45 Preoperative Oral Care Reduces The Bacterial Adhesion To Endotracheal Tubes

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Introduction

In the operation under general anesthesia, the adhered bacteria on the endotracheal tube can be a major causative agent of postoperative infections, since the bacterial contamination from saliva and mucosal surfaces can not be avoidable. It was reported that the preoperative oral care could reduce the risk of postoperative infections, however, the inhibitory effect of oral cares on the bacterial adhesion to endotracheal tubes remains to be elucidated.

In this study, we assessed the number of total bacteria and streptococci on the extubated endotracheal tubes after the operation in relation to preoperative oral cares.

Materials and Methods

Effects of oral care on the bacterial adhesion to the endotracheal tube and on the bacteria in saliva

Subjects

A total 58 patients, scheduled the general operation under anesthesia (table 1), took part in the present study after giving informed consent. This study was approved by the Ethics Committee of Iwate Medical University School of Dentistry (Approval #: D-01190). The patients were divided into two groups: 24 patients with preoperative oral cares (OC group) and 34 patients without oral cares (NOC group). There is no significant difference between the two groups in the mean age, the number of remaining teeth and the mean O'Leary PCR before the preoperative oral care. The oral care consisted of the professional mechanical tooth cleaning (PMTC) performed on 7 days and 1 day before operation.

Table 1 Operations for the subjects used in this study

Subjects were used in this study (operation name)

OC group (n=24)		NOC group (n=34)	
Chin cyst enucleation	7	Tympanoplasty	6
Extraction of wisdom tooth	5	Hip arthroplasty	2
Removal of a part of tongue	4	Paranasal sinus operation	2
		Nephrectomy by celoscope	2
Maxillary tumor enucleation	1	Debridement with skin grafting	Tibial tuberosity graft 1
Neck dissection		Benign tumor excision with grafting	Anterior cruciate ligament reconstruction
Removal of the bone cortex		Invasive foot joint fixation	Fixation art between the invasion lumbar vertebrae cone
Extraction of impacted tooth		Free compound tissue graft	Labrum skin malignant tumor excision
Cheilognathopalatoschisis		Eyebrows skin tumor resection	Malignant tumor excision with grafting
Removal of a part of maxillary bone		Fistula excision with flapplasty	Skin malignant tumor excision
Postoperative maxillary cyst enucleation		The Eyebrows cutify	Alinasal skin malignant tumor excision
Mandibulectomy		Meniscectomy	Ureter lithotripsy of the diameter urethra
		Cholecystectomy	Facial skin malignant tumor resection
		Cheeks malignant tumor excision	Postoperative maxillary cyst enucleation
		Removal of a part of tongue	Neck dissection

Collected 1 ml of total saliva just before the operation

↓

Obtained extubated endotracheal tubes after operation

↓

Rinsed the tubes with sterile PBS to remove the loosely attached bacteria

↓

Vortex mixing and centrifugation

↓

Collected the bacteria adhered to the tube

↓

Cultured on the 5% sheep blood agar plates and Mitis-Salivarius agar plates

↓

37˚C, 48 h under an anaerobic condition

↓

CFU count

Purification of bacterial DNA

Adhesion assay of oral streptococci to endotracheal tubes

Bacteria strains used in this study

Streptococcus mutans ATCC 25175 (Sm)
S. anginosus NCTC 10713
S. sanguinis ATCC 10556
S. oralis ATCC 10557
S. sobrinus ATCC 27351 (Ss)
S. salivarius ATCC 7073
S. gordonii ATCC 10558
Staphylococcus epidermidis ATCC 35984 (a strain with biofilm formation)

The seven oral streptococci and *Staphylococcus epidermidis* were used in this study. These bacteria were pre-incubated in Toryptic Soy Broth at 37˚C under an anaerobic condition. After 48 h incubation, the bacterial cells were collected by centrifugation. The endotracheal tube (3 cm length) was immersed in the bacterial suspension in PBS (1 x 10^7 CFU/ml), and kept at 4˚C for 2 h. Then the adhered bacteria were collected as described above.

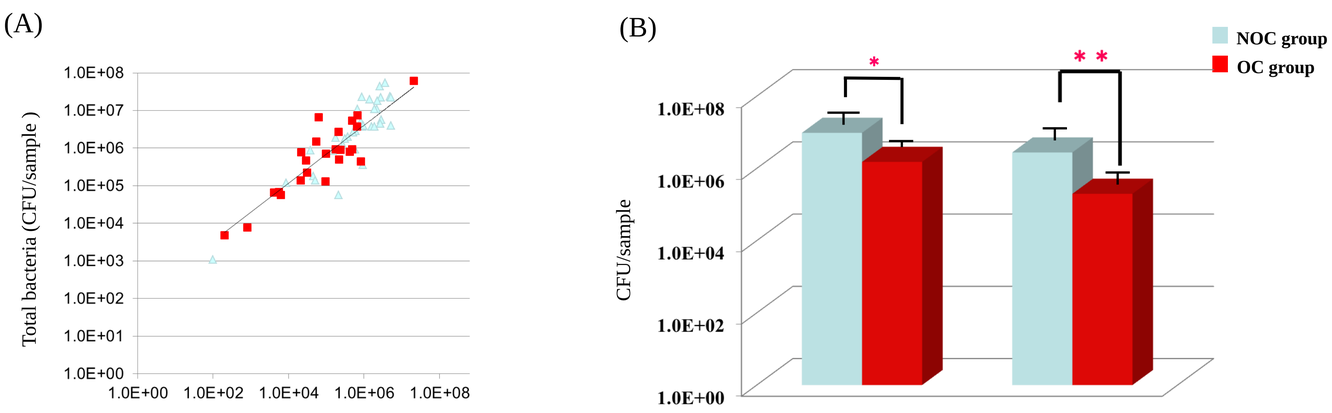
Detection and quantification of *S. mutans* and *S. sobrinus* in the samples from endotracheal tubes and saliva

a) Detection of *S. mutans* and *S. sobrinus*
S.mutans and *S.sobrinus* were detected by species-specific PCRs (Kimura, S. and Ohara-Nemoto, Y., 2007).

b) Quantification of *S. mutans* and *S. sobrinus.*
The total number of *S. mutans* and *S. sobrinus* were determined using the species-specific realtime PCR assay (Kishi, M., et al., 2009).

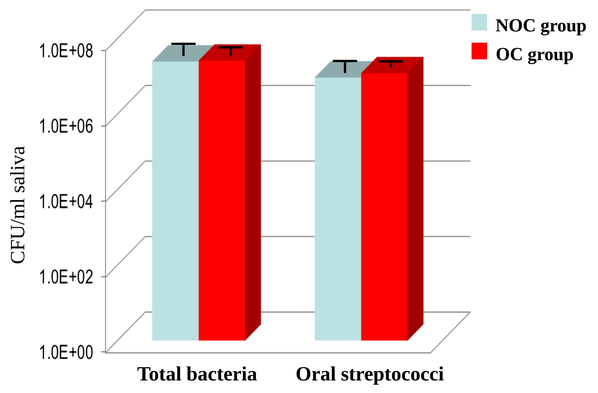
Results

Fig. 1 The numbers of total bacteria and oral streptococci on the endotracheal tube



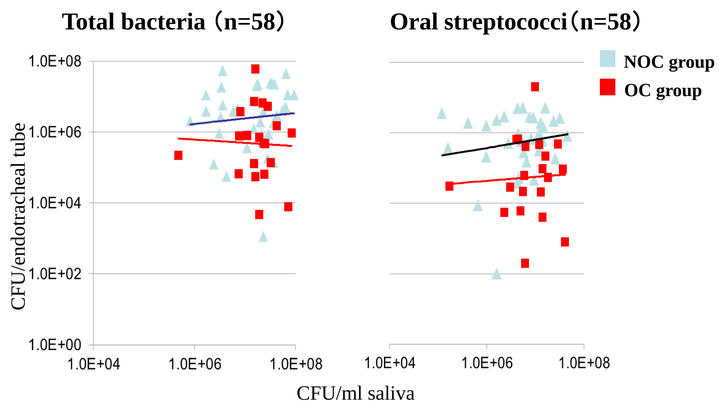
- (A) More than 10^3 CFU per tube of bacteria were detected in all the samples, in which oral streptococci were predominant. The number of total bacteria was correlated significantlywith those of oral streptococci in both OC and NOC groups (R^2= 0.7885 and R^2= 0.7197 respectively).
- (B) The numbers of total bacteria and oral streptococci that adhered to the extubated endotracheal tubes in OC group were significantly lower than those in NOC group (p=0.0007 * and p=0.0319 * *, respectively).

Fig. 2 The numbers of total bacteria and oral streptococci in the saliva sample



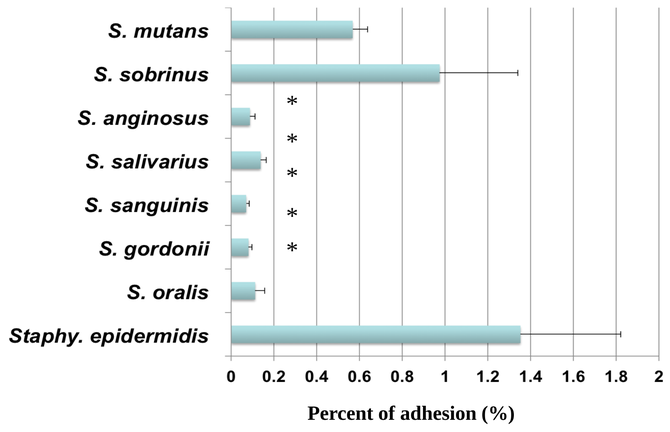
- There was no significant difference in the number of total bacteria and oral streptococci between OC and NOC groups in the saliva samples. (both p>0.05).

Fig. 3 Relationship between the numbers of bacteria on the endotracheal tube and that in the saliva sample



- In both OC and NOC groups, there was no significant correlation between the numbers of bacteria (total bacteria and oral streptococci) on the endotracheal tube and that in the saliva sample.

Fig. 4 Adhesive abilities of oral streptococcal species to an endotracheal tube



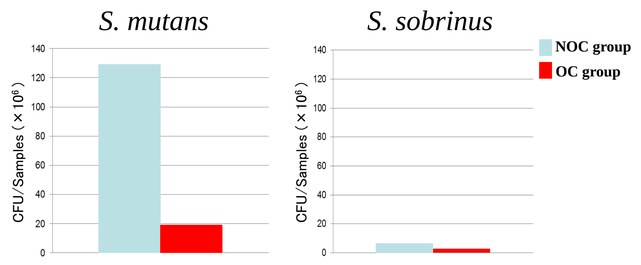
- In vitro adhesion assay demonstrated that both mutans streptococci (MS; *S. mutans* and *S. sobrinus*) have higher adhesive ability to the endotracheal tube than those in other oral streptococcal species (*; p<0.05).

Table. 2 Detection of MS in the saliva samples

		OC group	NOC group
Sm･Ss	+･+	2★	1★
	+･−	5★	4★
	−･+	0★	5★
	−･−	17★	24★
Percentage of MS-positive samples		29.2%	29.4%

★ Number of samples

Fig. 5 Numbers of MS in the MS-positive saliva samples



- The frequency of MS-positive samples in saliva was not influenced by the preoperative oral cares, although the numbers of MS in the MS-positive samples in OC group were markedly lower than those in NOC group.

Conclusions

- More than 10^3 CFU per tube were detected in all the samples, in which streptococci were predominant. (Fig. 1)
- Both the numbers of total bacteria and oral streptococci adhered to the tubes in OC group were significantly lower than those in NOC group, suggesting that the preoperative oral cares could reduce the bacterial adhesion to the endotracheal tubes. (Fig. 1)
- In saliva, however, the preoperative oral cares did not affect the number of total bacteria and oral streptococci (Fig. 2) and the frequency of MS-positive samples (Table2).
- The in vitro adhesion assay revealed that both mutans streptococci have significantly higher adhesive ability to endotracheal tubes than those of other oral streptococci (Fig. 4).

Consequently, significant number of bacteria, especially oral streptococci including mutans streptococci, can adhere to endotracheal tubes during operation, which may be controlled by preoperative OC.