

Reconstruction of a Bilateral Hypoplastic Soft Palate in a Cat

A 2-year-old, female spayed, domestic shorthair cat was presented with a history of dyspnea, upper respiratory congestion, and aspiration. Physical examination revealed a bilaterally hypoplastic soft palate resembling a uvula. A novel surgical technique was performed to reconstruct the soft palate, utilizing both a hard palate-derived mucoperiosteal flap combined with two pharyngeal wall-derived, random-pattern mucosal flaps. This is the first report of a bilaterally hypoplastic soft palate in the cat, as well as a description of a new surgical method for soft palate reconstruction. *J Am Anim Hosp Assoc* 2004;40:86-90.

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Case Report

A 2-year-old, 2.5-kg, female spayed, domestic shorthair cat was referred for chronic, intermittent, upper respiratory congestion. The owner described the cat as having difficulty breathing for the past 1.5 months and that it sneezed a lot when nasal congestion was present. The night prior to presentation, the cat had an episode of severe dyspnea and had required tracheal suctioning at a local emergency clinic to remove food particles from her trachea.

On physical examination, the cat was bright, alert, and responsive. Her temperature and pulse rate were within normal limits, but she was tachypneic and appeared slightly dyspneic with a respiratory rate of 68 breaths per minute. Increased lung sounds were detected on auscultation. Oral examination revealed an incompletely formed soft palate with only a small soft-tissue protrusion, resembling a uvula, present on the caudal midline of the hard palate [Figure 1]. Later examination of this structure under anesthesia found it to be fibrotic and inelastic. The only other abnormality found during physical examination was the presence of moderately enlarged pupils at rest. An ophthalmological consultation revealed bilateral incipient cataracts but found no reason for the enlarged pupils. The cat was admitted to the Veterinary Medical Teaching Hospital (VMTH) for surgical reconstruction of the soft palate.

Thoracic radiographs revealed a mild bronchial pattern, predominantly in the dorsal lung field. This was interpreted as mild bronchial disease, either of an allergic or infectious origin; but it was not indicative of significant aspiration pneumonia. The cat's packed cell volume and total protein were within reference ranges, and she was considered to be an acceptable anesthetic candidate.

For surgery, the cat was premedicated with acepromazine (0.1 mg/kg body weight, intramuscularly [IM]) and oxymorphone (0.1 mg/kg body weight, IM). Anesthesia was induced with thiopental sodium (5 mg/kg

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Figure 1—Photograph of the oropharynx of a 2-year-old cat with chronic upper respiratory disease, demonstrating the incompletely formed soft palate with only a small soft-tissue protrusion, resembling a uvula, present on the caudal midline of the hard palate.

body weight, intravenously [IV]); the cat was tracheally intubated; and then anesthesia was maintained throughout surgery using isoflurane and 100% oxygen. During surgery, glycopyrrolate (0.01 mg/kg body weight, IV) was administered to counteract bradycardia. Dexamethasone phosphate (1 mg/kg body weight, IV) was administered intraoperatively to help reduce swelling in the reconstructed palate and pharyngeal tissues after surgery. At the end of surgery, the cat received oxymorphone (0.05 mg/kg body weight, both IV and IM) to assist with postoperative analgesia. Cefazolin (20 mg/kg body weight, IV) was given intraoperatively as well, and at 6 and 12 hours postoperatively for antimicrobial prophylaxis.

Surgical reconstruction of the soft palate was accomplished by developing two sets of tissue flaps that would overlap to create an artificial palate. Two random-pattern flaps were developed from mucosal tissue on the right and left pharyngeal walls that extended dorsally into the nasopharynx [Figure 2]. The attached base of each flap began at the caudal border of the last molar and extended caudally to the cranial border of the tonsillar crypt. These flaps were of sufficient length to be able to be sutured together across the nasopharynx in an “H-plasty” configuration to form a shelf that would approximate a normal soft palate. Prior to suturing of these flaps, a second flap (comprised of the full thickness of the hard palate mucoperiosteum, extending from the left to the right dental arcades and approximately 2 cm in length) was elevated from the hard palate with its basal attachment retained at the caudal border of the hard palate [Figure 2]. One must use caution while incising the hard palate and identify if possible the location of the palatine arteries. If appreciated, these vessels should be preserved if possible or ligated or cauterized if

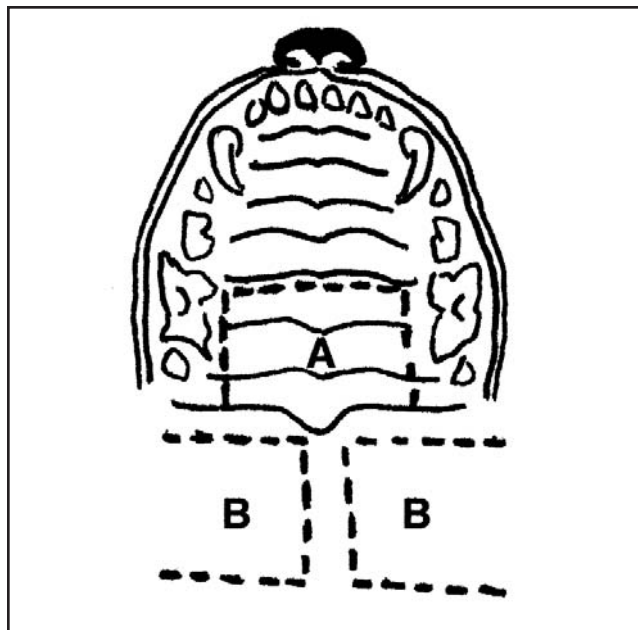


Figure 2—Illustration of the original incisions made into the pharyngeal walls and the caudal hard palate to correct the soft palate defect in the cat from Figure 1. The flaps include a mucoperiosteal flap obtained from the oral surface of the hard palate (A) and a set of two random-pattern mucosal flaps obtained from the lateral pharyngeal walls extending dorsally into the nasopharynx (B).

necessary in order to avoid hemorrhage. Once these flaps were developed, the new soft palate was constructed by flipping the hard palate mucoperiosteal flap 180° caudally, resulting in the original oral palatal mucosal surface becoming the dorsal surface of the newly constructed soft palate (as well as the ventral floor of the nasopharynx) [Figure 3]. The lateral edges of this flap were sutured to the pharyngeal wall, which had been denuded of mucosa when the first set of flaps had been created, with 5-0 polygalactin^a simple-continuous suture. The two flaps that were elevated from the pharyngeal/nasopharyngeal walls were then sutured together at midline ventral and to the mucoperiosteal flap and thus formed the ventral surface of the newly constructed soft palate [Figure 4]. The caudal mucosal edges of the hard palate mucoperiosteal flap and the two nasopharyngeal mucosal flaps were then apposed using a simple-continuous suture of 5-0 polygalactin.^a The cranial borders of the pharyngeal/nasopharyngeal mucosal flaps were then sutured to the edges of the hard palate mucoperiosteal excision site, and coverage of this excision site was attempted using the cranial portion of the nasopharyngeal mucosal flaps. However, pulling these edges cranially resulted in excess tension on the mucosal flaps, so the wound bed on the hard palate was left open. The final result was a shelf of soft tissue with epithelial coverage on both the oral and nasopharyngeal surfaces and epithelial apposition at the caudal edge to promote primary wound healing. Recovery from surgery was uneventful, and the cat was discharged from the VMTH on the following day. In this case, because the cat was eating

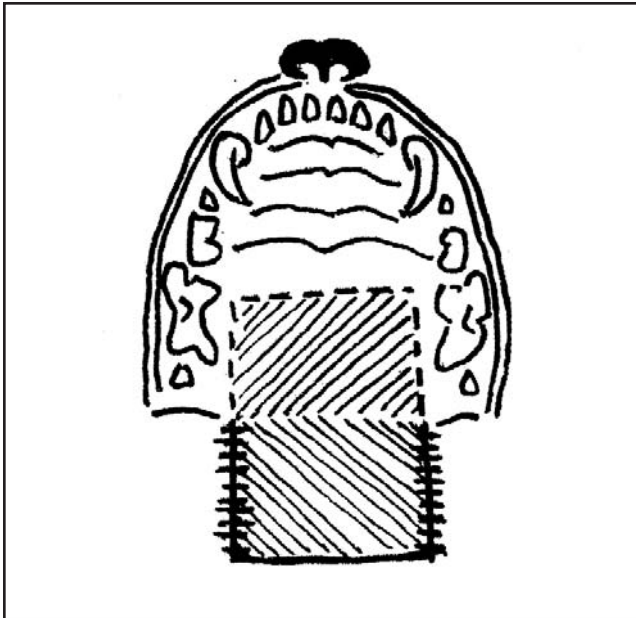


Figure 3—Illustration of the mucoperiosteal flap flipped 180° caudally and sutured to the lateral pharyngeal walls forming the dorsal surface of the new soft palate.

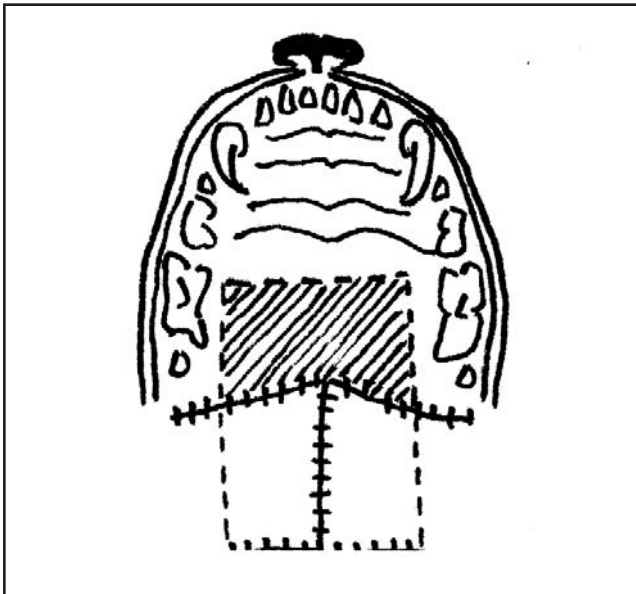


Figure 4—Illustration of the lateral pharyngeal wall flaps, sutured to the exposed oral surface of the mucoperiosteal flap, thus forming the ventral surface of the new soft palate. The pharyngeal wall mucosal flaps were sutured together at midline and to the mucoperiosteal flap at the caudal border to provide epithelial apposition and promote primary wound healing of these edges.

well and to avoid added complications, a feeding tube was not placed; the cat was released with instructions for owners to feed a gruel diet. However, placement of a feeding tube may be of value in the postoperative management of such cases.

The cat returned to the VMTH approximately 2 weeks later for a recheck examination. The owner stated that the

cat had been taken to the referring veterinarian the week prior for two treatments of penicillin due to mucus seen in the mouth. The cat's breath had smelled bad prior to these treatments and was better afterward. Physical examination revealed a small amount of necrotic tissue around the cranial border of the surgical site where the nasopharyngeal flaps had been sutured to the cranial aspect of the mucoperiosteal excision bed. This problem was most likely due to either tension or vascular compromise in that part of the suture line. The remainder of the mucosal edges still appeared viable and apposed, and the newly constructed soft palate was healing well. The cat was discharged with amoxicillin (50 mg per os [PO], liquid, *bid*) and orders to continue the gruel diet for an additional week.

The cat returned to the VMTH 2 months later for a recheck examination. The lateral aspects of the surgical site were intact. The medial distal aspect had a small "v" shape to it, representing a slight amount of contracture in the center of the new palate tissue in a cranial direction. Purulent nasal discharge was appreciated in the right nostril. The owner stated that the cat was eating well, had a good activity level, and that no food was coming out of her nose any longer. She was discharged on a 3-week course of amoxicillin-clavulanic acid (67.5 mg, PO *bid*). Telephone follow-up 2 months later indicated that the cat was doing well and that the nasal discharge had resolved. Examination 6 months after surgery showed that the palate had healed well, the mucoperiosteal flap donor bed was completely filled with granulation tissue and had epithelialized, and that the surgical procedure had significantly extended the palate to a position that approximated the extent of the normal soft palate [Figure 5].

Four years after the cat was last seen at the VMTH, telephone follow-up indicated that she continued to do well and had shown no signs of infection or any difficulty in eating or drinking.

Discussion

The palate is comprised of the primary palate (i.e., lip and incisive bone) and the secondary palate (i.e., hard and soft palates). A defect in the primary palate is usually, but not always, of an aesthetic concern and not of a functional concern. Defects of the secondary palate have a greater effect on the animal's well-being due to their impact on the functionality of the nasooropharynx.

Congenital palatal defects are not uncommon in animals, although cats are underrepresented in those affected and reported in the literature. Defects of the secondary palate include oronasal fistulas (i.e., medial, unilateral, or bilateral cleft palates) and hypoplasia (either unilateral or bilateral) of the soft palate. The presence of cleft palate appears to be much higher in brachycephalic dogs^{1,2} and Abyssinian cats,² although many other breeds are affected. Hard palate cleft is almost always medially located, unless there is involvement with the primary palate;³ this cleft often includes the soft palate as well. Soft palate clefts may or may not include the hard palate and can be unilateral,



Figure 5—Photograph of the repaired soft palate in the cat from Figure 1, 6 months after surgery. There was some contracture at the center of the new soft palate, but the overall extension of the palatal shelf was sufficient to restore normal function during swallowing and breathing.

bilateral, or medially located. The soft palate may be hypoplastic as well, usually retaining a medial aspect often described as a pseudo-uvula or uvula-like process.⁴⁻⁹

The secondary palate serves as a barrier between the oropharynx and nasopharynx. A defect that causes a loss of this barrier allows open communication between these two cavities, resulting in an animal that cannot control the correct passage of food and liquid from the mouth to the esophagus. Animals with these defects present for coughing, sneezing, poor growth, chronic rhinitis, and possibly aspiration pneumonia.^{4,10} This deformity is most likely a congenital defect and is often a result of the failure of the proper mesenchyma to grow laterally to medially.² It is likely that this occurs late in development if no other organ systems are involved.

The purpose of this paper is to describe a novel surgical approach to reconstruct a bilateral hypoplastic soft palate in a cat. There are few reports of bilateral soft palate hypoplasia in either large⁶⁻⁸ or small animals; all reported cases in small animals have been in dogs.^{4,5,9-11} To the authors' knowledge, no report exists regarding bilateral soft palate hypoplasia in cats. A number of reports have described surgical procedures on the soft palate,^{1,4,5,9,10} and some of these have been performed specifically on hypoplastic soft palates.^{4,5,9,10} Of the methods reported for repair of hypoplastic soft palates, only two have been successful.^{9,10} These methods would have been difficult to apply in the cat described here, because of the very small size of the soft palate remnant and its inelastic fibrotic character, which prevented extending its edges to the pharyngeal wall, and the thinness of the oral and pharyngeal mucosa for use as the sole flaps in reconstruction. Further, the need to rotate one of the mucosal flaps in the technique described by Sager, *et al.*,¹⁰ carries the potential for circulatory compromise to the flap; thus, this method was rejected for use in the cat reported here.

The technique described in this report has several strengths. The first is the fact that the new soft palate has mucosa comprising both its dorsal and ventral aspects. This is similar to the result obtained in several previous descriptions of soft palate surgeries; primary wound healing is promoted with a minimizing of wound contracture.^{1,3,9,10} Previous hypoplastic soft palate surgeries that were unsuccessful^{4,5} may have had better healing had this technique been utilized. In addition, providing an epithelialized surface facing into the nasopharynx prevents adhesion of the flaps to granulation tissue in the dorsal nasopharyngeal wall, if that is the site of harvest for the mucosal flaps.

The second primary attribute of this technique comes from the protection and reinforcement of the suture lines by using a combination of two flap techniques. The most common postsurgical problem that occurs in palatal reconstruction is dehiscence. This may be due to the fact that mucosal flaps may often not be very thick or strong, and excessive tension can be present at the suture lines either at the time of suturing or more commonly during dynamic cycling of tension during mastication and deglutition. The strength of the suture lines, in the method described here, was bolstered from reinforcement of the overlapping tissue flaps. The suture lines for the hard palate-derived mucoperiosteal flap that will be under stress during normal use of the tongue, were at the lateral pharyngeal walls. This area was located and covered by the attached bases of the pharyngeal mucosal flaps and thus was protected to a large degree from mechanical stress. Conversely, the suture line most at risk for the pharyngeal flaps, the midline of the "H-plasty" closure, was overlying the intact center of the mucoperiosteal flap. Thus, each flap was bolstered at its weakest point by intact tissue of the other flap, providing increased resistance to disruption from tension exerted by the tongue during swallowing.

Failure of soft palate reconstruction can also occur from contraction of healing granulation beds, resulting in excessive shrinkage of the newly constructed palate or adhesion and obstruction of the nasopharynx. In the case described here, there was some contracture that resulted in a shortening of the medial aspect of the cat's healed new soft palate. This may be explained by contraction present in the hard palate mucoperiosteal excision bed or in the new soft palate itself and may have been exacerbated by the attempt to cover a portion of the mucoperiosteal excision site with the cranial part of the pharyngeal mucosal flaps. In the future, the authors would not recommend attempting to cover this excision bed but to rely entirely on second-intention healing to fill this defect. Regardless of the contracture, adequate extension of the tissue shelf provided a functional, soft palate-like structure and eliminated the clinical signs associated with the palate defect in this cat.

Conclusion

Animals diagnosed with a bilateral hypoplastic soft palate have previously been given a poor prognosis,^{3,6,8,12} and

surgeries to correct this defect have often been unsuccessful.^{4,5} In this paper, the authors describe a novel surgical approach to reconstruct the hypoplastic palate. This method has not been previously described, and it has some attributes that may make its use advantageous over other previously described methods. Reconstruction of a hypoplastic soft palate is critical to restoration of normal function and maintenance of a good quality of life in the affected animal.

^a Vicryl; Ethicon, Inc., Somerville, NJ

References

1. Nelson AW. Upper respiratory system. In: Slatter DH, ed. Textbook of small animal surgery. 2nd ed. Philadelphia: WB Saunders, 1993:733-776.
 2. Noden DM, DeLahunta A. Craniofacial muscles and connective tissues. In: Embryology of domestic animals. Baltimore: Williams & Wilkins, 1985:156-195.
 3. Harvey CE. Palate defects in dogs and cats. *Comp Cont Ed Pract Vet* 1987;9(4):404-418.
 4. Baker GJ. Surgery of the canine pharynx and larynx. *J Sm Anim Pract* 1972;13:505-513.
 5. Bauer MS, Levitt L, Pharr JW, Fowler JD, Basher AWP. Unsuccessful surgical repair of a short soft palate in a dog. *J Am Vet Med Assoc* 1988;193(12):1551-1552.
 6. Bertone JJ, Traub-Dargatz JL, Trotter GW. Bilateral hypoplasia of the soft palate and aryepiglottic entrapment in a horse. *J Am Vet Med Assoc* 1986;188(7):727-728.
 7. Proudman CJ, Knottenbelt DC, May SA, Edwards GB. Soft palate hypoplasia in a horse. *Vet Rec* 1991;129:284-286.
 8. Riley CB, Yovich JV, Bolton JR. Bilateral hypoplasia of the soft palate in a foal. *Aust Vet J* 1991;68(5):178-179.
 9. Sylvestre AM, Sharma A. Management of a congenitally shortened soft palate in a dog. *J Am Vet Med Assoc* 1997;211(7):875-877.
 10. Sager M, Nefen S. Use of buccal mucosal flaps for the correction of congenital soft palate defects in three dogs. *Vet Surg* 1998;27:358-363.
 11. Griffiths LG, Sullivan H. Bilateral overlapping mucosal single-pedicle flaps for correction of soft palate defects. *J Am Anim Hosp Assoc* 2001;37:183-186.
 12. Harvey CE, Emily PP. Small animal dentistry. St. Louis: Mosby, 1993:312-377.
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