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Effect of Coconut Oil Intervention on Periodontal Health and Oral Health-related Quality of Life in Patients with Implants*

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ABSTRACT

Objectives: This study was to analyze the effects of comparative evaluation of the effects of oil pulling and chlorhexidine on periodontal and oral health-related quality of life. Methods: The total subjects were 38. In the experimental group (19 subjects), coconut oil was provided and In the control group (19 subjects), chlorhexidine was provided. The participants in each group were asked to routinely perform oil swishing with coconut oil or 2% chlorhexidine mouthwash every day in the morning after brushing for 2-3 minutes. We evaluated possession site of pocket depth ($\geq$4 mm) and hemorrhage on exploring. The following clinical parameters were assessed at baseline, after 4 weeks and after 12 weeks. Furthermore, oral health-related quality of life was evaluated at baseline and after 12 weeks. Results: The control group decreased 5.71 to 3.35 and the experimental group decreased 6.53 to 2.35 in hemorrhage on exploring by coconut oil and chlorhexidine intervention ($p=0.071$). Both two groups showed significant difference in hemorrhage on exploring by measurement time ($p<0.001$) and interaction between the group and measurement time ($p<0.001$). Furthermore, oral health-related quality of life showed a statistically significant decrease in experimental group ($p=0.046$). Conclusions: The coconut oil and chlorhexidine intervention were effective in on periodontal health in patients with implant.

1. Introduction

Teeth can be maintained for a lifetime through personalized preventive management, but if they are not maintained properly, they will be lost, affecting mastication or pronunciation. In addition,

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it can limit social activities and reduce the quality of life (Seo, 2009). Increasing interest in health has led to a lot of preventive efforts related to oral health, but clinical sites have continued to support those who lost their teeth, and various prosthesis treatments are being provided to them (Lee & Song, 2016).

Dental implants, which began to replace lost teeth, have been widely provided in clinical sites since the 2000s (Kong et al., 2012). From July 2014, the National Health Insurance began to be applied to this. In the case of the elderly aged 75 or older, insurance benefits with a 50% co-payment rate for two implants throughout their lives began (MHW, 2014). Furthermore, insurance benefits were expanded to those aged 70 or older from July 2015 and 65 or older from July 2016 (MHW, 2016). From July 2018, the co-payment rate was lowered to 30% (MHW, 2018). Demand for dental implant procedures is steadily increasing due to the expansion of insurance benefits, and chronic periodontal disease is reported to be the highest at 41.6% as the cause of implant procedures (Kim et al., 2021).

Periodontal disease (Krebs et al., 2006) is a representative oral disease that eventually loses teeth when tooth decay and alveolar bone are lost due to inflammation of the surrounding tissues, and the prevalence is increasing with age (MHW, 2013). At the 6th European Periodontology Workshop, it was reported that 80% of implant holders developed mucosal inflammation around the implant, and 28-56% reported that peripheral implant inflammation occurred (Lindhe & Meile, 2008). Therefore, for the soundness of periodontal tissue around the implant after the procedure, it is required to maintain a sound periodontal tissue through thorough oral hygiene management of the implant, and the importance of oral hygiene management and the need for behavior change are emphasized to the implant holder (Kang & Lee, 2012; Jang, 2001).

Oil pulling using coconut oil, one of the periodontal disease prevention methods, is a widely used method of traditional Indian folk remedies over the years to strengthen teeth, gums, and masticatory muscles and prevent tooth decay, bad breath, gum hemorrhage, dry throat, and cracked lips (Asokan et al., 2009). This has a local and systemic effect similar to oral cleaning by strongly wiping the mouth with oil and has a similar effect to chlorhexidine in systemic and chronic diseases and odor management (Asokan, 2008; Singh & Puroht, 2011). In addition, it is used as an auxiliary for reducing the formation of dental plaque and treating gingivitis (Peedikayil et al., 2015). Coconut oil used in oil pulling is a safe and easily available oil with few side effects and contains a lot of heavy-chain fatty acids, of which 40-50% is laurinic acid, which has anti-inflammatory and antibacterial effects (Peedikayil et al., 2015; Jauhari et al., 2015).

On the other hand, chlorhexidine is a cationic compound that combines enamel hydroxide stone, acquisition film, extracellular polysaccharides in the epigastric membrane, and especially oral mucosa to prevent bacteria from depositing on the surface of teeth. It also reduces the formation of the acquired film. The biofilm begins to deposit on the surface of the tooth, starting with the formation of a non-cellular acquisition film of less than 1 ㎛ by glycoprotein derived from saliva. Afterwards, hundreds of species of microorganisms adhere to them, constantly changing according to continuous interaction, that is, host or external environment, affecting oral health. The intervention of chlorhexidine against this is effective in the process of forming biofilm of oral bacteria and in preventing and managing oral diseases (Cho, 2021). In addition, it suppresses the formation of epigastric membranes and

inhibits gingivitis due to degeneration of bacterial adhesion mechanisms, degeneration of bacterial cell walls, and cell dissolution (Lorez et al., 2009; Sheen & Addy, 2003).

Previous studies on coconut oil and chlorhexidine interventions can be divided into studies that reported the growth inhibitory effect of microorganisms (Sezgin et al., 2019; Kaushik et al., 2016; Shino et al., 2016) and studies that reported clinical findings in patients with short-term gingivitis (Woolley et al., 2020; Singla et al., 2014). There is a lack of research that revealed the research results directly through clinical intervention to the subjects. Therefore, this study aims to provide academic evidence to patients with chronic periodontal disease to mediate coconut oil and chlorhexidine to compare periodontal health improvement effects and check oral health-related quality of life.

2. Research Method

2.1 Research subjects

This study targeted those who planted one or two implants at a dental institution located in the G area. These are patients suffering from chronic periodontal disease and are regularly managed by experts provided by dental institutions. This study was conducted after deliberation by the Bioethics Review Committee of 00 University (IRB No. 1041465-202105-HR-001-24). The number of study participants required for this study was calculated using G*power 3.1.9.2, and 28 people were calculated when the significance level was 0.05, power of 0.8, the effect size of 0.25, and the number of measurements was 3. Considering the dropout rate of about 20%, the final study subjects were 34, 17 per group.

2.2 Research procedure

From June 1, 2021 to October 16, 2021, after confirming that it meets the selection criteria of this study, the purpose and method of the study, and ethical aspects related to participation in the study were explained, and 34 people who signed the consent form were assigned to two groups of 17. Control group (0.12% hexamedine solution, 250㎖, 2 bottles provided) and experimental group (Honest organic coconut oil, by HONEST SUPPERFOOD, 500㎖, EARTH BORN CO. LTD, Thailand, Certification Authority; Konkuk Eco-Certification Institute, Certification Number: 50-8-104, 500㎖, 1 bottle) was provided with each tooth solution and trained to brush 5-10㎖ once every morning for 4 weeks for 2-3 minutes (Peedikayil et al., 2016). In the evaluation of clinical indicators, periodontal cyst depth and hemorrhoids were evaluated in advance, 4 weeks later, and 12 weeks later, oral health-related quality of life was measured in advance and 12 weeks later (Figure 1). In measuring oral health-related quality of life, the oral health impact profile (OHIP-14), which was translated and shortened from the oral health impact profile (OHIP-49) developed by Slader and Spencer (1994) by Lee et al., was used.

In order to secure homogeneity between the two groups, age, gender, the number of implants,

the number of own teeth, periodontal cyst depth, and gingival hemorrhage were identified. The periodontal cyst depth was divided into three parts for root, center, centrifugal areas using Williams' periodontal probe, and a total of six parts of the surface of teeth and tongue were measured. Gingival hemorrhage was given 1 point for hemorrhage within 10 seconds of periodontal cyst probe for each measurement point of implants, and 0 point for no hemorrhage. In order to reduce errors between measurements, one researcher measured them all directly.

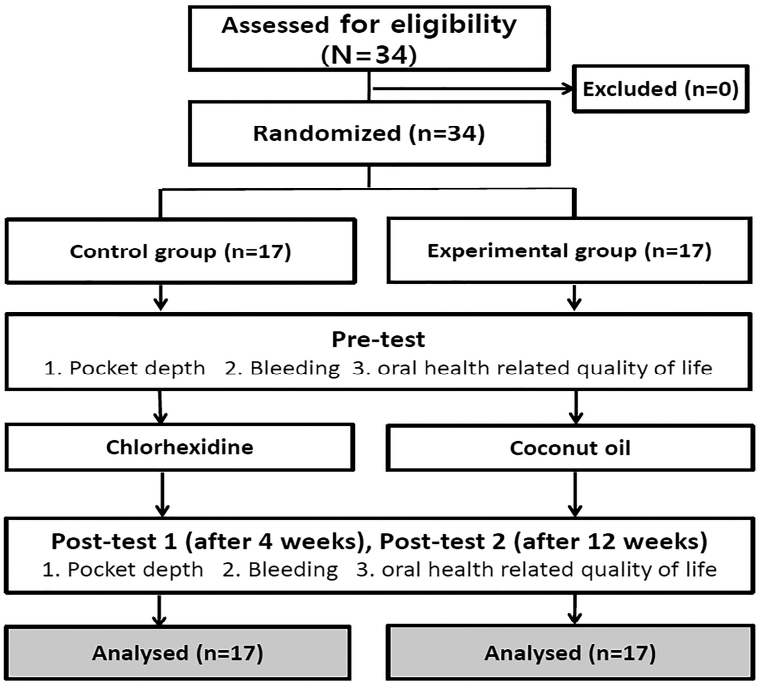

Fig. 1. Process flow diagram

2.3 Analysis method

The data collected in this study were analyzed using SPSS (ver 21.0 for windows, SPSS Inc. Chicago, IL. USA), and both tests were performed at the significance level of 0.05. The measured periodontal cyst depth of 4 mm or more and the gingival hemorrhage were recorded, and then the corresponding parts were summed for analysis. In the case of the homogeneity test of the subjects, the age, gender, implant number, periodontal cyst depth, gingival hemorrhage, and natural tooth count all satisfied normality and were tested using the x^2-test and the independent sample t-test. In the case of hypothesis tests in the experimental group and the control group, the dependent variables, periodontal cyst depth, and gingival hemorrhage, did not meet the parameter test, so structural transformation was performed and analyzed with GEE (generalized estimating equation). The quality of life-related oral health was also not satisfied with the normality, so it was tested using the Wilcoxon signed rank test.

3. Results

3.1 Pre-homogeneity test on the subjects

It was confirmed that the characteristics of the control group and the experimental group and that they were homogeneous in all items of the periodontal cyst and gingival hemorrhage measured in advance (p>0.05) Table 1.

Table 1. Homogeneity test of general characteristics in subjects

Unit: N(%)

Characteristics	Division	Total	Cont. (N=17)	Exp. (N=17)	p^*
Gender	Male	20 (58.8)	12 (70.6)	8 (47.1)	0.296
	Female	14 (41.2)	5 (29.4)	9 (52.9)	
Age†		54.12±14.98	52.24±16.50	56.00±13.52	0.472
Number of implant	1	16 (47.1)	10 (58.8)	6 (35.3)	0.303
	2	18 (52.9)	7 (41.2)	11 (64.7)	
Number of existing permanent teeth†		24.56±2.87	24.76±2.93	24.35±2.89	0.683
Pocket depth (≥4 mm)‡		6.68±0.44	6.18±0.56	7.18±0.67	0.262
Bleeding on exploring‡		6.12±0.40	5.71±0.58	6.53±0.56	0.313

Cont.=Control group; Exp.=Experimental group
* by x^2-test or independent t-test, † Mean±SD, ‡ Mean±SE

3.2 Changes in periodontal disease clinical indicators following coconut oil and chlorhexidine intervention

Changes in periodontal cyst following coconut oil and chlorhexidine interventions decreased from 6.18 to 3.59 in the control group and from 7.18 to 4.00 in the experimental group, but there was no statistically significant difference (p=0.329). However, in both groups, the change in periodontal cyst over time showed a significant decrease (p<0.001). There was no significant difference in the interaction between time and group (p=0.058) Table 2, Figure 2.

Changes in gingival hemorrhage following coconut oil and chlorhexidine intervention decreased from 5.71 to 3.35 in the control group and from 6.53 to 2.35 in the experimental group, and there was no significant difference between the groups (p=0.071). There was a significant difference in the change in gingival hemorrhage over time (p<0.001), and there was also a significant difference in the interaction between time and group (p<0.001) Table 2, Figure 3.

The change in oral health-related quality of life increased from 9.24 to 9.58 in the control group (p=0.034), and the experimental group increased from 9.24 to 9.71 in the experimental group (p=0.046) Table 3, Figure 4.

Table 2. Changes of periodontal indices

Unit: Mean±SE

Division	Group	Pretest	1 month	3 month	Source	Wald x^2	p^*
Pocket depth	Cont.	6.18±0.56	3.65±0.54	3.59±0.56	G	0.952	0.329
	Exp.	7.18±0.67	4.71±0.70	4.00±0.70	T	51.925	<0.001
					G*T	5.695	0.058
Bleeding on exploring	Cont.	5.71±0.58	2.82±0.37	3.35±0.45	G	3.265	0.071
	Exp.	6.53±0.56	1.41±0.31	2.35±0.39	T	206.713	<0.001
					G*T	25.230	<0.001

Cont.=Control group; Exp.=Experimental group
* by generalized estimating equation, CI=confidence interval, G: Group, T: Time

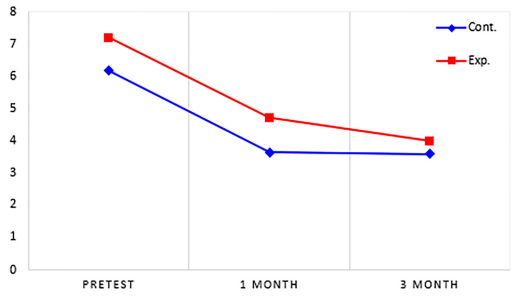

Fig. 2. Changes of pocket depth

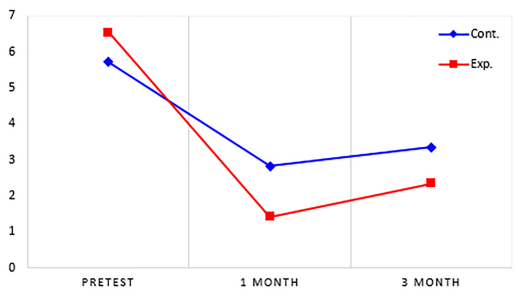

Fig. 3. Changes of bleeding on exploring

Table 3. Changes of oral health related quality of life in patients with implant and chronic periodontits

Group	Pretest	3 month	p^*
Cont.	9.24±1.20	9.58±0.80	0.034
Exp.	9.24±0.90	9.71±0.69	0.046

* by wilcoxon ranked test

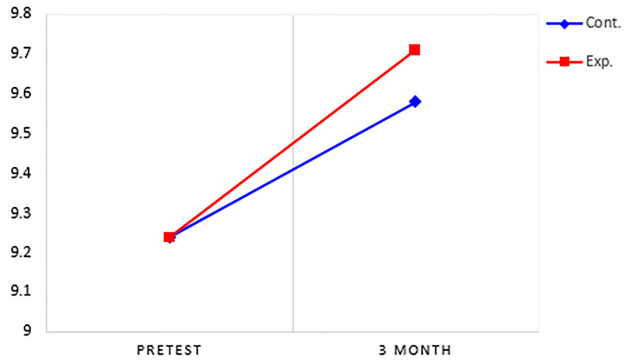

Fig. 4. Changes of oral health related quality of life in patients with implant and chronic periodontits

4. Discussion

To manage chronic periodontal disease, it is necessary not only to perform activities such as one-time fragmentary removal of tartar, but also to perform an efficient dental hygiene process that can systematically manage periodontal diseases as a universal and comprehensive process (Oh et al., 2012). Furthermore, as in the United States and Canada, the performance of dental hygiene procedures by dental hygienists should be established as a systematic continuous management system (Lee & Cho, 2005). In particular, since gingivitis symptoms are highly likely to lead to chronic disease, inflammation of periodontal tissue, and tooth loss (Baeg et al., 2011), active self-management must be supported for the management of chronic periodontal disease in implant patients.

Therefore, this study was conducted to compare periodontal health improvement effects by mediating coconut oil and chlorhexidine by the group in patients with chronic periodontal disease among implant patients. All subjects who participated in this study regularly visited the hospital after implantation and were managed by experts provided by dental institutions, and performed self-management mediated with coconut oil and chlorhexidine. As a result, the intervention effect of coconut oil and chlorhexidine could be verified, and the intervention of coconut oil and chlorhexidine significantly reduces periodontal cyst and gingival hemorrhage over time. These results were expected because chlorhexidine has been widely used as an antimicrobial agent recognized as the most effective dental membrane inhibitor to date (Lorez et al., 2009) and has been reported to be effective in overall chronic periodontitis (Lee et al., 2007). However, from the results of no significant difference between the control group and the experimental group, it was found that coconut oil, like chlorhexidine, had excellent effects. Coconut oil has been reported to be effective against gingivitis by combining toothbrushing and oil pulling using coconut oil in a study by Peedikayil et al. (2015), and Kim et al. (2020) reported the effect by mediating coconut oil in periodontal patients. However, as in this study, studies that mediated chlorhexidine and coconut oil by group and reported their effects are insufficient, so if research design is considered in subsequent studies, it will contribute to the establishment of the grounded periodontal disease effect on coconut oil. In the case of gingival hemorrhage, it was found that in the experimental group mediated with coconut oil, it was significantly reduced compared to the control group mediated with chlorhexidine. Previous studies have also reported a decrease in the retention rate of gingival hemorrhage in periodontal patients (2020), Dani et al. (2015), and as in this study, the control group mediated chlorhexidine, and the experimental group mediated oil pulling for 14 days was more effective in gingival hemorrhage than the control group. In conclusion, considering the differences between the subjects who participated in this study and the subjects in previous studies (Kim et al., 2020; Dani et al., 2015), oil pulling was found to have a reduced effect on periodontal disease patients (Kim et al., 2020), adolescents (Dani et al., 2015), and dental hemorrhage in implant patients. Therefore, in order to prevent the occurrence and progression of inflammation near implants, inflammatory changes in tissues around the implants should be recognized early through regular checkups and maintenance (Lee et al., 2007), and expert management and self-management should be combined to prevent the progression of inflammation near the implants. In addition, a paradigm shift in the health care system that can reduce dental expenses through the prevention of periodontal disease is being raised (Kim & Kwag, 2021), and

it is believed that various measures should be sought to maintain healthy periodontal tissue of implant patients.

Meanwhile, this study attempted to examine whether the quality of life related to oral health, which has been reported through previous studies, has changed since the intervention of chlorhexidine and coconut oil by the group. Factors influencing oral health-related quality of life reported in previous studies include the number of natural teeth (2020), implant placement (Kang, 2020), ability to take care of one's own daily life (Alfaro & Ahluwalia, 2010), oral health status and periodontal disease (Young & Kim, 2015), etc. The results of this study showed that the quality of life related to oral health improved more than that of the control group in the experimental group that mediated coconut oil, and that oil pulling using coconut oil contributed not only to the maintenance of healthy periodontal tissue but also to oral health-related quality of life in implant patients. Therefore, it is suggested that oil pulling using coconut oil be used in implant patients as an intervention agent that can replace chlorhexidine (da Costa, 2017), which is commonly used in clinical sites but can cause coloring of teeth. This is significant in that it can be used safely without a dentist's prescription, and is believed to contribute to the reduction of periodontal and dental-related expenses for implant patients.

However, there is a limitation in that the influence of expert management of dental hygienists cannot be measured due to the fact that the expert management of dental hygienists provided equally to all subjects in this study was not designed as an intervention variable. Therefore, in the follow-up study, we propose a clinical experimental study design that can verify the complex effect of expert management and self-management for implant patients by setting expert management as an intervention variable.

5. Conclusion

This study compared the effects of periodontal health improvement by mediating coconut oil and chlorhexidine in implant patients with chronic periodontal disease, and the following conclusions were obtained.

1. Changes in gingival hemorrhage following coconut oil and chlorhexidine intervention decreased from 5.71 to 3.35 in the control group and from 6.53 to 2.35 in the experimental group ($p=0.071$). There was a significant difference in the change in gingival hemorrhage over time ($p<0.001$). There was also a significant difference in the interaction between time and group ($p<0.001$).

2. The change in oral health-related quality of life increased from 9.24 to 9.58 in the control group ($p=0.034$) and increased from 9.24 to 9.71 in the experimental group ($p=0.046$).

From the above results, it is suggested that oil pulling using coconut oil be used in implant patients as an intervention that is commonly used in actual clinical sites but can replace chlorhexidine.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

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