

A Comparative Study of Ritual Tooth Ablation in Ancient China and Japan

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Abstract This paper comparatively examines ritual tooth ablation in ancient China and Japan. In China, as far as it is known at present, ritual tooth ablation first appeared among the people of the Shandong-North Jiangsu region, at least 6500 years ago, and then became very popular amongst the people of the Dawenkou culture of coastal China. In Japan, on the other hand, this custom was performed extensively among the people of the Late-Final Jomon period. This results in a time lag in their periods of prevalence of about 2000 years. There are also significant differences in the form of tooth ablation in ancient China and Japan. China is represented by the bilateral ablation of the upper lateral incisors (2I² type), and with the exception of a small group, showed no remarkable temporal change after its inception. Ritual ablation in Japan was more complex and the number of teeth extracted during this custom's most prevalent period was more numerous than that of China. On the other hand, there exist several points which may suggest some relation between both countries, such as the basic similarities in the age at commencement of ablation, the prevalence of extraction of under incisors from the Late Jomon period in western Japan and the existence of the same style of ablation in the peoples of nearly the same period in China. Especially, the abrupt increase of extraction of the upper lateral incisors in the people of the Yayoi period, such as Doigahama, who show morphological resemblances with the neolithic people of northern China, may suggest the influence of Chinese tradition. Although it is difficult, at the present, to trace and conclude any specific relationship between the traditions of these two countries due to the lack of skeletal remains from China corresponding to the Late-Final Jomon and Yayoi periods in Japan, these results strongly suggest the significance and necessity for further studies.

Key Words: ritual tooth ablation, ancient China, ancient Japan, cultural exchange

INTRODUCTION

Ritual tooth ablation, which is the intentional extraction of healthy frontal teeth, has a long history and can be traced back to at least the Mesolithic North Africans (Briggs, 1955). It has also been noted in skulls from many parts of the world, and shows significant variations in form and meaning. Many studies have been carried out on this custom as an effective means to gain an insight into ancient societies

(Jackson, 1914–1915; Hrdlička, 1940; Watanabe, 1966; Merbs, 1968; Harunari, 1973, Ikeda, 1981).

This custom has been noted frequently in skulls from both ancient China and Japan. In China, many studies have already been performed (Kanaseki, 1960; Yen, 1972, 1973; Han *et al.*, 1974, 1976; Han and Pan, 1981, 1982; Lien, 1987). Han and Pan (1981) collectively evaluated the materials related to this custom and discussed the origin and transition of ritual tooth ablation in ancient China. In Japan also, numerous studies have been done since the 1918 paper by Koganei centering mainly on the people of the Jomon period (Hasebe, 1919; Matsumoto, 1920; Miyamoto, 1925; Kiyono and Kintaka, 1929; Ohkura, 1939; Watanabe, 1966, 1967). Harunari (1973, 1974) discussed the social meaning of this custom in ancient peoples including material from the Yayoi period. Recently, Nakahashi (1990) has also analyzed the temporal changes in ritual tooth ablation from the Jomon to the Yayoi periods in Japan and discussed the possibility of a relationship in this custom between ancient China and Japan.

There are, however, few studies focusing on the relationship of ritual tooth ablation in ancient China and Japan, as most studies have been confined to the analysis of materials in their own country. It is well known that various kinds of exchange of both culture and people between these two countries have continued over a long period. Ritual tooth ablation, having a world-wide distribution and strong indigenous tradition, may therefore be expected to provide a new insight into the discussion on the history of interchange between both countries. This study attempts to elucidate differences and relationships between the ritual tooth ablation of these two countries based on the skeletal materials excavated from each country up to the present.

MATERIALS AND METHODS

The sites and skeletal populations of China used in this paper are shown in Table 1 and Fig. 1. The skeletal sample includes the results of a previous report (Han and Pan, 1981), additional new data examined by the authors (the numbers of sites in Table 1 are 1, 7, 12, 13, 15, 21, 22), and Taiwan examples documented by Lien (1987). A total of 576 skulls with ritual tooth ablation from sites ranging from the Dawenkow culture to the Ming Dynasty in China were used for analysis in this study. The majority of skeletal samples are housed in the Institute of Archaeology, Chinese Academy of Social Sciences, and those from the Weidun site are housed in the Shanghai Museum of Natural History.

The data for Japanese populations were collected from the following reports.

Jomon people: Hasebe, 1919; Matsumoto, 1920; Miyamoto, 1925; Kiyono and Kintaka, 1929; Nakayama, 1952; Ohkura, 1939.

Yayoi people: Kanaseki *et al.*, 1954; Naito and Eida, 1967; Naito and Nagasaki,

Table 1. Frequencies of individuals with ritual ablation of teeth in sites of China

Sites	Cultures	Carbon Dating (B.C.)	Frequencies (present/observed)		Total	Youngest age of tooth ablation
			Male	Female		
Shandong	1. Tengxian Beixin	5440–4310	—	—	—	—
	2. Taian Dawenkou I	4520–3830	70.6 (12/17)	77.8 (7/9)	73.1 (19/26)	17–25
	3. Taian Dawenkou II	2500–2100	64.0 (7/11)	80.0 (16/20)	74.2 (23/31)	12–13, 18–21
	4. Yanzhou Wangyin	4060–3210	77.4 (205/265)	75.2 (76/101)	76.8 (281/366)	15
	5. Qufu Xixiahou		60.0 (6/10)	40.0 (4/10)	50.0 (10/20)	adolescence
	6. Zhucheng Chengzi	3770–3370	88.9 (7/8)	100.0 (7/7)	93.8 (15/16)	25
	7. Zhucheng					
	8. Zhigou-Qianzhai	2030–1780	20.0 (1/5)	16.7 (1/6)	15.4 (2/13*)	14–18
	9. Jiaoxian Sanlihe I	2870–2690	9.9 (2/21)	11.1 (1/9)	10.0 (3/30)	30–35
	10. Jiaoxian Sanlihe II	2410–1810	23.8 (5/21)	16.7 (2/12)	21.2 (7/33)	30–35
	11. Chipping Shangzhuang		100.0 (1/1)	66.7 (4/6)	71.4 (5/7)	14
	12. Zouxian Yedian	4220–2690	50.0 (4/8)	75.0 (3/4)	58.3 (7/12)	16/18
	13. Guangrao Wucun	1880–1560	60.0 (6/10)	100.0 (3/3)	60.0 (9/15*)	20–22
Jiangsu	14. Pixian Dadunzi	4510	61.4 (27/44)	68.2 (15/22)	63.6 (42/66)	15–20
	15. Changzhou Weidun	4170–3270	70.0 (14/20)	68.4 (13/19)	69.2 (27/39)	14–16
Shanghai	16. Qingpu Songze	3900–3300	— (2/—)	— (2/—)	— (4/—)	—
Fujian	17. Minhai Tanshishan	1830–1250	33.3 (1/3)	0 (0/6)	11.1 (1/9)	adult
	18. Zengcheng Jinlansi	2500	50.0 (1/2)	—	50.0 (1/2)	25
Guangdong	19. Foshan Hedang	3660–2520	100.0 (10/10)	75.0 (9/12)	86.4 (19/22)	22–25
Hubei	20. Fangxian Qilihe	3150–2660	61.5 (8/13)	80.0 (4/5)	66.7 (12/18)	30
Henan	21. Xichuan Xiawanggang	4970–2710	—	—	—	—
Anhui	22. Boxian Fuzhang		100.0 (9/9)	80.0 (4/5)	92.9 (13/14)	16–18
Sichuan	23. Gongxian Luobiao		50.0 (3/6)	75.0 (3/4)	60.0 (6/10)	21–23
Taiwan	24. Gaoxiong Hengchun		—	—	— (21/—)	—
	25. Zhishanyan		—	—	100.0 (1/1)	—
	26. Yuanshan	2200–1500	—	—	100.0 (3/3)	—
	27. Kending	2000	—	—	94.0 (16/17)	adolescence
	28. Beinan	2700–700	—	—	90.0 (46/51)	—
	29. Penghu Suogan	2000	—	—	33.0 (1/3)	—
	30. Eluanbi		—	—	100.0 (2/2)	—

The numbers of sites correspond to the numbers in Figure 1.
*: These figures contain individuals of sex unknown.

(Merbs, 1968; Cook, 1981), the criteria for the presence of ablation were coordinated by reciprocal observation of skulls from both countries.

RESULTS AND DISCUSSION

1. Temporal Transition of Tooth Ablation Customs

Evidence of tooth ablation practices in human skeletal remains of China, as far as it is known at present, has been found principally on the eastern-southeastern coastal region of ancient continental China and Taiwan. As shown in Fig. 1 and Table 1, examples are particularly concentrated in the Neolithic sites of the Shandong-North Jiangsu region. Archaeologically speaking, the sites where ablation customs have been reported belong to the Dawenkou culture, Qinliangang culture, Majiabang culture, Qujialing culture, Impressed Stone Ware culture in South China and Taiwan's Prehistoric Culture periods, and extend over a considerably wide range both temporally and geographically.

Many points remain unclear as to when and where such customs started. Considering the fact that tooth ablation flourished in the Neolithic period of China, there is a possibility that this practice may date further back. No examples of ablation have yet been found from the Palaeolithic period, but this may be due to the insufficiency of fossilized human skeletal remains from that period. One of the oldest examples among data uncovered so far in China is from an early Dawenkou Neolithic culture site in Shandong Province, and dates back to 6500 years ago (Table 1). Signs of tooth ablation have also been detected in human skeletal remains from the Tengxian Beixin culture in Shandong which is older than the Dawenkou culture, though the detail of their practice is unknown. It can, therefore, be assumed that tooth ablation originated at least 6500 years ago in the Shandong Province region. Accordingly, data unearthed to date tentatively suggests the possibility that China's ablation practices started in the region of the Dawenkou-Qinliangang Neolithic cultures, that is, in the Shandong-North Jiangsu region (Fig. 2).

At either the end of the Dawenkou culture or the beginning of the Longshan culture, approximately 4000 years ago, this custom declined suddenly (Han and Pan, 1981), with almost no example being found in the Chou or Han period human remains from the Shandong-North Jiangsu region (for example, 436 skulls without ritual tooth ablation from Xindian site in Linzi, Shandong province). In regard to this problem, ancient Chinese books written between 2500–2200 years ago, such as "Shanghai Jing," describe the defeat of a "Chisel tooth" clan from the south who practiced ablation by a powerful "Yi" clan of the lower Yellow River valley, which took place in the Hsia period (4000–3500 years ago). If it can be assumed that such records are to some extent based on historical fact, this suggests that the practice of tooth ablation was already in decline in the Yellow River valley in the Hsia period. This corresponds well with the results from the skulls unearthed by

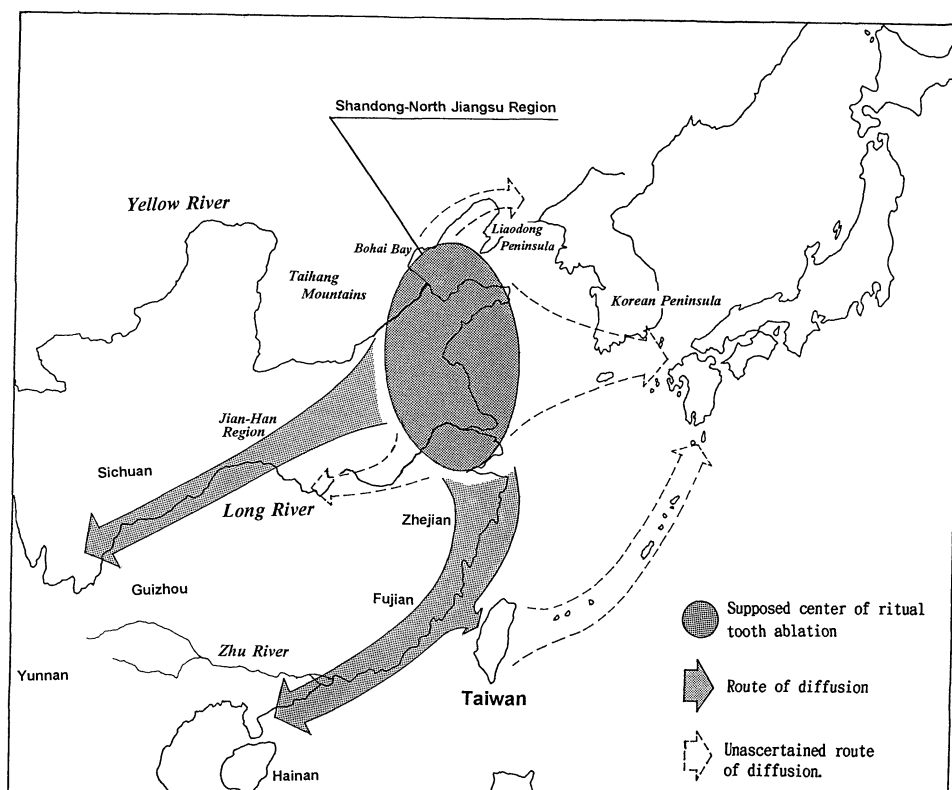


Fig. 2. Supposed geographical spread of ritual tooth ablation.

archaeological excavations to date.

The oldest example of tooth ablation in Japan, although still surrounded by controversy, is said to be that of Minatogawa man which was discovered in Minatogawa on Okinawa island (Fig. 1), and dates back to the Late Palaeolithic (18,000 years ago). The absence of both mandibular central incisors accompanied by alveolar resorption was recorded in one female mandible, but no evidence of incisor ablation could be detected on an adult male mandible (Hanihara and Ueda, 1982). It is difficult to make any definite conclusions concerning whether or not tooth ablation was practiced among the inhabitants of Okinawa during this period. In addition to this, Jomon period Okinawa remains are all but obscure. It has been pointed out, however, that mandibular central incisor ablation practices possibly existed from the Jomon to Yayoi period in the southern island (Mine, 1992) and western Japan, such as Todoroki site in Kyushu and Ohta site in Chugoku (Harunari, 1983).

With the exclusion of the Minatogawa example, tooth ablation made a definite appearance on the main islands of Japan at the end of the Middle Jomon period

around Sendai Bay (Watanabe, 1967), and flourished during the Late to Final Jomon period, approximately after 4000 years ago. Such customs have also been observed in Yayoi period human remains from various areas (Harunari, 1987; Nakahashi, 1990). It has also been noted that it may have continued into the Kofun period (Miyagawa, 1974; Morimoto *et al.*, 1983; Doi and Tanaka, 1988), but with the exception of a few coastal areas the practice subsequently declined rapidly.

As previously mentioned, the practice of tooth ablation around the Shandong-North Jiangsu coastal region reached its height during the Early to Middle Dawenkou culture (Table 1), which is considerably earlier than its most prevalent period in Japan. Ablation started to decline approximately 4000 years ago in the Shandong region during the Longshan culture, which is also much earlier than Japan's period of decline. In other words, both the period of prevalence and decline of tooth ablation in ancient China were some 2000 years earlier than Japan, with the period in which the practice of tooth ablation declined in the coastal region of China corresponding to its most prevalent period in the Japanese archipelago.

2. Ablation Frequency

The practice of tooth ablation at its height in both ancient Japan and China was carried out at a considerably high frequency. For example, at a number of Early and Middle Dawenkou culture sites (Taian Dawenkou, Yanzhou Wangyin, Juxian Lingyanghe, Pixian Dadunzi, etc.), the frequency of ablation was 60–90% (Table 1). At the major Japanese shell midden sites of Satohama (Matsumoto, 1920), Inariyama (Ohkura, 1939), Yoshiko (Kiyono and Kintaka, 1929; Nakayama, 1952) and Tsukumo (Miyamoto, 1925), the frequency reached 80–100%, indicating a tendency toward slightly higher frequencies among these Japanese representative ablation groups than those of China.

However, distinct differences in frequencies among the various sites in each countries, reveal vicissitudes in this practice among the respective inhabitants. In general, no male-female differences in tooth ablation can be confirmed in the Neolithic period of China, with both sexes indicating high frequencies of over 60% in sites where this practice was prevalent. In contrast, sexual differences have long been pointed out in Jomon groups of Japan (Hasebe, 1919; Koganei, 1923; Miyamoto, 1925; Suzuki *et al.*, 1957), and sexual differences in both frequency and form have been reported at the Yayoi period site of Doigahama (Nakahashi, 1990).

3. Ages at Commencement of Ablation

Examination of a considerably large number of individuals with tooth ablation from a number of sites from the Shandong-North Jiangsu region of China revealed that tooth ablation normally commenced at the age of 13–15 years, which is soon after the deciduous teeth are replaced by the permanent dentition (Table 1).

Although some slight discrepancies may emerge between observers due to the existence of differences in age estimation criteria, the general conclusion is that ablation in China was carried out in early adolescence, at approximately 13–15 years of age.

Investigations into the youngest age at which upper canines were extracted among the Jomon people of Japan indicate that extraction took place at the beginning of puberty, at an age when the epiphyseal line still remained on limb bones, and just prior to the eruption of the third molar (Hasebe, 1919; Miyamoto, 1925; Kiyono and Kintaka, 1929). Several papers report that at Yayoi period sites, such as Hirota (Nagai, 1961), Otomo (Matsushita, 1981), Doigahama (Nakahashi, *et al.*, 1989), ablation commenced at the age of 12–13 years. Such particularly young examples, however, are presently limited to Yayoi period sites in Kyushu and the westernmost part of Honshu island. Further investigations will be needed to elucidate exactly how universal this trend was in other regions and periods.

In any case, the above examples from both countries show basic similarities in the age at commencement of ablation, around adolescence, indicating a common physiological context. In connection with the age of commencement of ablation, the general consensus in Japan is that the practice of ablation was related to a “coming-of-age ceremony.” Harunari (1973), however, goes one step further in proposing that after the extraction of upper canines to mark adulthood, the mandibular teeth were extracted for marriage. If this hypothesis is correct, the age at ablation commencement in China would correspond to the Japanese coming-of-age ablation, but the existence of any additional extraction indicating matrimonial ablation in China has not yet been confirmed.

4. Tooth Extraction Types

In China, the upper lateral and central incisors and upper canines were ritually extracted. Few, if any, other teeth were extracted. In particular, the upper lateral incisors were the most frequently bilaterally extracted teeth (Table 2). Although there are a few cases of the unilateral extraction of tooth, they seem to be spontaneous except for the case of Weidun, as mentioned later.

The other interesting type of extraction is the upper lateral incisors and canines (for example, 2I²2C', in Table 2), though it was found only in a few sites of continental China, such as Fangxian Qilihe in Hubei and Chiping Shangzhuang in Shandong. However, this is the principal type in ancient Taiwan (Lien, 1987). The bilateral extraction of the upper canines alone has not been found in China.

The extraction of mandibular teeth has also been found in a few sites in China. For example, in the people of Jiaoxian Sanlihe in Shandong, both cases of extraction of lower incisors (2I₁, I₁ and 2I₁2I₂) and of combination of upper and lower incisors (2I²/2I₁, I¹I²/2I₁2I₂) have been found. Although ritual tooth ablation in the Dawenkou

Table 2. Type classification of tooth ablation in ancient China

Sites	Types	(?)2I ₁	2I ² (?)	2I ¹	I ¹	2I ¹ 2I ² 2C'	2I ² P ¹	2I ² 2C'	2I ² C'	2I ² 2C'	2I ² P ¹	2I ¹ 2I ² 2C'	I ₁	2I ₁	2I ₁ 2I ₂	2I ² /2I ₁	I ¹ I ² /2I ₁ 2I ₂	2I ¹ 2I ² 2C'/I ₁ I ₂ (?)	2I ¹ 2I ² 2C'/2I ₂	2I ¹ 2I ² 2C'/(?)	2I ² (?)	(?)/2I ₁	
Shandong	*1. Tengxian Beixin																						
	2. Taian Dawenkou																						
	3. Taian Dawenkou																						
	4. Yanzhou Wangyin																						
	5. Qufu Xixiaohu																						
	6. Zhucheng Chengzi																						
	7. Zhucheng																						
	Zhigou-Qianzhai																						
	8. Jiaoxian Sanlihe																						
	9. Jiaoxian Sanlihe																						
	10. Chiping Shangzhuang																						
	11. Zouxian Yedian																						
	12. Juxian Lingyanghe																						
13. Guangrao Wucun																							
Jiangsu	14. Pixian Dadunzi	1																					
	15. Changzhou Weidun																						
Shanghai	16. Qingpu Songze																						
Fujian	17. Minhou Tanshishan																						
Guangdong	18. Zengcheng Jinlansi																						
	19. Foshan Hedang																						
Hubei	20. Fangxian Qilihe																						
Henan	21. Xichuan Xiawangang																						
Anhui	22. Boxian Fuzhang																						
Sichuan	23. Gongxian Luobiao																						
Taiwan	24. Gaoxiong Hengchun																						
	25. Zhishanyan																						
	26. Yuanshan																						
	27. Kending																						
	28. Beinan																						
	29. Penghu Suogan																						
	30. Eluanbi																						
	Total	1	2	11	18	419	28	1	4	1	0	2	1	68	1	2	—	1	3	2	—	1	1

The number of sites correspond to the numbers in Figure 1.

Culture period of this site was rare, cases of $2I^2$ and $2I^1$ types, and one case of $2I_1$ type were found.

A rare example of a very complicated style of tooth extraction was found among the people of Boxian Fuzhang in Anhui, consisting of at least 4 types.

Type 1, $2I^2$ (2 cases)

Type 2, $2I^1 2I^2 / 2I_1 2I_2$ (4 cases)

Type 3, $2I^1 2I^2 2C'$ (2 cases)

Type 4, $2I^1 2I^2 2C' / 2I_2$ (1 case)

On the other hand, the types of tooth extraction of ancient Japan were more complicated than those of China. In the Jomon people, for example, the canines, especially the upper canines, were the principal teeth extracted ritually. The mandibular incisors were also extracted frequently (Tables 3 and 4).

Table 3. Distribution of types of tooth ablation in China and Japan

Forms	CHINA		JAPAN	
	Continent	Taiwan	Late-Final* Jomon	Doigahama* Yayoi
I^1	1	0	0	0
$2I^1$	2	0	0	0
I^2	30	0	0	3
$2I^2$	415	4	0	8
$I^1 I^2$	14	0	0	0
$I^1 2I^2$	4	0	0	0
$I^2 C'$	2	0	1	7
$2I^2 C'$	1	0	0	1
$2I^2 2C'$	3	65	0	5
$2I^2 P^1$	1	0	0	0
$2I^1 2I^2 2C'$	2	0	0	0
I_1	1	0	0	0
$2I_1$	3	0	0	0
$2I_1 2I_2$	2	0	2	0
$2I^2 / 2I_1$	1	0	0	1
$I^1 I^2 / 2I_1 2I_2$	1	0	0	0
$2I^1 2I^2 / 2I_1 2I_2$	4	0	0	0
$2I^1 2I^2 2C' / 2I_2$	1	0	0	0
Others	5	0	126	37
Total	493	69	129	62

*: This contains three representative Jomon populations in western Japan, Tsukumo (Miyamoto, 1925), Yoshiko (Kiyono *et al.*, 1929; Nakayama, 1952) and Inariyama (Ohkura, 1939).

**: Nakahashi (1990)

Table 4. Relative frequencies (%) of extracted teeth

Site	N*	I ¹	I ²	C'	P ¹	I ₁	I ₂	C	P ₁
CHINA									
Wangyin	559	0.2	99.6	0.2	0	0	0	0	0
Sanlihe II	23	4.3	13.0	0	0	56.5	26.1	0	0
Dadunzi	68	1.5	94.1	2.9	1.5	0	0	0	0
Weidun	54	50.0	50.0	0	0	0	0	0	0
Fuzhang	74	24.3	32.4	13.5	0	14.9	14.9	0	0
Taiwan	268	0	51.5	48.5	0	0	0	0	0
JAPAN									
Tsukumo (J)	333	0	3.6	33.0	13.5	16.2	8.7	20.7	4.2
Yoshiko (J)	321	0	3.7	31.8	7.2	33.7	15.3	17.1	1.2
Inariyama (J)	76	0	5.3	34.2	5.3	13.2	13.2	28.9	0
Doigahama (Y)	147	0	35.4	42.9	4.8	3.4	5.4	7.5	0.7
Koura (Y)	48	0	2.1	60.4	0	16.7	8.3	12.5	0
N-Kyushu (Y)	47	0	42.6	36.2	0	12.8	4.3	0	4.3
NW-Kyushu (Y)	137	0	2.2	42.3	1.5	24.1	19.7	10.2	0
Hirota (Y)	60	0	56.7	41.4	0	0	0	1.6	0

Males and females are combined.

*: Number of extracted teeth.

(J): Jomon period, (Y): Yayoi period

Although mandibular incisors were extracted in a few sites in China as mentioned above, it did not become as popular style as in ancient Japan. In addition to this, mandibular canines were never extracted with mandibular incisors in the two Chinese sites (Jiaoxian Sanlihe and Boxian Fuzhang) where mandibular incisor extraction has been recorded. In Japan, however, there are numerous cases of mandibular incisor and canine combination.

In other words, canine extraction did exist in China (Fangxian Qilihe and Chiping Shangzhuang), but it was restricted to the upper canines and they were always extracted together with the upper incisors (2I²2C'). Taiwan, however, is an exception, where there are sites where the 2I²2C' type of extraction predominated (Lien, 1987). But the mandibular incisors and mandibular canines at these sites were not extracted which is similar to continental China.

As a whole, the above results from China show a clear difference in the types of tooth extraction to Japan which has more complicated forms frequently containing combinations of upper and lower teeth extraction. The first premolars was also extracted in Japan and have been interpreted as a sign of mourning (Harunari, 1973). There are few types which are common to both countries as shown in Table 3. Consequently, the extracted number of teeth in the representative ablation groups of Japan generally exceed that of China (Table 5).

An exceptional case with the unilateral extraction of the upper central and lateral incisors has been observed in Changzhou Weidun (Nakahashi, 1995). Although it

Table 5. Average number of extracted teeth

CHINA			JAPAN		
Site	N	Mean	Site	N	Mean
Dawenkou	42	1.95	Tsukumo (J)	58	5.74
Wangyin	281	1.99	Yoshiko (J)	55	5.84
Sanlihe	10	1.90	Inariyama (J)	13	5.85
Dadunzi	42	1.62	Satohama (J)	11	2.82
Weidun	27	2.00	Doigahama (Y)	53	2.66
Hedang	19	1.89	Koura (Y)	14	3.00
Qilihe	12	2.33	N-Kyushu (Y)	28	1.68
Fuchang	10	6.40	NW-Kyushu (Y)	38	3.34
Beinan	46	3.87	Hirota (Y)	31	1.71
Total					
Continent*	493	2.09	Jomon	137	5.55
Taiwan*	69	3.88	Yayoi	164	2.50

Males and females are combined.

*: The total numbers for China were calculated from the results in Table 1, 2.

is not so difficult to find cases of unilateral extraction in several types of tooth extractions as shown in Table 2, no site has been found in ancient China where all the case of ritual tooth ablation consisted of unilateral extraction. In this regard, the Yayoi period people from Hirota on Tanegashima, a southern island of Japan, are also considered very unique due to their unilateral extraction applied to the upper lateral incisor and canine (Ohtawa, 1983). but there is about a 3000-year time lag between these sites. This type of tooth extraction has not been found in other ancient Japanese site except Torinomine (Yayoi period) on the same island of Tanegashima. Similarities between several kinds of burial accessories found at Hirota and in Southern China have been indicated (Kanaseki, 1966). Furthermore, the skulls from Hirota also resemble those of Changzhou Weidun in their cranial modification of occipital flattening (Yamaguchi and Huang, 1995), though it is difficult to find similarities in any other parts of the skulls from these two sites. These results suggest that it may be both interesting and fruitful to study the relation between Jiangnan and southern island of Japan.

5. The Meaning of Tooth Ablation

Various theories have been proposed concerning the meaning of tooth ablation among the primitive inhabitants of China, such as the coming-of-age theory, matrimony theory, mourning theory, native clan theory, ornamentation theory, and beautification theory etc. (Han and Pan, 1981; Harunari, 1973, 1974; Khomoto, 1993, 1995). Needless to say, it would be difficult to consider that such numerous meanings for this practice would have existed from its onset. It could be supposed

that the social meaning of this custom was relatively simple in its developmental stages, with the possible subsequent derivation of others.

In China, various extraction types have actually identified in examples of customary ablation known to the present (Tables 2, 3). It is thought, however, that the majority of these combinations were possibly later derivations, with the earliest types being comparatively universal and simple. At the present, type 2I² ablation is the oldest recorded type in ancient China. This type was not only universal, but it was also the principal type down to recent times. No other types have been found which spread to such an extent, and therefore, it is thought that this type may have had a more universal original meaning. As this is an uncomplicated type of ablation involving the extraction of only one tooth type, which is also a single-rooted tooth, it would be difficult to consider that this one type possessed many meanings. In other words, the simplicity of this type suggests that it may possibly be older than many of the more complicated types.

The results of investigations into a large number of sites indicate the upper lateral incisors were extracted around the period of transition into the adult age group (Tables 1, 2). The physiological changes during puberty would have been an easily perceivable phenomenon to the members of ancient societies, and may have served as a physiological mark signifying adulthood or eligibility for marriage in such strict clan societies. Extraction of the upper lateral incisors may, therefore, have been a kind of fixed sign indicating adult clan membership or eligibility for marriage.

When considering the meaning of such ablation customs, a number of interesting examples from the Early Dawenkou culture cemeteries in the Shandong-North Jiangsu region, such as Yanzhou Wangyin, should be noted (Han, 1995). Studies of human remains uncovered from this region have revealed the existence of multiple burials of individuals of the same sex and of the same age group. These examples indicate the custom of not burying males and females from the same clan together was popular to some extent. It may be speculated from such examples that men and women from the same clan were prohibited from marrying. That is, marriages during this period may have taken the form of inter-clan marriages. The origin of ritual customs such as tooth ablation also may have been closely related to the enforcement of such inter-clan marriage.

In Japan, one of the former general opinions was that of coming-of-age ablation as a form of passage rite. In considering the ablation age (around adolescence), however, as mentioned above, there was a distinct diversification in the types of tooth ablation in ancient Japan at its height, suggesting that a diversification in the social meaning of ablation practices may have occurred. Harunari (1973, 1974), noting the large number of extracted teeth and diversity in ablation types in the Late Jomon skeletal samples of Tsukumo, Yoshiko and Inariyama as examples (Tables 4, 5), speculated that ablation was not only carried out at adolescence to mark

adulthood, but also on a number of subsequent occasions to mark various rites of passage, such as marriage and mourning. Although there is still room for discussion regarding the extent to which such concrete interpretations can be applied to the ablation groups from various areas of Japan (Ikeda, 1981), it would be difficult to explain tooth ablation at its height in Japan as simply an adulthood rite. Accordingly, it would be logical to suppose the variation in types of ablation may, in some way, reflect the diversification in the social meaning of the practice in ancient Japan.

In the coastal region of China comparatively simple types of ablation were the most dominant at most sites, which is where the greatest differences lie between Japan and China (Tables 3, 4). Of course there are various ancient documentary records in China concerning the meaning of ablation, the majority of which describe it as a sign endorsing eligibility for marriage or adult status, but as yet, no exact correlations between types and meaning have been found. That is, even if there was diversification in the meaning of tooth ablation in China, it did not manifest any distinct typological changes. On the contrary, Japanese tooth ablation practices, based on Harunari's view (1973, 1974), display changes with close connections between typological diversification and functional diversification. Judging from these results, tooth ablation practices in China and Japan may indicate differences in the nature of the respective clan societies, or different tendencies to change in its developmental process. Similarly, the fact that the main ablation types in prehistoric Taiwan also differ from the mainland (Lien, 1987), may have resulted from independent changes.

6. Origin and Spread of Ritual Tooth Ablation

Figure 2 shows the speculated courses of the spread of tooth ablation in China. The Shandong-North Jiangsu region, in this figure, is regarded tentatively as the center of ritual tooth ablation in China, because the most ancient ritual tooth ablation is, as far as is known in China, that of the Dawenkou Culture or Tengxian Beixin culture in Shandong and, as mentioned above, the populations with this custom have mostly been discovered concentrated in this region. However, it should be noted that the origin of this custom in China cannot be hastily concluded. There are still many regions in China from which skeletal remains have not been unearthed, especially in the coastal area in southern China where there is an almost totally absence of skeletal remains. There are other ancient peoples in the world who practiced this custom, such as northern Africa (Mesolithic, Briggs, 1955) and probably Minatogawa site in Okinawa (Late Palaeolithic, Hanihara and Ueda, 1982). It would therefore, be necessary to continue investigation in the ancient people of China including those of the Palaeolithic period.

Judging from the results reported to date, this custom probably followed the courses shown in Fig. 2. That is, it spread to the west through the area between the

Yellow River and Long River (Yangtze River) to the people of the Qujialing Culture in the Jian-Han region but not to the Taihang-Mountains or to the people of Yangshao-Longshan cultures. To the south, it spread along the coastal region to Zhejiang and Fujian, reaching the Zhu river delta area. There is a possibility that ritual tooth ablation may have spread to the Taiwan and Hainan regions along this course. Although it would be possible to consider that it went upstream along the Long River from the coastal region and reached the area of the Qujialing Culture, there is little evidence for this hypothesis. To the south-west, this custom spread to Yunnan, Guizhou and the Sichuan region. Ritual tooth ablation among the minority people of recent periods (Liao-Gelo clan) may have originated from the period of the Qujialing Culture. This custom probably spread to the north along Bohai Bay or passed over to the Liaodong peninsula and Korean peninsula, but very few skulls with ritual tooth ablation have been unearthed from these regions. Only two female skulls from the Nukdo site (1c. B.C.) at the southern end of the Korean peninsula show ritual bilateral extraction of the upper canines (Ogata *et al.*, 1988). Thus, the addition of more abundant skeletal samples from these regions are necessary to elucidate the relation between China and Korea or Japan.

It is interesting to note that although the canines and lower incisors were the principal teeth extracted during this custom's most prevalent period in Japan (Late-final Jomon period), one of the earliest type of tooth extraction was upper lateral incisor(s) (Watanabe, 1966, 1967) which was the principal type in ancient China. The fact that one of the most ancient examples of this type of ablation has been found in the Tohoku region in Japan at the end of the Middle Jomon period, and not in western Japan, has provided a basis for the spontaneous theory of ritual tooth ablation in Japan (Watanabe, 1966, 1967).

However, there are ground for further study on the origin of this custom in Japan especially in western Japan. Firstly, human skeletal remains from the early phase of the Jomon period are rare in comparison to the later phase. Secondly, the existence of more ancient examples of mandibular central incisor extraction have been reported at Todoroki site in Kyushu (early Jomon period) and Minatogawa in Okinawa (Hanihara and Ueda, 1982; Harunari, 1983), though further examination is necessary to confirm whether these are cases of intentional extraction or accidental loss.

There is also room for further discussion concerning the derivation of canine and lower incisor extraction types in the Late Jomon people of western Japan. These types of tooth extraction have been found in China too, although only at few sites to date. It is interesting to note that the period of appearance of this type in China is at the final phase of the Dawenkou culture to the beginning of Longshan culture. Thus, there is no marked time lag between the period of appearance of this new style in the two countries. Furthermore, the results of the multivariate analysis

(Multi-dimensional Scaling Method) applied to the Q-mode correlation coefficients based on the relative frequency of tooth extraction (Table 4) show some similarities between these new types of tooth ablation in China, such as Sanlihe, and those of the Late-Final Jomon people of western Japan (Fig. 3). At the same time, the clear similarity in the kind of extracted teeth, the upper canine and upper lateral incisor, between Taiwan and Hirota (Fig. 3), may imply the possibility of diffusion through the southern islands of Japan (Fig. 2). Although we do not have sufficient material to show any direct connection between the types of tooth ablation in these two countries, these facts indicate the necessity for further research on the transition of this custom after the Dawenkou period in China and its influence on Japan.

The remarkable increase of upper lateral incisor extraction in the Yayoi people of Doigahama (Nakahashi, 1990) seems to offer a more concrete example of influence from China. This style of tooth extraction is not only rare in the Late-Final Jomon period in Japan, but it is also a principal form of ablation in ancient China. Furthermore, the morphological features of the Doigahama people show several similarities to the neolithic people of China and the Korean Peninsula, while being markedly different to the Jomon people (Kanaseki *et al.*, 1960; Nakahashi *et al.*, 1985; Nakahashi and Nagai, 1989; Yamaguchi, 1987; Mizoguchi, 1988; Hanihara, 1991; Kim *et al.*, 1993; Nakahashi, 1993). As is well known, the coastal area from Shandong to the lower Long River has been considered as one of the highly probable origins of rice agriculture which was introduced into Japan during the Yayoi period, and various close connections with ancient Japan have also been indicated by many archaeologist. Judging from these results, it would be reasonable to suppose some Chinese influence behind the remarkable increase of the ritual tooth ablation of the upper lateral incisors in the Yayoi people of Doigahama and northern Kyushu. However, it is still difficult to show a definite relationship during the period between both countries because there is a long time lag (about 2000 years) in the time of prevalence of this custom in China and Japan, and material from China and the Korean Peninsula contemporary to the Yayoi period is totally lacking.

The Yayoi people of Hirota site in southern Japan also offer an interesting subject for research into the connection with the ancient people of China such as Changzhou Weidun. Although the long time lag between both sites make it difficult to suppose any direct connection, the similarities between both sites as mentioned above, such as unilateral ablation of upper teeth, cranial modification in the form of occipital flattening and their archaeological artifacts, strongly imply the necessity for further research into the relation between southern China and the southern islands of Japan.

CONCLUSION

(1) By tracing the circumstances surrounding the appearance of tooth ablation practices in both ancient China and Japan, we found the following: the

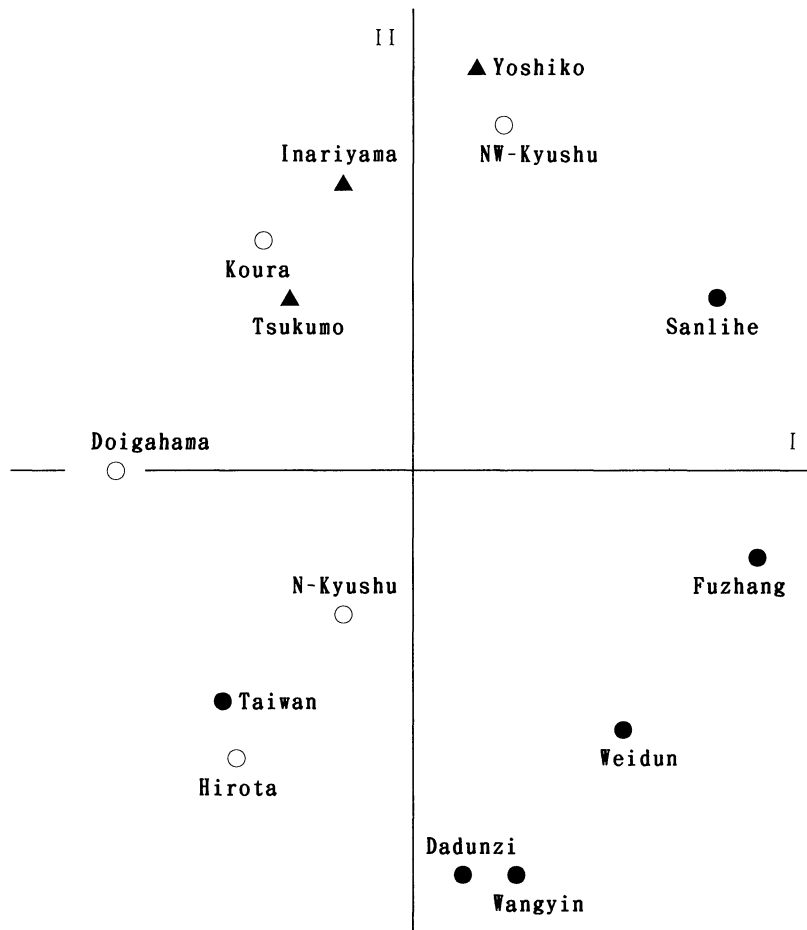


Fig. 3. Two dimensional scattergram of MDS applied to the Q-mode correlation coefficients based on the relative frequency of tooth extraction (Table 4). Contribution rate in the 1st axis is 44.7%, and 2nd axis is 28.7%.

(●: China ○: Yayoi ▲: Jomon)

geographical distributions of both were concentrated around the coastal regions; ablation frequencies during the most prevalent periods were high in both countries; the ages at which ablation was carried out were almost the same and common physiological contexts can be seen. These points indicate that these two countries may possibly have belonged to a common cultural sphere. However, when the actual practice of ritual tooth ablation were compared, differences and discrepancies were seen in the extraction forms, periods, developmental circumstances, and the meanings of ablation.

(2) The most prevalent period of ablation in China was considerably earlier than

that of Japan. That is, the period in which the practice of tooth ablation declined in the eastern coastal region of the Chinese mainland, corresponds to its most popular period in the Japanese archipelago. This means there is a 2000-year discrepancy between the most prevalent periods in China and Japan, which is considerably long time gap.

(3) Similar physiological contexts can be seen in the ablation practices of both countries, but the earliest type of ablation in China (2I² type), which was also the major type, clearly differed to the widespread type extracting upper canines in the Jomon period in Japan. In addition to this, the extraction of the mandibular incisors (the majority of which accompanied the extraction of the mandibular canines) became widespread in the Late and Final Jomon period, particularly in western Japan. Examples of extracted mandibular incisors have also been found at a few sites from the coastal region of China (such as Jiaoxian Sanlihe), and these have been dated to the transition period from the Late Dawenkou culture to the Longshan culture, which corresponds to the period of decline in this region. Although this type of ablation probably did not become the prevalent type in mainland China, it would be worthy of note that the period of appearance of mandibular incisors extraction in China also corresponds nearly to the beginning of this form of tooth ablation in western Japan.

(4) Extraction of the upper lateral incisors was the main type of ablation in China from start to finish. In contrast to this, examples of upper lateral incisors extraction have been found in human skeletal remains from the Final Jomon period in Japan, but their frequency is low, and in most cases they were extracted in combination with the canines. At a few Yayoi period sites, however, such as Doigahama, the frequency of maxillary lateral incisor extraction showed a distinct increase and there are many cases in which they are extracted alone (Nakahashi, 1990). Moreover, the Yayoi people of western Japan, such as the northern Kyushu and Doigahama people, differed morphologically from the Jomon and Jomon-type Yayoi people of western Japan, displaying characteristics in common with the Neolithic period people of mainland China. These results suggest there may have been some continental influence, giving support to the speculation that this continental influence in ritual tooth ablation significantly increased during the Yayoi period with the migration of people from China or Korean peninsula to western Japan.

(5) Another point which should be kept in mind is that the types of ablation practiced in ancient Japan clearly diversified after becoming widespread. Such differentiation of types may possibly suggest differences in social meaning. In contrast to this, however, in China the major ablation types at most sites were comparatively simple, and diversification is only seen at a small number of sites. There are various reports in ancient Chinese documents concerning the meaning behind ablation practices, but no distinct correlations between ablation type and

meaning have yet been found.

(6) In conclusion, no clear connection has yet been found between the two countries due to conspicuous differences in their ancestry as indicated by typological differences and temporal discontinuity. It is, therefore, difficult at present to conclude that the origin of tooth ablation in these two countries was mutually related and transmitted to succeeding generations. However, as there exist several points which suggest some relation between the traditions of these two countries, further investigations are necessary to fill in, and/or explain the many temporal and geographical blanks which are seen in the data at present.

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