

The association between COVID-19 Knowledge, perception of infection control and infection control practice among dental hygienists

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[Abstract]

This study was conducted to evaluate the association between knowledge of Coronavirus disease 2019 (COVID-19), perception of infection control and practice of infection control among dental hygienists. The questionnaires consisted of 9 demographic questions, 10 questions about COVID-19 knowledge, and 36 questions about perception and practice of infection control. The study analyzed 120 participants' data gathered from May 1 to May 31, 2021. For data analysis, T-test, ANOVA, and Pearson correlation were used. As a result, COVID-19 knowledge was 6.59 out of 10, the perception of infection control was 3.57 out of 4 and the practice of infection control was 3.55 out of 4. The COVID-19 knowledge($r=0.485$) and perception of infection control($r=0.614$) were significantly positively related to practice of infection control. To improve the practice of infection control in the dental field, education of infection control should be mandatory for dental hygienists. Also, the practice of infection control following "Dental Infection Control Standard Policy & Procedure" must be mandatory.

▶ **Key words:** Infection control, Perception, Practice, COVID-19 knowledge, Dental hygienist

[요 약]

이 연구는 코로나19 팬데믹 상황 이후 치과감염관리실태를 알아보려고 시행하였다. 치과위생사들을 대상으로 코로나19에 관한 지식과 감염관리인식, 감염관리실행정도를 파악하고, 이들 사이의 연관성을 측정하였다. 일반적 질문 9개, 코로나19 지식 10개, 감염관리에 대한 인식과 실행에 관한 36개 문항으로 이루어진 설문지를 이용하여, 2021년 5월 1일부터 31일까지 조사된 120부를 분석하였다. 분석을 위하여 T검정, 분산분석, 피어슨의 상관관계를 이용하였다. 연구결과, 코로나19 지식은 10점 중 6.59점, 감염관리 인식은 4점 중 3.57점, 감염관리 실행은 4점 중 3.55점이었다. 코로나19 지식과 감염관리 실행은 0.485 양의 상관관계, 감염관리 인식과 감염관리 실행은 0.614 양의 상관관계로 코로나19 지식보다 상관관계가 유의미하게 높았다. 코로나19와 같은 감염병을 차단하기 위해서는, 치과에서 치과위생사들에게 감염관리에 대한 교육을 의무화하고, 치과감염관리 매뉴얼에 따라 감염관리 실행을 의무화해야 할 것이다.

▶ **주제어:** 감염관리, 인식, 실행, 코로나19 지식, 치과위생사

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I. Introduction

The World Health Organization labeled the outbreak of SARS-Cov-2 (COVID-19) as a 'pandemic' on March 12, 2020. By mid-April of the next year, COVID-19 had infected nearly 134 million people worldwide and caused nearly 3 million deaths: in comparison, South Korea had 109,559 cumulative confirmed cases and 1,768 deaths [1].

As part of preventive measures, the Korean government mandated the wearing of facial masks and also instituted a social distancing scheme with three tiers that considered the weekly average daily number of confirmed cases [2]. Workers at medical institutions that treat patients have risk of COVID-19 infection due to exposure to multiple individuals [3]. Medical personnel are entitled to a work environment with guaranteed occupational safety, and patients are entitled to treatment in a safe and managed standard environment.

Although patients and medical workers are entitled to safe treatment and guaranteed occupational safety, respectively, both groups carry the risk of exposure to various infectious diseases including COVID-19 during procedures or treatments performed in medical institutions [4]. Infection control, as a response to such risk, minimizes the possibility of infection between individuals to ensure the safety of patients and medical workers [5]. Dental care is one such medical field that benefits greatly from the practice of infection control.

The dental care environment is always at risk of infection due to the specificity of procedures involving face-to-face communication with patients, exposure to saliva, blood and other bodily fluids, the handling of sharp instruments, the use of aerosols during treatment and dentistry treatment in general [5-6]. Moreover, the dental treatment environment has a high risk of cross-infection due to the close proximity of surgeon, assistant, and patient [7-8]. Thus, it is no

wonder that dental practitioners have voiced their fears of COVID-19 infections through droplet transmission [9].

Despite such valid concerns for health and safety, dental medical institutions in South Korea are not legally mandated for infection control [3]. Therefore, such institutions may play host to cross-infections of diseases such as hepatitis B, HIV, and even COVID-19. In order to protect all parties involved, it is necessary to recognize and practice infection prevention strategies [10]. Since dental institutions are concomitantly sites of patient treatment and zones of exposures to infectious diseases, thorough infection control is paramount. Naturally, personal protective equipment such as masks, safety goggles, clothing, and gloves must be worn at the time of treatment, and all equipment used must be thoroughly sterilized to prevent cross-infection [11-12]. In previous studies on dental infection control, awareness of infection control regulations, performance rate of infection control, relationship between infection control cognitive and practical factors by dental hygienists, and correlation between education experience of infection control and rate of infection control practice have been conducted [13-17]. However, there were just a few studies that association between COVID-19 Knowledge and dental infection control practice after COVID-19 pandemic.

The purpose of this study was to verify the relationship between practice of infection control, perception of infection control, and knowledge of COVID-19 among dental hygienists.

II. Methods

1. Subjects

To gather subjects, the authors visited general hospitals, dental hospitals, and dental clinics in the D area in person. After explaining the purpose of the study to dental hygienists working at dental clinics or hospitals, we received written consent

from subjects who indicated their intention to participate in a survey. Participants were given a questionnaire to self-assess their knowledge of COVID-19, perception of infection control, and their current infection control practices. Participants were gathered from a pool of 16 persons from general hospitals, 25 persons from dental hospitals, and 79 persons from dental clinics. Questionnaires were distributed and collected from May 1 to May 31, 2021. A total of 120 questionnaires were analyzed. The number of samples was calculated using the G*Power 3.1 program with a significance of .05, medium effect size, of 15, and power of test of .80. The number of samples required was 118 persons, but considering the dropout rate, data were collected from 120 people.

2. Research tools

This study's questionnaire was designed to gather data on the three major topics related to the research purpose. It was also revised and supplemented based on previous studies [3, 7, 9-12, 14]. The document requested dental hygienists to complete information related to the following: 9 demographic questions, 10 questions about COVID-19 knowledge, and 36 combined questions about perception of infection control and infection control practices.

The demographic questions included gender, age, years employed in dental hygiene, highest academic degree, type of workplace, and workplace position. There were three questions about the workplace, which included the number of hygienists working per day, the number of patients treated per day, the presence or absence of infection control practices.

The portion of the questionnaire regarding COVID-19 knowledge was designed based on related information from South Korea's Ministry of Health and Welfare website. The questions were then discussed with two medical professionals for their input and expert advice.

A total of 18 questions in six categories of three questions each were related to infection control perception: personal hygiene, personal protection equipment usage, sterilization and sterilization management, disposal of single-use medical supplies, dental equipment management, and waste management. For questions related to perception of infection control, participants responded according to a four-point scale: 1 'not at all important', 2 'not important', 3 'important', 4 'very important', with high score indicating better infection control perception.

In the case of infection control practices, the survey was used the same questionnaires like infection control perception. Participants again responded according to a four-point scale: 1 'not at all', 2 'sometimes', 3 'usually', and 4 'always', with high score indicating better infection control practice.

3. Statistical analysis

Statistical analyses were conducted using the IBM SPSS software (ver. 25.0), and it was found that the statistical significance was $p < 0.05$. The average values of the general characteristics and variables related to the study's participants were analyzed by demographic frequency. According to demographic factors, participants' degree of knowledge of COVID-19, perception of infection control, infection control practice were conducted by T-test and ANOVA. Scheffe was used as a post-hoc test. Pearson's correlation analyses were applied to the relationships between COVID-19 knowledge, perception of infection control, and infection control practice.

4. Ethical Consideration

The researcher directly informed subjects of the purpose and method of this study, the voluntariness of participation, the autonomy of withdrawal, and the confidentiality of information. And we received written consent from the subjects who agreed to participate in the study.

III. Results

1. COVID-19 knowledge according to general characteristics

COVID-19 knowledge was 6.53 ± 2.32 for 30 years and younger. COVID-19 knowledge was 6.59 ± 2.31 for 1-5 years of dental career, 6.75 ± 2.21 for graduate school education, and 6.68 ± 2.15 for dental hygienists who were working in general hospitals. COVID-19 knowledge was 6.60 ± 2.28 for team leaders and 6.50 ± 2.38 for 21-30 co-workers. And COVID-19 knowledge was 6.63 ± 2.30 for 41-60 patients per day, 6.61 ± 2.38 for 20 or less patients per day, and 6.65 ± 2.27 for workers with infection control training. There was no significant result in COVID-19 knowledge according to demographic characteristics (Table 1).

Table 1. COVID-19 knowledge according to participant demographics (N=120) (Mean=6.59)

Characteristics	Division	N(%)	Mean±SD	p
Age (years)	≤30	87(72.5)	6.53±2.32	0.856
	31-40	24(20.0)	6.59±2.32	
	≥41	7(5.8)	6.81±2.28	
Dental Career (years)	<1	25(20.8)	6.51±2.31	0.776
	1-5	63(52.5)	6.59±2.31	
	6-10	16(13.3)	6.67±2.33	
	≥11	16(13.3)	6.72±2.40	
Education	College	77(64.2)	6.55±2.29	0.245
	University	36(30.0)	6.59±2.35	
	≥ Graduate School	7(5.8)	6.75±2.21	
Work Place	Dental Clinic	79(65.8)	6.55±2.30	0.610
	Dental Hospital	25(20.8)	6.64±2.35	
	≥ General Hospital	16(13.4)	6.68±2.15	
Position	General Staff	94(78.3)	6.57±2.32	0.785
	Team Leader	26(21.7)	6.60±2.28	
NDH	≤10	90(75.0)	6.60±2.31	0.720
	11-20	11(9.2)	6.56±2.27	
	21-30	9(7.5)	6.50±2.38	
	≥31	10(8.4)	6.68±2.44	
NP	≤20	16(13.3)	6.61±2.38	0.130
	21-40	41(34.2)	6.55±2.28	
	41-60	32(26.7)	6.63±2.30	
	61-80	14(11.7)	6.57±2.17	
	≥81	15(12.5)	6.62±2.36	
EE	Yes	56(46.7)	6.65±2.27	0.272
	No	64(53.3)	6.55±2.29	

NDH: N of Dental Hygienists as Co-worker, NP:N of Patients per a day, EE: Education Experience of Infection Control

2. Perception of infection control according to general characteristics

In terms of age, the perception of infection control was 3.57 ± 0.32 for participants aged 30 years and younger. The perception of infection control is 3.59 ± 0.31 for 1-5 years of dental career. There were no differences in age, dental career. In terms of education level, the perception of infection control was 3.87 ± 0.21 for dental hygienists with education beyond graduate school. It was significantly higher than those of college graduates and university graduates. In terms of workplace, the perception of infection control was 3.68 ± 0.15 for participants working in general hospitals. The perception of infection control among team leaders was 3.60 ± 0.28 . In the case with 21-30 co-workers, it was 3.59 ± 0.38 , and similar to other groups. The perception of infection control in the case of 41-60 patients per a day is the lowest as 3.43 ± 0.30 , It was significantly low compared to the case of 20 patients or less. In the case of taking infection control education, it was 3.65 ± 0.27 and significantly higher than those with no education experience. The general characteristics including education level, type of work place, number of patients per a day, and infection control education experience, were significantly different (Table 2).

Table 2. Perception of infection control according to participant demographics (N=120) (Mean=3.57)

Characteristics	Division	N(%)	Mean±SD	p
Age (years)	≤30	87(72.5)	3.57±0.32	0.856
	31-40	24(20.0)	3.56±0.32	
	≥41	7(5.8)	3.46±0.28	
Dental Career (years)	<1	25(20.8)	3.57±0.31	0.776
	1-5	63(52.5)	3.59±0.31	
	6-10	16(13.3)	3.51±0.33	
	≥11	16(13.3)	3.49±0.40	
Education	College ^a	77(64.2)	3.53±0.29	0.025* (a<c, b<c)
	University ^b	36(30.0)	3.56±0.25	
	≥ Graduate School ^c	7(5.8)	3.87±0.21	
Work Place	Dental Clinic	79(65.8)	3.52±0.30	0.040*
	Dental Hospital	25(20.8)	3.64±0.35	
	≥ General Hospital	16(13.4)	3.68±0.15	
Position	General Staff	94(78.3)	3.56±0.32	0.785
	Team Leader	26(21.7)	3.60±0.28	

NDH	≤10	90(75.0)	3.55±0.31	0.720
	11-20	11(9.2)	3.56±0.27	
	21-30	9(7.5)	3.59±0.38	
	≥31	10(8.4)	3.58±0.44	
NP	≤20 ^a	16(13.3)	3.71±0.38	0.020* (a>c)
	21-40 ^b	41(34.2)	3.55±0.28	
	41-60 ^c	32(26.7)	3.43±0.30	
	61-80 ^d	14(11.7)	3.67±0.17	
	≥81 ^e	15(12.5)	3.62±0.36	
EE	Yes	56(46.7)	3.65±0.27	0.003**
	No	64(53.3)	3.51±0.29	

*:p<0.05, **:p<0.01, NDH: N of Dental Hygienists as Co-worker, NP:N of Patients per a day, EE: Education Experience of Infection Control

3. Infection control practice according to general characteristics

The practice of infection control was 3.55±0.22 for 30 years or younger, and 3.65±0.14 for participants with a 16 years or more career, and 3.66±0.51 for persons who got education beyond graduate school. In terms of workplace, the practice of infection control was 3.76±0.14 for general hospital workers, and significantly higher than those of dental clinic workers and dental hospital workers. The practice of infection control was 3.66±0.22 for team leaders, 3.78±0.09 in case of working with 31 or more co-workers. In terms of workplace environment, infection practice control was 3.70±0.21 for 81 or more patients per day, and significantly higher than those of 21-40 patients and 41-60 patients. In terms of education experience about infection control, the practice of infection control was 3.66±0.19 for participants with infection control training. There were significant differences in variables such as work place, number of dental hygienists as co-workers, number of patients per a day, and infection control education experience (Table 3).

Table 3. Infection control practices according to participant demographics (N=120) (Mean=3.55)

Characteristics	Division	N(%)	Mean±SD	p
Age(years)	≤ 30	87(72.5)	3.55±0.22	0.291
	31-40	24(20.0)	3.49±0.30	
	≥ 41	7(5.8)	3.69±0.15	
Dental Career (years)	<1	25(20.8)	3.47±0.21	0.243
	1-5	63(52.5)	3.57±0.26	
	6-10	16(13.3)	3.54±0.20	
	≥ 11	16(13.3)	3.55±0.25	
Education	College	77(64.2)	3.54±0.21	0.374
	University	36(30.0)	3.52±0.21	
	≥ Graduate School	7(5.8)	3.66±0.51	
Work Place	Dental Clinic ^a	79(65.8)	3.51±0.23	0.040* (a<c, b<c)
	Dental Hospital ^b	25(20.8)	3.57±0.16	
	≥ General Hospital ^c	16(13.4)	3.76±0.14	
Position	General Staff	94(78.3)	3.52±0.24	0.134
	Team Leader	26(21.7)	3.66±0.22	
NDH	≤ 10	90(75.0)	3.52±0.24	0.048*
	11-20	11(9.2)	3.56±0.18	
	21-30	9(7.5)	3.58±0.25	
	≥ 31	10(8.4)	3.78±0.09	
NP	≤20 ^a	16(13.3)	3.57±0.37	0.014* (c<e, d<e)
	21-40 ^b	41(34.2)	3.57±0.17	
	41-60 ^c	32(26.7)	3.47±0.22	
	61-80 ^d	14(11.7)	3.47±0.21	
	≥81 ^e	15(12.5)	3.70±0.21	
EE	Yes	56(46.7)	3.66±0.19	0.000**
	No	64(53.3)	3.34±0.28	

*:p<0.05, **:p<0.01, NDH: N of Dental Hygienists as Co-worker, NP:N of Patients per a day, EE: Education Experience of Infection Control

4. Correlations between COVID-19 knowledge, perception of infection control and infection control practice

There was a positive correlation (r=.405) between COVID-19 knowledge and perception of infection control (p<0.01), and a positive correlation (r=.485) between COVID-19 knowledge and practice of infection control (p<0.05). Additionally, there was a positive correlation (r=.614) between perception of infection control and practice of infection control. (p<.05) (Table 4).

Table 4. Correlation between COVID-19 knowledge, perception of infection control and infection control practice

Variables	Knowledge of COVID-19	Perception of infection control	Practice of Infection control
Knowledge of COVID-19	1		
Perception of infection control	0.405**	1	
Practice of Infection control	0.485*	0.614*	1

*:p<0.05, **:p<0.01

IV. Discussion

Dental institutes are sites with high risk for the spreading of COVID-19 and other infectious diseases. Considering that medical consumers are selecting prospective sites of care not only on professionals' ability to perform desired procedures but also on the quality of environmental disinfection or sterilization [15], this study was conducted to examine association between dental hygienists' knowledge of COVID-19, perception of infection control and infection control practice. Our study verified positive correlations between COVID-19 knowledge and perception of infection control, between COVID-19 knowledge and infection control practices, and between perception of infection control and infection control practice showing the highest positive correlation between perception of infection control and infection control practice.

This study showed that perception of infection control and infection control practice was 3.57(out of 4), 3.55(out of 4) respectively. The perception of infection control was similar to the practice of infection control. This result are different to some previous studies showed that the perception of infection control was higher than the practice of infection control [14-17]. After applying the Medical Waste Management Act, infection control practice was slightly improved [18]. On June 26, 2020, the

ministry of Health and Welfare published Dental Infection Control Standard Policy & Procedure [19].

Our result showed that infection control practice was higher when the work place was general hospitals. This was consist with previous studies. [7, 20, 21]. One researcher mentioned the reason why 73.9% of dentists and 12.9% of dental hygienists were designated as infection control officers [7]. Other previous studies additionally reported that there was higher rate of infection control practices in dental institutions operating with standardized guidelines and safety management rules [20-21]. The large general hospitals regularly designate infection control managers to fulfill and supervise infection control guidelines to obtain medical institutional certification. Also, relatively more patients visited large general hospitals than dental clinics. Those facts might lead to the result that there was a better practice of infection control in the case of more co-workers or the case of more patients per day. So, we suggest that introducing a mandatory certification system for dental institutions is one strategy to improve practice of infection control.

Our study results revealed that infection control practices among dental hygienists differed depending on whether or not they had a training experience of infection control. A previous study has already shown a positive correlation between infection control education and practice [22]. However, even after completing their training, dental professionals were often unable to implement it due to their work [22]. In this study, subjects completed infection control education showed better practice of infection control. To improve practice of infection control in dentistry, we suggest that education for infection control practice based on infectious diseases should be mandatory and infection control practice should be mandatory.

The participants' knowledge of COVID-19 was 6.59 points (out of 10). COVID-19 knowledge was not different according to demographic

characteristics. But COVID-19 knowledge had significantly positive relationship on infection control practice. It was consistent with some previous studies [23-26]. Park's study showed strong relationship between infection control performance and COVID-19 knowledge [23]. Also, another previous studies of nursing part reported significant positive relationship [24-25]. Kwon mentioned the significant correlation between COVID-19 knowledge and infection control practice in dental hygienist [26]. However, Ryu's study reported that there was not significant correlation between infection control practice and COVID-19 [27].

Our results indicated that infection control practices was strongly related to perception of infection control than COVID-19 knowledge in dental hygienists. Therefore, it is necessary to plan and operate an infection control education program focusing on changing perception of infection control and practicing infection control for dental hygienists to prevent the spread of infectious diseases and to create a safe working environment.

Before the COVID-19, there were already numerous studies about other infectious diseases such as hepatitis B [28], swine flu [29], and Middle East respiratory syndrome [30-31]. In the case of dental treatment environments, safety precautions against infections from dental unit chairs and equipment [32], and between dental workers [33-35] were not secured. Considering the risk of infection among dental medical workers, systematic infection control is required through professional infection control education and training specialists in infection control organizations.

Beginning April 18th 2022, South Korea has started lifting social distancing measures. Even so, mask mandates remain current. Regardless of public health circumstances, dental hygienists should take systemic infection control education about various infectious diseases. Additionally, manuals on infection control practices such as

Dental Infection Control Standard Policy & Procedure should be mandatory. Continued research is required to improve infection control practice and comprehensive management in the dentistry field.

As a limitation of this study, the segmentation of dental workers was insufficient, and convenience extraction and difficulty evaluation of COVID-19 knowledge were insufficient. In the future, continuous research is required for improving infection control practice and systematic management in the dental medical community.

V. Conclusion

This study investigated the relationship between knowledge of COVID-19, perception of infection control, and infection control practice among dental hygienists. There were positive correlations between COVID-19 knowledge and perception of infection control, and between COVID-19 knowledge and infection control practices, and between perception of infection control and practice of infection control.

The results indicated that infection control practices was strongly related to perception of infection control than COVID-19 knowledge in dental hygienists. Therefore, it is necessary to plan and operate an infection control education program focusing on changing perception of infection control and practicing infection control for dental hygienists to prevent the spread of infectious diseases and to create a safe working environment. Also, manuals on infection control practices such as Dental Infection Control Standard Policy & Procedure should be mandatory.

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