

Low Incidence of Dental Caries among a Rural Population in the Early Modern Age Unearthed from Oterayama Site

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Abstract About 500 teeth belonging to 42 individuals of skeletal remains, unearthed from Oterayama burial site, were examined for dental caries. The remains were considered to be of a rural population in the Early Modern age (beginning of Edo period). An extremely low incidence of dental caries was found in this population, compared to the contemporary urban populations formerly known.

Introduction

It has been recognized since long that the status of the dental caries in human populations is closely related to the status of the life way, especially of the food habit. In my former study (SAKURA, 1964), I discussed on the historical changes in the incidence of dental caies among Japanese people, from prehistoric Jomon period to the recent time, mainly in relation to the changes in food habit. In that study, I presented the caries frequencies of some polulations from historic ages in Japan, including those of Late Mediaeval (Muromachi period) and Early Modern (Edo period) ages. These populations showed a marked increase in caries frequency compared to those of the earlier periods (*e.g.* Early Mediaeval, Kamakura period), but still a lesser degree of incidence than that in recent Japanese.

However, the available materials of those periods were the skeletal populations derived only form urban areas, mainly from several burial sites in Edo (Tokyo) City. Since far greater differences of life way should have existed between urban and rural inhabitants, as well as between social classes, in Early Modern or earlier ages than in the recent times, there also might be some differences of caries incidence between such distant populations in those contemporary ages.

After my work mentioned above, a few reports on the dental caries in Edo period have appeared. But they are all fragmentary evidences with a small number of teeth examined. Recently, a fairly large number of teeth of a rural population at the beginning of Edo period became available for my observation. The status of dental caries of them is reported here.

Material

The material used is a dental population unearthed from Oterayama (Temple

Hill) burial site in Tsurugashima Town, Saitama Prefecture, situated at some 30 km northwest of Tokyo. This site consists of hundreds of small burial pits, in each of which one dead body was buried.

The ages when these pits were made could be estimated with associated cultural objects, mainly coins, found in not a few cases. Though the age of the site as a whole was considered to cover a certain length of time span, those pits could be divided into two groups, based on the age and the burial type. The older pits were of the type containing burnt corpses, and were mostly of Late Mediaeval age, while the younger pits containing non-burnt corpses were mostly of the beginning of Early Modern age (early Edo period, ca. 17c.). And the teeth have remained only in the latter type of burial pits. Therefore, it can be said that most of the teeth examined in this study have derived from Early Modern age.

The bones of the buried have largely disappeared, and only a small amount of fragments of them remain. But the teeth, especially the parts of enamel substance, are relatively well-preserved in considerable number of cases.

The number of teeth available is 495, belonging to 42 individuals, mostly of unknown sex. Teeth of a few sub-adult individuals and those with broken enamel crowns are excluded from the material. The number in each tooth kind is shown in Table 1. Though individual ages of the population can not be determined exactly, the mean age seems to be not very young, inferred from fairly advanced tooth wear in general. So the influence of age on the caries occurrence can be minimized.

Ordinary descriptions on the bone fragments and teeth from Oterayama site will appear in a publication, which will include reports on the excavation and archaeological findings of the site (SAKURA, 1985).

Method

As I mentioned in my former study, the commonly used indices as to indicate the status of caries occurrence in a population, *i.e.*, (1) rate of persons having carious teeth, (2) rate of carious teeth, and (3) caries frequency per person (CFP), are not adequate for significant comparison between populations where a considerable number of postmortem lost teeth are involved, because of possible biases from the true values. So I used my formerly defined ACFP (approximate estimate of caries frequency per person) as a valuable index, which is an unbiased estimate of CFP (SAKURA, 1964; see Appendix).

Results and Discussion

Out of all 495 Oterayama teeth examined, only four carious teeth are observed. Three of them are the left M^1 , right M^2 and left M_2 of a same individual from E-48 pit, whose 23 teeth are preserved. The former two molars have caries in third degree, and the latter one has a caries in fourth degree; all the caries originated in the center

Table 1. Incidence of dental caries in Oterayama burials compared to those in two urban populations in Edo period. (*N*, no. of examined teeth; *C*, no. of carious teeth; *R*, rate of carious teeth)

		Oterayama (present study)			Unko-in (SAKURA, 1964)			Joshin-ji (SAKURA, 1964)		
		<i>N</i>	<i>C</i>	<i>R</i>	<i>N</i>	<i>C</i>	<i>R</i>	<i>N</i>	<i>C</i>	<i>R</i>
Maxillary										
I ¹	r	14	0	0	0	0	—	4	0	0
	l	15	0	0	0	0		6	0	0
I ²	r	13	0	0	9	0	0	6	0	0.15
	l	11	0	0	8	0		7	2	
C'	r	18	0	0	22	2	0.10	23	3	0.10
	l	16	0	0	17	2		17	1	
P ¹	r	16	0	0	38	2	0.09	31	3	0.07
	l	15	0	0	37	5		24	1	
P ²	r	21	0	0	46	3	0.08	35	3	0.08
	l	14	0	0	47	4		30	2	
M ¹	r	21	0	0	97	23	0.24	61	14	0.26
	l	19	1	0.05	92	22		58	15	
M ²	r	21	0	0	72	18	0.30	54	16	0.32
	l	18	0	0	68	24		42	15	
M ³	r	9	0	0	22	3	0.21	12	4	0.30
	l	5	0	0	17	5		15	4	
Mandibular										
I ₁	r	10	0	0	1	0	(0)	1	0	(0)
	l	4	0	(0)	0	0		0	0	
I ₂	r	15	0	(0)	2	0	(0)	2	0	(0)
	l	4	0	(0)	1	0		2	0	
C ₁	r	15	0	0	2	0	(0)	8	0	0
	l	14	0	0	2	0		4	0	
P ₁	r	15	0	0	2	0	(0)	9	1	0.07
	l	17	0	0	3	0		5	0	
P ₂	r	22	0	0	2	0	(0)	8	1	0.08
	l	15	0	0	3	0		4	0	
M ₁	r	28	0	0	5	0	0.20	14	3	0.29
	l	22	0	0	5	1		14	5	
M ₂	r	26	2	0.08	5	3	0.30	11	5	0.48
	l	19	1	0.05	5	2		10	5	
M ₃	r	12	0	0	4	1	0.25	7	2	0.39
	l	11	0	0	4	1		6	3	
Total		495	4	0.008	638	123	0.19	530	108	0.20
ACFP (method)				0.18(A)			3.9(B)			5.2(B)

ACFP: Approximate estimate of caries frequency per person.

of occlusal surface. The fourth carious tooth is the right M_1 of another individual from G-31 pit. whose preserved teeth are seven in number. This tooth has a caries in third degree, also at the center of occlusal surface.

The ACFP calculated for Oterayama population is only 0.18. This figure implies an extremely low incidence of dental caries among this population, compared to the formerly known urban populations of nearly the same age (Table 1). Skeletal remains of Unko-in and Joshin-ji referred in the table, were both unearthed from the east part of Tokyo, where was fully urbanized already in Edo period. The ACFP of them are 3.9 and 5.2 respectively, both are much higher than that of Oterayama. These two figures of the urban Edo populations are a little different from each other, but as a whole approximate to the figure 4.3 for a group of the Late Mediaeval, Muromachi period, also from urbanized Tokyo (SAKURA, 1964).

According to historical documents, the local area covering Oterayama site was purely rural throughout Mediaeval to Early Modern ages, and almost all inhabitants of the area were poor farmers. Though the food habits of the people there are difficult to reconstruct, it can be supposed that their food items scarcely included such artificial hard farinaceous foods, which probably caused the increase of dental caries among contemporary urban inhabitants in Japan.

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Reference

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Appendix

Implication and Calculation of ACFP (Approximate estimate of Caries Frequency per Person) (SAKURA, 1964)

Under the condition that every person in a given population has a complete set of 32 permanent teeth, two indices, the rate of carious teeth (R) and the caries frequency per person (CFP), can be transferred each other, as follows:

$$R = C/T,$$

$$CFP = C/N = C/(T/32) = 32R,$$

where C , T , N are the number of carious teeth, examined teeth, and persons, respectively.

Both the indices may have considerable biases for a population with many lost teeth, because more tooth loss may tend to occur in the anterior region of the dentition, while caries is more frequent in the posterior teeth in general. But the caries rate in each tooth kind or in each tooth group has no or a very small bias even for such a population. Hence the ACFP, an unbiased estimate of CFP, can be calculated by one of the three methods as follows:

(A) By summing up caries rates in 32 kinds of teeth,

$$ACFP = R\{\underline{1}\} + R\{\underline{1}\} + R\{\overline{1}\} + \cdots + R\{\overline{8}\};$$

(B) By summing up caries rates in 16 groups of teeth, grouping both sides together,

$$ACFP = 2[R\{\underline{1}\} + R\{\overline{1}\} + R\{\underline{2}\} + \cdots + R\{\overline{8}\}];$$

(C) By summing up caries rates in 5 groups of teeth, grouping the same type of teeth on both sides and on both jaws together,

$$ACFP = 8R\{I\} + 4R\{C\} + 8R\{P\} + 8R\{M1 + M2\} + 4R\{M3\}.$$

Note that method C may make results with a little lower accuracy than the other two.

