Early historic human remains from the Hasekouji-Shuhen site in Kamakura, Japan

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Abstract Eight human skeletons in a good state of preservation have been recovered from excavations at the Hasekouji-Shuhen site in Kamakura city, Kanto region, Japan. We conducted AMS radio-carbon dating that revealed the skeletons to belong to the early historic Asuka, Nara, and early Heian periods (circa 670–970 calAD). In terms of their cranial, dental, and limb bone measurements, the Hasekouji-Shuhen skeletons exhibit morphological characteristics that show affinities with the earlier Yayoi series, which are generally considered to represent immigrant populations from the Asian continent. Furthermore, an early indication of dolichocephalization was observed in these early historic people, a trait which became more pronounced in later medieval times. Three adult males have scars that may have been caused by assaults with a spear or a sword-like weapon. One male individual exhibits skeletal abnormalities including multiple cartilaginous exostosis.

Key words: Hasekouji-Shuhen site, AMS dating, Asuka–Nara–Heian period, dolichocephalization, trauma

Introduction

The Hasekouji-Shuhen site is located at Yuigahama-3-chome in Kamakura city, in the southwestern coastal area of the Kanto region, Japan (Figure 1). The site was formed on a sand dune, 10.6 m above sea level. The excavation of this site was undertaken by the Togoku Institute of History and Archaeology under the direction of one of the authors (H.S.) in 1998 (Shudai et al., 2002). An area of 722 m² was excavated, revealing five cultural layers.

The first cultural level is situated at a depth of about 0.5–1.7 m, and revealed early modern agricultural features, trails, and pots. The second and third levels are of the medieval period. Typical ceramics and bronze coins made during the 14th and 15th centuries (second level) and 13th and 14th centuries (third level) were recovered at depths of about 1.7–2.2 m and 2.2–2.8 m, respectively. The fourth level, at a depth of about 2.8–4 m, is characterized by an abundance of pots produced between the 7th and 10th centuries, corresponding to the early historic Asuka, Nara, and Heian periods. The fifth level, situated below about 4 m depth, was formed naturally and does not contain any artifacts.

Inhumation burials were found in a white sand layer in the fifth level. Fission track dating indicated an age of 250–350 AD for the volcanic pumice that covers the fifth level, and about 1 AD for the volcanic conglomerate collected from the fifth level. This suggested that the layer was formed during

the Middle to Late Yayoi period (circa 300 BC–300 AD). Eleven human skeletons were unearthed from the fifth level but without any associated artifacts. Shudai et al. (2002) and Anezaki and Shudai (2001) reported that these human skeletal remains were buried during the Middle and Late Yayoi period or at least before the beginning of the protohistoric Kofun period (circa 300–500 AD).

However, the accuracy of the dates assigned to the human remains from the Hasekouji-Shuhen site is now in doubt. The layer containing the human skeletal remains lacks any cultural material and the stratigraphic relationship between the burial pits and the volcanic ash sampled for dating is unclear. In this study, we provide new radioisotopic dates,

Figure 1. Map showing the location of the Hasekouji-Shuhen site.

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based on accelerator mass spectrometry (AMS) analysis, for the human skeletons from the Hasekouji-Shuhen site that suggest a somewhat later early historic age of the skeletons.

We also report on observations of the preservation and morphological features of the Hasekouji-Shuhen skeletons, including sex, estimates of age-at-death, and some paleopathological observations. Using skeletal and dental measurements recorded from these specimens, we further discuss some of the current models that have been proposed to explain the population history of the Japanese archipelago.

It is now widely accepted that there was a major influx of people immigrating from the East Asian continent into the Japanese archipelago during the Yayoi period (circa 800 BC–300 AD), and that those people then presumably interbred with the indigenous Jomon people (e.g. Kanaseki et al., 1960; Yamaguchi, 1985; Hanihara, 1987, 1991; Mizoguchi, 1988; Nakahashi et al., 1989; Dodo and Ishida 1990; Nakahashi, 1993; Matsumura, 2001). The immigrants with their advanced technology and culture continued to arrive in Japan from the East Asian continent throughout the proto-historic and early historic periods. These new immigrants are believed to have been responsible for establishing the imperial court in the Kinki district in western Japan, whose influence and power would eventually expand eastward. According to Hanihara's (1991) 'dual structural model', genetic influence stemming from the immigrants gradually spread throughout Japan, a process that continues to this day. Therefore, the nature and degree of influx of the immigrants during the Yayoi and early historic periods have been a crucial point of discussion in considering the population history of Japan. The skeletal and dental features of the Hasekouji-Shuhen skeletons provide an opportunity to see what, if any, the effects of this presumed immigration had on the proto-historic to early historic inhabitants of Japan.

A large number of medieval human skeletons of the Kamakura period (1192–1333 AD) have been excavated in Kamakura city, including those from the Zaimokuza (Suzuki, 1956), Gokurakuji, and Yuigahama sites (Hirata et al., 2002, 2004). Suzuki's (1956) study of diachronic change of Japanese skeletal morphology demonstrated that the medieval people had morphological peculiarities such as a dolichocranic cranium and alveolar prognathism, traits that are not characteristically seen in other Japanese skeletal remains from any time period. Specimens from the Hasekouji-Shuhen site, a site that predates the Kamakura period,

are compared with the Kamakura period series in order to discuss possible temporal changes in skeletal morphology from pre-medieval times to the medieval period in the same region.

Age of the Skeletons

New radiocarbon dates for the human skeletal remains from the Hasekouji-Shuhen site were obtained by NIES-TERRA, the accelerator facility of the Institute for Environmental Studies located at Tsukuba city, Japan (Yoneda et al., 2004). Stable carbon isotope ratios ($\delta^{13}\text{C}$ values) and atomic C/N ratios in collagen were measured by a mass spectrometer with an elemental analyzer (EA-IRMS). All dates were made on well-preserved human bones with good agreement of their C/N ratio (between 2.9 and 3.5) to modern animal bones (DeNiro, 1985). The collagen content in bone was high enough to produce a reliable date (Table 1).

Table 1 shows Conventional Radiocarbon Ages (CRA) (Stuiver and Pollach, 1977) and $\delta^{13}\text{C}$ values used for correcting fractionation of ^{14}C ratios. Some individuals show less negative $\delta^{13}\text{C}$ values in collagen, suggesting the possibility that some amount of carbon in collagen might have originated from the marine reservoir. A correction must be made to account for the marine reservoir effect that is caused by the upwelling of ^{14}C -depleted deep water. The percentage of marine carbon was estimated from a linear mixing model of typical $\delta^{13}\text{C}$ values for marine and terrestrial food consumers between -12.5% and -21.0% , respectively (Yoneda et al., 2002, 2005). A calibration curve is calculated by mixing terrestrial and marine samples depending on their marine carbon content. The calibrated ^{14}C ages were calculated by the OxCal program (version 3.9; Bronk Ramsey, 1995, 2001) based on dendrochronological and marine data sets, INTCAL98 and MARINE98 (Stuiver et al., 1986, 1998; Stuiver and Reimer, 1993).

The calibrated ages of 670–970 AD correspond to the Asuka, Nara, and early Heian periods (Table 2). Regional correction (ΔR value) for the marine reservoir effect was tentatively estimated to be null in this region, based on water mass in the Kuroshio current evaluated from a coral core in Okinawa prefecture (Hideshima et al., 2001).

Description of the Human Remains

Eleven individual skeletons were recovered from the

Table 1. Conventional ^{14}C ages, $\delta^{13}\text{C}$ values and C/N ratios of human collagen

Sample	C/N ratio	^{14}C age (year BP)	$\delta^{13}\text{C}$ (‰)	Lab. No.
No. 1	2.88	1319 $\pm$ 44	–18.3	TERRA-081002a17
No. 2	3.08	1363 $\pm$ 47	–16.1	TERRA-081002a18
No. 3	2.98	1228 $\pm$ 47	–19.2	TERRA-081002a19
No. 4	2.95	1338 $\pm$ 44	–18.6	TERRA-081002a20
No. 5	3.06	1486 $\pm$ 43	–17.4	TERRA-081002a23
No. 6	2.96	1290 $\pm$ 44	–17.8	TERRA-081002a24
No. 7	2.97	1376 $\pm$ 44	–18.5	TERRA-081002a25
No. X	2.98	1423 $\pm$ 43	–17.4	TERRA-081002a26

Conventional ^{14}C ages (Stuiver and Pollach, 1977).

Table 2. Contribution of carbon from the marine reservoir and calibrated ¹⁴C ages correcting for the ¹⁴C marine reservoir effect

Sample	Marine %	Calibrated ¹⁴ C age (calAD)
No. 1	32%	720–900
No. 2	58%	810–970
No. 3	21%	780–970
No. 4	28%	710–870
No. 5	42%	650–770
No. 6	38%	810–970
No. 7	29%	670–710
No. X	42%	680–810

Hasekouji-Shuhen site. Three skeletons had been cremated or were fragmented. The other eight individuals were well preserved without any evidence of burning. The age, sex, morphological features, and paleopathological conditions

were recorded for these eight specimens. Different views of the crania from this site are shown in Figure 2. For recording occlusal surface wear of the dentition, Smith’s (1984) system for anterior teeth (incisors, canines, and premolars) and Scott’s (1979) system for molars were adopted. Degrees of cranial suture closure were recorded according to the criteria of Meindl and Lovejoy (1985). Morphological changes of the pubic symphyseal face were scored following the scoring system of Todd (1921a, b). Estimation of age-at-death of the subadult remains was based on dental calcification and eruption, following the scale of Ubelaker (1989).

No. 1: sex, male; age, old adult (50–60 years old)

This skeleton is well preserved with an almost complete skull. The narrow greater sciatic notch and subpubic angle indicate that the sex is male. The tooth crown surfaces are heavily worn (anterior teeth, score 5; molars, score 6). The

Figure 2. Frontal and lateral views of the skulls from the Hasekouji-Shuhen site.

sagittal and lambdoidal sutures are completely fused on both the outer and inner surfaces (stage 3, complete obliteration). The pubic symphyseal face exhibits well-defined rims and irregular ossifications (phase 10). Age at death of this individual is estimated to be old adult (50–60 years).

The facial skeleton is characterized by a prominent glabella region, flat superciliary arch, thin nasal bones, flat nasal root, rectangular orbital shape, over-bite occlusion at the incisors, and a high facial height (upper facial height, 71 mm). The maxillary central incisors exhibit marked shoveling (depth of lingual fossa, 1.09 mm).

This skull shows a deep depression on the outer surface of the frontal bone (Figure 3). The depressed area expands toward the sagittal plane and measures 3 cm by 1 cm. There is no evidence of healing. The inner surface of the frontal bone projects inwards in this area. This injury might be due to an attack with a sharp implement.

There were no dental caries in this individual.

Figure 3. Scars found on the right side of the frontal bones in three individuals from the Hasekouji-Shuhen site.

No. 2: sex, male; age, young adult (20–30 years old)

This skeleton is almost complete. The sex is male judging from the os coxae. The tooth crown surfaces are slightly worn (anterior teeth, score 2; M1, score 5; M2 and M3, score 3). The major cranial sutures (coronal, sagittal, and lambdoidal) are not fused ecto- or endocranially (degree 0). Age at death of this individual is estimated to be young adult (20–30 years).

The facial skeleton is very high (upper facial height, 75 mm). The orbital shape is round. The glabella region, superciliary arch, and nasal root are flat. Incisor edge-to-edge occlusal bite is observed. The maxillary central incisors show marked shoveling (depth of lingual fossa, 1.38 mm).

Dental caries were observed in four teeth: the maxillary left first and right second molars, and the right and left mandibular second molars. Of these, the left maxillary first molar exhibit severe carious destruction that has led to the crown of this tooth being entirely lost. In the other molars, caries occur as small pits that have eroded the tooth crown grooves.

No. 3: sex, female; age, middle-aged adult (30–40 years old)

This skeleton is well preserved. The pelvis indicates that the sex is female. The moderately worn tooth crown surfaces (anterior teeth, score 4; molars, score 6), unfused major sutures of the calvarium (stage 0), and the fine-grained pubic symphyseal face (phase 6) indicate that this individual is a middle-aged adult (30–40 years).

The facial skeleton is relatively low (upper facial height, 64 mm). The orbital shape is square and the orbits are placed high. The glabella region, superciliary arches, and nasal root are very flat. The incisor occlusal pattern shows an over-bite. The maxillary central incisors are moderately shovel-shaped (depth of lingual fossa, 0.95 mm).

Dental caries were observed in the right maxillary central incisor, the mandibular second molars of both sides, and the left mandibular third molar. The mesial half of the superior crown of the right maxillary central incisor is missing, a deep pit was observed on the surface of the worn dentine, obviously not due to attrition. Although some postmortem chipping is visible on the maxillary central incisor, the depth of the lesion suggests caries. The mandibular molars have small eroded pits on the tooth crown grooves and fissures.

No. 4: sex, male; age, middle-aged to old adult (35–60 years old)

The skull is well preserved except for the cranial base. The pelvic indicators clearly suggest the sex is male. The tooth crown surfaces are heavily worn (anterior teeth, score 5; molars, score 8). The major sutures of the calvarium are partially or completely fused on the outer surfaces (coronal, stage 1; sagittal and lambdoidal, stage 3) and are completely fused on the inner surfaces (stage 3). The pubic symphyseal face is fine grained although furrows still remain (phase 6). From these findings, the age at death of this male is estimated to be between middle-aged and old (35–60 years).

The facial skeleton is relatively high (upper facial height, 69 mm), the orbital shape is rounded, the glabella region is weakly developed, and the superciliary arches are flat. The

degree of the shovel-shaped incisors is unclear due to heavy attrition. Incisor occlusion shows over-bite.

Dental caries were found in the left maxillary first molar and the mandibular first molars on both sides. The crown of the left maxillary first molar is completely missing due to severe caries. Alveolar abscess is present at the roots of the right maxillary first molar.

No. 5: sex, male; age, middle-aged adult (30–40 years old)

This skeleton is nearly complete. Based on the os coxae, the sex of this skeleton is male. The age at death is estimated to be middle-aged (30–40 years), from the moderately worn teeth (anterior teeth, score 4; molars, score 5), the mostly fused major cranial sutures on the endocranial surfaces (stage 2), and the somewhat granular appearance of the pubic symphyseal face despite the presence of some ridges and furrows (phase 5).

The skull possesses a high facial skeleton (upper facial height, 71 mm), slightly protruding glabella, and rounded orbital margins. Incisor occlusion is not observable due to the missing maxillary incisors.

Dental caries were observed in four maxillary teeth: the left first premolar, the right first and third molars, and the left third molar. The left third molar exhibits erosion at the dental cervical line on the buccal side due to severe caries. The other teeth are eroded on the occlusal crown surfaces.

Three shallow cut marks are observed on the right side of the frontal bone in the temporal fossa region (Figure 3). The outer two cut marks are short in length, less than 1 cm long, while the middle one is about 4 cm long.

Other skeletal lesions are observed in this skeleton. Large bony growths form sessile protuberances in the distal metaphyseal areas of the femora, tibiae, and fibulae (Figure 4). The right forearm bones exhibit severe shortening associated with strong radial and ulnar bowing, marked deformations at the radio-ulnar distal joints, and subsequent posterior dislocation of the ulna. According to T. Suzuki (personal communications), these characteristics are most likely due to multiple cartilaginous exostosis rather than enchondromatosis, myositis ossificans, or chondrosarcoma. Suzuki will report on further details of this pathology elsewhere.

No. 6: sex, female; age, middle-aged adult (30–50 years)

This skeleton is only partly preserved. Portions of the cranium and the lower leg bones are preserved. The gracile cranium with small mastoid processes suggests that the sex is female. The tooth crown surfaces are moderately worn (anterior teeth, score 4; molars, score 6). Dental caries are not observed in the teeth present.

No. 7: sex, unknown; age, child (about 5 years)

This skeleton is relatively well preserved. The deciduous teeth are fully erupted and the first permanent molars are visible in the alveoli. The age at death is estimated to be approximately 5 years. Dental caries is not observed in any of teeth of this child.

No. X-1: sex, male; age, middle-aged adult (40–50 years)

The skull is nearly complete, although the preservation of

Figure 4. The skeletal lesions in the adult male No. 5 diagnosed as multiple cartilaginous exostosis (upper left, upper limb bones; upper right, lower limb bones; lower left, close up of the right radius and ulna; lower right, close up of lower limbs around knee joint).

the postcranial bones is poor. The pelvis indicates the sex is male. The tooth crown surfaces are heavily worn (anterior teeth, score 5; molars, score 7). Only the coronal suture is completely fused on the inner surface (stage 3). The age at death is estimated to be middle-aged (40–50 years).

The cranium exhibits robust features. The glabella region and superciliary arches are prominent. The nasal root is moderately concave. The orbital shape is square. The facial skeleton is high (upper facial height, 71 mm). The degree of shoveling of the maxillary incisors is weak (depth of lingual fossa, 0.34 mm). Incisor occlusion shows over-bite.

Dental caries were observed on the distal crown surfaces of the left upper first molar and on the cervical line of the mesial side of upper second molar.

This cranium has a wide scar on the right forehead region of the frontal bone (Figure 3). A bony ridge runs obliquely for a length of 5 cm, although no cut marks are present. This injury was obviously ante-mortem because there is clear evidence of the bone healing around the lesion. There is a possibility that the damage was caused by a simple fracture; however, the fracture is not traceable on the inner surface of the frontal bone. We speculate that the damage resulted from an attack with a sword-like weapon.

Cranial Metrics

Cranial measurements were recorded by one of us (H.M.), following the method of Martin and Saller (1957). The facial flatness measurements were recorded according to the methods outlined in Yamaguchi (1973). The results of the cranial measurements of the Hasekouji-Shuhen series are given in Table 3. The mean values are presented only in males

Table 3. Cranial measurements (mm) of the Hasekouji-Shuhen series

Specimen No.	1	2	3	4	5	X-1	Male average	
Sex	Male	Male	Female	Male	Male	Male	Mean	SD
1. Maximum cranial length	181	187	180	183	176	180	181.4	4.0
5. Basion–nasion length	105	104	95		97		102.0	4.4
8. Maximum cranial breadth	136	141	124	138	141	141	139.4	2.3
9. Minimum frontal breadth	92	91	88	87	96		91.5	3.5
10. Maximum frontal breadth	115	118	108	111	116		115.1	2.7
17. Basion–bregma height	140	145	135		136		140.3	4.5
25. Sagittal arc	362	388	358	376	358	378	372.4	12.3
26. Frontal arc	123	130	116	130	125		127.0	3.6
27. Parietal arc	131	139	128	125	119		128.5	8.5
28. Occipital arc	108	118	114	120	116		115.5	5.3
40. Basion–prosthion breadth	99	98	89		94		97.0	2.6
43. Upper facial breadth	101	107	102	97	109		103.5	5.5
45. Bizygomatic breadth	136	143	128	133	146	136	138.6	5.7
46. Bimaxillary breadth	106	106	102	106	107		106.1	0.4
48. Upper facial height	71	75	64	69	71	71	71.5	2.3
51. Orbital breadth	42	41	42	41	44	43	42.1	1.4
52. Orbital height	33	34	35	34	39	35	35.2	2.5
54. Nasal breadth	28	24	27	28	26	25	26.2	2.0
55. Nasal height	52	52	50	52	56	55	53.2	1.7
66. Bigonial breadth	108	120	94	105	110		110.6	6.7
68. Mandibular length	78	84	85	84	82		82.2	2.9
69. Symphyseal height	33	38	30	36	35		35.6	2.0
70. Ramus height	64	69	67	61	69		65.9	3.9
71. Ramus breadth	38	36	35	39	36		37.2	1.7
8:1. Cranial index	75.1	75.4	68.9	75.4	80.1		76.5	2.4
17:1. Length–height index	77.3	77.5	75.0		77.3		77.4	0.1
17:8. Breadth–height index	102.9	102.8	108.9		96.5		100.7	3.7
48:45. Upper facial index	52.2	52.7	50.1	52.2	48.7		51.5	1.8
48:46. Upper facial index (Virchow)	66.9	71.1	62.8	65.4	66.7		67.5	2.5
52:51. Orbital index	79.6	83.4	83.2	83.6	89.6		84.1	4.1
54:55. Nasal index	53.7	45.4	54.2	54.2	47.3		50.1	4.4
Frontal chord	94.0	96.8	94.7	92.6	101.5	102.0	97.4	4.0
Frontal subtense	14.5	15.8	9.4	13.6	17.2	17.0	15.6	2.9
Frontal index	15.5	16.3	10.0	14.7	16.9	16.6	16.0	2.6
Simotic chord	6.5	6.0	5.9				6.2	0.3
Simotic subtense	2.5	1.7	1.1				2.1	0.7
Simotic index	38.4	28.9	18.6				33.7	6.7
Zygomaxillary chord	103.9	107.9	100.9	102.0	103.8	104.5	104.4	2.4
Zygomaxillary subtense	19.9	19.5	18.1	20.3	21.3	24.5	21.1	2.2
Zygomaxillary index	19.1	18.1	17.9	19.9	20.5	23.4	20.2	2.0

because of the small number of female specimens.

A comparison of the standardized means of the ten cranial linear variables and nine indices of the Hasekouji-Shuhen males is provided in Figure 5, together with the standardized means of the medieval Kamakura period Zaimokuza series (Suzuki, 1956) and the protohistoric Kofun series from eastern Japan (Yamaguchi, 1987). The means and standard deviations of the modern Japanese series of Morita (1950) were used in standardizing the means of each skeletal series; the standardized means are the relative deviations from the modern Japanese means. The overall pattern of the standardized means of the Hasekouji-Shuhen series resembles that of the Kofun sample of eastern Japan, while that of the Kamakura sample differs from the Hasekouji-Shuhen pattern. In the measurement items that exhibit a difference of the standardized means of greater than 0.5 units, the Hasekouji-Shuhen means are larger than those of the Kofun and Kamakura series in the cranial and facial height measurements, as represented by basion–bregma height, upper facial

height, orbital height, and nasal height. The facial skeleton of the Hasekouji-Shuhen sample is much higher than that of the Kamakura and Kofun samples, as indicated also by the upper facial index. The indices of facial flatness of the three protohistoric/historic series are very similar; all three series are characterized by flatter faces than the modern Japanese.

The standardized means of the Yayoi (northern Kyushu and Yamaguchi prefecture) and Jomon cranial series are also provided in Figure 5. The cranial measurements of the Yayoi series were taken from Nakahashi et al. (1989) and the facial flatness measurements from Ishida (1992). The cranial measurements of the Jomon series were recorded by Suzuki (1969), and facial flatness measurements of the same series were recorded by Yamaguchi (1980). In this comparison, the Hasekouji-Shuhen sample resembles the Yayoi rather than the Kofun series (Figure 5). The close morphological affinity between the Hasekouji-Shuhen and Yayoi series is due to the larger orbital, nasal, and upper facial heights of the Yayoi sample, which are not seen in the Kofun sample. On the

Figure 5. Standardized means of 10 cranial measurements and 3 facial flatness indices of the Hasekouji-Shuhen and the comparative series. The modern Kanto Japanese male means and standard deviations were used in the standardization of sample means.

other hand, the Jomon series exhibits a pattern that contrasts with that of the Hasekouji-Shuhen sample, especially in the low upper facial index.

In order to further examine the cranial affinities of the Hasekouji-Shuhen series, Penrose's shape distance (Penrose, 1954) and a distance measure ($1-r$) based on the Q -mode correlation coefficient were computed using eight cranial measurements (Martin's numbers 1, 8, 45, 48, 51, 52, 54, and 55) (Table 4). The results of either of the two methods place the Hasekouji-Shuhen males closest to the Yayoi, and well separated from the Jomon.

Dental Metrics

The mesiodistal and buccolingual tooth crown diameters of the permanent dentition of the Hasekouji-Shuhen series were recorded by one of us (H.M.), following the method of Fujita (1949). The measurements were taken on teeth from the right side, except when the right side tooth was missing or heavily worn, in which case the left side was measured. The results are given in Table 5. The means values are given only in males, because there was only one female specimen.

Using the means and standard deviations of modern Japa-

Table 4. Distance from the Hasekouji-Shuhen males to six comparative population samples based on 8 cranial and 28 tooth crown measurements

	Distance by skull		Distance by teeth	
	Cq^2	$1-r$	Cq^2	$1-r$
Medieval Kanto Kamakura	0.583	0.131	0.291	0.756
Kanto Kofun	0.284	0.047	0.507	1.159
Yayoi immigrants	0.167	0.017	0.371	0.743
Kanto Jomon	0.976	0.155	0.347	1.144
Modern Kanto Japanese	0.276	0.053	0.374	0.856

Cq^2 , Penrose's shape distance; $1-r$, distance derived from the Q -mode correlation coefficient.

nese males (Matsumura, 1989), the standardized means of the 28 tooth crown diameters of the Hasekouji-Shuhen male sample were calculated (Figure 6). We also included the following male series in this comparison: Kanto Jomon, Yayoi, a Kofun sample from eastern Japan, and medieval Kamakura from the Kanto region (Matsumura, 1989, 1990, 1994). As shown in the upper portion of Figure 6, the Hasekouji-Shuhen pattern of the standardized means is very different

Table 5. Dental crown measurements (mm) of the Hasekouji-Shuhen series

No.	1	2	3	4	5	X-1	Male average	
Sex	Male	Male	Female	Male	Male	Male	Mean	SD
Mesiodistal diameters								
UI1	8.41	9.18	8.77			8.69	8.76	0.39
UI2	7.37	8.25	7.05			6.07	7.23	1.10
UC	8.00	8.77	8.00		8.11	7.53	8.10	0.51
UP1	6.74	7.53	7.47		7.31	7.18	7.19	0.33
UP2	6.32	7.09	7.12		6.84	6.25	6.63	0.41
UM1	10.35	11.07	10.58				10.71	0.51
UM2	9.86	10.02	10.13		10.73		10.20	0.46
LI1	5.05	5.60	5.27			5.10	5.25	0.51
LI2	5.82	6.74	6.16		5.66	5.98	6.05	0.48
LC	7.01	7.40	7.49		6.82	6.86	7.02	0.26
LP1	6.34	7.72	7.09		6.51	7.42	7.00	0.68
LP2	6.95	7.60	7.62		6.13		6.89	0.74
LM1	11.03	11.86	11.85		11.05		11.31	0.47
LM2	11.05	11.67	11.47		10.85		11.19	0.43
Buccolingual diameters								
UI1	7.76	7.51	7.83	7.74		7.72	7.68	0.12
UI2	7.10	7.12	7.67	6.55		6.30	6.77	0.41
UC	8.73	9.15	8.13	8.68	8.87	8.53	8.79	0.23
UP1	9.33	10.15	10.10	9.51	10.10	9.64	9.75	0.36
UP2	9.35	10.09	10.33		9.35		9.60	0.43
UM1	11.71	12.63	12.85		11.45	11.93	11.93	0.51
UM2	12.27	12.43	12.26		12.13		12.28	0.15
LI1	6.44	5.90	6.15	6.10	6.34	6.34	6.22	0.22
LI2	6.29	6.37	6.65	6.84	6.38	6.89	6.55	0.29
LC	8.88	7.96	8.19	8.68	8.16	8.00	8.34	0.42
LP1	8.30	8.22	8.84	8.21	7.64	8.35	8.14	0.29
LP2	8.69	8.07	9.27		8.93		8.56	0.44
LM1	11.27	11.35	11.14		10.47		11.03	0.49
LM2	10.69	11.04	10.72		10.21		10.65	0.42

Figure 6. Standardized means of 28 dental tooth crown measurements of the Hasekouji-Shuhen and the comparative series. The modern Kanto Japanese male means and standard deviations were used in the standardization of sample means.

from that of the Kamakura and Kofun series. Compared with the Kanto Jomon and the Yayoi immigrant series (Figure 6, bottom), the Hasekouji-Shuhen series shows a close affinity to the Yayoi immigrant series only in the buccolingual diameters.

Penrose's shape distance (Penrose, 1954) and a distance measure ($1-r$) based on the Q -mode correlation coefficient were computed between the Hasekouji-Shuhen males and the comparative series, using the 28 tooth crown diameters presented in Table 4. Both distances indicate that the Hasekouji-Shuhen and medieval Kamakura samples are morphologically close. Examination of the Q -mode correlation coefficients indicates an affinity between these and the Yayoi series as well.

Limb Bone Metrics

The limb bone measurements of the Hasekouji-Shuhen series are given in Table 6. Because of anomalies in the right forearm and leg bones noted for Burial No. 5, the following comparisons were made using data only from the left side.

Some metric indices and estimated stature based on the limb bone measurements were compared with data available for the following comparative series: Yayoi from western Japan (Nakahashi et al., 1989), a Kofun sample from eastern Japan (Yamaguchi, 1987), and a combined Jomon sample from all regions of Japan (Yamaguchi, 1989). This comparison was made only with males, because there was only a single female specimen from Hasekouji-Shuhen. The

Table 6. Limb bone measurements (mm) of the Hasekouji-Shuhen series

Specimen No.	1	2	3	4	5	5	6	X-1	Male average ¹	
Sex	Male	Male	Female	Male	Male		Female	Male	Mean	SD
Humerus	Left	Left	Left	Left	Left	Right		Left		
1 Maximum length	289		300	300	310	314			299.7	10.5
4 Biepicondylar width	64		56	57	60	57			60.7	3.4
5 Maximum midshaft diameter	22	24	20	20	21	20		24	22.1	2.0
6 Minimum midshaft diameter	20	21	15	16	17	16		16	18.0	2.1
9 Transverse head diameter	46		39	41	44	42			43.2	2.5
10 Sagittal diameter of the head	48		40	39	47	45			44.5	5.1
6:5 Index of cross-section of midshaft	90	84	75	83	81	80		69	81.5	7.8
Radius	Left	Left	Left	Left	Left	Right		Right		
1 Maximum length	217	235	235	240	218	154			227.5	11.7
4 Transverse shaft diameter	15	16	13	13	15	15		19	15.6	2.1
5 Sagittal shaft diameter	13	13	11	12	12	13		12	12.3	0.3
5:4 Index of cross-section of midshaft	82	76	86	92	83	87		67	79.9	9.3
Ulna	Left	Right	Left	Right	Left	Right		Left		
1 Maximum length	239	260	250	260	240	152			249.8	11.8
11 Dorsovolar shaft diameter	18	15	13	13	16	15		13	14.9	1.8
12 Transverse shaft diameter	14	17	12	16	16	13		16	15.9	0.9
11:12 Index of cross-section of midshaft	122	88	106	80	99	115		81	94.0	17.2
Femur	Left	Left	Left	Left	Left	Right		Right		
1 Maximum length	412		422	422	415	397		423	418.0	5.4
6 Sagittal midshaft diameter	29	30	29	26	30	31		28	28.6	1.5
7 Transverse midshaft diameter	27	29	26	27	28	26		30	28.3	1.0
18 Medio-head diameter	49		43	43	48	48			46.8	3.7
19 Transverse diameter of the head	48		43	43	48	47			46.4	3.0
6:7 Index of cross-section of midshaft	107	102	110	96	106	119		94	101.0	5.7
Tibia	Left	Right	Left	Left	Left	Right	Right			
1a Maximum length	333				330	344	312		331.5	2.1
8 Maximum midshaft diameter	30	34	28	29	29	28	24		30.4	2.2
9 Transverse midshaft diameter	24	23	19	22	22	22	21		22.8	1.1
9:8 Index of cross-section of midshaft	80	68	68	75	78	79	87		75.1	5.3
Fibula	Left	Left	Left	Left	Left	Right	Left			
1 Maximum length	324				324	322			324.0	0.0
2 Maximum midshaft diameter	16	17	12	13	17	18	12		16.0	1.7
3 Minimum midshaft diameter	10	13	10	12	11	12	9		11.6	1.5
3:2 Index of cross-section of midshaft	61	78	83	90	65	67	76		73.5	13.3
Radiohumeral index	75.1		78.3	80.0	70.3	49.0			75.1	4.8
Tibiofemoral index	80.8				79.5	86.6			80.2	0.9
Estimated stature	162.0	160.0	156.0	164.0	157.4	153.0			160.9	2.8

¹ Data from the right side of individual No. 5 were not included in the basic statistics because of skeletal abnormalities.

Hasekouji-Shuhen pilastric index of the femur (index 6:7, mean 101.0) is most similar to that of the eastern Japan Kofun (mean 102.2); the Hasekouji-Shuhen mean is smaller than both the Yayoi (106.4) and Jomon (110.6) means. The Hasekouji-Shuhen tibial mid-shaft index (index 9:8, mean 75.1) is closer to the Yayoi (72.2) and Kofun (73.8) means than to the Jomon mean (69.8). The Hasekouji-Shuhen radiohumeral index (mean 75.1) is smaller than that of the Yayoi (mean 78.2) and much smaller than in the Jomon (mean 80.5). The Hasekouji-Shuhen tibiofemoral index (mean 80.2) is closest to the Yayoi (81.3), and less than the means of the Kofun (82.1) and Jomon (83.2) series.

The estimated stature of the Hasekouji-Shuhen individuals shown in Table 6 are mostly based on the maximum length of the femur, using Fujii's formulae (Fujii, 1960). The stature of Burial No. 2, from which the femora were missing, was calculated using the maximum length of the radius. The mean male stature of the Hasekouji-Shuhen series is 160.9 cm, which is intermediate between that of the Yayoi (162.6 cm) and the Kofun series (160.4 cm), but higher than that of the Kamakura (159.0 cm) and Jomon (159.1 cm), according to the estimates of Hiramoto (1972).

Discussion and Conclusions

The results of the AMS dating, 670–970 calAD, reveal that the human remains from the Hasekouji-Shuhen site do not belong to either the Yayoi or the protohistoric Kofun periods. They most likely date to the early historic Asuka (500–710 AD), the subsequent Nara (710–794 AD), and early Heian (794–1192 AD) periods. Although the skeletons are not of Yayoi age as initially thought, these specimens are important because of the scarcity of ancient human skeletal remains from the early historic Asuka–Nara–Heian periods in Japan.

In debating the population history of Japan, one crucial topic of interest is the nature and degree of influx of immigrant people from the Asian continent, from the Yayoi to Kofun and early historic periods (Hanihara, 1987, 1991). Thus far, well-dated Yayoi skeletons have been found only from a few sites in eastern Japan (Yoneda et al., 2005). In the Kanto region, human skeletal remains associated with the Yayoi period were discovered at the Awajinsha site in Chiba prefecture (Suzuki, 1969), the Bishamon and Ourayama sites in Kanagawa prefecture (Suzuki, 1969, 1998), and the Iwatsubo site in Gunma prefecture (Kaifu, 1992)—all these remains are generally poorly preserved. Of these five Yayoi sites, Matsumura (2001) found characteristics in the dental measurements of the Bishamon specimens that were suggestive of immigrant affinities. By contrast, the sites from the Kofun period have yielded a large number of human skeletal remains that allow the study of the impact of the new immigrants. Several studies have demonstrated that the Kofun remains of the Kanto region retain cranial metric features of the Jomon to a certain extent, although genetic admixture of the immigrants is considered to have been large even in eastern Japan (Morisawa, 1976; Hanihara, 1987; Mizoguchi, 1988; Matsumura, 2001). Given the early historic date of the skeletons from the Hasekouji-Shuhen site, the degree of immigrant genetic influence in this series, as

expressed in their skeletal and dental morphology, is worth mentioning.

In general, the skeletons from the Hasekouji-Shuhen site are characterized by large upper facial heights, high orbital openings, flat nasal roots, strongly developed shovel-shaped maxillary incisors, and relatively tall stature. These features are commonly seen so far in the Yayoi skeletons of western Japan. The results of the distance analysis of the present study, based on cranial measurements, confirm the close similarity of the Hasekouji-Shuhen sample to the Yayoi rather than to the Kofun people of eastern Japan. The comparison of limb bone proportions further demonstrates the similarities between the Hasekouji-Shuhen and the Yayoi series, although the affinity with the Yayoi series is not clearly indicated in the dental measurements. These findings suggest a strong influence from the Yayoi or subsequent immigrants on the Hasekouji-Shuhen people of the early historic period.

As is well known, the people of medieval Kamakura (13–14th centuries), represented by the sample from the Zaimokuza site, which is located close to the Hasekouji-Shuhen site, possess unique cranial features such as a dolichocranic cranium (male average cranial index: 74.2) and marked alveolar prognathism (Suzuki, 1956, 1969). The question arises as to whether they had acquired such specific characters during the medieval period or before. Alveolar prognathism is not found in any of the Hasekouji-Shuhen specimens, though most of them possess relatively long cranial vaults (four of five individuals have cranial index values of about 75 or less, see Table 3). The cranial index values of the Hasekouji-Shuhen specimens are higher than in the Kofun sample from eastern Japan (Yamaguchi, 1987) (mean values: males, 78.7; females, 78.8), suggesting that cranial shape of the early historic Hasekouji-Shuhen people had already acquired the tendency toward a dolichocranic cranial shape.

Evidence of trauma was observed in three male skulls. It is of interest that all the injuries are on the right side of the frontal bone, suggesting right-handed fighting with a shield of some sort used with the left hand. Skeletal abnormalities were found in one adult male, whose right forearm bones were shortened and strongly curved, and whose lower limbs possessed a large bony growth forming sessile protuberances. Further paleopathological research is required to identify the cause of these bony lesions.

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Erratum:

Page 208, right column, line 31.

Now reads:

“...the Hasekouji-Shuhen specimens are higher than in the...”

Should read:

“...the Hasekouji-Shuhen specimens are lower than in the...”