Factors related to changes in salivary bacterial counts in perioperative patients

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Background

In recent years, perioperative oral care has been widespread in many hospital.
One of the purposes of oral management in patients with general anesthesia is to reduce the number of bacteria in saliva, which is to prevent postoperative aspiration pneumonia caused by direct migration of bacteria.
The other is to prevent the occurrence of SSI and to prevent blood circulation infection to distant organs from the oral.
However,it is unclear what kind of patients originally have a large amount of oral bacteria, what kind of patient and when should focus on postoperative oral care. The purpose of this study is to clarify what kind of patients have a large number of bacteria in saliva, changes in the number of bacteria before and after surgery.

Materials and methods

・Patients：121 patients who under went general anesthesia at Kansai University Medicalcenter and received standard preoperative oral care
・Term of research：3/1/2021～12/31/2021
・Research day: first visit, 1 day before surgery, 1 and 7 day after surgery
・Oral care management: removal of dental calculus, professional mechanical tooth cleaning, removal of tongue coating, cleaning of dentures, and extraction of infectious teeth
・Number of vacteria was measured with a rapid oral bacteria quantification system (Panasonic Healthcare Co.Ltd., Osaka Japan) using the dielectrophoresis and impedance measurement methods.

Sex, Age, BMI, Smoking habit, Drinking habit, Primay disease, Regular dental management, Serum total protein, Serum albumin, Plaque control record, Periodontal pocket, Extraction before surgery, Number of teeth, Denture use, Dry mouth, Operation time, Feeding condition

- Dental plaque was defined as the O'Leary plaque score × number of the teeth.
- Oral wetness was measured by the Kakinoki classification.

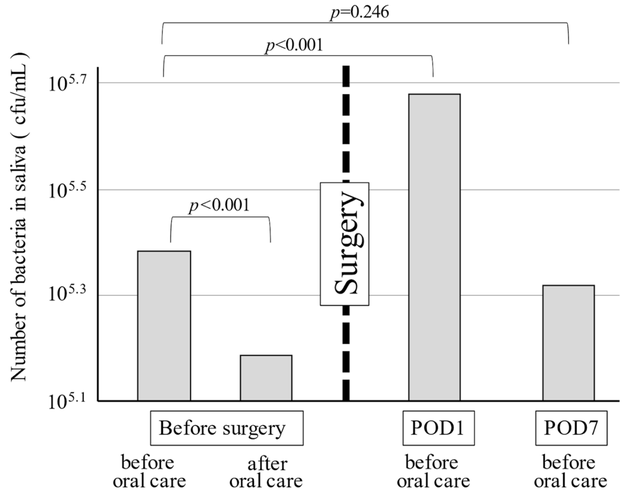

Figure 1. The number of bacteria in saliva during the perioperative period.

Table 1 Patients characteristics

Variable		Number of patients / mean ± standard deviation
Sex	male	54
	female	67
Age		69.4±12.3
Primary disease	bone/joint	41
	gastrointestinal tract	25
	liver/gall bladder/pancreas	16
	uterus/ovaries	15
	cardiovascular	10
	lung	6
	others	8
Body mass index		22.8±3.70
Smoking habit	(-)	93
	(+)	28
Drinking habit	(-)	96
	(+)	25
Regular dental management	(-)	61
	(+)	60
Serum total protein (preoperative)		6.99±0.547
Serum albumin (preoperative)		4.01±0.530
Plaque control record (preoperative)		56.9±27.2
Periodontal pocket	<6mm	115
	≥6mm	6
Extraction before surgery	(-)	109
	(+)	12
Number of teeth		20.5±8.74
Denture use	(-)	80
	(+)	41
Dry mouth (preoperative)	grade 0	70
	grade 1	37
	grade 2	11
	grade 3	3
Operation time (minutes)		214±138
Feeding condition (next day after surgery)	fasting	47
	orally	74

COI Disclosure
I have no financial relationships to disclose.

Results

Table 1 shows patient characteristics. The average logarithmic mean of number of bacteria in saliva before oral care on the day before surgery was 5.38. After oral care before surgery, the number of bacteria in saliva decreased to approximately 1/10 of the original count. On the day after surgery, the number of bacteria in saliva increased markedly to a value of 5.68. Thereafter, the number of bacteria in saliva decreased, and the value on the 7 days after surgery was restored to that before surgery (Figure 1).

The number of bacteria in saliva decreased after preoperative oral care, increased significantly after surgery, and were restored 7 days after surgery to number before performing preoperative oral care.

Factors related to the number of bacteria in saliva before surgery Univariate analysis of factors associated with the number of bacteria in saliva before oral care on the day before surgery showed that older adults (p=0.005) and xerostomia (p=0.004) were significantly associated with increased number of bacteria in saliva (Table 2). Multiple regression analysis was performed with five factors entered as covariates: age and xerostomia, which were found to be significant in univariate analysis, and smoking, PCR, and regular dental checkups, which were believed to potentially affect the number of bacteria in saliva. The results showed that older age (p=0.004, standardized coefficient β=0.283) and xerostomia (p=0.034, standardized coefficient β=0.192) were significantly associated with the preoperative number of bacteria in saliva (Table 3).

Factors related to the number of bacteria in saliva on the day after surgery Five factors were found to influence the increase in the number of bacteria in saliva the day after surgery in univariate analysis: older adults (p=0.016), smoking (p=0.040), low albumin level (p=0.035), increased number of bacteria in saliva after oral care the day before surgery (p=0.005), and postoperative fasting (p<0.001) (Table 4). Multiple regression analysis including these five univariate significant factors with covariates revealed that an increased number of bacteria in saliva after oral care the day before surgery (p=0.007, standardized coefficient β=0.241) and postoperative fasting (p=0.001, standardized coefficient β=-0.329) were significantly associated with the increased number of bacteria in saliva on the day after surgery (Table 5).

Conclusion

The number of bacteria in saliva increases markedly after surgery, especially in those with a greater number of bacteria after oral care on the day before surgery and who do not eat orally on the day after surgery. Establishing good oral hygiene before surgery and a method to suppress the increase in the number of bacteria in saliva of patients with a high risk of postoperative SSI or postoperative pneumonia is essential, especially in elderly patients and when postoperative oral feeding is not possible.

Table 2 Factors related to number of bacteria in saliva before surgery (univariate analysis)

Variable		mean±standart deviation	correlation coefficient	p-value
i) Category data				
Sex	male	5.40±0.472		0.763
	female	5.37±0.535		
Smoking habit	(-)	5.39±0.516		0.891
	(+)	5.37±0.478		
Drinking habit	(-)	5.42±0.537		0.126
	(+)	5.24±0.334		
Regular dental management	(-)	5.37±0.518		0.784
	(+)	5.40±0.498		
Denture use	(-)	5.36±0.475		0.419
	(+)	5.43±0.565		
Periodontal pocket	<6mm	5.38±0.507		0.491
	≥6mm	5.52±0.510		
Extraction before surgery	(-)	5.38±0.516		0.959
	(+)	5.38±0.421		
Dry mouth	grade 0-1	5.32±0.438		*0.005
	grade 2-3	5.64±0.681		
ii) Continuous data				
Age			0.263	*0.004
Body mass index			0.041	0.656
Serum total protein			-0.064	0.490
Serum albumin			-0.062	0.518
Number of teeth			-0.063	0.493
Plaque control record			0.079	0.391
Number of bacteria on the tongue			0.058	0.527

Table 3 Factors related to number of bacteria in saliva before surgery (multivariate analysis)

Variable	unstandardized coefficient		standardized coefficient	95% confidence interval of B		
	B	SE	β	lower	upper	
Age	0.012	0.004	0.283	0.004	0.019	*0.004
Smoking habit	0.076	0.108	0.063	-0.139	0.290	0.485
Plaque control record	0.001	0.002	0.032	-0.003	0.004	0.732
Routine dental management	0.076	0.090	0.076	-0.102	0.254	0.399
Dry mouth (preoperative)	0.246	0.114	0.192	0.020	0.473	*0.034

Table 4 Factors related to number of bacteria in saliva on the day after surgery (univariate analysis)

Variable		mean±standart deviation	correlation coefficient	p-value
i) Category data				
Sex	male	5.73±0.667		0.528
	female	5.66±0.514		
Smoking habit	(-)	5.76±0.633		*0.040
	(+)	5.48±0.612		
Drinking habit	(-)	5.74±0.654		0.135
	(+)	5.51±0.539		
Regular dental management	(-)	5.74±0.691		0.436
	(+)	5.64±0.574		
Denture use	(-)	5.66±0.643		0.427
	(+)	5.76±0.626		
Periodontal pocket	<6mm	5.71±0.642		0.231
	≥6mm	5.34±0.422		
Extraction before surgery	(-)	5.68±0.632		0.503
	(+)	5.81±0.691		
Dry mouth (preoperative)	grade 0-1	5.62±0.618		0.064
	grade 2-3	5.90±0.676		
Feeding condition (next day after surgery)	fasting	6.00±0.702		*<0.001
	orally	5.48±0.495		
ii) Continuous data				
Age			0.222	*0.016
Body mass index			0.036	0.702
Serum total protein (preoperative)			-0.098	0.293
Serum albumin (preoperative)			-0.202	*0.035
Number of teeth			-0.098	0.294
Number of bacteria in saliva (preoperative, before oral care)			0.173	0.057
Number of bacteria in saliva (preoperative, after oral care)			0.254	*0.005
Plaque control record (preoperative)			0.126	0.175
Number of bacteria on the tongue (next day after surgery)			0.133	0.154
Operation time (minutes)			0.131	0.161

Table 5 Factors related to number of bacteria in saliva on the day after surgery (multivariate analysis)

Variable	Unstandardized coefficient		Standardized coefficient	95% confidence interval		
	B	SE	β	lower	upper	
Age	-0.002	0.005	-0.035	-0.011	0.008	0.701
Smoking habit	-0.197	0.130	-0.132	-0.456	0.061	0.133
Serum albumin	-0.107	0.117	-0.087	-0.339	0.124	0.360
Dry mouth (preoperative)	0.158	0.143	0.097	-0.126	0.442	0.272
Numbrt of bacteria in saliva (preoperative, after oral care)	0.456	0.166	0.241	0.126	0.786	0.007
Feeding condition (next day after surgery)	-0.432	0.121	-0.329	-0.673	-0.191	0.001