Short report

Higher prevalence of meticillin-resistant Staphylococcus aureus among dental students


a Laboratorio de Microbiología, Posgrado de la Facultad de Odontología, Universidad Nacional Autónoma de México, Mexico City, Mexico
b Departamento de Atención a la Salud, Universidad Autónoma Metropolitana, Unidad Xochimilco, Mexico City, Mexico

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S U M M A R Y

In order to test the hypothesis that more dental students are meticillin-resistant Staphylococcus aureus (MRSA) carriers than non-dental students, 100 dental students with five to six years of exposure to patients and 81 non-dental students were tested for nasal and pharyngeal MRSA carriage by polymerase chain reaction. All 181 students were clinically healthy and none had taken antibiotics. Significantly more dental students (20/100) carried MRSA than non-dental students (5/81) (odds ratio: 4.04; 95% confidence interval: 1.6–12.6; \( P = 0.0033 \)). Also, more dental students’ mobile phones (8/100) carried MRSA. All MRSA isolates were distinguished by pulsed-field gel electrophoresis from epidemiologically significant strains. The results suggest that dental students are occupationally exposed to MRSA.

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Introduction

Meticillin-resistant Staphylococcus aureus (MRSA) is a cause for concern for both patients and healthcare providers. Dental patients may carry MRSA. There is increasing evidence of this pathogen’s presence on dental clinic surfaces, and among dental students. The aim of this investigation was to test the a priori hypothesis that more dental students are MRSA carriers than other university students.

Methods

Sample collection took place in October 2011. The protocol was reviewed and approved by the ethics and biosafety committees at the National University of Mexico. All participants provided their informed consent to participate as volunteers. No incentives were offered.

All samples from dental students were obtained during an unannounced visit to the teaching clinics. MRSA screening was offered to 100 consecutive students working on their patients. All agreed to participate.

Students on pharmacy and microbiology courses (\( N = 111 \)) were visited in their classrooms and invited to participate. Eighty-one clinically healthy non-dental students volunteered and were included in the study.

Paired nasal and throat swabs were collected from each participant. Additionally, all students’ mobile-phone key-boards were swabbed and samples subjected to the same bacteriological procedures. Immediately after collection, each swab was immersed in soy trypticase broth, and incubated overnight at 37 °C. The broth was then subcultured on to phenol-red manitol salt agar and incubated aerobically at 37 °C for 24 h.

Antibiotic susceptibility and oxacillin minimum inhibitory concentration (MIC) were determined on typical Staphylococcus...
*Staphylococcus aureus* colonies according to Clinical and Laboratory Standards Institute protocols.5–7 *S. aureus* ATCC 43300 and *S. aureus* ATCC 29213 served as positive and negative controls, respectively.

Genomic DNA from pure staphylococcal cultures was extracted and amplified by polymerase chain reaction to detect the *mecA* gene with the primers described by Oliveira and de Lencastre.7 *S. aureus* MR5643 served as positive control. 

MRSA isolates were characterized according to the following criteria: oxacillin MIC $\geq 4$ mg/mL, and *mecA* gene positivity.

Molecular analysis was conducted using pulsed-field gel electrophoresis (PFGE) as described previously.8 Briefly, MRSA isolates were grown overnight at $37^\circ$ C, and the cells then embedded into SeaKem Gold agarose (Lonza, Rockland, ME, USA). Genomic DNA in the agarose plugs was cut with *Sma I* (Promega, Sunnyvale, CA, USA), and restriction fragments separated. Strain relatedness was interpreted according to published guidelines.9

All MRSA isolates from the participants and their phones were compared with the PFGE patterns from epidemiologically significant reference strains.

**Statistical analysis**

Chi-square and nominal logistic analysis was applied between the two student populations to estimate the confidence intervals (CIs) between the proportions of MRSA-positive students. Data were analysed with the JMP 9.0 statistical package (SAS Institute Inc., Cary, NC, USA). $P \leq 0.05$ was considered statistically significant.

**Results**

A total of 181 university students participated; none was involved in laboratory work with MRSA. All were clinically healthy when sampled, and none had taken antibiotics in the six months prior to the study. The dental group comprised 26 males and 74 females (1:3 ratio) aged 23.9 ± 1.1 years. All dental students had five to six years of cumulative clinical exposure to patients. The non-dental student group comprised 34 males and 47 females (1:1.5 ratio) aged 23.6 ± 5 years. There were no significant differences in age ($P = 0.6592$) between the two groups.

The nominal logistic analysis model revealed that the proportions 20/100 (dental) vs 6/81 (non-dental) were significantly different ($P = 0.0033$). For the dental students the odds ratio (OR) was 4.04 [95% confidence interval (CI): 1.6–12.6]; for the non-dental group the OR was 0.3 (95% CI: 0.08–0.6). MRSA status was not associated with the students’ gender ($P = 0.4608$). Among the positive students, MRSA was found in 14 nasal and 13 throat swabs; only two students were positive in both sites at the time of testing (Table I). All carriers were notified of their MRSA status and advised to consult with their physician.

More dental students’ phones (8/100) carried MRSA than those belonging to non-dental students (1/81). At the time of sampling, nine nasal carriers and eight throat carriers had MRSA-negative phones, and an MRSA-negative dental student had an MRSA-positive phone.

All 36 MRSA isolates were typed. PFGE revealed that all MRSA isolates from the university students were different from epidemiologically significant reference strains (dendrogram data not shown).

**Discussion**

A significantly greater proportion of dental students (20/100) carried MRSA than their non-dental peers (5/81), suggesting occupational exposure. This finding warrants comparison of MRSA carriage rates among dental students at different levels of cumulative clinical exposure to patients.

Differences in recruitment methods may have contributed to participation rates of 100% for dental students approached in clinics versus 73% for non-dental students invited as class groups. However, the students’ behavioural characteristics, including levels of social interaction and personal hygiene, are rather homogeneous to be considered possible sources of bias associated with their MRSA carrier status or unwillingness to participate in the study.

It is necessary to consider all possible modes of exposure to MRSA in the dental environment, because a proportion of dental patients are MRSA carriers, and may disseminate MRSA through the air, particularly when dental work generates spray and splashes.1,12

We are evaluating whether compliance with infection control protocols has increased with the dissemination of this newly available information on MRSA among our dental students.
A nasal swab survey at the University of Washington Dental School found that 21% (13/61) of dental students were MRSA carriers. Anterior nasal swabs are the preferred sampling strategy but our results demonstrate that failure to collect both nasal and pharyngeal samples may underestimate MRSA carrier prevalence.

The isolates from our university students in Mexico City showed great clonal diversity, appear to be endemic, and have not been reported as causally associated with healthcare or community outbreaks.

Only two dental students had the same nasal MRSA isolates. We did not evaluate whether this potential cross-contamination was occupational or through social networks.

This study did not evaluate surface contamination in our teaching clinics. We focused our sampling on the students’ mobile phones, and found that more mobile phones were contaminated among dental students.

To better understand the associated factors, mechanisms and directionality of MRSA transmission in dental clinics, work is underway to type isolates from dentist-and-patient pairs.

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Conflict of interest statement

None declared.

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