

Gender Expression from the Jomon to Yayoi Periods in Western Japan: A Case Study of Ritual Tooth Extraction

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ABSTRACT

The ritual tooth ablation from Jomon to Yayoi in Japanese archipelago has never been discussed from the point of view of gender. In this paper, I focused on the relationship between social organization and ritual tooth ablation based on the gender viewpoint. In this article, I examined the relationship of a type of tooth ablation at a coming of age and sex difference, mortuary practices based on the analysis of human skeletal remains from burial sites located in the western half of Honsyu and Kyushu islands within Japanese archipelago during the Final Jomon and Early Yayoi period. Based upon the analysis, I suggest the following: X) between the Final Jomon and the Early Yayoi periods, tooth ablation custom in terms of gender expression was different between Western and Eastern Japan, and Y) In the same burial site, the meaning of the tooth ablation might be changed by a difference of the time. Z) the meaning(s) of tooth ablation, including gender-related expressions, and its socio-cultural background co-transformed.

KEYWORDS: gender expression, tooth ablation, mortuary practice, moiety, social division

This study investigates the way gender and other social divisions were expressed during the Jomon and Yayoi periods by examining the practice of ritual tooth extraction and its socio-cultural background. Although until the 1990s there were few studies of ancient society in the Japanese archipelago that were conducted from the perspective of “gender,” from the 2000s onward a number of studies pointed to the importance of gender as an analytical viewpoint (e.g., Matsumoto 2008). However, this perspective has never been applied in the analysis of ritual tooth ablation to reconstruct prehistoric society during the Jomon and Yayoi periods in the Japanese archipelago.

Emergence of the “village descent” model of tooth ablation

In early research on ritual tooth ablation in the Jomon and Yayoi periods, gender difference had already been identified as correlating with types of teeth extraction (Hasebe 1919; Kaneseki 1951). However, that correlation was not argued in terms of its social meaning, because these studies were conducted before an awareness of the gender viewpoint

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emerged.

In the decades after World WarII, especially from the 1970s, the ancient ritual of tooth ablation came to be studied systematically in terms of the social significance of body modification. Pioneering works aimed to reconstruct kinship organization and post-marital residential rules through analysis of ritual tooth extraction (Harunari 1973, 1974, 1979, 1980).

As a consequence of such studies, a hypothesis was advanced interpreting different types of tooth ablation as reflecting social divisions in accordance with village lines of descent (e.g., Harunari 1995). Because these studies paved the way for reconstructing ancient kinship organization and post-marital residential rules in the prehistoric era, subsequent research has been affected by Harunari's interpretive model. Although the model led to analysis of the rituals and studies focusing intensively on reconstruction of past society, the early findings of the interrelationship between sex difference and types of ritual tooth ablation (Hasebe 1919; Kaneseki 1951) were excluded from this research trend. As a result, the ritual has not been examined in terms of gender perspective (Funahashi 2004, 2010, 2019).

Critical studies on ritual tooth ablation during the Jomon period

Although Harunari's "village descent hypothesis" had had an impact on research relating to ritual tooth extraction, several studies emerged to critique the model from both the archaeological and anthropological viewpoints. Physical anthropological studies, analyzing genetically inheritable metric and non-metric traits of both teeth and the cranium, did not verify any significant kinship relationship with classificatory variations of tooth ablation (Tanaka and Doi 1988; Hashimoto and Baba 1998; Mori and Oku 1998; Tanaka 2001). In addition to critical work in physical anthropology, the appropriateness of the "village descent hypothesis" in reconstructing prehistoric society was reconsidered, and tooth extraction types were interpreted as reflecting moiety based on social-anthropological outcomes (Tanaka 1998). These critiques of the powerful existing hypothesis focused on kinship relations, but gender perspective was not integrated into them.

Previous research, however, examines the ritual in terms of two aspects: the nature of the ritual, through methodological refinements for study of the age at which teeth were ablated, and the social principles, including gender, reflected in tooth ablation (Funahashi 2003, 2006, 2010). Although the "village descent hypothesis" was formulated on the speculation that teeth were extracted during marriage rites (Harunari 1973), the timing of the tooth extraction during the individual's lifetime needs to be clarified. Anthropological re-examinations of the age of tooth extraction in the Jomon and Yayoi periods revealed inconsistency with the "village descent hypothesis" regarding timing of the ritual (Funahashi 2000, 2003). The results showed that during the Final Jomon period there were two moments of ritual tooth extraction in each lifetime. The first mean age group of teeth modification was 13–16 years

old; among them the youngest case was approximately 11 years of age. The second timing of modification was after 20 years of age. Furthermore, in most cases the first moment of extraction is younger than the youngest age of females who had experienced pregnancy based on analysis of the pre-auricular groove. These results indicate that the initial ritual of tooth extraction during the Final Jomon period was in general conducted on individuals who had not yet married. Alternatively, taking into account the results for the first age group, initial tooth extraction might have been conducted as part of a ritual of initiation into adult status. In this ritual moment for entering adulthood in the society, the teeth were ablated in accordance with certain social ties such as moiety and gender that operated as dividing/integrating categorical devices within the regional society (Funahashi 2008, 2010). Later, Harunari changed his “village descent model” to a moiety model (Harunari 2013).

Subsequent to these critical studies, the “village descent model” was tested by several isotope analyses (Kusaka *et al.* 2008, 2009, 2010, 2011, 2018; Temple *et al.* 2011). Among them, Sr isotope analysis rejected Harunari’s hypothetical model (Kusaka *et al.* 2009, 2011). Alternatively, typological differences of tooth ablation were argued to reflect various levels of social segmental units such as “lineage-based subsistence procurement groups” in terms of carbon and nitrogen stable isotope analysis (Kusaka *et al.* 2008), and “kin-based descent groups” in terms of metric analysis of crania and first molars (Temple *et al.* 2011). In addition to these arguments, the type differences of tooth extraction were also defined as symbolizing “the kinship of individuals” or “relatedness” in a recent study of the chronological refinement by radiocarbon dating (Kusaka *et al.* 2018).

In contrast to the rich research climate pertaining to ritual tooth ablation during the Jomon period, there were far fewer studies conducted on the ritual in the Yayoi period, and post-marital residential rules and descent systems were argued to be the basis for the social divisions (Harunari 1974; Yamada 1997; Funahashi 2000). In addition to prevailing research, a few studies referred to gender as a possible candidate for the social dividing rule, which was reflected in the style of ritual tooth extraction (Funahashi 2006, 2010).

As seen in the above-mentioned research, ritual tooth ablation has been studied in its relationship to the social order, which might be reflected in the differences of teeth removal. The main social categories were in particular various kinds or levels of kin groups, which were argued to be associated with tooth extraction. However, to properly describe the social background expressed in teeth modification, it is necessary to consider the existence of various other social divisions depending on the developmental stage of each of the societies (Tanaka 1998). In this sense, the principles of gender should also be considered as a fundamental axis for dividing and integrating societies. Previously, the author has researched ritual tooth extraction in the prehistoric Japanese archipelago from the gender perspective (e.g., Funahashi 2010). In the present study, the meanings of ritual tooth extraction and their transformation will be reviewed with focus on gender

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Table 1. *Materials used in the study*

No. on the map	Name of site	Phase	Number of skeletal remains			
			Male	Female	Unknown	Total
1	Ikawadu	Final Jomon	16	14	2	32
2	Yoshigo	Final Jomon	58	38	2	98
3	Inariyama	Final Jomon	12	15	2	29
4	Hobi	Final Jomon	26	38	2	66
5	Tsukumo	Final Jomon	42	37	6	85
6	Ōtomo	Early Yayoi	5	3	—	8
7	Shinmatchi	Early Yayoi	2	2	—	4
8	Sasai	Early Yayoi	—	3	—	3
9	Kannenokuma	Yayoi	25	25	—	50
10	Arita	The first half of Middle Yayoi	1	1	—	2
11	Nishihiratsuka	The early protion of Middle Yayoi	3	3	—	6
12	Monden	The early protion of Middle Yayoi	3	1	—	4
13	Hara	The middle and later of Middle Yayoi	3	7	1	11
14	Yshigaura	The second half of Middle Yayoi	5	6	1	12
15	Hasakonomiya	The first half of Middle Yayoi	6	—	—	6
16	Syoubaru	The first half of Middle Yayoi	4	—	—	4
17	Kitsunezuka	The first half of Middle and Late Yayoi	33	20	3	56
18	Nishijima	The first half of Middle and Late Yayoi	1	1	—	2
19	Tateiwa	The second half of Middle Yayoi	2	1	—	3
20	Yamamura	The early protion of Middle Yayoi	1	—	—	1
	Total		248	215	19	482

perspective as a kind of social segmenting/integrating principle.

Materials and methods

Data used in the following analysis was skeletal remains found at burial sites of the Final Jomon period and the Yayoi period.

These burial sites are located in the western half of Honshu and Kyushu islands within the Japanese archipelago.

The periods of each burial site and skeletal remains are based upon the typo-chronological system of pottery.

The principal aim of the following analyses is to uncover a principle or rule behind the various types of tooth extraction. Methodologically, the research constitutes two goals: firstly, to reconstruct the nature of the ritual in which teeth were ablated, and secondly,

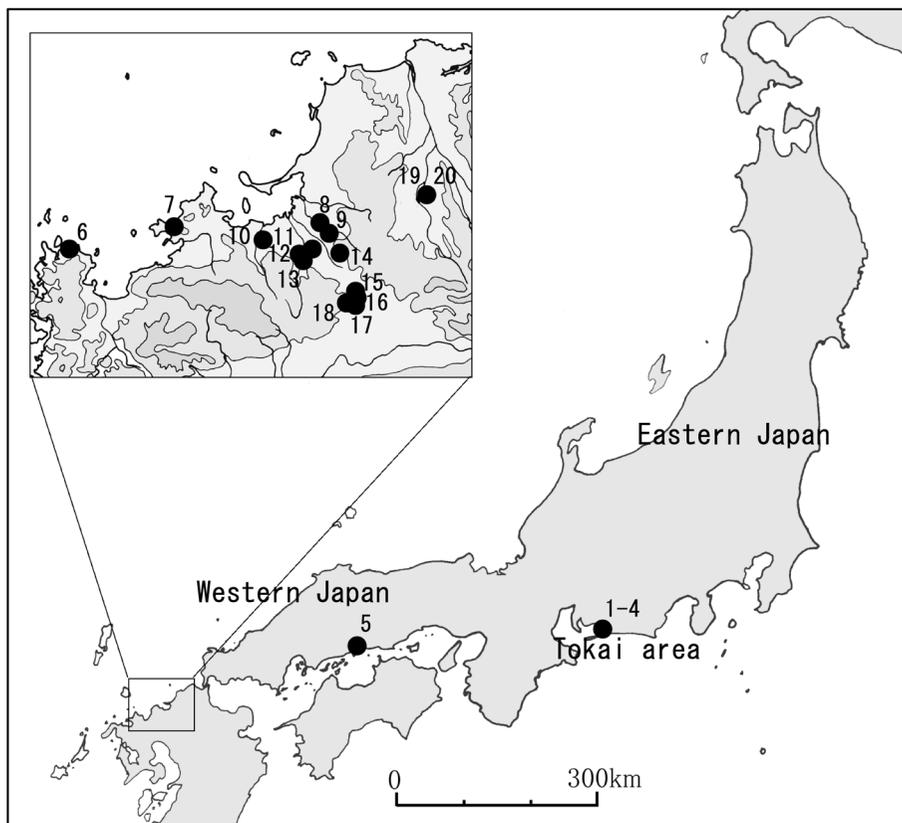


Figure 1. Map and location of the sites used in the study

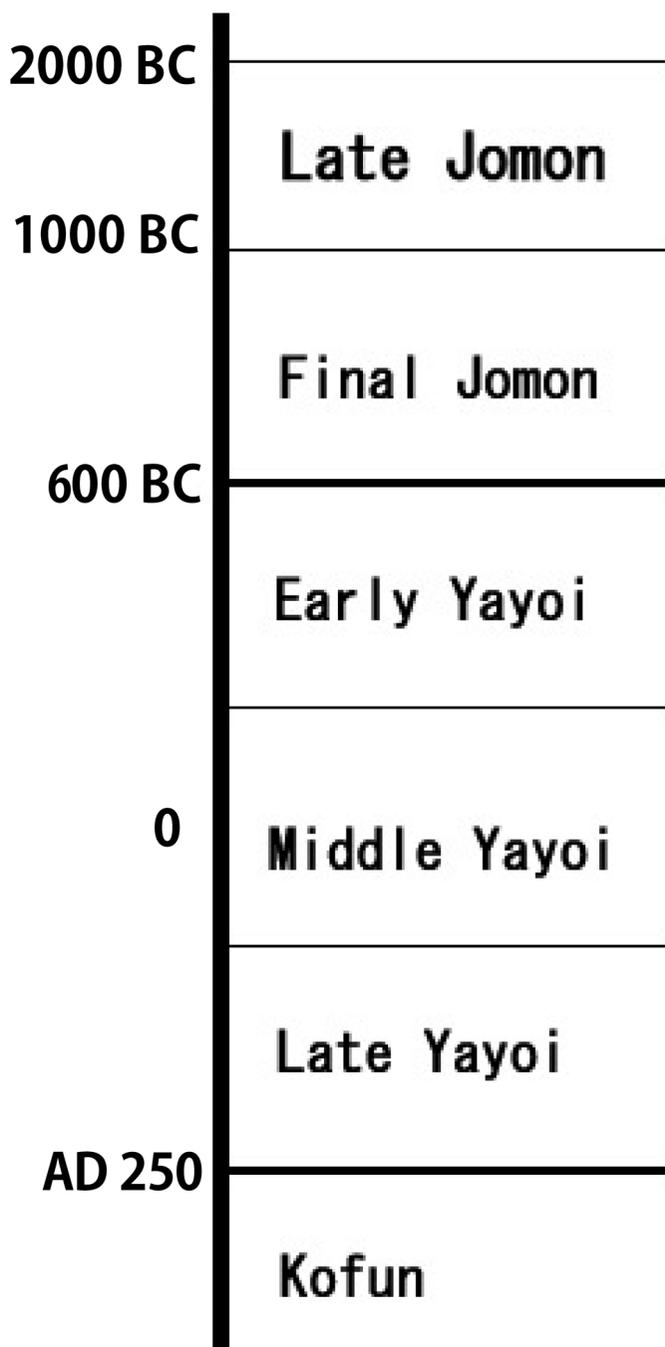


Figure 2. Chronological system based on Kobayashi and Hashiguchi

to hypothesize the principles or rules that gave rise to the various types of resultant tooth extraction. The social principles behind the typological variations of tooth ablation relate to the nature of rites of passage. The timing of ritual tooth extraction was already identified as initiation into adult status in the case of this study's sample (Funahashi 2000, 2003). So, the present study mainly focuses on the social dividing/integrating principle which was emphasized by tooth extraction, while partly reconsidering ritual meanings. Taking into consideration previous ethnographical and osteoarchaeological studies (Funahashi 2003), I will firstly construct hypotheses about the social meaning reflected in tooth extraction and then examine the test implications of those hypotheses.

According to several ethnographic examples, initiation rites into adult status subsumed simultaneous admission into either religious, subsistence, or age groups (Beaglehole 1937; Evans-Pritchard 1940; Radcliffe-Brown 1948; Turnbull 1962, 1965; Venema 1978; Clemmer 1995). These various kinds of sub-groups relied on gender as one of their important dividing principles. In contrast to these ethnographies, rituals of initiation seen in other ethnographic cases indicated that the primary social dividing rule was fulfilled by kinship groups (e.g., Firth 1936). Although an ethno-archaeological study shows that kin groupings are scarcely expressed in the archaeological remains of various mortuary practices, units of kin may have been expressed through these spatial sub-groups or divisions (O'Shea 1984).

In regard to these archaeological and ethnographic implications, it is necessary to clarify what kind of socially segmented units are associated with the variation seen in the types of tooth extraction. In order to make clear the inter-relationship between the social entity and its reflection in the method of tooth ablation, types and frequencies of tooth extraction will

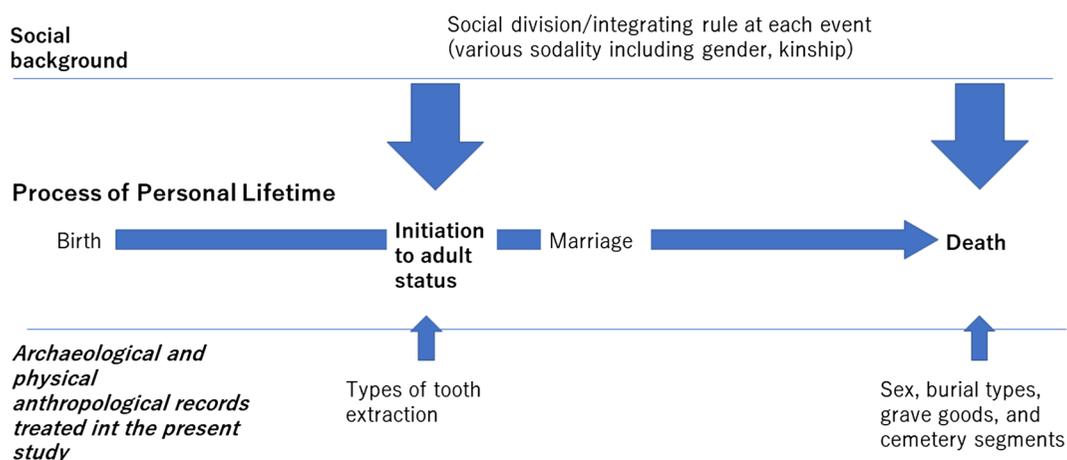
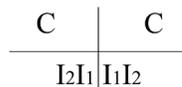
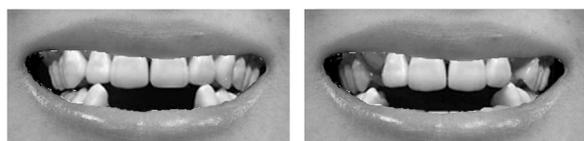
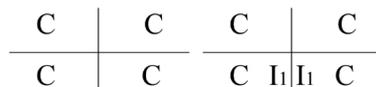
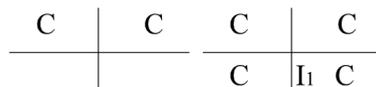
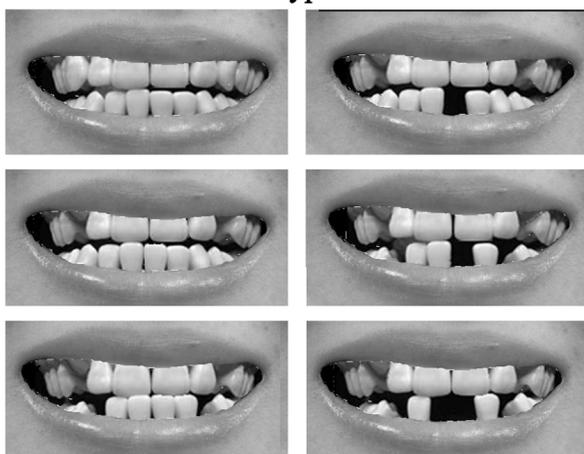


Figure 3. Rite of passage and its relation with social aspect and resultant osteoarchaeological records

be examined in terms of their relationship to various aspects of funerary treatment of the dead: male/female difference, burial type including reburial, burial goods, and the spatial sub-groups within a graveyard.

To clarify the principles of social division behind ritual tooth extraction, classification of the extracted teeth is a fundamental point of analysis. During the Final Jomon and Early Yayoi periods, many teeth were extracted per person at the same rite of passage, such as initiation into adult status (Funahashi 2003, 2004), and most cases can be classified into a number of types. Both extracting teeth and its consequences are expected to have visual impact not only in the ritual context but also in the context of the subsequent ordinary life of the individual because most of the extracted teeth are frontal, i.e. highly visible ones. Thus, it is useful to classify the various types of ablated teeth in the same rite in terms of visual similarity for succeeding estimations of social divisions expressed through the teeth modification.

Type 1



Type 2

Figure 4. Two broad categories of the tooth extraction types

As far as variation seen in tooth extraction during the Final Jomon and Early Yayoi periods is concerned, ablation of mandibular frontal teeth can be a key attribute for visual categorization into either a wider or narrower vacancy in the lower jaw. According to this classification reflecting the difference in visual impact, it can be divided into two types: Type 1 is an extraction of 0 to 4 lower frontal teeth, which creates a narrow or no space between the remaining teeth; Type 2 is an extraction of 4 to 6 lower frontal adjacent teeth, which makes a wider space between the remaining teeth. There are a certain number of individuals who had not experienced tooth extraction during their sub-adult phase. These people would have belonged to a social category which did not need to emphasize a change in appearance by the custom of tooth extraction. However, this population might have been demonstrating the visual effects of coming-of-age rituals or social category in some other body modification (e.g., tattoos or piercings). Concerning these visually unchanged types, the non-extracted cases are included in Type 1.

From an archaeological perspective, other mortuary practices will be analyzed in relation to differences in tooth ablation. According to Harunari, two groups of different types of tooth extraction correspond to the possession/non-possession of grave goods. The correlation between these two attributes was thought to suggest social inequality (Harunari 1979). To test this argument, burial goods will be examined in terms of their relation to the types of tooth extraction.

In addition to these archaeological methods, the physical anthropological method will be used to effectively estimate the relationship between the variation of tooth ablation and kin groups. For this purpose, tooth crown measurement is employed in the way modified by Doi, Tanaka, and Funakoshi (Doi *et al.* 1986). Tooth crown measurement analysis was applied for skeletal samples of several subject sites in which large amounts of human remains were excavated. However, two factors should be taken into consideration when applying this analysis to the Jomon sample: the oral health of humans in the Jomon period and the relatively long duration of use of each burial site. Regarding the first factor, heavy tooth attrition, one of typical and popular dental disease of the period, and AMTL (ante-mortem tooth loss) including ritual tooth ablation, affected the sample population to no small extent. In addition to the first factor, PMTL (post-mortem tooth loss) caused by previous excavations also affected the condition of the samples for analysis of tooth crown measurement. Meanwhile, the Q-mode correlation coefficient ranging between -1.0 and 1.0 is used in the analysis of tooth crown measurement for estimating kin relationship between paired individuals. Based on the modern clinical sample population in which the kin relations among sample individuals are known, a score of more than 0.5 for the Q-mode correlation coefficient is thought to be one standard for estimating a positive kin relationship between two paired individuals. However, if the sample population was buried in a site over long duration, the outcomes of the Q-mode correlation coefficient can be affected by accidental

resemblance, which means a sample population buried over a long period could include individuals who accidentally resemble each other in tooth size and proportion but have no kin relationship. Jomon cemeteries in general were likely to be used over long periods of time. Therefore, the direct outcome of the Q-mode correlation coefficient scores of paired individuals have a high risk of including accidental resemblance. To avoid such accidental issues, the mean value of the Q-mode correlation coefficient is statistically compared with the modern mean value of the Q-mode correlation coefficient of a non-kin related clinical population. The result of this significant test between each sample population and a modern clinical mean value is used to evaluate the kin relatedness of each sample population.

This usage of mean values of analytical outcomes requires a certain number of individuals who were buried in the same burial site, because the mean value of the Q-mode correlation coefficient of a small number of individuals is less likely to represent the characteristics of the whole sample buried in a specific graveyard. Further, the outcome of a significant test of mean value of the analysis suggests only that the sample population includes or does not include a certain amount of kin-related individuals. In this sense the analysis applying to the Jomon sample is of limited usefulness in estimating any concrete kin relationship among individuals buried in a cemetery. Because of these factors and other methodological constraints, only the skeletal samples of the Inariyama shell mound site yielded a sufficient number of (pairs of) individuals to enable the analysis and to estimate kin relationships. The analytical outcomes of the tooth crown measurements will be mentioned of this site Inariyama shell mound.

Meanwhile, the age categories used in the analysis are as follows: the sub-adult category, which includes individuals from 13 to 20 years of age; adult, from 20 to 40 years; and mature, from 40 to 60 years.

Spatio-temporal variation of tooth ablation and association with other archaeological phenomena

The types of tooth extraction correlate with sex differences in several sites located in the western part of Honshu Island and the Tokai area during the Final Jomon period. Clear correlations were observed both in the Tsukumo and Hobi sites.

Final Jomon period

The Tsukumo site is located in western Japan and the Hobi site is located in the Tokai area which is the intermediate area between western and eastern Japan. The results of both sites indicate that Type 1 (narrow type) tooth extraction is seen more frequently in males than in females. Type 2 (wider type) is observed in a reverse pattern. The other three sites, the Yoshigo, Ikawazu, and Inariyama sites, which are all located in the Tokai region, show a

less obvious relationship between sex difference and types of tooth extraction. Similarly, negative or less clear results can be seen in the Sanganji site, which is even further to the east in Honshu Island (Funahashi 2010).

Besides the interrelationship of sex difference, archaeological evidence was provided to correlate with the type differences of tooth ablation. According to Harunari (Harunari 1979, 1980), in the Tokai area the types of extracted teeth correlated with spatially segmented sub-groups within burial areas, with the reburied individuals, and with burial goods. It is difficult to identify any clear burial subgroups or distributional clusters of specific types of tooth ablation at the Yoshigo and the Tsukumo shell mound sites. Within the excavated area of the Inariyama shell mound, however, graves or skeletal remains were clustered in three spatial subgroups. Although the spatial segmented clusters as seen at the Inariyama site were not configured, buried individuals of the same types of tooth extraction constituted spatial clusters within the Ikawazu shell mound burial area. Therefore, the results of the latter two

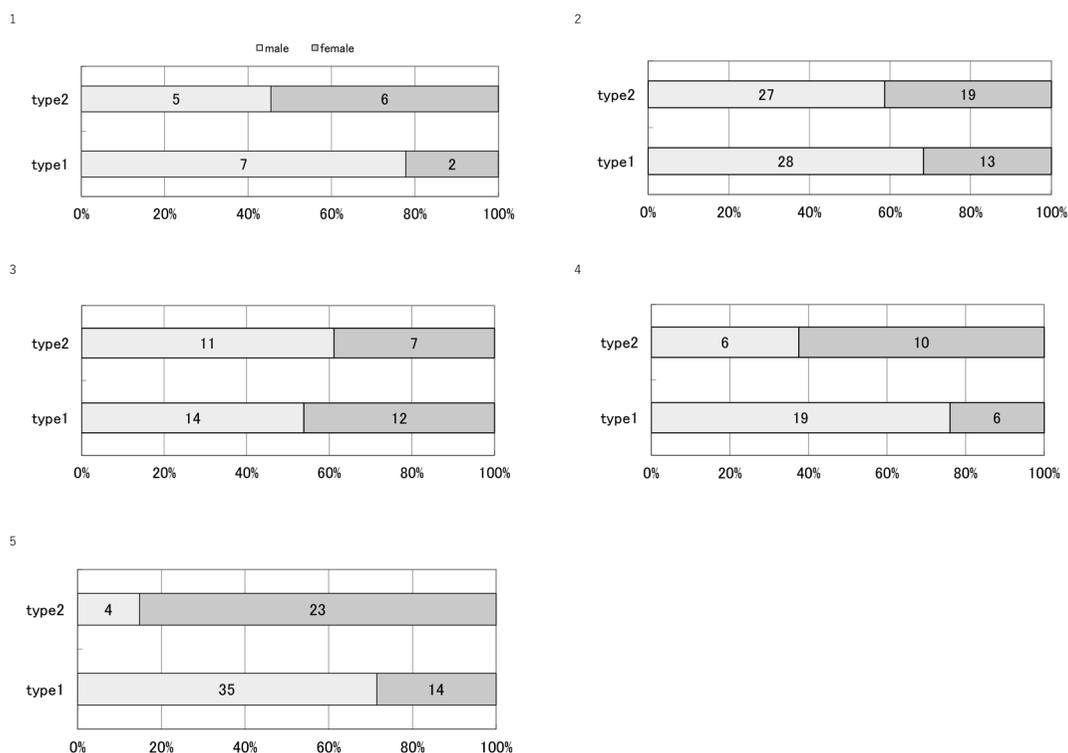


Figure 5. Result of correlation between the tooth ablation types and sexual difference in the Final Jomon Period

Light gray: male Dark gray: female. 1: Inariyama site, 2: Yoshigo site, 3: Hobi site, 4: Ikawazu site, 5: Tsukumo site. Results of chi square test: 3. Hobi site: $P < 0.05$, 5. Tsukumo site: $P < 0.001$

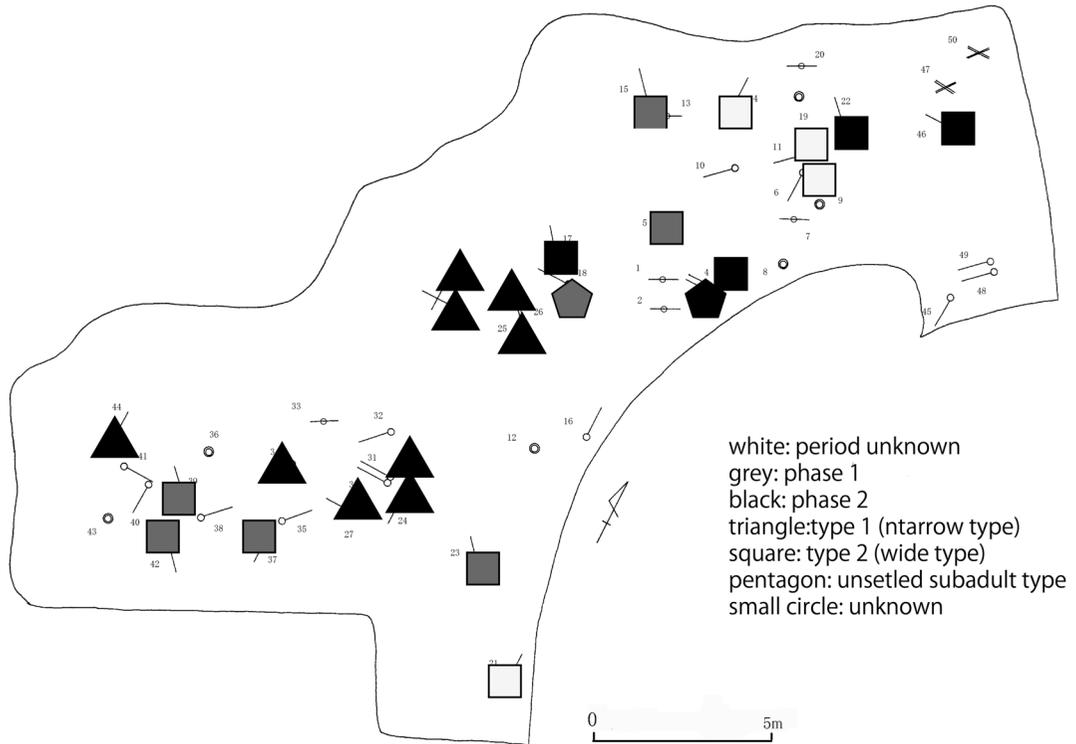


Figure 6. Spatial distribution of two different tooth extraction types in the Inariyama site burial area

Inariyama sites and the Ikawazu shell mound are discussed below.

The burial area of the Inariyama site can be divided into three sub-groups in terms of the spatial distribution of skeletal remains. A significant test of the mean value of the Q-mode correlation coefficient with that of the clinical control group indicated negative results in various teeth combinations because of insufficiency of the sample quantity. However, high average values of the Q-mode correlation coefficient observed in the kin-related modern control group are seen in plural teeth combinations in two areas of the Inariyama site: L P1P2M1M2, and L P1P2 in the middle segment grave area: UL P1P2M1M2, UL P1P2M1, UL P1M1, and L P1P2M1M2 in the south segment (Table 2). Taking into account all of the insufficient sample conditions, the resultant negative outcomes of significant tests, and the multiple high values of the Q-mode correlation coefficient seen in several teeth combinations, a certain number of kin-related individuals might be buried in each spatially segmental subgroup.

Furthermore, these three spatially segmented units differed in dominant types of teeth

Table 2. *Q-mode correlation coefficients of the tooth crown measurements at the Inariyama site and modern non-kin population*

Category	U and L PIP2MIM2		U and L PIP2MI		U and L PIMI		U PIP2MIM2		U PIP2MI		L PIP2MIM2		L PIP2									
	Pair	M	SD	Pair	M	SD	Pair	M	SD	Pair	M	SD	Pair	M								
	Pair	M	SD	Pair	M	SD	Pair	M	SD	Pair	M	SD	Pair	M								
Total	21	0.131	0.325	21	0.255	0.343	21	0.324*	0.381	36	0.163	0.394	45	0.167	0.515	66	0.138	0.447	91	0.229	0.621	
Male	21	0.344	0.283	10	0.422**	0.270	10	0.421*	0.345	10	0.243	0.345	10	0.295	0.479	21	0.396*	0.256	15	0.445	0.667	
Female	—	—	—	—	—	—	—	—	—	—	—	—	3	-0.309	0.825	6	-0.139	0.390	15	-0.145	0.429	
Type 1	10	0.344	0.283	10	0.422**	0.270	10	0.421*	0.345	10	0.243	0.345	10	0.295	0.479	21	0.396*	0.256	28	0.263	0.545	
Type 2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	6	-0.233	0.551
South group	3	0.210	0.300	3	0.250	0.296	3	0.319	0.463	6	0.181	0.344	6	0.034	0.483	10	0.341	0.261	10	0.078	0.522	
Middle group	—	—	—	—	—	—	—	—	—	3	-0.019	0.365	3	0.027	0.417	3	0.475	0.136	6	0.595	0.244	
Unrelated	200	0.114	0.348	200	0.114	0.348	200	0.112	0.392	200	0.019	0.443	200	0.019	0.443	200	0.167	0.410	200	0.118	0.626	
Parent-child	33	0.290**	0.318	33	0.290**	0.318	46	0.318**	0.451	52	0.219**	0.436	52	0.219**	0.436	23	0.190	0.460	52	0.106	0.648	
Siblings, grandparents- grandchildren	31	0.318**	0.29	31	0.318**	0.29	43	0.295*	0.45	45	0.315***	0.41	45	0.315***	0.41	28	0.402**	0.24	29	0.348*	0.538	
Uncle/aunt-nephew/ niece	45	0.210	0.304	45	0.210	0.304	46	0.231*	0.307	56	0.268***	0.401	56	0.268***	0.401	29	0.365*	0.404	46	0.397**	0.557	
Cousins	69	0.206*	0.262	69	0.206*	0.262	34	0.202	0.355	73	0.222**	0.424	73	0.222**	0.424	61	0.300*	0.391	38	0.160	0.547	

evulsion. In the most northern sub-group, the majority of the extracted tooth patterns are Type 2, and in the adjacent intermediate sub-group, Type 1 becomes dominant. The most southern area includes both Types 1 and 2.

The existence of the two different types in the southernmost area could be divided into two different chronological phases. Recent study has revealed that most of the Inariyama burial site was laid out in two phases: 12 individuals in Phase 1 (3060–2760 BP), and 15 in Phase 2 (2600–2380 BP). In addition to these main phases, two individuals were buried during the succeeding latest phase (Kusaka *et al.* 2018). Although both Type 1 and Type 2 tooth extraction styles were seen in the southernmost burial sub-group of this site, these two different types of ritual tooth ablation belonged to two different phases according to the result of recent radiocarbon dating: only Type 2 is observed in Phase 1, and Type 1 emerged in Phase 2.

The chronological data of Kusaka *et al.* (2018) indicates that the constitution of types of tooth ablation were different in Phase 1 and Phase 2. Although not all individuals with ritual tooth ablation were included, this data enables us to reconstruct the diachronic trajectory of tooth extraction types. The wider type of tooth ablation was the predominant type during Phase 1. After this phase, both the wider and narrower types were seen and these visually different types correlate with gender difference (Figure 8). Seven of the nine samples of Type 1 tooth extraction were male. Meanwhile, all four samples of Type 2 extraction were female.

In the Ikawazu site, the types of tooth ablation were also distributed spatially in different areas as in the Inariyama site.

Type 1 is the predominant type among the skeletal remains unearthed from excavated areas in the 1980s. In contrast to this result, Type 2 is the dominant variation from other areas excavated in 1936, 1937, and 1959 under the initiative of Suzuki (1960). Furthermore, a secondary multi-individual burial which commingled 13 skeletal remains gives important information to examine the nature of the tooth extraction in this region. Among the 13 human remains, ritual tooth extractions were observed in eight adult samples and all of them have the same kind of tooth ablation, Type 1. As mentioned previously, physical anthropological studies revealed that kin-relationships were indicated in many pairs of different teeth combinations among nine individuals found at this secondary burial (Tanaka and Doi 1988).

In addition to the spatial distribution of burials in a cemetery, grave goods were also examined in terms of their interrelationship with the tooth extraction types. Many burial goods had been excavated in the Yoshigo and Tsukumo sites. In the two sites, the presence or absence of burial goods correlated with the sex, but not with the types of extracted teeth.

Although Harunari showed that the types of tooth ablation had correlation with the possession of burial goods (Harunari 1973), the statistical test confirmed only the relation between the possession of grave goods and sexual division as significant.

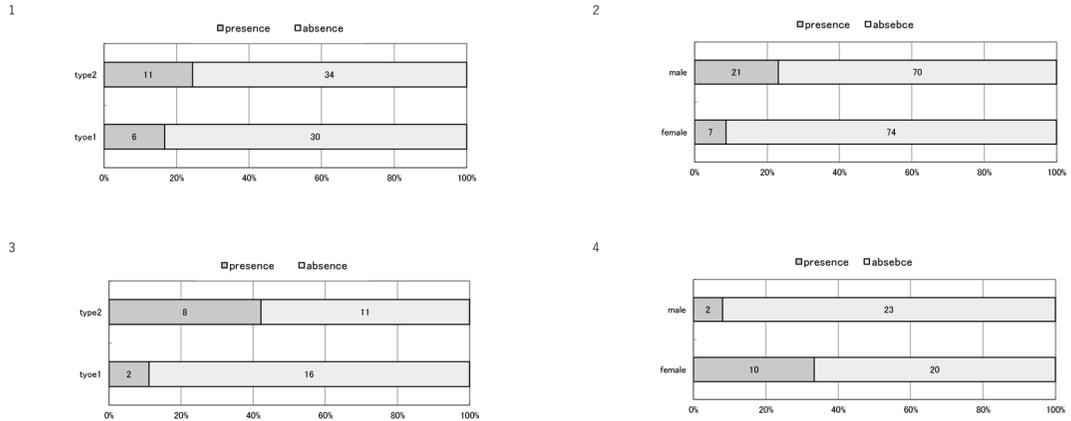


Figure 9. Correlation of possession of grave goods and sex, and types of tooth ablation
 1. Correlation of tooth extraction types and possessions of grave goods in the Yoshigo site.
 2. Correlation of the gender difference and possessions of grave goods in the Yoshigo site.
 3. Correlation of tooth extraction types and possessions of grave goods in the Tsukumo site.
 4. Correlation of the gender difference and possessions of grave goods in the Tsukumo site. Results of chi square test. Possessions of grave goods in the Yoshigo site *gender: $P < 0.05$. Possessions of grave goods in the Tsukumo site *gender: $P < 0.05$.



Figure 10. Variation in the kinds and the number of ritual tooth extraction during the Yayoi Period
 1: Comparison of the kinds of extracted teeth, 2: Comparison of the number of extracted teeth.
 N=the number of extracted teeth

was similar to those observed during the Jomon period.

The types of tooth extraction correlated with sex differences.

Type 2 was seen more frequently in females and Type 1 more in males. This indicates a similar relationship between sex and the types of tooth extraction as seen in the two sites of Tsukumo and Hobi during the preceding Final Jomon period.

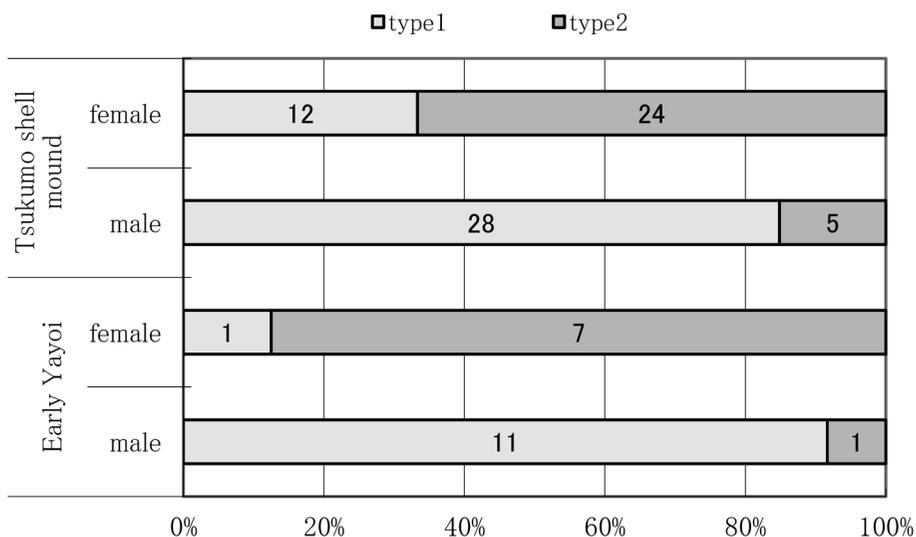


Figure 11. Correlation between sex difference and types of extracted teeth in the Early Yayoi Period of the Northern Kyushu area

Results of chi square test: $P < 0.001$

Discussion

As shown in previous studies, typical types of tooth ablation were conducted during Coming-of-age rituals from the Final Jomon period to the Early Yayoi period (e.g., Funahashi 2003, 2004, 2010). At the same time, in spite of the ritual commonality, spatio-temporal variability in the reflected social entity was also observed. These dynamics of ritual tooth ablation and its expression of certain social categories in each regional society had an interrelationship with each contemporary social transformation (e.g., Funahashi 2008, 2010). Meanwhile, ethnographic research has supplied much information showing that kin groups played an essential role in the initiation rite (Radcliffe-Brown 1964; Evans-Pritchard 1985, 1997). Furthermore, in some ethnographic cases, initiation into adulthood was managed by division based on gender (Beaglehole 1937; Griaule 1938; Turnbull 1965).

Hence, the following discusses the interrelationship of the types of tooth extraction and social divisions or social categories including gender differences as a crucial social category in prehistoric society. The following will discuss continuity and transformation in the relationships between types of tooth ablation as reflected in the social context.

Social division reflected in the tooth extraction

Kinship based social division

This section examines social divisions reflected in tooth extraction. Firstly, during the Final Jomon period of eastern Japan, types of extracted teeth correspond to differences of spatial sub-groups or location in burial sites. Multi-individual reburial graves included many relatives, as seen in those burials in the Ikawazu sites (Harunari 1979, 1980; Funahashi 2010). These preceding studies concluded that the extracted tooth types reflect sodalities such as moiety, which consisted of segmental kin-related social units (Harunari 2013; Funahashi 2010). However, recent chronological re-examination indicates that wider types dominated the practice of tooth ablation during Phase 1 at the Inariyama site. According to Kusaka *et al.* (2018, p. 385), this result was thought to be negative evidence for interpreting the types of tooth extraction as a reflection of moiety.

According to the result of tooth crown measurement analysis, it was estimated that there are a certain number of kin-related individuals in each burial subgroup within the Inariyama site. Therefore, the burial subgroup might be made up of social groups such as a lineage or a subclan. In other words, one possible dividing principle of burial subgroup was estimated to be based on kinship sodality (Service 1979). On the other hand, spatial distribution of different types of tooth ablation necessitates reconsideration in accordance with the recent outcomes of C14 dating of skeletal remains. The results indicate a wider type (type 2) of tooth ablation spread through the subgroups represented in the excavated area of the Inariyama site during phase 1. Although a previous study estimated that the two different types of tooth ablation (type 1; narrower, type 2; wider) coexisted and two different types configured spatially different clusters during the usage of the cemetery (Funahashi 2008), the resultant chronological division of the skeletal remains in the phase 1 and phase 2 uncovered that during the phase 1 wider type of tooth ablation distributed over the subgroups. According to this distributional pattern seen in the phase 1, type of ritual tooth ablation might differentiate the social group under which three mortuary subgroups were subsumed. Each of these burial subgroups was possibly used by different social groups based on kinship sodality such as lineages and/or segment of clans according to abovementioned results of tooth crown measurement analysis. Integrating these two analytical outcomes, one type of tooth ablation subsumed social groups which were constituted by several lineages or segmental units of clans.

On the basis of the above examination, moiety might be the most likely social groups which coincides with the above social characteristics. The dualistic nature of type variations of wider/narrower division seen in the tooth ablation is consistent with the characteristics of the moiety as potential social group reflected in the difference of the tooth ablation types. Furthermore, these dualistic type division of the ritual tooth ablation did not correlate with the possession of grave good. This negative interrelationship of

the two types of tooth ablation and possession of grave goods suggests the binary social groups were not based on certain kind of disparity. These characteristics are also comfort with the moiety as an estimated social entity reflected in the binary division of the types of tooth ablation. Furthermore, it is clear that different types of tooth ablation distributed in different area in the Ikawazu site; in the north-western area type 2 dominated the variation of tooth ablation; type 1 of tooth ablation were mainly distributed in the south-eastern area of the site. Whereas tooth crown measurements analysis revealed that not a few numbers of relative were included among the human remains found at the same excavation area at 1984 (Doi and Tanaka 1988). Therefore, despite of the unclearness of the spatial subgroups within the Ikawazu cemetery, it is likely that several burial subgroups might be originally configured by different social groups which included many relatives. Meanwhile, each type of tooth ablation distributed over wider area (as north-western area and south-eastern area) than the expected spatial area of segmental units/subgroup within cemetery. This might suggest that each of the binary types of ritual tooth ablation subsumed several numbers of segmental grave units.

What is the background of asymmetrical domination of one type of tooth ablation during Phase 1 in Inariyama site? Spatial constitution came to be segmented with binary division in some cases in the circular configured settlements in the Jomon period. Among these typical Jomon settlements, there are spatially asymmetrical binary segments that composed a circular settlement. Furthermore, some settlement sites constituted only a segmental unit that is presumed to be a half part of the settlement (ex., Taniguchi 2005). Asymmetrical domination of one type of tooth ablation during Phase 1 indicates a certain instability and dynamic in the social groups partly corresponding to conditions seen in the spatial organization of settlements. However, because the past excavation did not reveal the entire burial site, the possibility should be taken into account that the grounds could extend into surrounding areas, in which other types of tooth ablation, the narrower type in Phase 1, could be found to dominate and constitute the other half of the cemetery. In these senses the evidence seen in Phase 1 of the Inariyama site is not enough to reject the previous account of the tooth ablation as reflecting moiety.

Gender differences

The two different types of tooth extraction corresponded with sex differences both in western Japan in the Final Jomon period and in the northern Kyushu area in the Early Yayoi period. However, the correlation is not so rigid, because there are females who have male types of tooth extraction and vice versa. Furthermore, these deviating individuals were treated in the ordinary way in terms of various mortuary practices. In this sense, the types of extracted teeth have a moderate correlation with sex differences. This kind of inter-relationship can be considered to reflect not biological differences but social division

by gender.

There are many ethnographic cases of initiation into adult status which coincide with becoming a member of religious, political, and occupational groups, and so on. In a general sense, initiation into the various social groups requires the cultural maturity of each person as a necessary condition (e.g., Gennepe 1969). Taking into consideration the tendency seen in the ethnographic examples, it can be understood that tooth extraction in a ritual context for initiation into adulthood simultaneously reflects the achievement of social division by gender or status.

Regional differences in social division reflected in tooth extraction

As mentioned above, the ritual nature of tooth ablation was postulated to be an initiation ritual for becoming an adult member of society. Rites of passage that included tooth extraction covered a wide area from eastern to western Japan. Although the nature of the ritual was common over a large area, social memberships reflected in the types of tooth ablation are different in the two areas. In the eastern part of the Japanese archipelago, the types of tooth extraction reflect kinship membership; in the western part, they reflect gender division. In between the two areas, both kinship membership and gender division were reflected in the types of ritual tooth extraction among the adjacent sites.

Looking at the situation of the Tokai area in detail, including the latest dating of the Inariyama shell mound in the Tokai region (Kusaka *et al.* 2018), both patterns of tooth extraction existed. Different types of tooth extraction corresponded with kinship as seen in the Ikawazu and in Phase 1 of the Inariyama sites. In contrast, in the Hobi site and in Phase 2 of the Inariyama site, the gender division correlated with the type differences.

This co-existence of either kinship or gender principles in the ritual tooth extraction indicates the characteristics of the transitional geographical circumstances of this area. To summarize, it can be stated that people used the same technique of tooth extraction for expressing different principles of social division in different areas during the Final Jomon period. These differences indicate a relative difference in significance or importance of each social division emphasized in each area.

That being so, what is the reason for the kind of geographical difference that occurred between eastern and western Japan? One of the possibilities may be the different degree of evaluation of or social value placed on descent images of, which were supported by segmented kinship organizations. These different attitudes toward the descent system resulted in the differences in social categories reflected in ritual tooth extraction in each area. Meanwhile, the intermediate situation of the Tokai area can be seen in various other archaeological artefacts such as pottery, magical goods, and ornaments from the Late and Final Jomon periods (e.g., Shitara 1992). Furthermore, this intermingled state was observed in the mortuary treatment of the dead as multi-individual reburial graves (in

the Ikawazu site), which were widely distributed in eastern Japan but were uncommon in western Japan. Yamada pointed out that reburial graves appear to represent ancestor worship, because this type of secondary burial emerged with the disruption of the large-scale sedentary settlement system into small-scale, less sedentary settlements (Yamada 1995). From the middle of the Jomon period onward, regional society had developed in its segmentation into various sodalities more systematically in eastern Japan than in the western part of the archipelago (Tanaka 1998). Under the social dynamics of eastern Japan, clan or clanship increasingly became an important kinship sodality for dividing or integrating regional society. In this context, socially significant principles of kinship came to be reflected in the context of ritual initiation into adult status. In the case of western Japan, gender was a required category of social division used as a device for consolidating regional societies. The mechanism and driving forces for causing these spatial differences seen in the dynamics of the social system will need to be studied further.

Temporal transformation of gender expression and its social context

Other than the regional variability of social reflection, diachronic changes of gender expression in ritual tooth extraction were becoming clear in the Inariyama site. According to a recent study, the greater part of this site constituted two phases and the food procurement system was thought to have shifted to more intensively rely upon marine resources in the course of climate change (Kusaka *et al.* 2018). In accordance with the transition from Phase 1 to Phase 2, the social principles expressed in tooth ablation changed from kinship to gender division. These outcomes indicate that social sodality other than kinship became more important following the climate change.

After the change of climate, Phase 2 of the Inariyama site is the time when the newly introduced cultural package partly accompanying human migration diffused from the northern Kyushu area to Honshu Island. The new cultural complex was associated with the new subsistence technology of paddy field agriculture, which had been brought from the Korean Peninsula. The cultural diffusion that took place over the western part of the archipelago might have brought about the emergence of gender expression in ritual tooth extraction in the Tōkai region. As mentioned above, several ethnographic examples have shown how initiation rites into adult status subsumed simultaneous admission into either religious, subsistence, or age groups (Beaglehole 1937; Evans-Pritchard 1940; Radcliffe-Brown 1948; Turnbull 1962, 1965; Venema 1978; Clemmer 1995). As seen in the ritual tooth ablation of the Northern Kyushu area, ritual reflection of gender division across the kinship sodality was probably associated with the organization of the subsistence group. When the cultural information based on the paddy field agriculture complex was accepted from the Northern Kyushu area, part of the population of the Tōkai region continued the ritual of tooth ablation and maintained the existing type variations of

ablation. However, they modified the prevailing principles and social meaning reflected in ritual tooth ablation in accordance with the newly arrived subsistence system from the western part of the archipelago. Gender was one of the important social divisions, as seen in the correlation between grave goods and gender in the Yoshigo site, that may have been one of the factors that prompted the change in social divisions reflected in tooth ablation.

Meanwhile, this change in social categories expressed in tooth ablation might be a result of the change in subsistence strategy. Food dependence on marine resources was indicated to be intensified from Phase 1 to Phase 2 in the Inariyama site (Kusaka *et al.* 2018). Transformation of the subsistence system in response to climate change might have led to or forced the reorganization and/or reintegration of existing social groups. These two factors of cultural diffusion and subsistence transition during and after the climate change might not be exclusive, but rather integrated and interrelated factors contributing to the shift of the social categories expressed in tooth ablation. The sample sites for the Final Jomon Period were burial sites, which were the resultant configuration of long-term usage. The social meaning of tooth ablation could have fluctuated through the long duration of utilization of burial sites in locations other than the Inariyama site. Clarification of the transformation of the social meanings of tooth ablation may be enabled by more comprehensive/inclusive application of the result of recent C14 dating of Jomon skeletal remains (e.g., Kusaka *et al.* 2018).

In contrast to this transformation, the ritual continuity reflected in social categories was also observed in the western part of the archipelago. The focal point is the succession of gender expression in the types of tooth ablation, which occurred from the Final Jomon period to the Early Yayoi period in western Japan. Since the early 1900s, many scholars have discussed the cultural transition from the Jomon to Yayoi periods. The Yayoi culture was based on the preceding Jomon culture, while integrating new cultural influences from the Korean Peninsula (e.g., Mori 1966). Although the cultural transformation occurred at the beginning of the Yayoi period (fifth to sixth centuries BC) with the acceptance of the cultural knowledge centered on paddy-field agriculture, gender division continued to be reflected in ritual tooth extraction until the beginning of the Middle Yayoi period (first century BC). Meanwhile, tooth ablation in the Korean Peninsula was not conducted in the context of the initiation ritual but in the context of mourning during the parallel period of the beginning of the Yayoi Period (Funahashi 2010).

Why did the indigenous people of the Japanese archipelago not accept the custom of tooth ablation as a new element from the Korean Peninsula expressing mourning? And why did they maintain the reflection of gender division in the types of extracted teeth during initiation rites? What was the trigger for transformation of the meaning of ritual tooth extraction at the transition from the Early to Middle Yayoi periods?

One of the key factors in examining these questions may be the demographic change

that occurred at about the same time. One possible factor inducing the transformation of ritual tooth ablation might be the population expansion that occurred during the Middle Yayoi period, rather than it being the immediate effect of the introduction of paddy field agriculture at the beginning of the Yayoi period. Estimations of the significant increase in population in this transitional period have been made through investigation of rice paddy sites, settlements (Hashiguchi 1985; Tanaka and Ozawa 2000), and the increase of burials (Nakahashi 1993) of northern Kyushu. According to Tanaka, under the circumstances of this population increase and the coincident acceptance of various effects newly arriving from the Korean Peninsula in this transitional period of northern Kyushu, each clan expanded its scale in increasingly segmented sub-units (Tanaka 2000). In this context, transformation of the tribal social organization occurred at the beginning of the Middle Yayoi period (Tanaka 2000). With detailed reconstruction of the formation processes of jar burial grounds and the accompanying mortuary practices, the society of the northern Kyushu area underwent social stratification during the Middle Yayoi period and consequently transformed from a tribal to a chiefdom society in the Late Yayoi period (Mizoguchi 1998, 2001, 2002; Tanaka 2000).

Taking into account these previous studies, the social divisions reflected in the initiation rites did not change directly from the impact of cultural diffusion including the implementation of paddy field agriculture and the integration of human immigrants at the beginning of the Yayoi period in Northern Kyushu, but rather transformed in accordance with the social reorganization and increasing complexity resulting from population expansion after the transition from the Early to the Middle Yayoi periods.

Conclusion

The above discussion illustrates one potential gender perspective for reconstructing past societies. At the same time, it is obvious that the spatial variations and temporal changes in ritual tooth extraction have to be contextualized in each socio-cultural system in order to interpret what they signified. The spatiotemporal variability seen in gender expression as seen in the case study of tooth extraction reflects (1) the relativity of social significance of the gender category in each social context and (2) the gender category as one of the constituents within the social system as a whole. Therefore—as many archaeologists have already pointed out by using the gender category—in this study, it is recognized that gender is one of the most important social divisions contributing to the reconstruction of prehistoric society; further, the social role of the gender category is not stable.

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