Studies on the characterization and the classification of staphylococci isolated from human oral cavity

Hidefumi Kumada and Asako Yuge
Department of Oral Microbiology, (Chief: Prof. Asako Yuge) Kanagawa Dental College, Inaoka 82, Yokosuka, Kanagawa, 238 Japan

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Staphylococci have been classified into three species: *Staphylococcus aureus* (S. aureus), *S. epidermidis* and *S. saprophyticus* (Bergey’s Manual 8th edition, 1974). *S. aureus* has been regarded as a potential pathogen, whereas the coagulase-negative staphylococci as nonpathogens. Recently evidences, however, suggest that *S. epidermidis* causes various pyogenic infections. As *S. epidermidis* has been widely looked upon as one of the opportunistic bacteria, the further taxonomic classification of this species is especially indicated. Since *S. epidermidis* contains those types which have different biochemical characterization, Baird-Parker has classified it into four biotypes, while Pelzer et al. used eight biotypes. By the Kloos & Schleifer method, the coagulase-negative staphylococci have been classified into nine species. Their classifications were performed by collecting staphylococci from the skin, but there have only been few reports concerning oral staphylococci. In the present paper, we attempted to classify oral staphylococci on the basis of Bergey’s Manual, Baird-Parker’s biotyping and Kloos & Schleifer’s classifications.

For this study, *dorsum linguae* of 276 healthy adults were swabbed and staphylococci were found in 244 subjects (the detection rate was 88.4%). For controls, the following strains were used: *S. aureus* (ATCC 12600), *S. simulans* (MK 148=ATCC 27848), *S. xylosus* (KL 162=DSM 20266), *S. cohnii* (GH 137=DSM 20260), *S. saprophyticus* (CCM 883=ATCC 15305), *S. haemolyticus* (SM 131=DSM 20263), *S. warneri* (AW 25=ATCC 27836), *S. hominis* (DM 122=ATCC 27844), *S. epidermidis* (ATCC 14990), *S. capitis* (LK 499=ATCC 27840) (all of them were presented by Dr. Schleifer), and *S. aureus* 209p (preserved in our laboratory).

150 strains of isolated staphylococci were examined and classified on the basis of Bergey’s Manual. The results: 35 strains (23.3%) were *S. aureus*, 97 strains (64.7%) were *S. epidermidis*, 1 strain (0.7%) was *S. saprophyticus*, and the other 17 strains (11.3%) did not belong to any of the three species. Subsequently, Baird-Parker’s biotyping was applied to 97 strains of *S. epidermidis*. As a result, 60 strains (61.8%) were regarded as biotype 1, there were no biotype 2, 5 strains (5.2%) were biotype 3, 12 strains (12.4%) were biotype 4, and the other 20 strains (17.6%) could not be classified.

Using the Kloos & Schleifer method, all of the 150 strains were classified into the typical nine species and *S. sp.*. *S. cohnii* was not isolated in our strains. The results were as follows: 35 strains (23.3%) were *S. aureus*, 74 strains (49.3%) were *S. epidermidis*, 15 strains (10.0%) were *S. simulans*, 5 strains (3.3%) were *S. warneri*, 4 strains (2.7%) were *S. haemolyticus*, 4 strains (2.7%) were *S. hominis*, 2 strains (1.3%) were *S. saprophyticus*, 1 strain (0.7%) was *S. xylosus*, 1 strain (0.7%) was *S. capitis* and 9 strains (6.0%) were *S. sp.*.

Finally, Bergey’s Manual and Kloos & Schleifer’s classifications were compared with each other in the classification of isolated strains (Table 1). As a result, 35 strains were classified as *S. aureus* by both methods, while 97 strains determined to be *S. epidermidis* by Bergey’s Manual belonged to
Table 1. The variations and correlations of the results of classifications by Bergey’s Manual and the Kloos & Schleifer method

<table>
<thead>
<tr>
<th>Kloos &amp; Schleifer</th>
<th>Bergey No. of strains</th>
<th>S. aureus</th>
<th>S. epidermidis</th>
<th>S. saprophyticus</th>
<th>The others</th>
</tr>
</thead>
<tbody>
<tr>
<td>S. aureus</td>
<td>35</td>
<td></td>
<td>97</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>S. sp.</td>
<td>I</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. simulans</td>
<td>II</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. xylosus</td>
<td>II</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. saprophyticus</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. haemolyticus</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. warneri</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. hominis</td>
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<tr>
<td>S. epidermidis</td>
<td>74</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. capitis</td>
<td>1</td>
<td></td>
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</tr>
</tbody>
</table>

O : This mark indicates distribution of each species by Kloos & Schleifer’s classification.
* : $\% = \frac{\text{No. of strains by Kloos & Schleifer method}}{\text{No. of strains by Bergey’s Manual}} \times 100$

seven separate species of Kloos & Schleifer’s classification.

Classification of oral staphylococci by the Kloos & Schleifer method revealed that the distribution of oral staphylococci was different from that of skin staphylococci in the following: S. epidermidis was the dominant species in both the skin and oral cavity, S. aureus was the next most prevalent species in the oral cavity, while on the skin, S. hominis was isolated as often as S. epidermidis, and S. aureus was quite few (2%). This data indicates that there are more pathogenic staphylococci in the oral cavity than on the skin.

Staphylococci which inhabit the oral cavity act as pathogens causing suppurative infections in the oral cavity. It is reported that the carriers of pathogenic strains in the oral cavity are more frequently affected by supplicative inflammations than those who do not have such strains.12) Thus, the study on distribution of pathogenic strains of staphylococci in the oral cavity may be an important step toward preventive measures against oral diseases. In conclusion, staphylococci in the oral cavity were classified and investigated. Experimental results suggested that the Kloos & Schleifer method was useful, because all strains of staphylococci isolated from the oral cavity could be classified.

References

7) Baird-Parker, A. C.: Classification and iden-


