

## THE ORAL CAVITY OF REPTILES – ANATOMY, PHYSIOLOGY AND CLINICAL PERSPECTIVES

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### Oral cavity

The oral cavity is formed by the anterior-most parts of the gastrointestinal system and respiratory system and includes the mouth and the internal choanae. Most reptiles have little in the way of a secondary palate. It is best developed in species that lack cranial kinesis (movement of the snout relative to the braincase). Some aquatic turtles and crocodylians have the best developed separation of air and food passages. Lizards, snakes, and tuataras lack even a partial secondary palate. All snakes and most lizards have kinetic skulls.

The tongues of reptiles are as varied as the species and range from exceptionally protrusible (as in chameleons), to the virtually fixed tongues of freshwater sliders (*Trachemys spp.*) and crocodylians, and the forked tongues of snakes and monitor lizards (Varanids), to the mobile fleshy tongue of geckos and tortoises. The tongue has many functions including the capture of prey, the transport of food to the back of the mouth, in some species it provides for taste, and in squamates it can deliver scents to the vomeronasal organ in roof of the mouth (Schwenk 2000).

All turtles lack teeth at all ages. Snakes, lizards, crocodylians and tuataras all have teeth. The teeth vary in their form, their attachment, and whether they are shed. Generally the teeth of herbivorous species are broadly flattened with crushing surfaces. Those of most carnivorous reptiles are tapered to sharp points. Often the teeth in the front of the mouth have recurved tips, which facilitate the puncture of prey during the strike and reduce the chance of prey escape. Some snakes have fangs that deliver venom, in either the anterior of the mouth or near the temporomandibular joint (rear-fanged snakes).

Teeth may be attached in sockets (thecodont), on the alveolar surface of the jaw (acrodont), or on the inner side of the jaws (pleurodont) (Kardong 2002). Few reptiles have thecodont teeth. These are replaced within the same socket. Crocodylian teeth are thecodont. Snakes typically have acrodont teeth; each tooth resides on the occlusal surfaces of the jaws in a very shallow socket. Replacement teeth arise adjacent to the active teeth. Most lizards have pleurodont teeth but there are many exceptions including chameleons and bearded dragons. Tuataras also have acrodont tooth attachments. The teeth of reptiles usually are similar throughout the mouth. However, the tuatara, crocodylians and venomous snakes have heterodont dentition with more than one tooth type per arcade (Romer and Parsons, 1986).

Oral glands (loosely termed salivary glands) include the premaxillary, palatine, nasal, lacrimal, Duvernoy's, Harderian, posterior, sublingual, lingual, infralabial, and

mandibular glands (Kardong 2002). Not all of the oral glands are found in all reptile species. The infralabial, supralabial, lingual, sublingual, premaxillary, nasal, and palatine glands all produce mucus which lubricates the mouth and aids in food transport. The lacrimal and Harderian glands lubricate the eyes and vomeronasal organs via a duct that connects the eye to mouth. The Duvernoy's gland is present in all snakes and produces a serous material that is released on the maxillary teeth. This gland is modified in the venom gland in poisonous snakes. Oral glands are found in all terrestrial reptiles but are typically lost or very reduced in aquatic species. The notable exceptions are the sea snakes and crocodilians.

### **Clinical perspectives**

"Mouth Rot," is the lay term for one of the most common medical problems seen in captive reptiles. This condition, which refers loosely to any disease of the mouth region, also goes by a number of different names including infectious stomatitis (the preferred medical term), ulcerative stomatitis, and Type I and Type II canker. Regardless of what you call it, Infectious stomatitis, if left untreated, will often progress to terminal disease and death of the affected reptile.

Infectious stomatitis is not a primary disease. That means the symptoms such as the swollen gums and loose teeth are a result of some other ailment. Infectious stomatitis is most commonly associated with some type of husbandry or management problem that causes stress in the reptile. Common examples include overcrowding, excessively low ambient temperatures and poor nutrition. This stress depresses the animal's immune system and makes it susceptible to various diseases.

Infectious stomatitis is most commonly seen in snakes, but it also occurs in lizards, turtles and crocodilians. Treatment of Infectious stomatitis depends on many factors including type of patient, severity of the disease, experience of the owner and cost limitations.

### **Differential Diagnosis**

The infected oral tissue can be diseased by a number of different pathogens. Gram negative bacteria such as *Pseudomonas*, *Aeromonas*, *Klebsiella* and *Salmonella* are of the more common bacteria isolated in cases of infectious stomatitis. However, Mycobacteria, fungal invaders and underlying viruses have all been implicated.

Trauma, such as chronic rostral rubbing, or acute trauma, such as glass strikes, can pre-dispose to infectious stomatitis. Bites from prey in the mouth region will rapidly initiate oral infections.

Malnutrition, especially protein and vitamin deficiencies, can be contributing factors in Infectious stomatitis. Vitamin C deficiency, specifically, has been implicated in the literature.

### **History**

When evaluating infectious stomatitis patients it is prudent to quiz the owners on husbandry practices. Especially important is the ambient temperature of the cage

environment. Diet, frequency of feeding and types of food are important to evaluate. Always question the use of supplements such as vitamins, multivitamins and minerals. If mites are not present at the time of the examination, find out if there has been a history of mite infestation. Mites are a known vector of *Aeromonas*, a common pathogen isolated in cases of infectious stomatitis. Information needs to be obtained regarding home treatments or current therapy. An estimate of duration of disease may also be helpful.

### **Clinical Findings**

Mites are a common finding in poorly maintained reptile collections and are often implicated in cases of infectious stomatitis. Although the mites themselves don't actually cause the infectious stomatitis, they are hematophagous and can transmit bacteria, such as *Aeromonas*, which can potentially lead to the development of infectious stomatitis. A reptile infested with mites is easily weakened from the blood loss. In addition, these mites are extremely irritating and cause the snake great discomfort.

Depending on the stage of the disease, the appearance of infectious stomatitis can be as simple as excessive salivation and a lack of appetite, to being as severe as having swollen and cracked gums which are so friable that they bleed whenever the mouth is opened. It is not uncommon in severe cases to see loose teeth, eye infections and pneumonia.

The disease usually starts out as reddening of the gum tissue. This may be generalized, or there may just be small, pinpoint blood spots called petechia. From this point the gum tissue often changes color, usually turning to shades of gray, and may begin to swell. Again, this can be generalized, confined to just the lower or upper jaw, limited to one side of the jaw, or even localized to a single point, as is seen when there is a tooth abscess.

If the infection is localized, such as in a tooth abscess, and left untreated, it has the potential to spread. The infection will often dissect between the gums and the skin, forming an abscess under the jaw or over the bridge of the nose. If the infectious stomatitis spreads inward it can enter the bone (either the mandible or maxilla) and cause a serious infection called osteomyelitis. This is a very dangerous situation as it results in destruction of the bone, loose teeth and extreme pain to the affected patient. This is very difficult to treat and often requires surgery as part of the therapy.

The glottis, which is the opening to the trachea, or windpipe, is situated in the middle of the lower jaw. When there is severe disease it is not uncommon for the bacteria to be sucked into the windpipe and down into the lungs where it causes pneumonia. In a similar fashion, there is a duct, called the Hardarian duct, which connects the inside of the mouth to the space between the front of the eye and the inside of the clear scale covering the eye called the spectacle. As in the case with pneumonia, bacteria and disease can travel from the inside of the mouth, up the Hardarian duct, and into the space between the eye and the spectacle. This can result in a very serious eye infection, and if not immediately and aggressively treated, can lead to the loss of the eye.

When a reptile is this sick it usually doesn't eat. The disease can easily spread in the weakened animal and the once localized mouth infection can become a serious systemic illness. These patients require aggressive treatment to maximize their chances of full recovery.

### **Diagnostics**

Complete laboratory analysis is essential in evaluating the status of the infectious stomatitis patients. Bacterial culture and sensitivity of affected tissue will aid in selecting appropriate antimicrobials. In severe or chronic cases, radiographs of the maxillofacial bones will help rule out osteomyelitis.

### **Management**

The single most important factor to consider when deciding on a treatment for a case of infectious stomatitis is to determine the actual cause of the infection. Since the majority of the cases are secondary to poor husbandry, if the treatment is to be successful, the husbandry practices of the owner must be corrected. Once the underlying deficiencies are corrected, the balance of the treatment, that part relating the diseased tissue, can be initiated.

Treatment varies depending on the severity of the disease. Many times a minor case of infectious stomatitis can be corrected merely by warming the animal's environment to its optimal temperature. If warranted, such as in some superficial infections, antibiotic creams and solutions can be applied to the gum's surface. In more severe infections, those without abscesses, systemic medications need to be administered. Antibiotics directed at gram negative pathogens, such as amikacin, enrofloxacin and ceftazidime are all excellent first choices.

### **Follow up**

There are a number of reasons why seemingly appropriate treatment may fail. As mentioned, non-bacterial organisms can also cause infectious stomatitis. Attempting to treat a fungal infection with bacterial antibiotics would be totally ineffective. Likewise, a viral stomatitis would not respond to a bacterial auto-vaccine. There are numerous other conditions that look like infectious stomatitis. It is important to be able to distinguish these conditions from the actual mouth infection, as they often require substantially different treatments. Treating for infectious stomatitis when the symptoms are caused by something else may not correct the problem and, in some cases, may actually hurt the patient.

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