 스케일링을 시행한 후 치은출혈 지수는 중재군에서 3.32, 대조군에서 7.9 감소하였다($p<0.05$). 다중회귀분석을 시행한 최종 모형Ⅲ의 결과, 치은출혈 지수 변화량(ΔBOP score)은 처음과 16주의 치면세균막 지수 감소량(ΔPHP index)이 증가할수록($t=-2.174$, $p<0.05$), 대조군에 비해 중재군에서 유의하게 증가하였다($t=2.143$, $p<0.05$).

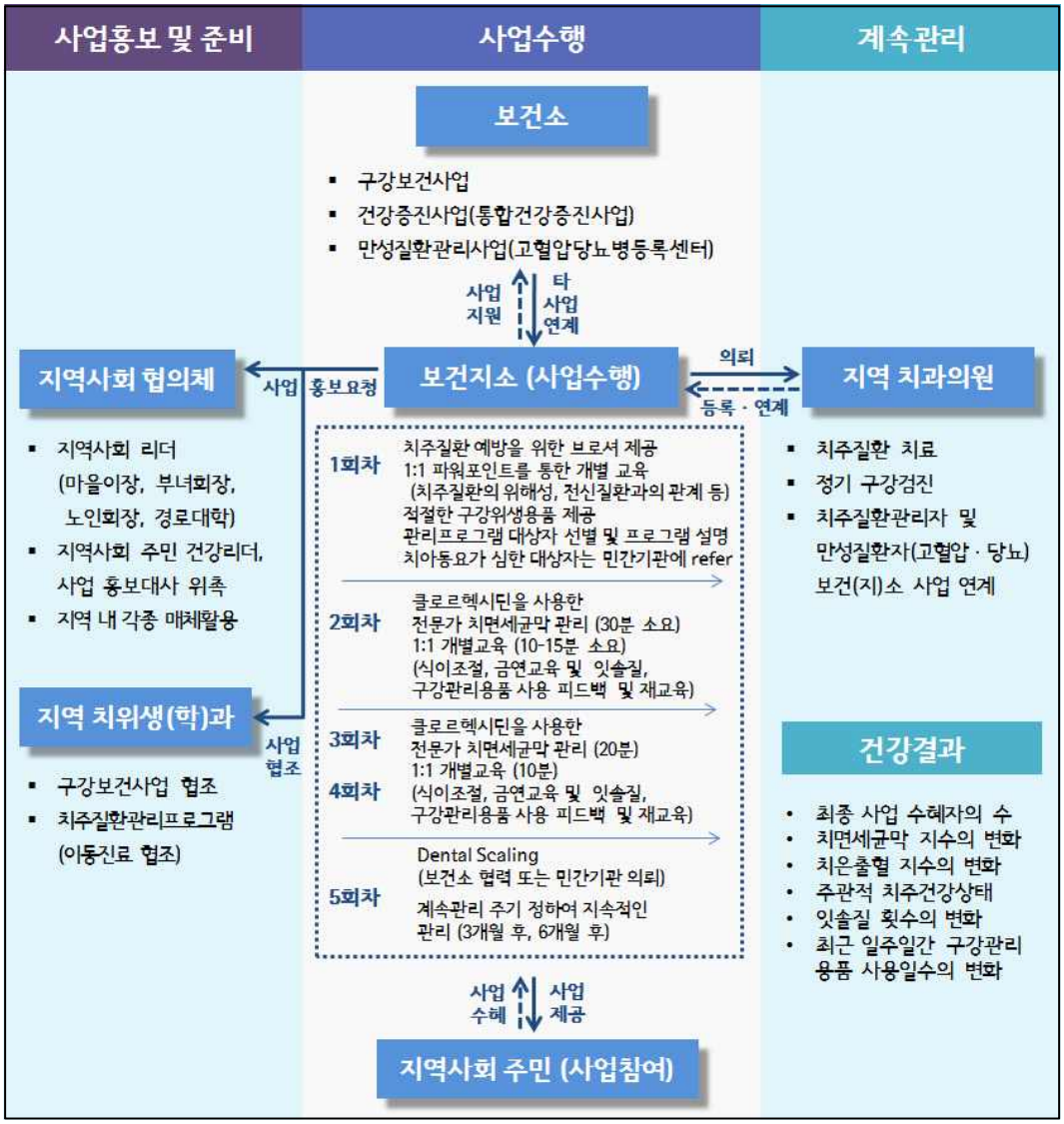
치과진료 이용의 접근성이 떨어지는 농촌 지역 주민을 대상으로 스케일링 시행 전 8주 동안 시행한 치주관리 프로그램은 구강건강행동, 구강위생상태, 치은출혈 감소에 효과적이었다. 따라서 구강보건인력과 의료시설에 대한 가용성을 고려하여 치과진료 이용의 접근성이 떨어지는 농촌지역에서 치주질환 예방을 위한 공중구강보건사업과 치주관리 중심의 구강보건교육사업을 확대 실시하여 의료 인력의 격차를 해소 할 필

요가 있다.

농촌지역 보건(지)소에서 치주관리 프로그램을 수행할 경우 먼저 마을이장, 지역 보건소, 지역 치과의원과의 유기적인 협력관계를 구축하고 사업시기는 농한기를 적극적으로 활용하는 것이 좋겠다. 프로그램 수행간격은 치면세균막 감소 유지 및 증진을 위하여 1-2주 간격으로 3회가 적당하며, 수행시간은 치주질환의 원인, 예방법, 전신질환과의 관련성 교육과 전문가 관리를 위하여 첫 내원 시는 45분, 2회차, 3회차는 전문가 관리와 칫솔질, 구강위생용품 사용 교육시간을 포함하여 30분 정도가 적당할 것으로 판단된다. 또한 적어도 2회차까지는 전문가관리와 자가관리를 시행한 후 스케일링을 수진하도록 단계화한다면 지역주민들의 구강건강 향상뿐만 아니라 실천 역량을 강화할 수 있을 것이다. 또한 세균집락을 최소화하기 위하여 전문가 칫솔질을 통한 치면세균막의 기계적 제거와 클로르헥시딘의 화학적 살균을 동시에 적용하는 것이 치주건강에 도움이 될 것이라 판단된다.

향후 지역사회 내에서 금연, 영양, 전신질환 교육을 포함한 치과위생사 치주관리 프로토콜을 개발하고 상용화 할 필요가 있으며, 이는 1차 치과진료를 보다 보편적으로 제공할 수 있게 할 ADHP(Advanced Dental Hygiene Practitioners)와 같은 프로그램의 도입을 통해 치과위생사의 자율성을 확대하고 촉구할 수 있을 것이다. 치과위생사가 마을주민의 옹호자로서, 의료서비스 제공자, 교육자로 보다 적극적인 활동을 할 수 있도록 인적자원의 활용 및 가치 향상을 위한 제도적 뒷받침과 기반시설의 개선이 이루어진다면 농촌 지역 주민의 치주건강 수준은 점차 향상될 것으로 기대된다.

핵심되는 말: 치주관리 프로그램; 지역사회 보건(지)소; 치주건강; 치면세균막 지수; 치은출혈 지수; 구강건강행동



보건(지)소 치주관리 프로그램 협력 모형