

The Actual Condition and an Alternative of Students in the Department of Dental Hygiene about Dental Instrument Injuries during Clinical Practice

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Background: Students in the department of dental hygiene are exposed to injections and sharp instruments during clinical practice. Therefore, it is necessary to develop measures for a safe practice environment. This study aimed to investigate dental stabbing accidents caused by dental instruments during clinical practice among students in the department of dental hygiene and suggest appropriate preventative measures.

Methods: This study was conducted from May 1 to June 30, 2016, with students in the department of dental hygiene located at several universities in Seoul and Gyeonggi area. The study included 339 participants. A frequency analysis was performed to determine the general characteristics of dental infection control. A cross-analysis was conducted to identify the relationship between dental infection control education, stabbing accident prevention education, and treatment after stabbing accidents with a dental instrument.

Results: Among the participants, 81.1% received dental infection control education and 66.4% received stabbing accident prevention education. Only 50.9% received hepatitis B vaccinations.

Conclusion: Dental infection control education and stabbing accident prevention education were shown to be effective in preventing dental instrument stabbing in students. However, post-accident processing, such as reporting to upper management and medical treatment after the accident, was insufficient. Therefore, it is necessary to present a treatment flowchart for dealing with stab accidents in clinical practice for students in the department of dental hygiene and strengthen education.

Key Words: Dental infection control, Infection control, Injuries

Introduction

Clinical practice in the curriculum of the department of dental hygiene provides direct and indirect clinical experience based on basic theories and knowledge of dental hygiene and dentistry, demonstrating professional functions for future dental hygienists. It enhances the professional competency required of clinical dental hygienists to facilitate the transition to clinical practice after graduation¹⁾. In addition, students have an opportunity to indirectly experience the process of cooperation between dental

teams through clinical practice²⁾.

The dentistry environment exposes practitioners to saliva and blood due to the use of a high or low speed handpiece to prepared the tooth cavity and scaling with an ultra-sonic scaler as well as pathogenic microorganisms due to the generation of aerosols during treatment. This presents a high risk of cross-infection for medical staff and patients³⁾. Stabbing accidents cause damage to the epidermis or deeper layers of the skin by puncturing with needles or sharp instruments. Needle stabbing accidents can transmit blood-borne infectious diseases, such as hepatitis B,

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hepatitis C, and human immunodeficiency virus (HIV). According to Yoon and Choi⁴⁾, dental hygienists were 3 to 6 times more likely to be infected with hepatitis B than the general population. In addition, Kim et al.⁵⁾ reported a high probability of acquiring a blood-borne infectious disease, such as hepatitis B. Stabbing accidents with a used needle carry a 6 to 30% risk of infection with hepatitis B, 5 to 10% for hepatitis C, and 0.3% for HIV⁶⁾. The rate of stabbing accidents with needles or dental instruments was 76.6%⁴⁾. Choi and Bae⁷⁾ reported that 80.3% of puncture accidents in dentistry were with a sharp instrument, followed by needle puncture accidents. Among medical laboratory technologists, 90.9% experienced stabbing accidents, out of which only 3.6% consulted a doctor⁸⁾. A study of 2,624 licensed nurses in two states in the United States found that 85% had experienced an injury, which was significantly correlated with physical job demands, such as weekend or shift work⁹⁾.

Despite the frequent occurrence of needle puncture accidents in the medical field, most studies in South Korea have focused on dentists, dental hygienists, and nurses, whereas few studies targeted students who regularly participate in clinical practice. During clinical practice, students may be exposed to frequent puncture accidents due to lack of experience, tension during practice, and insensitivity to safety when handling or moving used needles, sharp instruments, or blood-stained instruments. In addition, students with no work experience may experience fatigue in clinical practice and become vulnerable to stabbing accidents.

Therefore, this study aimed to investigate sharp instrument and needle puncture accidents in the department of dental hygiene and clinical practice, establish preventative measures for stabbing accidents, and develop appropriate counter-measures for prevention and post-accident treatment after stabbing accidents

Materials and Methods

1. Participants

This study was conducted with students enrolled in the department of dental hygiene located at several universities in Seoul and Gyeonggi-do. An online and offline survey

was conducted from May 1, 2016 to June 30, 2016. The online survey used a Google Forms questionnaire. The sample size was calculated based on the significance level of 0.05, statistical power of 0.95, and effect size of 0.3, which are required by G Power 3.1. A survey was conducted for students who agreed to the purpose of the study. Among a total of 380 questionnaires, 41 questionnaires with missing values were excluded and 330 questionnaires were used for the final analysis.

2. Variables used in the analysis

The questionnaire was modified and supplemented to fit the purpose of this study based on previous research¹⁰⁾. The questionnaire included seven questions on participant characteristics, six questions on experience of stabbing accidents, and six questions on post-processing after stabbing accidents. Stabbing accidents were defined as accidents with a dental anesthetic syringe, general syringe, periodontal instrument or scaler tip.

3. Data analysis

The analysis was performed using R package 3.1 (University of Auckland, Auckland, New Zealand). Frequency and percentage were calculated for participant characteristics and factors of stabbing accident experience. A chi-square test was performed to determine the relationship between infection control education and post-processing after stabbing accidents, as well as between stabbing accident education and post-processing after stabbing accident.

Results

1. Participant characteristics

Among the participants, 62.8% had clinic experience. In addition, 54.3% were 3rd grade. Most of the practice hospitals were university hospitals (33.9%). In addition, 81.1% and 66.4% received dental infection control education and stabbing accident prevention education, respectively. Only half (50.9%) of the participants received hepatitis B vaccinations (Table 1).

Table 1. Participant Characteristics

| Characteristic | Division | n | % |
|---------------------------------------|----------------------------|-----|------|
| Clinical practice experience | Yes | 213 | 62.8 |
| | No | 126 | 37.2 |
| Grade | 2nd grade | 141 | 41.6 |
| | 3rd grade | 184 | 54.3 |
| | 4th grade | 14 | 4.1 |
| Clinic type | Dental university hospital | 115 | 33.9 |
| | Dental hospital | 46 | 13.6 |
| | Corporation dental clinic | 46 | 13.6 |
| | Dental clinic | 76 | 22.4 |
| Dental infection control education | Received | 275 | 81.1 |
| | Not received | 64 | 18.9 |
| Prevention education of stab accident | Received | 225 | 66.4 |
| | Not received | 114 | 33.6 |
| Experience of stab accident | Have | 116 | 34.2 |
| | Not have | 223 | 65.8 |
| Hepatitis B vaccine | Vaccinated | 171 | 50.9 |
| | Not vaccinated | 108 | 32.1 |

Table 2. Experience of Stab Accident by Dental Instrument

| Variable | Division | n | % |
|--|-----------------------------|-----|------|
| Place of stab accident | In practice class | 13 | 11.2 |
| | Dental clinic | 59 | 50.9 |
| | Dental university hospitals | 31 | 26.7 |
| Part time job dental clinic | | 13 | 11.2 |
| | | | |
| Type of stab accident | Dental injection | 79 | 68.1 |
| | General injection | 12 | 10.3 |
| | Periodontal curette | 12 | 10.3 |
| | Scaler tip | 7 | 6.0 |
| | Other | 6 | 5.2 |
| State of dental instrument | Used instrument | 81 | 70.4 |
| | Not used instrument | 29 | 25.2 |
| | Not know | 5 | 4.3 |
| Disinfection treatment after stabbing accident | Yes | 84 | 73.0 |
| | No | 31 | 27.0 |
| Cause of stab accident | Careless | 98 | 86.6 |
| | Overwork | 12 | 10.5 |
| | Other | 4 | 3.5 |
| Doctor treatment after stabbing accident | Yes | 6 | 5.2 |
| | No | 109 | 94.8 |

2. Experience of stabbing accident with a dental instrument

Table 2 shows the results for experiences of puncture accidents. Over half (50.9%) of stabbing accident occurred at dental clinics, 26.7% occurred at university hospitals, and 11.2% occurred at school or part-time job dental clinic. Dental syringes accounted for 68.1% of accident, followed by general syringes and periodontal curettes (10.3% each), scaler tips (6.0%), and other instruments (5.2%). Of the instruments involved in puncture accidents, 70.4% were used and 25.2% were unused. Furthermore, 73.0% of the participants disinfected the puncture after the accident while 27.0% did not. In addition, 94.8% of the participants did not receive medical treatment after the stabbing accident.

3. Education for prevention of puncture injuries and post-accident processing

Cross-analysis was conducted to identify out the relationship between stabbing accident education and post-accident processing. The results revealed a statistically significant correlation between needle puncture accidents, medical history checks, and post-puncture disinfection. Participants who received puncture accident prevention

education had fewer needle puncture accidents. Also the disinfection rate was higher in stabbing accidents. However, in the case of medical history confirmation, fewer cases of stabbing accident prevention education were received. There were no statistically significant differences in receive a medical examination and reporting the incident to superiors post-accident between participants who received stabbing accident prevention education and those who did not (Table 3).

4. Dental infection control education and post-accident processing

A cross-analysis was performed to determine the relationship between infection control education and stabbing accidents. The results indicated a statistically significant correlation between dental infection control education and disinfection after puncture accidents. Participants who received dental infection control training had fewer puncture accidents and more often performed disinfection after puncture accidents (Table 4).

Table 3. Stabbing Accident Prevention Education and Post-Accident Processing

| Variable | Division | Stab accident prevention education | | Total | χ^2 (p) |
|---------------------------------|----------|------------------------------------|------------|-------------|---------------|
| | | Yes | No | | |
| Examination or doctor | Yes | 6 (5.9) | 96 (94.1) | 102 (100.0) | 0.807 (0.369) |
| | No | 0 (0.0) | 13 (100.0) | 13 (100.0) | |
| Needle stab accident | Yes | 88 (39.1) | 137 (60.9) | 225 (100.0) | 6.778 (0.013) |
| | No | 28 (24.6) | 86 (75.4) | 114 (100.0) | |
| Medical history check | Yes | 36 (35.3) | 66 (64.7) | 102 (100.0) | 0.104 (0.019) |
| | No | 4 (30.8) | 9 (69.2) | 13 (100.0) | |
| Disinfection after stabaccident | Yes | 69 (78.4) | 19 (21.6) | 88 (100.0) | 5.480 (0.019) |
| | No | 15 (55.6) | 12 (44.4) | 27 (100.0) | |
| Inform to superior | Yes | 24 (27.6) | 63 (72.4) | 87 (100.0) | 0.331 (0.565) |
| | No | 9 (33.3) | 18 (66.7) | 27 (100.0) | |

Values are presented as number (%).

Data was analysed by chi-square test.

Table 4. Dental Infection Control Education and Post-Accident Processing

| Variable | Division | Dental infection control education | | Total | χ^2 (p) |
|----------------------------------|----------|------------------------------------|------------|-------------|---------------|
| | | Yes | No | | |
| Examination of doctor | Yes | 6 (5.9) | 96 (94.1) | 102 (100.0) | 0.807 (0.479) |
| | No | 0 (0.0) | 13 (100.0) | 13 (100.0) | |
| Needle stab accident | Yes | 103 (37.5) | 172 (62.5) | 275 (100.0) | 6.778 (0.006) |
| | No | 13 (20.3) | 51 (79.7) | 64 (100.0) | |
| Medical history check | Yes | 36 (35.3) | 66 (64.7) | 102 (100.0) | 0.104 (0.505) |
| | No | 4 (30.8) | 9 (69.2) | 13 (100.0) | |
| Disinfection after stab accident | Yes | 79 (77.5) | 23 (22.5) | 102 (100.0) | 8.902 (0.006) |
| | No | 5 (38.5) | 8 (61.5) | 13 (100.0) | |
| Inform to superior | Yes | 31 (30.7) | 70 (69.3) | 101 (100.0) | 0.807 (0.479) |
| | No | 2 (15.4) | 11 (84.6) | 13 (100.0) | |

Values are presented as number (%).

Data was analysed by chi-square test.

Discussion

Clinical practice courses in the department of dental hygiene are required to receive professional qualification for future dental hygienists. A variety of dental instruments are used in schools and clinical practice. In particular, dental anesthesia injections and the use of sharp instruments may act as risk factors for inexperienced students. Therefore, education and manuals on post-injury treatment is necessary to minimize possible risk factors prior to practice.

The dental infection control standard policy and procedure manual of the Korean Ministry of Health and Welfare presents the measures to be taken in case of accidents,

such as a needle puncture or exposure to blood or bodily fluids¹¹⁾. Seoul National University Bundang Hospital provides a flowchart of treatment to prevent infectious disease in the event of an accident involving exposure to blood or bodily fluids while on duty in accordance with the health and safety guidelines for employees (Fig. 1)¹²⁾. Students injured with dental instruments during practice should be provided with a similar flowchart. However, most dental clinics, except university hospitals, do not separately stipulate infection prevention education or treatment flow for students. According to Son and Jung¹³⁾, pre-practice infection control education helps form patient-related infection awareness. Therefore, systematic

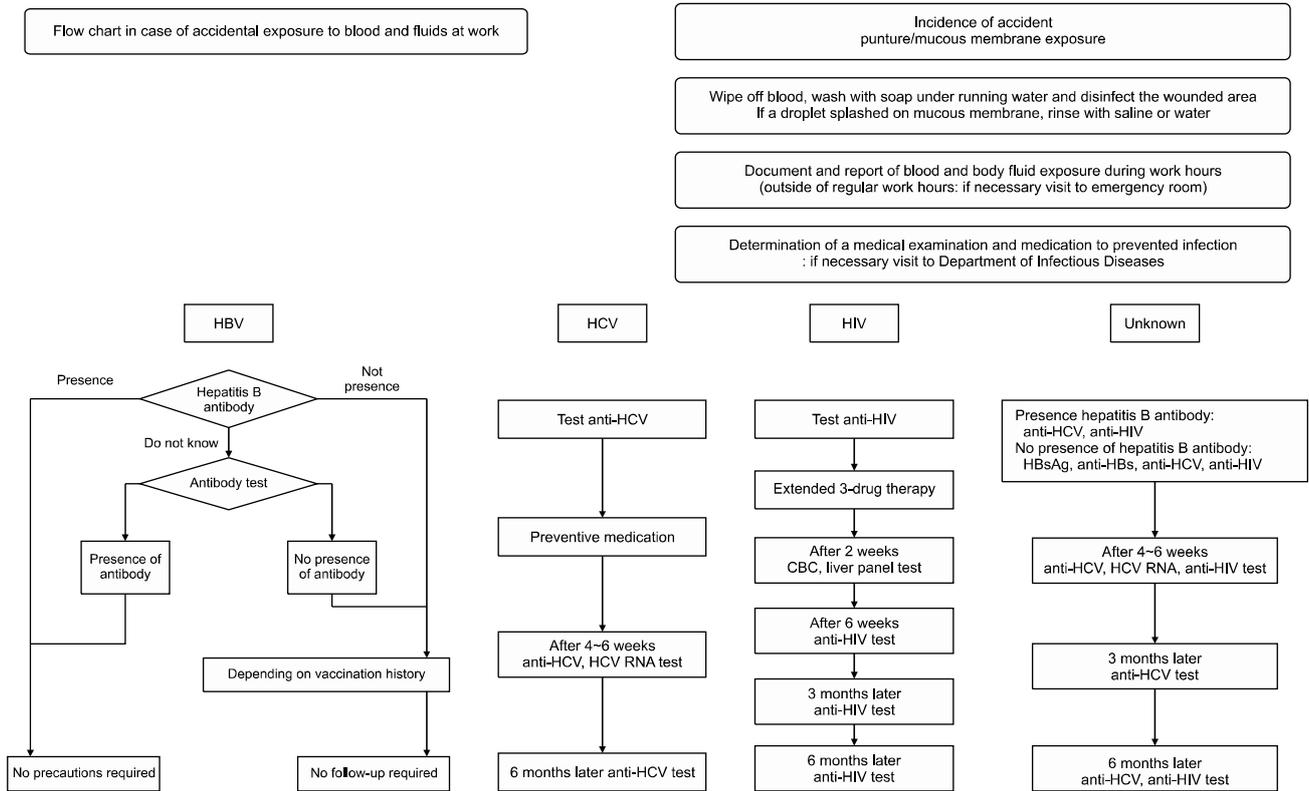


Fig. 1. Treatment flow Chart (Seoul National University Bundang Hospital). HBV: hepatitis B virus, HCV: hepatitis C virus, HIV: human immunodeficiency virus, CBC: complete blood cell count. Data from Seoul National University Bundang Hospital (Guideline of infection control; 2021)¹²⁾.

infection prevention education should be conducted to improve awareness of infection control and prevention of stabbing accidents among students before clinical practice.

The results of this study indicated that 81.1% of the respondents received dental infection control education and 66.4% received stabbing accident prevention education. The department of dental hygiene provides basic education on overall infection control. However, stabbing accidents require a more active response. At Seoul National University Bundang Hospital, personnel exposed to blood or bodily fluids should respond actively to prevent serious problems. However, most of the study participants did not take active follow-up measures, such as notifying superiors and receiving medical treatment after the stabbing accident. This may be because as a student, it was difficult to actively respond.

The correlation between dental infection control education and stabbing accident post-processing was analyzed using a cross tabulation analysis. The results indicated a significant

difference in needle stabbing accidents and disinfection after stabbing accidents based on dental infection control education. Participants who did not receive dental infection control education had a higher frequency of needle stab accidents. Participants who did receive stabbing accident prevention education had a higher rate of disinfection after stabbing accidents and there was a significant difference needle stabbing accidents, medical history checks, and disinfection. Participants who received stabbing accident prevention education had lower exposure to needle puncture accidents, higher frequency of medical history checks, and higher frequency of disinfection after stabbing accidents. Therefore, participants who received dental infection control and stabbing accident prevention education participated in treatment after stabbing accidents more often. Students often have a vague fear of clinical practice, leading to stabbing accidents. The results of this study revealed that 86.6% of students thought that they a stabbing accident due to their own negligence. This

suggests that students will be reluctant to inform superiors, and disinfection and medical treatment were passive.

Based on the results of this study, we would like to propose the following measures to handle stabbing accidents during clinical practice. First, universities should provide a flowchart on responding to stab accidents as part of basic infection control education to facilitate active post-accident processing among students. Second, as students are potential human resource, clinical practice institution have an obligation to ensure a safe environment during clinical practice. Jeon et al.¹⁰⁾ presented guidelines for preventing needle puncture accidents in dental clinics. Clinical practice institutions should provide guidelines to prevent stabbing accidents. In addition, efforts to improve the environment to prevent accidents and management systems to provide appropriate post-accident treatment are required. Third, dental hygienists in charge of clinical practice should predict variables that may occur during practice, educate students on using instruments correctly, and provide periodic feedback. Choi et al.¹⁴⁾ demonstrated a significant correlation between infection control practices and dental hygienists' awareness of the importance of infection control. Dental hygienists should have a high awareness of infection control.

Dentistry is an environment in which dental instrument stabbing accidents can occur frequently. The risk may be higher for inexperienced students; therefore, universities and hospitals need systematic preventative management education and guidelines to establish a safer practice environment.

This study has limitations on data and lack of in-depth analysis. However, this study outlined goals for universities and hospitals to develop accident prevention and management guidelines. We hope that this study will encourage future omnidirectional research.

Notes

Conflict of interest

No potential conflict of interest relevant to this article was reported.

Ethical approval

This study was approved by the Committee's Institutional Review Board of Seoul National University Bundang Hospital (approval number: B-1608-357-302).

Author contributions

Conceptualization: Eun-Ha Yoo and Hye-Young Oh. Data acquisition: Eun-Ha Yoo. Formal analysis: Hye-Young Oh. Supervision: Hye-Young Oh. Writing—original draft: Eun-Ha Yoo and Hye-Young Oh. Writing—review & editing: Hye-Young Oh and Eun-Ha Yoo.

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