Higher nasal carriage rate of methicillin-resistant *Staphylococcus aureus* among dental students who have clinical experience

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Since its isolation in the early 1960s, methicillin-resistant *Staphylococcus aureus* (MRSA) has been a cause of great concern.[1] The Asia-Pacific region in particular has a relatively high rate of *S. aureus* methicillin resistance.[2] MRSA is considered to be one of the most important nosocomial pathogens and is associated with multidrug resistance.[2,3] In addition to hospital-acquired MRSA (HA-MRSA), community-associated MRSA (CA-MRSA) emerged in the 1990s and has spread worldwide.[3,4]

Supplemental material is available online.

Investigators have reported that some people have nasal MRSA colonization.[5] Theoretically, nasal MRSA colonization can serve as a reservoir for transmission and as a risk factor for the development of MRSA infection.[6] There is increasing evidence that MRSA also is present in dental patients, on dental clinical surfaces, and in dental health care professionals (DHCPs), including students.[7-11] Although there has been limited documentation of the transmission of MRSA infection from DHCPs to patients during conventional dental therapy,[11,12] DHCPs should not disregard the possibility of MRSA colonization. In a case report by Martin and Hardy,[12] the dentist involved in the transmission described by the authors did not routinely use gloves and had recently been hospitalized for emergency surgery when the hospital was dealing with an MRSA outbreak. In a report by Kurita and colleagues,[11] 8 of 140 patients who had no evidence of MRSA when they were admitted to a hospital ward for special dental care and oral surgery became MRSA carriers during their hospitalization. Kurita and colleagues[11]

ABSTRACT

Background. Methicillin-resistant *Staphylococcus aureus* (MRSA) has been isolated from dental clinical surfaces, dental patients, and dental health care professionals. The authors conducted a study to determine the prevalence rate of nasal MRSA colonization among dental school students and to identify the characteristics of the isolated strains.

Methods. The authors collected nasal samples from 159 dental students. The authors performed *mec*A gene detection, staphylococcal cassette chromosome *mec* (SCC*mec*) typing, and antimicrobial susceptibility tests on each sample. The authors compared the results of 2 groups (students who had clinical experience and students who did not have clinical experience).

Results. Five (3.1%) dental students had MRSA colonization, as confirmed by the presence of the *mec*A gene in the nasal cavity. Prior clinical experience was associated significantly with nasal MRSA carriage ($P < .05$). Four of the strains were SCC*mec* type IV, and 1 strain was SCC*mec* type I. All isolates were resistant to amoxicillin and clavulanic acid, imipenem, and oxacillin, but were susceptible to several antimicrobial agents including mupirocin, trimethoprim and sulfamethoxazole, and rifampin. The nasal MRSA colonization was eradicated with the use of mupirocin ointment.

Conclusions. Nasal MRSA colonization occurs in some dental students, especially those who have clinical experience.

Practical Implications. Education about MRSA colonization and transmission, as well as infection prevention and control measures is necessary for dental students, especially when they participate in clinical practice.

Key Words. Methicillin-resistant *Staphylococcus aureus*; MRSA; dental student; nasal carriage; colonization.

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suggested that the MRSA-contaminated surfaces of the dental operatory were the reservoirs for MRSA transmission. After appropriate infection prevention practices were implemented at both of these studies' sites, the investigators found no subsequent instances of MRSA transmission.[11,12]

Compared with the medical field, proper studies of MRSA carriage in the dental field are relatively sparse. The aim of our study was to investigate the nasal MRSA carriage rate among dental students and to identify the characteristics of isolated strains. In addition, we aimed to support the hypothesis that dental students who had clinical practice experience would have a higher risk of being an MRSA carrier compared with students who did not have clinical practice experience.

METHODS

Participants. The institutional review board of Seoul National University Dental Hospital, Seoul, South Korea, approved the protocol of this study (CRI14040). We conducted the survey during a 2-week period from December 2014 to January 2015. First- to third-year dental students at the Seoul National University School of Dentistry participated in this study. Each dental student volunteer provided informed consent, and the participants did not receive any compensation.

Each participant completed a questionnaire (Appendix, available online at the end of this article) that included sex, age, school year, duration of clinical training, and a brief medical history (for example, hypertension, diabetes mellitus, hepatitis, and asthma). We excluded from the study participants who had a history of hospitalization, participants who had taken antibiotics within 30 days, and participants who were undergoing immunosuppressive or chemotherapeutic treatment.

Sample collection and processing. We inserted a sterile swab moistened with normal saline into each participant's anterior nostril to a depth of approximately 1.5 centimeters and rotated the swab 5 times. For each specimen, we sampled both nostrils consecutively using the same swab.

We took all swab samples to the Seoul National University Clinical Research Institute to be screened for MRSA growth using chromID MRSA agar (bioMérieux).

Detection of *mec*A gene and staphylococcal cassette chromosome *mec* typing. We extracted and amplified genomic DNA from each culture with presumptive MRSA growth by polymerase chain reaction (PCR) to detect the *mec*A gene. We determined the staphylococcal cassette chromosome *mec* (SCC*mec*) type (that is, type I to type V) of each strain consecutively using PCR assay.

Antimicrobial susceptibility testing of isolated MRSA strains. Using an automated MicroScan WalkAway 96 system (Siemens Healthcare Diagnostics), we measured the minimal inhibitory concentration of each antimicrobial agent to determine each agent's resistance or susceptibility. We tested the following 22 antimicrobials: amoxicillin and clavulanic acid, azithromycin, ciprofloxacin, clindamycin, daptomycin, erythromycin, fosfomycin, fusidic acid, gentamicin, imipenem, levofloxacin, linezolid, moxifloxacin, mupirocin, nitrofurantoin, oxacillin, quinupristin and dalfopristin (Synercid, Pfizer), rifampin, teicoplanin, tetracycline, trimethoprim and sulfamethoxazole (TMP-SMX), and vancomycin. We considered resistance to oxacillin to be equivalent to resistance to methicillin.[13] We performed quality control by testing a standard *S. aureus* strain (American Type Culture Collection 29213).

Decolonization of nasal MRSA carriers. We advised all students with nasal MRSA colonization to see a clinician to discuss possible decolonization. To achieve decolonization, these students applied mupirocin ointment twice daily for 7 consecutive days. We retested all students who had undergone decolonization for MRSA colonization.

Statistics. We carried out statistical comparisons using SPSS software 20.0 (IBM). We applied the χ^2 test or the Fisher exact test to determine the significance of differences between 2 dental student groups (that is, students who had clinical experience and students who did not have clinical experience). We considered a P value of $< .05$ to be statistically significant.

RESULTS

Demographic characteristics of participants. Initially, 160 dental students participated in our study. However, we excluded 1 student from the study because the student had been hospitalized within 30 days of the study. Therefore, we included a total of 159 dental students. Among these students were 38 (23.9%) first-year, 44 (27.7%) second-year, and 77 (48.4%) third-year dental students. There were 109 (68.6%) male students, and the mean age was 26.8 years (range, 22-35).

Microbiological results. Of the 159 students, 5 (3.1%) students' nasal cultures contained MRSA isolates. We confirmed this by determining the presence of the *mec*A gene. All isolates occurred in third-year male students, who had a mean age of 29.4 years (range, 26-32). Subsequently, we determined the SCC*mec* types and found that 4 strains were SCC*mec* type IV, and 1 strain was SCC*mec* type I (Table 1).

ABBREVIATION KEY. **CA-MRSA:** Community-associated methicillin-resistant *Staphylococcus aureus*. **CDC:** Centers for Disease Control and Prevention. **DHCP:** Dental health care professional. **HA-MRSA:** Hospital-associated methicillin-resistant *Staphylococcus aureus*. **HCP:** Health care professional. **MRSA:** Methicillin-resistant *Staphylococcus aureus*. **NA:** Not applicable. **PCR:** Polymerase chain reaction. **PPE:** Personal protective equipment. **R:** Resistant. **S:** Susceptible. **SCC*mec*:** Staphylococcal cassette chromosome *mec*. **TMP-SMX:** Trimethoprim and sulfamethoxazole.