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Material report: A partially mummified human remain excavated from the Shiroganecho nishi site, Shinjuku-ku, Tokyo

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Abstract This report aims to record the human skeletal remain with partial preservation of human soft tissue excavated from an archeological site (the Shiroganecho nishi site) of the Edo era. This individual was estimated to be a middle-aged male in the Samurai class according to his morphological characteristics of his skeletal remain and his burial system and accessories. The remaining soft tissues were restricted to the skin and muscles of the face, right ribs, lower vertebra, and right lower leg, except for the right eyeball. When excavated, these soft tissues remained wet and flexible, with movement in the joints. Thus, the reason as to why these soft tissues have remained in such a condition must not be due to mummification but rather adipoceration. Computed tomography images revealed that his right eye ball was well preserved and artificial teeth made of stones within his mouth.
KeyWords: Mummy, Edo era, anthropology, CT analysis, artificial teeth

Introduction

In Japan, human skeletal remains that adhere to soft tissues are rarely found in historical sites. While the precise reason that soft tissues remain preserved under certain conditions is unclear, the adipocere phenomenon may play a role as skin is sometimes white and soapy, with maintained flexibility and articulation, and sometimes soaked in groundwater upon discovery. Unfortunately, such preserved soft tissue findings tend to be briefly reported in archeological site reports only in Japanese (for example, the sample of 'No. 300' excavated from the Yanakamisakicho site: Kajigayama, 2000), and have never been researched and published in the field of physical anthropology in Japan.

The aim of this report was to record the human skeletal remain with partial preservation of human soft tissue excavated from an archeological site in Japan.

Material and Methods

This individual was excavated from the Shiroganecho nishi site, Shinjuku-ku, Tokyo, in 2019. This area was the cemetery of the Buddhist temple "Tentokuin" in the Edo era. During the excavation, ten pits for graves were found, which comprised eight human skeletal remains, one dog skeletal remains, and one human skeletal remain with partial preservation of soft tissue.

The individual described in this report is referred to as "No. 3", and was found in a partially fragmental ceramic pot, "Kamekan", that had been broken by a tomb stone that might have been a cover stone of a basement (Figure 1). Thus, this burial pit might have been disturbed by construction work between the burial of the Edo era and modern excavation. Some burial accessories, including two wooden imitation swords for ceremony, some porcelain sake cups, and sake bottles, were recovered from the site.

The preservation of this individual is shown in Figure 2–3. Almost all parts of the skeletal

Fig. 1. Photographs of the excavation of the ceramic pot, “Kamekan”, containing the human remains of No. 3. The figure on the right shows the grave stone that fell into the ceramic pot. The figure on the left shows the appearance of this individual after removing the grave stone.

Fig. 2. Photographs of the skull.

Fig. 3. Photographs of the postcranial bones.

Table 1. Mesurements of postcranial bones of 'No.3'

Martin No.	Measurements	Right	Left
Humerus			
1	maxiumu length	301.5	298.0
5	maximum diameter of midshaft	21.8	21.5
6	minimun diameter of midshaft	17.9	17.5
6/5	index	82.2	81.4
7a	midshaft circumference	64.0	63.5
Radius			
1	maxiumu length	231.0	225.5
4	maximum transverse shaft diameter	16.7	16.7
5	minimum sagittal shaft diameter	11.9	11.7
5/4	index	71.3	70.1
5(5)	midshaft circumference	44.5	43.5
Ulna			
1	maxiumu length	244.0	243.0
11	dorso ventral shaft diameter	12.9	12.9
12	transverse shaft diameter	16.8	16.2
11/12	index	76.8	79.8
3(a)	midshaft circumference	48.0	47.0
Femur			
1	maxiumu length		435.0
6	anterior-posterior diameter of midshaft		27.9
7	medio-lateral diameter of midshaft		25.7
6/7	index		108.5
5	midshaft circumference		83.5
Tibia			
1a	maxiumu length		360.0
8	sagittal diameter of midshaft		30.3
9	transverse diameter of midshaft		22.0
9/8	index		72.8
10a	circumference at nutrient foramen		93.5
Fibula			
1	maxiumu length		347.5
2	maximum diameter of midshaft		12.4
3	minimun diameter of midshaft		11.5
3/2	index		92.3
4	midshaft circumference		38.0

Fig. 4. Bilateral asymmetry of the first rib.
The distal end of the right first rib might have been fractured during his lifetime.

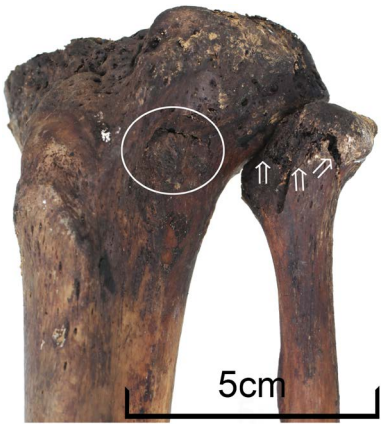

Fig. 5. Anterior-lateral view of the proximal parts of left tibia and left fibula.
The circle indicates the compression fracture and the double arrows indicate the linear fracture.

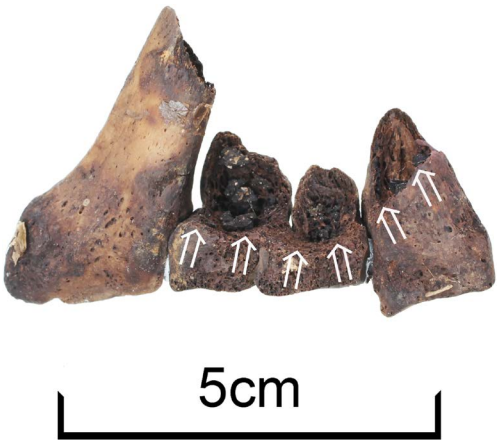

Fig. 6. Superior view of the left second to fifth metatarsal bones.
Double arrows indicate the continuous contour of broken parts of these metatarsal bones.

Fig. 7. A CT image of the orbital cavity.
The circle indicates the right eyeball of this individual.

remains were recognizable, except that the cranial vault was partially broken and some cervical vertebra and foot bones were missing. Soft tissues were identified on almost all bones, and a large number of them were adhered to the skull, right ribs, spinal column from the 7th thoracic vertebra to the sacrum, and the right lower leg. Seven hand nails also remained.

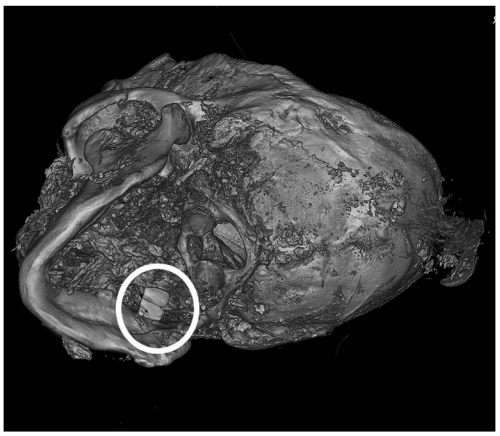

Fig. 8. Computer graphics reconstructed from CT images.
This image shows an inferior view of the skull. The circle indicates a high density artifact.

Fig. 9. Inferior view of the oral cavity before removing the leaves and biological tissues (upper panel) and after removing them (lower panel).
The circle indicates the artificial teeth covered with leaves and tissues.

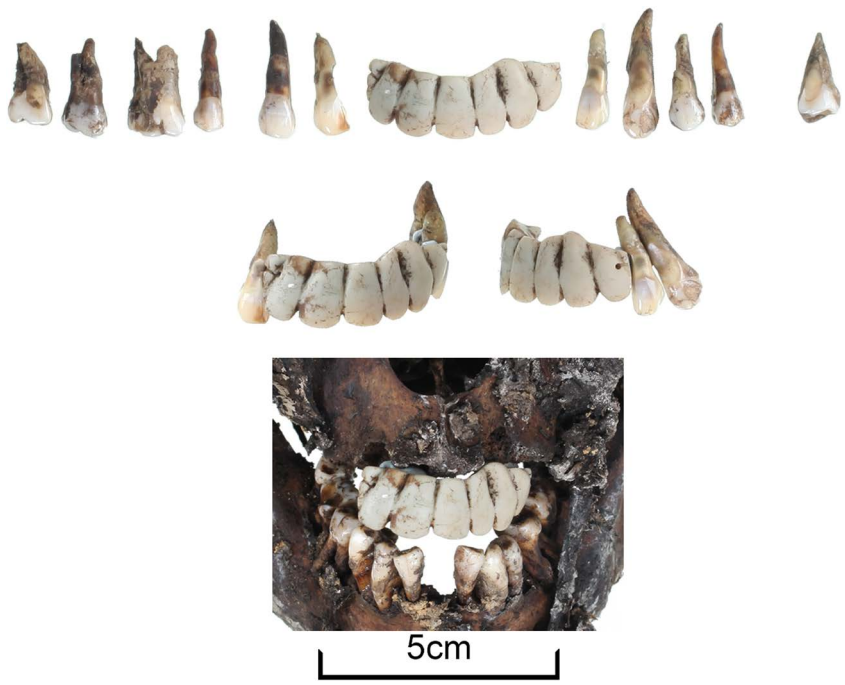

Fig. 10. Upper teeth and artificial teeth found in the oral cavity.
The upper panels show the buccal view of the eleven isolated teeth and the denture. The middle left panel shows the articulation of the right second incisor with this denture, and the middle right panel shows the articulation of the left second incisor and left canine with this denture. The lower panels show the fitting of this denture with the alveolar margin of maxilla.

When excavated, the soft tissues remained wet and flexible, and showed joint mobility. The reason as to why these soft tissues were preserved in such a manner is likely not due to mummification but rather adipoceration. In order to preserve these soft tissues for later research, they were rinsed gently and air-dried with an electric fan for two months.

The partial breakage of bones and the existence of soft tissues restricted the linear measurements of bones. Thirty variables of the postcranial bones were measured (Table 1).

The remaining soft tissues were superficial, except for the right orbital and oral cavities The skull was examined using high-resolution computed tomography (CT; InspeXio SMZ-225CT FPD HR, Shimadzu Corporation) to obtain additional information and provide a digital record for the future. The 3D images were rendered using the Radiant DICOM viewer software (Medixant, Poznan, Poland).

Results and Discussion

The burial system with a ceramic pot and burial accessories indicated that this individual belonged to the Samurai class during the late Edo era (Tanigawa, 2004; Sakaue, 2012).

The sex was estimated to be male, because of the narrow shape of the greater sciatic notch and relatively massive supraorbital ridges. The age-at-death was estimated to be between 30 and 49, because the morphology of the pubic symphysis indicated Phase 4 of the Suchey-Brooks system (Brooks and Suchey, 1990; Sakaue, 2006). The estimated stature was 162.3 cm with the formula of Fujii (Fujii, 1960).

The right first rib of this individual was shorter than the left one (Figure 4). The distal end of the right side was rounded, and the costal cartilage

was ossified and connected to the manubrium of the sternum. This seems to be the hypoplasia of the right first rib during his lifetime. There are some breakages in the skull and lower leg bones of this individual. An annular bone defect with a polished margin was apparent in the cranial value, and the color of this defect was as brown as that of the bone surface. A compression fracture with a diameter of approximately 1 cm was observed on the lateral surface of the proximal diaphysis of the left tibia, and there was a linear fracture in the proximal epiphysis of the left fibula (Figure 5). These fractures can be regarded as having the same impact on the proximal and lateral parts of the left lower leg. The left second to fifth metatarsal bones were preserved with only the proximal parts remaining and the distal ends worn away. In these articulations, the contours of the broken parts of the second to fifth metatarsal bones seem to be continuous (Figure 6). These damages seem to have occurred when he was around his death or just after death, as his body had kept articulation in the left lower leg and right foot. However, it is difficult to estimate the timing of these damages because this adipocerated body must have maintained its humidity long after his death. As one of the grave stones had fallen into the burial pot, it is plausible that some disturbance of the burial condition could have occurred after his burial and resulted in the breakages of these bones. This is why the preservation of soft tissues was restricted. Before this contamination, the body may have been fully adipocerated.

The CT images revealed that the right eyeball and surrounding muscles were preserved well enough to visualize the optic nerve, sclera, and lens (Figure 7). There were artificial teeth within the oral cavity, as well as leaves and biological tissues (skin, muscles, and teeth) (Figure 8 and 9). The artificial teeth were made of stone, which may be made of agalmatolite because the wooden plate dentures during the Edo era were sometimes decorated with artificial teeth of agalmatolite (Hasegawa, 2010). The upper margin of this denture was fitted with the alveolar margin of the maxilla (Figure 10, lower panel). The remaining eleven upper teeth were isolated (Figure 10, upper panel), and the right and left second incisors were shaved in their medial parts to fit the lateral aspects of the denture (Figure 10, middle panel). These findings indicate that the denture was designed only for this individual.

This paper reports the partially mummified human remains of an individual from the Edo era. In Japan, over 15 natural mummies (after adipoceration) have been excavated from archeological sites and stored in universities and museums. However, detailed studies have never been published, except for a few brief reports on excavations. If the opportunity is allowed, the publication of detailed reports on such findings will be beneficial to scientists in the field.

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