The Lamination of the Masseter Muscle in the Japanese Serow
(Capricornis crispus)

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Summary: The lamination of the masseter muscle in 21 Japanese serows of different sexes and ages was studied by the method of Yoshikawa et al. who proposed a lamination theory for this muscle. The masseter muscle in the Japanese serow was found to be composed of I) the proper masseter muscle which included 1) the first superficial, 2) the second superficial, 3) the intermediate and 4) the deep masseter muscles, in which the deep masseter muscle could be subdivided into a pars anterior and pars posterior and II) the improper masseter muscle which included 5) the maxillomandibular and 6) the zygomaticomandibular muscles, in which the maxillomandibular muscle was further divided into first and second layers. These findings indicate that the lamination of the masseter muscle in the Japanese serow is the same as that in the goat and sheep.

The masseter muscle of various ruminants including the goat, sheep, cow, Japanese mainland deer, nilgai, camel and giraffe as well as other mammals is divided essentially into I) the proper masseter muscle which includes 1) the first superficial, 2) the second superficial, 3) the intermediate and 4) the deep masseter muscles, in which the deep masseter muscle can be subdivided into a pars anterior and pars posterior and II) the improper masseter muscle which includes 5) the maxillomandibular and 6) the zygomaticomandibular muscles (Yoshikawa et al. 1961, 1962a, b, c and d, 1963, 1965a and b, 1969 and 1974). This lamination theory of Yoshikawa et al. was considered by Gaspard (1964, 1971 and 1972) to be the most suitable one in comparison with the similar theories proposed by other authors such as Allen (1880), Toldt (1905), Zlabek (1938) and Schumacher (1961). However, the manner of development of the six subdivided muscles in the masseter muscle varies from animal to animal. In this paper, the lamination of the masseter muscle in the Japanese serow is described in order to supplement the previous reports on ruminants.

Materials and Methods

Twenty-one Japanese serows of different sexes and ages were examined. Of these, 11 were preserved in 10% formalin solution and the remaining 10 animals were in a fresh state without any fixation. The specimens were dissected from both sides of the masseter muscle to examine the lamination of the...
masseter muscle according to the method of Yoshikawa et al. who proposed the lamination theory for this muscle.

Results and Discussion

When the skin of the face had been stripped off, the pars superficialis and pars profunda of the masseter muscle (P.N.A.) could be clearly distinguished (Fig. 1). The principal part of the first superficial masseter muscle (sup. I) arose from the facial tubercle with a strong tendon and terminated along the whole mandibular angle, while the remaining part arose from the whole facial crest with a weak tendon (Fig. 1). When the first superficial masseter muscle was overturned by cutting its muscular substance along the mandibular angle, a complex muscular arrangement became apparent. The orally situated muscle which arose from the anterior portion of the facial crest with the muscular substance, terminating on the mandibular tubercle with the strong tendon, was the first layer of the maxillomandibular muscle (maxi-mand. 1) (Fig. 2). The posterior muscle arose from the orbital portion of the facial crest with the muscular substance and terminated along the tendinous impression parallel along the mandibular angle with the tendon. Its anterior margin retracted more posteriorly than that of the first superficial masseter muscle. This was the second superficial masseter muscle (sup. 2) (Fig. 2). If the second superficial masseter muscle only was removed by cutting the muscular substance along the ventral border of the zygomatic arch, the underlying intermediate masseter muscle (interm) spread out in the same area, involving the tendon along the facial crest and the muscular substance on the mandibular branch (Fig. 3). The first and second superficial and intermediate masseter muscles of the Japanese serow are thus the same as those observed in the goat, sheep, cow, Japanese mainland deer, nilgai and giraffe (Yoshikawa et al. 1961, 1962d and 1969), but not the camel (Yoshikawa et al. 1962d), in which the anterior margin of the second superficial masseter muscle occupies the same level as that of the first superficial masseter muscle. Under the intermediate masseter muscle, the first layer of the maxillomandibular and the deep masseter muscles spread out (Fig. 4). The deep masseter muscle could be subdivided into a pars anterior and pars posterior by the intervening masseteric nerve (nm) (Fig. 4). The pars anterior of the deep masseter muscle can be recognized in the goat, sheep, cow and nilgai (Yoshikawa et al. 1961 and 1962d) as well as the Japanese serow, but not the camel and Japanese mainland deer (Yoshikawa et al. 1962d). However, in the cow and nilgai, a vestigial pars anterior is found only as a slender band of muscle on the other side of the masseteric nerve (Yoshikawa et al. 1961 and 1962d). The pars posterior which arose from the zygomatic arch with the muscular substance constituted the first layer (prof. post. 1) and terminated with the tendon along the ventral margin of the masseteric fossa (Fig. 4), under which the second layer (prof. post. 2) spread out, terminating with the muscular substance upon the mandible (Fig. 4) and further under which the third layer might be developed in different individuals. The pars posterior of the deep masseter muscle in the goat and sheep is subdivided into two layers (Yoshikawa et al. 1961) and in the cow, Japanese mainland deer, giraffe and camel into three layers (Yoshikawa et al. 1961, 1962d and 1969), while in the nilgai, not only is it separated into seven layers, but also the first and second precursory layers make an appearance (Yoshikawa et al. 1962d). In the Japanese serow, the pars posterior of the deep masseter muscle can be divided into two layers as observed in the goat and sheep. However, a poorly developed third layer may be present in different individuals. When the pars
anterior of the deep masseter muscle was removed, the whole first layer of the maxillo-mandibular muscle (maxil-mand. 1) became apparent. It took its origin with the muscular substance along the whole facial crest and the zygomatic arch, terminating on the mandibular tubercle and the tendinous line which connected the mandibular tubercle to the lateral base of the coronoid process (Fig. 5). Under this layer, the second layer of the maxillomandibular muscle was visible (maxil-mand. 2) taking its origin from the lateral surface of the maxilla with a reversed relation of the tendon and the muscular substance (Fig. 6). The maxillomandibular muscle is known to be divided into three layers, precursory, first and second, in the cow, Japanese mainland deer and nilgai (Yoshikawa et al. 1961 and 1962d) and into four layers, first, second, third and fourth, in the giraffe (Yoshikawa et al. 1969), while in the goat and sheep, just two layers, first and second, are recognized (Yoshikawa et al. 1961). The maxillomandibular muscle in the Japanese serow can be divided into two layers as observed in the goat and sheep. Behind the maxillomandibular muscle, the zygomaticomandibular muscle (zyg-mand) was recognized as a thin layer (Fig. 7). The zygomaticomandibular muscle is differentiated into three layers in the Japanese mainland deer and nilgai (Yoshikawa et al. 1962d) and into two layers in the giraffe (Yoshikawa et al. 1969), while in the goat, sheep and camel, it remains as a single layer (Yoshikawa et al. 1961 and 1962d). In the Japanese serow, the zygomaticomandibular muscle is similar to that of the goat and sheep.

References

Abbreviations in Figures

interm: M. masseter intermedius
maxil-mand. 1: M. maxillomandibularis, lamina prima
maxil-mand. 2: M. maxillomandibularis, lamina secunda
prof. ant: M. masseter profundus, pars anterior
prof. post. 1: M. masseter profundus, pars posterior, lamina prima
prof. post. 2: M. masseter profundus, pars posterior, lamina secunda
sup. 1: M. masseter superficialis, lamina prima
sup. 2: M. masseter superficialis, lamina secunda
temp. sup: M. temporalis superficialis
zyg-mand: M. zygomaticomandibularis
nm: N. massetericus

Explanation of Figures

Plate I

Fig. 1. The first superficial masseter muscle.
Fig. 2. The second superficial masseter muscle.
Fig. 3. The intermediate masseter muscle.
Plate II

Fig. 4. The pars anterior and pars posterior (1 and 2) of the deep masseter and the first layer of the maxillomandibular muscles.

Fig. 5. The first layer of the maxillomandibular muscle.

Fig. 6. The second layer of the maxillomandibular muscle.
Plate III

Fig. 7. The zygomaticomandibular muscle and the origin or insertion of each muscular layer.