



Anthropological Research into Double Teeth of Upper Canines in Modern Japanese



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Abstract

One of the most important problems in orthodontics is the canine's double teeth. In this paper, double teeth are discussed in terms of orthodontics, anthropology, and dental anatomy. The appearance of double teeth in humans has not been observed in non-human primates. This phenomenon is thought to be specific to humans. In the course of human evolution, double-toothed fossils have already been found at the time of *Australopithecus africanus*, 2.5 million years ago. Double teeth have attracted the attention of the Japanese people since ancient times. In particular, the number of people with double teeth has been increasing today. This phenomenon is thought to be caused by the increase in tooth size due to high nutritional diet and the fact that the presence of the third molars does not degenerate the upper lateral incisors, thus narrowing the space for canine tooth eruption.

Keywords: Double teeth; Enlargement of tooth sizes; Incisor suture; World War II; Improvement of Dietary habits

Introduction

In Japan, a maxillary canine tooth that grows in protruding on the labial side of the dental arch is called a "Yae-ba" (tooth resembling double flowers). In orthodontics, it is called maxillary canine labial transposition, commonly referred to as double tooth, canine's double tooth, or labially protruding tooth. Clinically, the double tooth makes it difficult to close the mouth, which can lead to dryness of the mouth, decreased saliva production, and an increase in bacteria, which can cause bad breath (Figure 1). There was a time when double tooth was called "Oshi-ba" in Japan. In the "Kojiki," Japan's oldest extant book, it is written that a prince of the 17th emperor (first half of the 5th century) was called Prince of "Oshi-ba" because he had a projecting canine. The double tooth was a familiar appearance among the common people and was often used until a while ago because of its "childishness" and "small and cute" image. Although double teeth, especially in women, were a seductive attraction to the male eye, they are nowadays not so welcome. Rather, they have become the object of orthodontic treatment from an aesthetic and cosmetic point of view today. In Western society, such teeth are called devil teeth (devil fangs) because of their resemblance to animal fangs, giving them a bad impression.

History of the "Double tooth"

In the course of human evolution, it appears that the origin of double teeth can be traced back to the fossil hominid *Australopithecus africanus*, 2.5 million years ago [1]. It is thought that signs of double teeth may have begun to appear from at least this time. This fossil is specimen Stw 498 (Figure 1), excavated at the Sterkfontein site near Johannesburg, South Africa, and shows a maxillary canine tooth protruding labially between the maxillary lateral incisor and first premolar. This is probably the oldest example of a double tooth in the world today (Figure 2).

Why are there so many double teeth among modern Japanese?

One of the causes of double teeth is said to be that in the maxilla, the canine teeth erupt later than the first premolars. This is discussed below. Another cause of double teeth is the question of whether the teeth are more enlarged than before. This is because when enlarged teeth grow in, they protrude from the space that was originally needed and disrupt the dentition. This means that teeth that grow later will be outside the dentition. For instance, in TATS value (sum of the averages of the mesiodistal diameters from the central incisor to the second molar in the upper and lower jaws) [2-4], the values (male: 122.23 mm, female: 118.44

mm) of orthodontic patients with crowding including double teeth [5] were greater than the TATS values (male: 115.76 mm, female: 110.91 mm) of the general population [6] in both sexes. This means that orthodontic patients with the crowding, including double teeth, have larger teeth than the common people.

Causes of enlarged teeth

Possible causes of enlarged teeth are genetics and environmental influences. From the Edo era to today, there has been no influx of genes from abroad that would affect the physical changes of the Japanese people, so there is no genetic influence. The other is environmental factors. Before World War II, i.e., after the Meiji era, Western food culture, such as beef dishes, had been introduced, but the common people had no connection to it. In the Meiji and Taisho eras (1880s~1920s), common people often ate "barley rice" instead of expensive white rice. It was not until the Taisho era (1920s) that Western food became popular among the common people, especially in urban areas. However, from the start of the Japan-China War in 1937 to the end of the Pacific War in 1945, Japan was in the midst of an external war. Throughout this period, the national food began to run short. The food situation deteriorated due to the prolonged war.

After the end of World War II, eating habits improved dramatically, and the common people's lifestyles became richer as they had more opportunities to consume high-protein, high-

fat, nutritious foods. In the 1970s, family restaurants appeared on the scene, offering hamburgers and other Western-style foods at relatively low prices. Figure 3 compares prewar and postwar TATS values. In many areas of the Japanese archipelago, TATS values have increased in the postwar period. Even in studies with laboratory mouse, it has been reported that teeth have larger when they consume nutritious food [7-9].

Why do monkeys have no Double teeth?

Many monkey teeth do not show double teeth. In monkeys, as in humans, the maxillary canines erupt later than the first premolars (Table 1). So why are double teeth not seen in monkeys? It is because the growth of facial bones, especially incisor and maxillary bones, is different between humans and monkeys. In monkeys, this is because the incisal suture between the incisor borns and maxillary bones grow and enlarges the bone as the canines erupt, pushing the maxillary canines forward and into the correct position. Incisor sutures in monkeys do not fuse for a lifetime. Table 1 shows the eruption order of permanent teeth for cercopithecids (*Macaca fuscata*), great apes (*Pan troglodytes*), and humans (*Homo sapiens*). In Japanese monkeys, chimpanzees, and humans, the maxillary canines erupt later than the maxillary first premolar (P³). Therefore, the eruption of premolars earlier than canines in humans is not a cause of double teeth.

Table 1: Eruption order of permanent teeth for Japanese monkeys (*Macaca fuscata*), great apes (*Pan troglodytes*), and humans (*Homo sapiens*).

Cercopithecids	Japanese monkeys	Both jaws	M1→I1→I2→M2→P3→P4→C→M3
Great apes	Chimpanzee	Both jaws	M1→I1→I2→M2→P3→P4→C→M3
Humans	Modern people	Maxilla	M1→I1→I2→P1→C→P2→M2→M3
	Modern people	Mandible	I1→M1→I2→C→P1→P2→M2→M3

I1: central incisor; I2: lateral incisor; C: canine; P1: first premolar; P2: second premolar; P3: third premolar; P4: forth premolar; M1: first molar; M2: second molar. Upper row: Swindler (2002). Lower row: The Japanese Society of Pediatric Dentistry (1988)

Reasons for Double teeth in humans

The incisal sutures in the human maxilla fuse around 7 to 9 years of age when the maxillary incisors begin to erupt (Figure 3). By 10-11 years of age, when the canine teeth erupt, the incisal sutures have already fused and no forward movement of bone is expected. Sato [10] measured diameter (vertical distance from the midpoint of the left and right central incisors to the (primary) canine teeth) as 6.7 mm in the deciduous dentition phase, 9.0 mm in the mixed dentition phase, and 8.4 mm in the permanent dentition phase in the patients with normal occlusion. The results indicate that anterior growth from the incisal suture continues to increase until the early mixed dentition phase, when the maxillary incisors begin to erupt, but not later. So, there is no growth between the lateral incisors and first premolars (Figure 4), and therefore not enough space is available for them to erupt, resulting in double teeth. The double canine tooth phenomenon is believed to occur only in humans. This is because, first, incisal sutures fuse prematurely in humans, and second, each tooth is

enlarged, and if there is not enough space for the canine teeth to erupt, double teeth are more likely to occur. In other words, tooth enlargement is a major factor.

Relationship between Double tooth and third molar (M3)

In a study of orthodontic patients with double teeth and third molars in the maxilla, more than 90% of those with double teeth on one or both sides had third molars. In addition, all maxillary lateral incisors showed normal morphology in both sides. Sakai [11] considered the incidence of degenerate forms of maxillary lateral incisors to be about 6-10% in Japanese. In orthodontic patients, none of the lateral incisors on all 40 sides showed degenerate forms. Yamada and Kosio [12] found that the mesiodistal crown diameters of the maxillary anterior teeth were significantly larger in patients with crowding, including double teeth, than in the general population [13]. It is still thought that tooth enlargement has a strong influence on double teeth (Yamada, in preparation).



Figure 1: Maxillary canine's "Double" teeth.



Figure 2: Drawing of *Au. africanus* (Stw 498) from Moggi-Cecchi et al. [1]. Sketched by the author

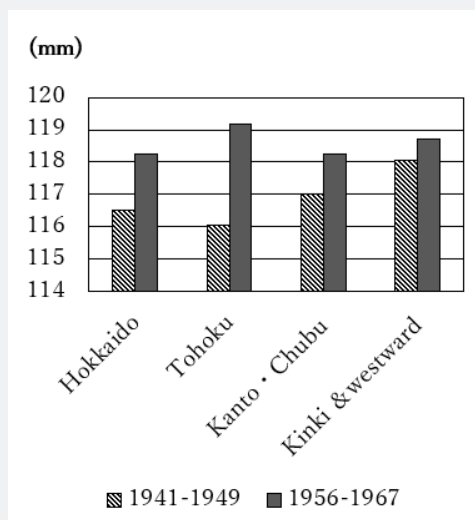


Figure 3: Comparison of prewar and postwar TATS values (modified from Suzuki [7]).

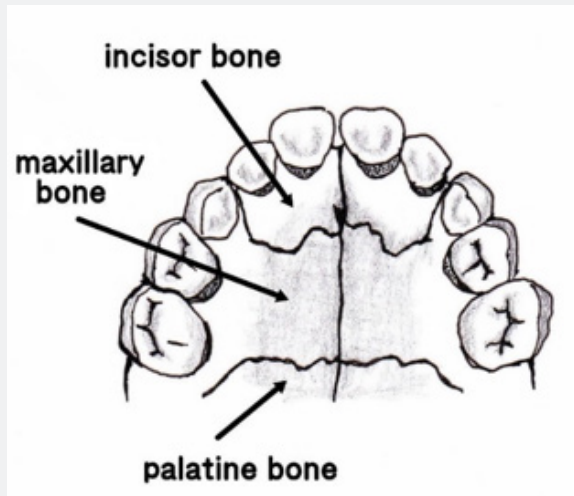


Figure 4: Incisor sutures in deciduous dentition.

According to Garn and Lewis [14] and Le Bot and Salmon [15], who studied the third molars in a population with European ancestry, when third molars are absent, the other remaining teeth are also smaller in size. However, according to Yamada et al. [16], who studied Japanese, when the third molars were absent, the other teeth became larger than controls, but only upper lateral incisor became smaller. In other words, the upper lateral incisor is unlikely to degenerate when all third molars are present. The larger teeth due to a high nutrition diet and the non-degeneracy of the upper lateral incisor due to the presence of third molars may have narrowed the space for canine tooth eruption, and this may have caused the appearance of the double tooth [17,18].

Conclusion

Double teeth are discussed in terms of orthodontics, anthropology, and dental anatomy. The appearance of double teeth in humans has not been observed in non-human primates. This phenomenon is believed to be unique to humans. During the course of human evolution, fossils of double teeth were already found at the time of *Australopithecus africanus* 2.5 million years ago. Double teeth have been of interest to the Japanese since ancient times. Especially in modern times, the number of people with double teeth is increasing. This phenomenon is thought to be caused by the increase in tooth size due to high nutritional diet and the fact that the presence of the third molars does not degenerate the upper lateral incisors, thus narrowing the space for canine tooth eruption.

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