MANDIBULAR ANESTHESIA AND TOOTH EXTRACTION IN THE BOTTLENOSED DOLPHIN

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Abstract: Anatomical dissections were done to show the innervation of the teeth and mandible of the bottlenosed dolphin (*Tursiops truncatus*). Using structural landmarks, a method has been devised for anesthetizing the lower jaw. With this procedure teeth can be extracted and age determined by counting dentine layers in sections of etched teeth. Animals of the most desirable ages can thus be selected and the ages of animals already in captivity can be determined.

INTRODUCTION

The age of the bottlenosed dolphin can be determined by longitudinal section of a tooth, etching the cut surfaces, and counting the layers of dentine rings. The method has been described and used for age determination in toothed cetaceans by several investigators.[2,4,5] Sergeant *et al.*[6] have shown that one dentine layer is laid down yearly in *T. truncatus* while Perrin and Coe[1] and Hui[3] have studied the patterns in other species.

Age determination is quite important in selecting animals to be brought from the wild into research laboratory colonies or into aquarium displays. Dolphins over 10 or 12 years of age do not, on the average, adapt as readily to the new situation, their expected useful life span is shorter, and they are not as easily trained. Animals under 2 or 3 years of age are also avoided by many institutions because their mortality rate is higher than that of more mature animals. Therefore, bottlenosed dolphins between 2 or 3 and 10 or 12 years of age are most desirable.

In the past we have rejected Atlantic bottlenosed dolphins under 2 m in length as being too young. Occasionally animals slightly larger than this may be under 2½ years of age and there are probably instances where a 2 m animal is over 3 years of age. We have also used body size, scarring and the degree of tooth wear as an indication of advanced age. Such criteria, although not always accurate, are still employed at the time of capture to make initial selections. Since tooth section is the best method we have for assessing age in dolphins, those finally selected for our laboratory are aged by this technique as soon as possible after they are taken from the sea. Animals outside the desirable age limits are released.

ANATOMICAL CONSIDERATIONS

The *T. truncatus* mandible is innervated by the infraalveolar nerve, one of four branches of the mandibular nerve (Figure 1). The mandibular nerve is a branch of the trigeminal nerve. The infraalveolar arises just medial and slightly posterior to the coronoid process passing forward to enter the mandibular canal through the mandibular foramen.

In the mandibular canal the infraalveolar nerve passes inferiorly and laterally to the roots of the teeth. Anteriorly the nerve sends off three or more branches which exit through mental foramina as anterior, middle, and posterior mental nerves. There is some variation

[1] Perrin, W. F. and J. M. Coe. 1973. Growth of the spotted porpoise *Stenella attenuata* (Gray) in the offshore eastern tropical Pacific. (Manuscript in preparation).

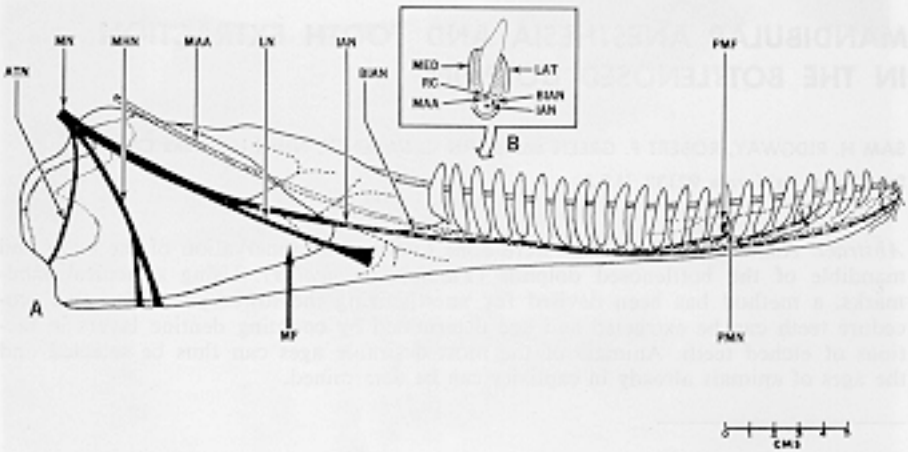

FIGURE 1. Neurologic and vascular anatomy of the lower jaw of the bottlenose dolphin, **Tursiops truncatus.** ATN, Auriculotemporal nerve; BIAN, Branch infraalveolar nerve; IAN, Infraalveolar nerve; LAT, Lateral; LN, Lingual nerve; MAA, Mandibular alveolar artery (surrounded by veins); MED, Medial; MHN, Mylohyoid nerve; MN, Mandibular nerve; PMF, Posterior mental foramen; PMN, Posterior mental nerve; RC, Root Canal.

in the number and location of the mental foramina. The anterior foramen located close to the point of the jaw where the two haves join, seems to be the most variable. The middle foramen is on the outside of the jaw between the base of the seventh and eighth teeth. (The first two teeth are very short and are not usually seen in a live animal, so the middle foramen actually appears to exit opposite the fifth and sixth teeth). The posterior foramen is on the side of the jaw bone between the eleventh and twelfth (ninth and tenth visible) teeth.

Along its path through the mandibular canal, the infraalveolar nerve gives off numerous branches to the gums and teeth. The branches which innervate the teeth subdivide from the infraalveolar nerve some three or four teeth posterior to the tooth they actually enter. The entrance to the root canals is directed slightly to lateral side of the jaw.

At the origin of the infraalveolar, the mandibular nerve puts out three other branches: the auriculotemporal, the mylohyoid, and the lingual. The auriculotemporal passes downward toward the angle of the jaw, the mylohyoid to the ventral margin, and the lingual just medial to the infraalveolar nerve. At the point where the infraalveolar nerve passes into the mandibular canal, the lingual passes along the side of the base of the tongue. Near the anterior end of the mandible the infraalveolar nerve sends branches (the mental nerves) through the mental foramina into the tip of the lower jaw.

The mandibular alveolar artery passes anteriorly just inside the coronoid process about 1 cm above the infraalveolar nerve. After entering the mandibular canal the artery passes close to the roots of the teeth, sending off one or more branches to each root canal as well as several branches to the area of the dental alveolus. At the anterior end of the mandibular canal the mandibular alveolar artery sends off three or more subdivisions which leave the canal through the mental foramina as anterior, middle, and posterior mental arteries.

The veins which drain blood from the various areas of the jaw fed by the mandibular alveolar artery form a venus plexus closely surrounding the artery. This plexus is composed of from six to

eight channels running parallel to the artery.

After completing the dissections just described, we received a very recent translation of a paper by two Soviet investigators.[1] Our description is in general agreement with their findings.

ANESTHESIA PROCEDURE

The dolphin's jaws are opened and two moist towels are placed through the opening. Attendants hold the mouth open using the towels. The mandibular foramen can be palpated lateral to the base of the tongue. One can feel the characteristic triangle or anterior angle of the medial opening of the foramen seen in Figure 2. The infraalveolar nerve is most accessable as it passes into the canal just inside the bony angle about 2 to 3 cm deep. Ten to 20 ml of 2% xylocaine (Lidocaine HC1)[2] is infiltrated into the area using a 4-6 cm needle (Figure 3). Anesthesia is produced and extraction may proceed 10 to 15 min after injection.

All teeth of *T. truncatus* are single-rooted (Figure 2) and extraction is usually a simple procedure requiring only one extractor and an elevator. The gum and fibrous connective tissue are freed from the tooth using the elevator. Then the elevator is used with a rocking motion to carefully loosen the tooth in its alveolus. When the tooth is loose, the extractor is used to lift it free. Upward pressure may be applied with the elevator to facilitate extraction if necessary. A coagulant material such as an absorbable gelatine sponge[3] is placed into the tooth alveolus to control bleeding.

Any tooth behind the fifteenth is preferred since teeth anterior to this cease to grow at some point in early juvenility.

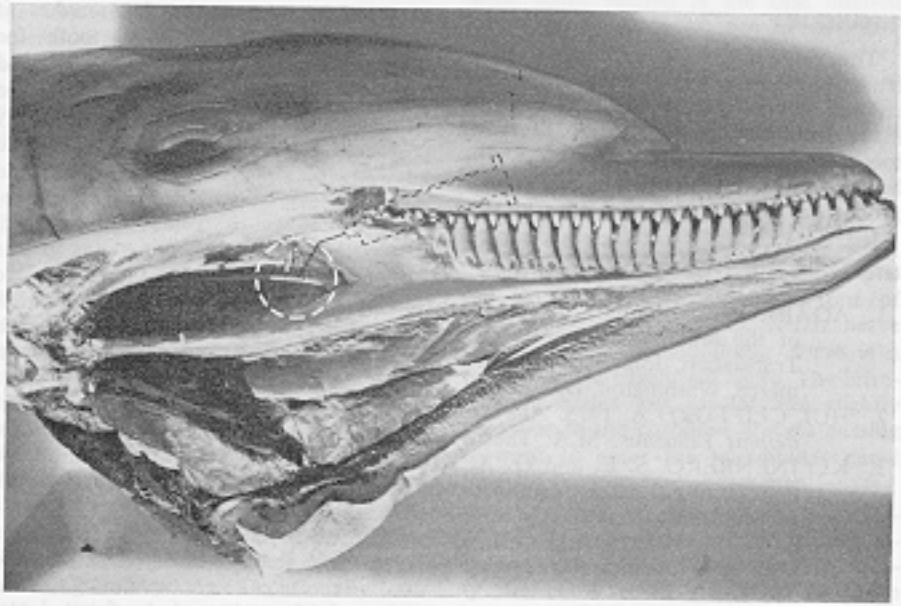

FIGURE 2. Anatomic dissection of the lower jaw (lateral view) of the bottlenosed dolphin, **Tursiops truncatus**, showing area where anesthetic is injected from the medial aspect of the mandible.

[2] Xylocaine, Astra Pharmaceutical Products Inc., Worcester, Mass. 01606, U.S.A.
[3] Gelfoam, Upjohn Company, Kalamazoo, Michigan.

FIGURE 3. Infusion of anesthetic for local mandibular anesthesia in the bottlenosed dolphin, **Tursiops truncatus.**

DISCUSSION

The probability for successful maintenance of *Tursiops* in captivity is increased by the proper selection of animals. Determining the animals' age by tooth sectioning is important along with health and behavioral criteria. The simple procedure described here for locally anesthetizing the lower jaw makes it practical for removal of a tooth for examination. A technician can be trained to section and read the teeth[3,5] in the field using a kit which is relatively easily prepared. Teeth may also be referred to laboratories already well experienced in the procedure.

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Received for publication 29 January 1975