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Comparative Studies upon the Infraorbital Canal and the Mandibular Canal in Dogs from Different Cephalic Types

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Comparative studies on infraorbital canal and mandibular canals as well as on infraorbital and mental foramina have been performed in 26 canine skulls (with mandibulae) from dolichocephalic dogs. Nineteen of them belonged to various breeds: Miniature Pinscher, Dachshund, Poodle, Drathaar, Collie, German Shepherd, Caucasian Ovcharka, Belgian Sheepdog, Dogue, Rottweiler and Shar Planinets. Another 7 skulls of mixed-breed dogs, obtained from the Stara Zagora Community Kennel were furthermore studied. It was found out that contrary to the infraorbital canal, the mandibular canal was with irregular margins. It was stated that the index infraorbital canal length/nasal bones length (Nasion/Rhinion) was with identical value only in Dachshunds (0.23). It was also observed that the ration of mandibular canal length and mandibular length varied within very narrow limits in purebred dogs as well as in mixed-breed dogs, being 0.58-0.62 and 0.59-0.62 respectively.

Key words: infraorbital and mandibular canal, dog, cephalic types.

Introduction

Data referring to the anatomy of canine breeds are still insufficient and are primarily about the dimensions of the foramen magnum [9, 10], cephalometric indices in growing and adult shepherd dogs [7, 8] as well as diagnostic imaging studies of normal nasal cavities and the paranasal sinuses in mesaticephalic dogs [2].

It is known that both the infraorbital and the mandibular canals are important from a clinical point of view, because the blood vessels and the nerves responsible for the blood supply and the inervation of teeth are located inside them. The biggest part of reported literature data are about the location of those foramina and canals in the dog as a species, without considering the type and breed-related peculiarities. There is not a uniform opinion about the number of mental foramina [3, 6, 11]. Also, there are no data about the ratio of both canals' lengths vs the length of nasal bones and the mandibula, respectively.

This motivated our interest in studying the particularities of both canals in dogs from different cephaic types as well as in mixed-breed dogs.

Material and Methods

Twenty-six canine skulls were included in the study. Nineteen skulls were obtained from different cephalic type canine breeds as follows: Miniature Pinscher, Dachshund, Poodle, Drathaar, Collie, German Shepherd, Caucasian Ovcharka, Belgian Sheepdog, Dogue, Rottweiler and Shar Planinets. Another 7 skulls of mixed-breed dogs, obtained from the Stara Zagora Community Kennel.

All skulls were taken from dead or euthanasized dogs. After skinning, they were soaked for several hours in running water. Afterwards, the heads were boiled in water, the soft tissues were removed and the skulls dried at room temperature. Then they were defatted in an ether/chloroform mixture (1:1) and bleached in 4% hydrogen peroxide solution.

Osteological investigations on the shape and the location of the infraorbital foramen, the mandibular foramen and the mental foramina were performed in all skulls. Using a caliper-gauge and Wilkins compasses, the following measurements were taken: ratio of the infraorbital canal to the biggest nasal bone length and ratio of the mandibular canal to the mandibular length.

The infraorbital canal length was taken between the maxillar and the infraorbital foramina and the mandibular canal length - between the mandibular foramen and the foramen magnum that in all cases was the middle foramen. The greatest nasal bones length was measured from the caudal margin of the frontonasal suture in the median plane (Nasion) to the rostral end of nasal process (Rhinion) according to the skull morphometry proposed by several authors [1, 4, 5, 8, 9, 12]. The length of mandibula was obtained between the caudalmost point of the condylar process to the rostralmost median mandibular point.

Both canals were examined on radiographs as well as on whole and previously bisected skulls and mandibulae in a lateromedial view. Into the canals of 3 mixed-breed dogs skulls, warmed 10% Pb_3O_4 solution in gelatine was injected. After the polymerization of gelatine, the skulls were bisected along the median plane and radiographs in lateromedial views were taken.

Results and Discussion

The radiological studies after the application of saturated lead tetroxide solution in aqueous gelatine in the arterial system of the head showed that both canals were distinctly differentiated from the adjacent bone tissue. Their shadow was more radiolucent due to the presence of air and soft tissues (blood vessels and nerves) within. Only the shadows of the filled infraorbital and mandibular alveolar arteries were dense and well visible. Only the apical parts of roots of carnassial teeth, P_4 and M_1 respectively, were bended inward to the cavity of canals (Fig. 1).

The osteological and osteoscopic studies revealed that in all skulls, the infraorbital foramen was located in the transverse plane between the third and the fourth premolars. The shape of the foramen was similar to an isosceles triangle in most breeds (Fig. 2). Only in Dachshunds, the foramen's shape was eliptical. The location of the infraorbital foramen could be detected via palpation through the skin in all cases.

The mental foramina in almost all studied mandibulae were three, the middle one being with the biggest dimensions, so we suggest that it could be specified as foramen magnum. The other two foramina, located anterior to and posterior to the foramen magnum, could be designated as rostral and caudal mental foramina, re-

Fig. 1. Radiograph of a canine skull from a mixed breed following application of saturated lead tetroxide solution in aqueous gelatine in the arteries. The margins of the infraorbital and the mandibular canals with the respective arteries are seen

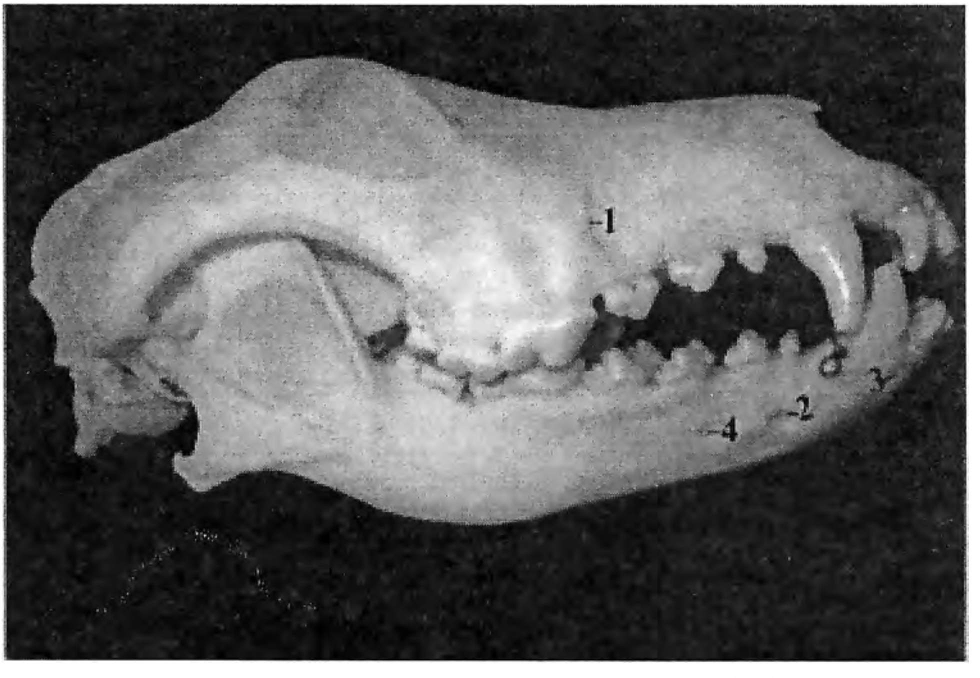

Fig. 2. Skull of German Shepherds: 1 — For. infraorbitale; 2 — For. mentale magnum; 3 — For. mentale rostrale; 4 — For. mentale caudale

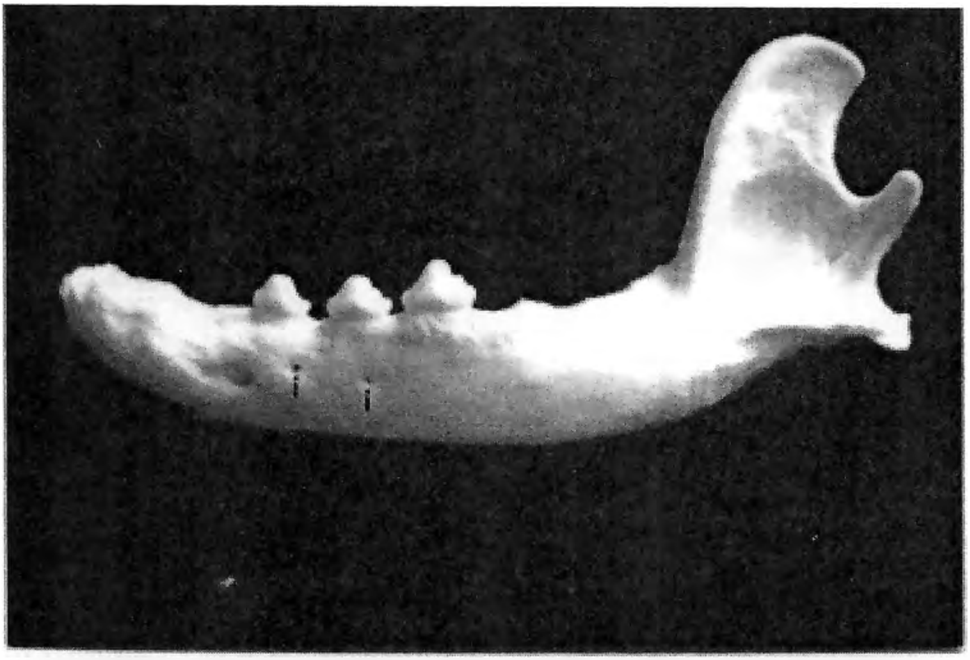

Fig. 3. Left mandibula of a Labrador with two caudal mental foramina (i)

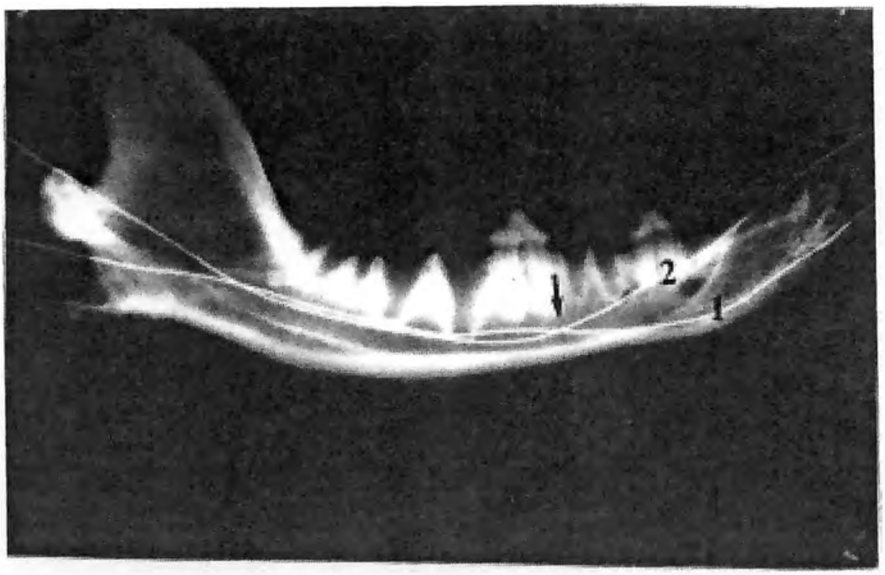

Fig. 4. Radiograph of the mandibula of a Labrador. A wire is inserted through the rostral and caudal mental foramina, that leaves through the mandibular foramen. The beginning (arrow) of canals for the rostral (1) and caudal (2) openings is visible

spectively. Only in one Labrador, two caudal mental foramina were observed on the left mandibula, located under the caudal halves of P_1 and P_2 at the level of the upper margin of the foramen magnum. The foramen magnum in Collies, German Shepherds, Belgian Sheepdogs and Caucasian Ovcharkas was situated at the rostral root of P_2, whereas the caudal mental foramen was positioned by the rostral root of P_3. In Dachshunds, American Pitbull Terriers and Dogues, the foramen magnus was under P_1 and in German Shorhaired Pointer — anterior to P1. The other two mental foramina were situated as followed: rostral mental foramen —between I_1 and I_2 and the caudal mental foramen — between the rostral root of P_3, i.e. in a manner such that in already mentioned breeds. The radiological studies of the mandibular canal (following preliminary introduction of a wire in rostral and caudal foramina) showed that the canals originated considerably behind the foramen magnus — in the transverse plane passing through the anterior contact surface of the third premolar (Fig. 4).

The data about the ratio of infraorbital canal /Nasion-Rhinion lengths showed that it varied in relatively large limits in studied skulls: from 0.23 to 0.39. The lowest value was observed in Miniature Pinschers (0.23) and the highest — in Collies (0.39). It was interesting that the index was considerably variable in skulls of mixed-breed dogs (0.26 — 0.36). Various ratios were obsetained in Dogue skulls — 0.27, 0.30 and 0.32 respectively as well as in German Shepherds (0.29 and 0.33), Caucasian Ovcharkas (0.28) and Belgian sheepdogs. For the other studied breeds, the index was as followed: 0.31 in Drathaars, 0.32 in Shar Planinets and 0.28 in Rottweilers. Furthermore, information about the shape of the infraorbital foramen is reported for the first time — except for Dachshunds, in the skulls of all other studied breeds (including mixed-breed dogs), it was similar to an isosceles triangle. This fact could be important from a clinical point of view as well.

The index reflecting the ratio of mandibular canal and mandibular lengths was less variable. In purebred dogs it was between 0.58-0.62 and in mixed-breed dogs — between 0.59-0.62. The lowest value of the index was obtained in the Shar Planinets breed (0.58) and the highest one — in Dachshunds and Belgian Sheepdogs (0.62).

The data of our investigations evidenced that mandibular canal values were considerably less variable than those of the infraorbital canal. Because of the relatively few number of purebred canine skulls, a statistical analysis of data was not performed. Yet, the obtained results allowed us to assume that the mandibula and the mandibular canal were in more constant association compared to the index presenting the infraorbital canal/Nasion-Rhinion ratio.

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