論文内容の要旨

論文題目

Morphological interrelationship between the developing anterior teeth and mandible: a comparative study using four primate species including modern humans
（個体発生過程における歯牙と下顎骨の形態学的関連性：ヒトを含む４種の霊長類を用いた比較研究）

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Morphology of the mandibular corpus has been frequently accounted for from a biomechanical perspective in association with masticatory environments, but it has been also suggested that biomechanical factors alone cannot explain variation in corpus dimensions and proportions. Spatial requirement of anterior teeth has been indicated as another factor that may play a significant role in determining anterior corpus form of the mandible. However, most previous studies focused on the sizes of the adult tooth crown and mandible, and the interaction between dental and mandibular growth remains still unclear. The present thesis, therefore, evaluated the morphological interrelationship between the forming dentition and mandible in three particular studies.

In Chapter 1, an interpopulation comparison was made between prehistoric Jomon and modern Japanese mandibles. The juvenile mandible of the modern Japanese has a lower symphysis than that of the prehistoric Jomon, while the adult symphysis is conversely higher in the modern Japanese. This cannot be explained from population differences in masticatory environments. To examine whether spatial demands of the developing dentition could explain the higher anterior corpus of the adult modern Japanese mandible, tooth crypt size and placement patterns were investigated in the skeletal growth series of the two populations. Results showed that although the Jomon mandible had larger bicanine breadth than in the modern Japanese during growth, the modern Japanese has faster growing anterior teeth that became larger than those of the Jomon by the time of eruption, necessitating greater space. This is expressed as the faster growth rate of anterior alveolar height in the modern Japanese, measured as corpus height above the mandibular canal. Canine eruption distance and root length were greater in the modern Japanese than in the Jomon, corresponding to the increased difference of anterior corpus height between the two populations after canine eruption. However, the influence of tooth root length on anterior corpus height during later growth cannot be evaluated by this study. The present study suggests that the size and spatial dispositions of the developing anterior teeth have significant effects on symphyseal dimensions of the mandible until the time of tooth eruption.

In Chapter 2, relationships between canine size dimorphism and mandibular corpus form were examined in the hamadryas baboon and the Japanese monkey, known to display extreme and moderate canine dimorphism, respectively. Results of adult comparisons showed that all mandibular dimensions were significantly larger in the males than in the females in both species. In the hamadryas baboon, the males also exhibited higher proportion of anterior to posterior corpus heights than the females. This sex difference in corpus shape was not significant in the Japanese monkey, indicating lack of involvement of canine dimorphism. Analysis of mandibular growth patterns in the hamadryas baboon demonstrated that sexual size difference does not occur significantly before incisor eruption, and that the anteriorly high corpus of the adult male mandible was caused by fast increasing symphyseal height after incisor eruption. It is also shown that the female canine started erupting shortly after incisor eruption, while the forming male canine continued to stay near the mandibular base and further developed in size until eruption. The relative positions of the incisors kept shifting upwards even after eruption in the males, while they hardly changed in the females. It is therefore suggested that the prolonged development and size increase of the male canine is accompanied by further enlargement of the symphysis, resulting in the higher anterior corpus of the adult males compared to the adult females.

In Chapter 3, in order to rethink the functional significance of the cross-sectional geometry of the mandibular symphysis, spatial conditions of the developing anterior teeth were examined in the following four species: modern human, chimpanzee, Japanese monkey, and hamadryas baboon. Results showed some interspecies differences in the relative position of the lateral incisor crypt. The two cercopithecine primates had extremely narrow inter-canine breadth, and therefore their lateral incisor was developed posterior to the central incisor and above the canine until the time of eruption. In contrast, the modern human possessed broad bicanine space and small anterior teeth, resulting in a lateral incisor position between the central incisor and canine. In the chimpanzee, although bicanine breadth was large, the central and lateral incisors grew with a large anteroposterior overlap, due to their large incisor size. Furthermore, in the nonhuman primates, the position and contour of the lateral incisor crypt corresponded to the superior transverse torus on the lingual side of the symphysis. Species differences in the placement of the developing canine appeared to relate with inferior transverse torus form. It is therefore hypothesized that the transverse tori of the symphysis are produced in relation with spatial necessity of the developing dentition. However, species difference in symphyseal inclination was consistently expressed throughout ontogeny, and cannot be explained simply by a local tooth-jaw relationship. These results indicate that the species-specific symphyseal configuration is accountable in part to the placement patterns of the forming anterior dentition.

The results of the above three studies can yield the following general interpretations. (1) Overall population- and species-specific characteristics of the mandible [e.g. the ratio of mandibular

breadth to length, anterior mandibular breadth (bicanine distance), and symphyseal inclination] are determined early during ontogeny, regardless of condition of dental formation. (2) Subsequent dental development has a substantial involvement in local modification of anterior corpus morphology, which consequently produces populational or sexual differences in corpus height shape (Chapter 1 and Chapter 2) and species differences in the form of the transverse tori (Chapter 3). Thus, the results obtained in this thesis indicate the importance of understanding the spatial conditions of the developing teeth in interpreting mandibular morphology.