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# Level of Awareness and Conditions of Performance regarding Ultrasonic Scaling by Clinical Dental Hygienists

**Kyung-Min Kim[1], Hye-Jin Kim[*2]**

*[1]Assistant professor, The Research Institute Health for Functional Material, Dongeui University, Gaya 1-dong, Busanjin-gu, Busan, Republic of Korea,*

*[2]Associate professor, Department of Dental Hygiene, Dongeui University, Gaya 1-dong, Busanjin-gu, Busan, Republic of Korea,*

*kimkm0607@deu.ac.kr[1], khj1126@deu.ac.kr[*2]*

**Abstract**

**Background/Objectives**: The present study attempted to establish source data for strengthening their expertise as oral health promoters by examining the awareness and performance of dental hygienists toward ultrasonic scaling.

**Methods/Statistical analysis**: The study conducted a survey on awareness and performance regarding ultrasonic scaling by surveying clinical dental hygienists working in the Busan and Gyeongsangnam-do region between June 1 and October 2020. A total of 228 were ultimately used as samples. SPSS 25.0 was used for statistics.

**Findings**: Dental hygienists demonstrated a high level of awareness toward ultrasonic scaling, but an observation of their actual performance shows that they failed to adequately select tips for each case and replace tips following a schedule. Furthermore, many places lacked personnel exclusively in charge of scaling, and more years of experience in scaling was identified as being connected to a higher level of understanding toward scaling.

**Improvements/Applications**: Many hands-on courses must be opened to expand educational opportunities so that dental hygienists can perform ultrasonic scaling tasks according to each year in their career.

***Keywords*:** dental hygienist, oral health promotion preventive, dental treatment, scaling, ultrasonic scaler

## 1. Introduction

An analysis of K05, the disease code for gingivitis and periodontal disease, in the judgement decision data of the past five years(2008-2012) by the Health Insurance Review and Assessment Service shows an increase of 1.7 million (25.3%) people, from 6.73 million in 2008 to 8.43 million in 2012 [1]. The causes behind periodontal disease are plaque and tartar[2], with approximately 500 species of bacteria existing in plaque. Major pathogens known as highly related to periodontal disease include Porphyromonas gingivalis, Actinobacillus actinomycetemcomitans, Treponema denticola, Prevotella intermedia, and spirochete [3]. Regularly carrying out scaling, which removes supra- and subgingival, soft and hard plaque and tartar as well as granulation tissue and endotoxins, with the aim of preventing periodontal disease, not only prevents the progression of disease but also serves as a reasonable method both ethically and economically for achieving a reduction in treatment costs [4,5]. Therefore, scaling was covered by public insurance on July 1, 2013 for anyone aged 20 and above in South Korea, and this was again expanded to age 19 on July 1 2017 [6].

As oral health management programs are clinically developed, applied, and operated to suit the concepts of each dental and medical institution[7], the number of patients who visit dental treatment institutions for oral health management and scaling has increased [6]. As a technique that must be administered delicately, scaling differs in the level of damage[8] it inflicts on the tooth surface depending on what type of scaler is used as well as in the level of damage to the surface and the level of pain experienced by the patient depending on the technician's technique, the state of the patient's tooth surface[9], and the intensity of the scaler's power[10].

Although incorrect perceptions regarding scaling such as 'the gums give way after scaling' or

'scaling chips away at the teeth' have decreased in recent years thanks to an increased level of dental knowledge regarding scaling on the part of patients, negative opinions about scaling that must be resolved, such as 'scaling hurts', or 'teeth ache after scaling' still persist[11]. According to preceding studies, periodontal probe testing, scaling, and contact between the gums and periodontal appliances are deeply related to the pain experienced by patients[12], revealing the importance of awareness and the performance capabilities involved in the scaling tasks of dental hygienists.

Hence, the present study would like to deal with the importance of the dental hygienist' role as preventive dental treatment providers and oral health promoters – their main work – by identifying their awareness toward ultrasonic scaling and their methods of operating ultrasonic scaling. The study was also conducted to offer source data for improving the scaling work environment for clinical dental hygienists and for strengthening their level of expertise.

## 2. Materials and Methods

### 2.1. *Research Subjects*

The present study surveyed clinical dental hygienists working in the Busan and Gyeonsangnam-do region from June 1 to October, 2020, on awareness and performance regarding ultrasonic scaling by explaining to them the intent and purpose of the study and obtaining their consent. After making calculations by setting a confidence level of 95% and an effect size of 0.5 on the G*Power 3.1.3 program to calculate the number of samples necessary for the purpose of the research, the study identified a total of 108 as the possible condition. A total of 300 surveys were administered considering retrieval rates, and ultimately 228 surveys were used as samples after excluding 28 questionnaires that included insincere answers during the survey process or those falling under minority areas that are difficult to calculate as samples.

### 2.2. *Research Methods*

The study used the questionnaire developed by extracting, revising, and supplementing the questionnaire from the studies by Kang[13] and Kang[14] in order to identify the awareness toward and use of ultrasonic scaling by dental hygienists. The present questionnaire consisted of 8 questions on the general and work characteristics of the subjects, 10 questions on the knowledge and awareness of dental hygienists concerning ultrasonic scalers(5-point Likert scale, Cronbach's $\alpha$=.737), and 11 questions on the use of ultrasonic scalers.

### 2.3. *Analysis Methods*

The SPSS(ver. 25.0 for windows, Chicago, IL. USA) statistical program was used for data analysis, with the results deemed statistically significant by conducting significance testing at a significance level under 0.05. Regarding the method used for statistical analysis, the study conducted frequency analysis and descriptive statistics for the general characteristics and work characteristics of the subjects, knowledge and awareness regarding ultrasonic scaler use, and conditions of use involving ultrasonic scalers. T-testing and ANOVA were implemented for the level of knowledge and awareness toward ultrasonic scaler use depending on the general characteristics and work characteristics of the subjects as well as for the use of ultrasonic scalers depending on the method of operating ultrasonic scaling, while Scheffé's Test was conducted as the post-hoc test.

## 3. Results and Discussion

### 3.1. *Results*

Analysis of the general characteristics and the work characteristics of the subjects show that, in terms of age, 71% were 29 years old or younger; in terms of gender, 96.5% were female; and in terms of education level, 74.1% were junior college graduates(3-year program), all of which accounted for the greatest proportion of responses in their category. In terms of place of work, 54.4% worked at dental clinics; in terms of total years of career experience, 45.2% had less than 3 years of experience; and for their main tasks, 85.5% stated they involved tasks within the dentist's office, all of which accounted for

the greatest proportion of responses in their category. In terms of average daily number of patients, 43.9% answered '36 to 80', whereas, for average daily work hours, 86.0% answered '8 hours or more', both of which accounted for the greatest proportion of responses in their category<Table 1>.

**Table 1 : General characteristics and work characteristics of the subjects**

| Division | | N(%) |
|---|---|---|
| Age | 29 or younger | 164(71.9) |
| | 30 to 39 | 55(24.1) |
| | 40 or older | 9(3.9) |
| Gender | Male | 8(3.5) |
| | Female | 220(96.5) |
| Education level | Junior college graduate(3-year program) | 169(74.1) |
| | University graduate(4-year program) | 59(25.9) |
| Place of work | Dental clinic | 124(54.4) |
| | Dental hospital | 99(43.4) |
| | Dental department at a university hospital | 4(1.8) |
| | Community health center, miscellaneous | 1(0.4) |
| Total years of career experience | Less than 3 years | 103(45.2) |
| | 3 years to less than 5 years | 32(!4.0) |
| | 5 years to less than 10 years | 68(29.8) |
| | 10 years or more | 25(11.0) |
| Average monthly income | 800K to 1.2 million KRW | 2(0.9) |
| | 1.21 to 1.6 million KRW | 14(6.1) |
| | 1.61 to 2 million KRW | 113(49.6) |
| | 2.01 to 2.4 million KRW | 56(24.6) |
| | 2.41 million KRW or more | 43(18.9) |
| Main tasks | Consultation | 27(11.8) |
| | Dentist's office | 195(85.5) |
| | Management(personnel and management support) | 6(2.7) |
| Average daily number of patients | 35 or less | 72(31.6) |
| | 36 to 80 | 100(43.9) |
| | 81 or more | 54(23.7) |
| | Unknown | 2(0.9) |
| Average daily work hours | 7 hours or less | 32(14.0) |
| | 8 hours or more | 196(86.0) |
| Total | | 228(100.0) |

With regard to the statement 'I'm aware of tips that must be applied in accordance with specific cases', 39.5% answered 'yes'. Regarding the statement 'I'm aware when I have to replace a tip for the ultrasonic scaler', 40.8% answered 'yes'. Regarding the statement 'I'm well informed about how to use each type of ultrasonic scaler(magnetostrictive, piezoelectric)', 37.3% answered 'to a normal degree'. Regarding the statement 'I know that there are cartridges for checking ultrasonic scaler tips', 31.1% answered 'yes'. Regarding the statement 'I adjust power and water to suit each case when carrying out scaling', 37.7% answered 'yes'. Regarding the statement 'I've been doubtful about a tip when scaling didn't go well', 40.4% answered 'yes'. Regarding the statement 'I'm aware of the problems that occur when ultrasonic scaler tips aren't replaced', 37.7% answered 'yes'. Regarding the statement 'I've felt a

tip was dull during scaling', 40.8% answered 'yes'. Regarding the statement 'I apply hand-operated instruments after scaling', 28.5% answered 'to a normal degree'. All of these answers respectively accounted for the greatest proportion among answers for each statement<Table 2>.

**Table 2 : Dental hygienists' awareness toward ultrasonic scalers**

| Division | Not at all | No | Normal | Yes | Very much yes | M±SD |
|---|---|---|---|---|---|---|
| Applying tips suitable to the case | 5(2.2) | 27(11.8) | 70(30.7) | 90(39.5) | 36(15.8) | 3.54±.967 |
| Tip replacement period | 6(2.6) | 30(13.2) | 58(25.4) | 93(40.8) | 41(18.0) | 3.58±1.01 |
| Aware of how to use each type of scaler | 16(7.0) | 49(21.5) | 85(37.3) | 49(21.5) | 29(12.7) | 3.11±1.10 |
| Aware of tip check cartridges | 12(5.3) | 42(18.4) | 58(25.4) | 71(31.1) | 45(19.7) | 3.41±1.15 |
| Adjusting the power and water to suit each case | 3(1.3) | 8(3.5) | 27(11.8) | 86(37.7) | 104(45.6) | 4.22±.885 |
| Doubting tips | 3(1.3) | 13(5.7) | 38(16.7) | 92(40.4) | 81(35.5) | 4.03±.935 |
| Problems when tips are not replaced | 3(1.3) | 19(8.3) | 57(25.0) | 86(37.7) | 63(27.6) | 3.82±.974 |
| Feeling of dull tips | 3(1.3) | 15(6.6) | 38(16.7) | 93(40.8) | 79(34.6) | 4.00±.947 |
| Applying hand-operated instruments after scaling | 25(11.0) | 44(19.3) | 65(28.5) | 62(27.2) | 32(14.0) | 3.14±1.20 |

The average level of awareness toward ultrasonic scalers by age was 3.55 for 'those aged 29 or younger', 3.85 for 'those aged 30 to 39', and 3.86 for 'those aged 40 or older', demonstrating a higher level of scaler awareness with an increase in age, a result that was statistically significant ($p<0.05$). Level of awareness by work experience was 3.48 for those with 'less than 3 years', 3.59 for those with '3 to less than 5 years', 3.81 for those with '5 to less than 10 years', and 3.86 for those with '10 or more years', demonstrating a higher level of scaler awareness with an increase in work experience, a result that was statistically significant ($p<0.05$). Level of awareness by income was 3.00 for those making '800 thousand to 1.2 million KRW', 3.45 for those making '1.21 to 1.6 million KRW', 3.50 for those making '1.61 to 2 million KRW', 3.83 for those making '2.01 to 2.4 million KRW', and 3.81 for those making '2.41 million KRW', demonstrating a higher level of scaler awareness with an increase in income, a result that was statistically significant ($p<0.05$)<Table 3>.

**Table 3 : Awareness toward ultrasonic scalers depending on general characteristics and work characteristics**

| Division | | M±SD[1)2)] | t/F(p) |
|---|---|---|---|
| Age | 29 or younger | 3.55±.64 | |
| | 30 to 39 | 3.85±.80 | 4.368(.014) |
| | 40 or older | 3.86±.55 | |
| Gender | Male | 3.43±.59 | -.840(.402) |
| | Female | 3.64±.69 | |
| Education level | Junior college graduate(3-year program) | 3.63±.69 | .006(.995) |
| | University graduate(4-year program) | 3.63±.67 | |
| Place of work | Dental clinic | 3.60±.69 | 1.184(.317) |
| | Dental Hospital | 3.65±.68 | |

| | | | |
|---|---|---|---|
| | Dental department at a university hospital<br>Community health center, miscellaneous | 4.22±.53<br>4.00 | |
| Total years of career experience | Less than 3 years<br>3 years to less than 5 years<br>5 years to less than 10 years<br>10 years or more | 3.48±.63<br>3.59±.53<br>3.81±.69<br>3.86±.90 | 4.292(.006) |
| Average monthly income | 800K to 1.2 million KRW<br>1.21 to 1.6 million KRW<br>1.61 to 2 million KRW<br>2.01 to 2.4 million KRW<br>2.41 million KRW or more | 3.00±.98<br>3.45±.74<br>3.50±.60<br>3.83±.72<br>3.81±.73 | 3.749(.006) |
| Main tasks | Consultation<br>Dentist's office<br>Management(personnel and management support) | 3.84±.68<br>3.60±.69<br>3.83±.71 | 1.721(.181) |
| Average daily number of patients | 35 or less<br>36 to 80<br>81 or more | 3.59±.70<br>3.59±.64<br>3.77±.76 | 1.392(.251) |
| Average daily work hours | 7 hours or less<br>8 hours or more | 3.51±.55<br>3.65±.71 | -1.065(.288) |

1) 5-point Likert scale

2) a<b : Scheffe's multiple comparison test.

The following concerns items about personnel in charge of ultrasonic scaling and the number of patients. In terms of years of experience on the part of personnel in charge of ultrasonic scaling, 53.1% answered 'unknown', followed by 16.7% who answered '5th year and on', 14.0% who answered '1st year', 7.5% who answered '2nd year', and 4.8% who answered '4th year'. For the average daily number of patients, 46.5% answered '5 or less', followed by 32.0% who answered '6 to 10', 13.2% who answered '16 or more', and 4.4% who answered '11 to 15'<Table 4>.

**Table 4 : Personnel in charge of ultrasonic scaling and the number of patients**

| Type | | N(%) |
|---|---|---|
| Personnel in charge of ultrasonic scaling | 1st year<br>2nd year<br>3rd year<br>4th year<br>5th year and on<br>Unknown (Unable to distinguish year) | 16.7)<br>17(7.5)<br>9(3.9)<br>11(4.8)<br>38(16.7)<br>121(53.1) |
| Average daily number of ultrasonic scaling patients | 5 or less<br>6 to 10<br>11 to 15<br>16 or more<br>Unknown | 106(46.5)<br>73(32.0)<br>10(4.4)<br>30(13.2)<br>9(3.9) |
| Total | | 228(100.0) |

The level of awareness for ultrasonic scalers depending on the year of experience on the part of personnel in charge of ultrasonic scaling is as follows. The average level of awareness for the main workers in charge of ultrasonic scaling in their '1st year of experience' was 3.36, for those in their '2nd year of experience', it was 3.73, for those in their '3rd year of experience', it was 3.62, for those in their '4th year of experience, it was 3.40, and for those in their '5th year of experience and on', it was 3.93 – results which were statistically significant ($p<0.05$)<Table 5>.

**Table5 : Level of awareness toward ultrasonic scalers depending on the year of experience of the personnel in charge of ultrasonic scaling**

| Type | | M±SD | F(p) |
|---|---|---|---|
| Personnel in charge of ultrasonic scaling | 1st year | 3.36±.70 | 3.152(.017) |
| | 2nd year | 3.73±.65 | |
| | 3rd year | 3.62±.90 | |
| | 4nd year | 3.40±.61 | |
| | 5th year and on | 3.93±.71 | |
| | Unknown(Unable to distinguish year) | 3.62±.65 | |

When conducting ultrasonic scaling, 54.4% of the subjects were able to distinguish the number of clinical visits by case type, while 45.6% were unable to do so. When being able to distinguish the number of clinical visits, the duration of applying scaling for '11 to 20 minutes' for 1 session for light, moderate, and heavy cases was 33.8%, 28.1%, and 26.3% respectively, the highest percentages in that category. When unable to distinguish the number of clinical visits for scaling, the duration of 'under 10 minutes' was the highest percentage for light cases at 23.7%; the duration of '11 to 20' minutes was the highest percentage for moderate cases at 33.3%; and the duration of '21 to 30 minutes' was the highest for heavy cases at 18.9%<Table 6>.

**Table 6 : Ability to distinguish by case type and duration of application**

| Type | Duration | Distinguishable(n=124) | Undistinguishable(n=104) |
|---|---|---|---|
| Light | 10m or less | 33(14.5) | 54(23.7) |
| | 11~20m | 77(33.8) | 46(20.2) |
| | 21~30m | 12(5.3) | 2(0.9) |
| | 31m or more | 2(0.9) | - |
| | Unknown | - | 2(0.9) |
| Moderate | 10m or less | 8(3.5) | 12(5.3) |
| | 11~20m | 64(28.1) | 76(33.3) |
| | 21~30m | 45(19.7) | 13(5.7) |
| | 31m or more | 7(3.1) | 1(0.4) |
| | Unknown | - | 2(0.9) |
| Heavy | 10m or less | 2(0.9) | 2(0.9) |
| | 11~20m | 60(26.3) | 42(18.4) |
| | 21~30m | 47(20.6) | 43(18.9) |
| | 31m or more | 15(6.6) | 15(6.6) |
| | Unknown | - | 2(0.9) |
| Total | | 228(100.0) | |

Ultrasonic scalers used by dental hygienists are as follows. The most common type of ultrasonic scaler currently used at hospitals is the 'piezoelectric' at 55.3%, and in terms of tips used during scaling, the 'tips equipped at the hospital' were the ones most commonly used at 77.2%. Regarding the types of scaler tips equipped at hospitals, 'two types' was the most common at 32.5%. Regarding the term for replacing scaler tips, '25 months or more' was the most common answer at 28.1%. Regarding whether dental polishing was conducted after scaling, 'depending on the circumstance' was the most common answer at 46.5%<Table 7>.

**Table 7: Ultrasonic scalers used**

| Type | | N(%) |
|---|---|---|
| Ultrasonic scaler types | Piezoelectric | 126(55.3) |
| | Magnetostrictive | 32(14.0) |
| | Sonic | 8(3.5) |
| | Unknown | 62(27.2) |
| Scaler tips used | Selection based on the case | 38(16.7) |
| | Equipped tips used only | 176(77.2) |
| | Replaced and used depending on the area | 8(3.5) |
| | Miscellaneous | 5(2.2) |
| | Unknown | 1(0.4) |
| Tip types | 1 type | 54(23.7) |
| | 2 types | 74(32.5) |
| | 3 types | 14(6.1) |
| | 4 types or more | 17(7.5) |
| | Unknown | 69(30.3) |
| Term for tip replacement | 3 months or less | 33(14.5) |
| | 4 to 6 months | 43(18.9) |
| | 7 to 12 months | 58(25.4) |
| | 13 to 24 months | 29(12.7) |
| | 25 months or more | 64(28.1) |
| | Unknown | 1(0.4) |
| Presence of dental polishing | Yes | 74(32.5) |
| | No | 47(20.6) |
| | Depending on the circumstance | 106(46.5) |
| | Missing | 1(0.4) |
| Total | | 228(100.0) |

### 3.2. *Discussion*

As the prevalence of periodontal disease was increasing every year[1], the government decided to give health insurance scaling benefits once a year to adults aged 20 and older starting on July 1, 2013 and subsequently extended the age of coverage to 19 four years later, on July 1 [15]. Thus, there is an increasing number of patients who visit dental care institutions to maintain their oral health by preventing oral disease.

As a technique that must be carried out delicately, scaling differs in the degree of damage inflicted on the tooth surface depending on the type of scaler used and how power is adjusted[10] during scaling. When technicians fail to properly choose a tip, apply the proper angle during their performance, or manage

their tips, scaling can cause negative results by damaging the tooth surface[16,17,18], thus highlighting the extreme importance of the dental hygienists' role during scaling. Hence, the present study was conducted to deal with the importance of the dental hygienist' role as preventive dental treatment providers and oral health promoters – their main work – by identifying their awareness toward ultrasonic scaling and their methods of operating ultrasonic scaling. The level of awareness for ultrasonic scalers depending on the general characteristics and work characteristics of the subjects increased with an increase in age, work experience, and income – a conclusion similar to the study by Kim[19], which reported that subjects demonstrated a higher level of job performance when their work experience and annual salary were greater. Upon investigating the performance of scaling by subjects, the study found that the piezoelectric type scaler was the most commonly used ultrasonic scaler type and that most often subjects used two types of tips equipped at their place of work. The greatest number of respondents said the term for replacing tips was 25 months or more, a statistically significant difference ($p<0.05$). There was a difference between the results of responding positively to awareness items regarding scalers and the actual conditions of scaling performance, which seems to be due to the monolithic performance of ultrasonic scaling tasks resulting from the limitations of the given clinical environment as well as due to the lack of interest in ultrasonic scalers specifically types of scalers, types of tips, and duration of use. Often times, scaling was performed without the main worker in charge of scaling, a result which corresponds to the study by Hwang[20], which reports that personnel exclusive to scaling accounts for only 11.5% of the cases. This could refer to the absence of dental hygienists who only serve as preventive treatment providers, but it could also mean, on the contrary, the obvious result that all dental hygienists must be basically capable of performing ultrasonic scaling. When there was personnel exclusive to scaling, they were most often in their 1st year, and the level of awareness for ultrasonic scaling was lower with an absence of personnel exclusive to scaling or when personnel had fewer years of experience ($p<0.05$). Considering the fact that, according to the study by Cho[21], the ultrasonic scaling performance of dental hygienists is deeply related to hypersensitivity and microdamage to the patient's tooth surface, it is valid that dental hygienists with more years of experience should perform ultrasonic scaling tasks rather than those with less years of experience because those with more years of experience are more likely to have a higher level of understanding toward ultrasonic scaling.

The scaling duration for one clinical visit by case type was less than 10 minutes for light cases, 11 to 20 minutes for moderate cases, and 21 to 30 minutes for heavy cases. When the number of clinical visits was distinguished by case type, one visit was the most common for light and moderate cases and two visits for heavy cases, with most responses stating that 11 to 20 minutes of scaling was done for one clinical visit. The results also corresponded to the study by Hwang[20], which indicated that cases of scaling less than 20 minutes increased after scaling was covered by health insurance, and if the duration of scaling is reduced without distinguishing the number visits by the amount of tartar, there is concern that it will lower the quality of scaling performance.

A summary of the results above prove that the direction for the main work of dental hygienists must be concentrated on dental hygiene management tasks such as oral health promotion and preventive treatment, and many hands-on courses on scaling for each year of experience should be opened to expand training opportunities which would enable a more accurate performance of ultrasonic scaling tasks. Furthermore, it is necessary to expand the occupational authority of dental hygienists so that patients are able to receive high-quality medical services from dental hygienists who perform scaling with a sense of pride as oral health promoters.

## 4. Conclusion

Dental hygienists demonstrated a high level of awareness toward ultrasonic scaling, but an observation of their actual performance shows that they failed to adequately select tips for each case and

replace tips following a schedule. This means that, despite being aware of these issues, dental hygienists face many limitations in terms of furnishing equipment and focusing on scaling tasks because they work as members of dental clinics which serve as private medical institutions. Furthermore, it is valid for dental hygienists with more years of experience to perform ultrasonic scaling tasks rather than those with less years of experience because those with more years of experience are more likely to have a higher level of understanding toward ultrasonic scaling. On such a basis, the study has determined that many hands-on courses must be opened to expand educational opportunities so that dental hygienists can perform ultrasonic scaling tasks according to each year in their career. Furthermore, it is necessary to expand the occupational authority of dental hygienists so as to instill pride in them as oral health promoters. The study has determined that follow-up research by expanding the scope of research subjects and quantifying performance is necessary to alleviate the limitations of the present study.

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