

# Use of a split-thickness soft palate hinged flap and bilateral buccal mucosal rotation flaps for one-stage repair of a bilateral hypoplastic soft palate in a dog

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This study was performed at Gilabbe Veterinary Hospital, Vicars Road, Togher, Cork, Ireland.

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## CASE DESCRIPTION

A 14-week-old 8.5-kg (18.7-lb) sexually intact female Springer Spaniel was evaluated because of chronic rhinitis with bilateral mucopurulent nasal discharge. The dog had a history since birth of sneezing and oronasal reflux of food and liquid.

## CLINICAL FINDINGS

Oral examination under anesthesia revealed a short, incompletely formed soft palate with bilateral clefts. A pseudouvula was not a prominent feature of the condition in this dog.

## TREATMENT AND OUTCOME

The dog underwent 1-stage reconstruction of the soft palate by means of a split-thickness soft palate hinged flap and bilateral buccal mucosal rotation flaps. Long-term follow-up obtained 3 years after surgery revealed the dog to be in good general health, with resolution of oronasal reflux; however, occasional episodes of mild sneezing and nasal discharge persisted. Oral examination under sedation revealed attenuation of the bilateral clefts; however, a normal soft palate length was not achieved.

## CLINICAL RELEVANCE

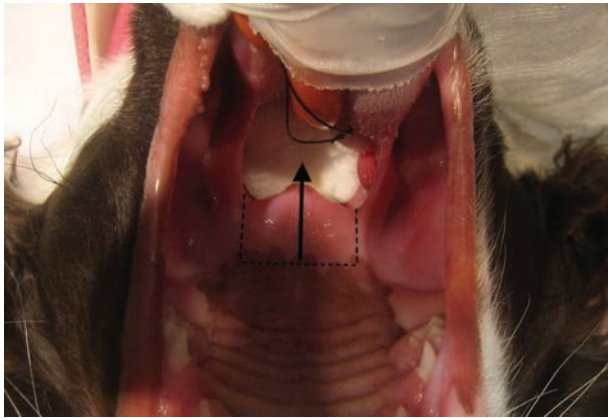
Compared with previously described techniques, this technique offered the possibility of 1-stage reconstruction of the soft palate in dogs, rather than having 2 staged procedures performed, and a robust tissue combination that was expected to be less prone to trauma. This technique may be particularly suitable for affected dogs where a pseudouvula is not a prominent feature and appears to be applicable to a variety of skull morphologies. Owners should be made aware that the absence of normal palatine muscle within the reconstructed palate may affect function, but even where normal function is not regained, a good quality of life with minimal clinical signs may be achieved. (*J Am Vet Med Assoc* 2016;248:91–95)

**A** 14-week-old 8.5-kg (18.7-lb) sexually intact female Springer Spaniel was evaluated because of chronic rhinitis with bilateral mucopurulent nasal discharge. The dog had a history since birth of sneezing and oronasal reflux of food and liquid. On physical examination, the dog was bright, alert, and responsive with a body condition score of 3 on a scale of 1 to 9.<sup>1</sup> Mandibular lymph nodes were bilaterally moderately enlarged. No abnormalities were detected on thoracic auscultation. Vital parameters were within reference limits. The dog had mild bilateral symmetric protrusion of the nictitating membranes. Otoscopic examination revealed no abnormalities. Oral examination under anesthesia revealed a short, incompletely formed soft palate with bilateral clefts. A pseudouvula was not a prominent feature (**Figure 1**). Following premedication with acepromazine maleate<sup>a</sup> (0.025 mg/kg [0.011 mg/lb], IM) and morphine sulfate<sup>b</sup> (0.15 mg/kg [0.07 mg/lb], IM), anesthesia was induced with alfaxalone<sup>c</sup> (2.0 mg/kg [0.9 mg/lb], IV). Following endotracheal intubation, anesthesia was maintained with 2% isoflu-

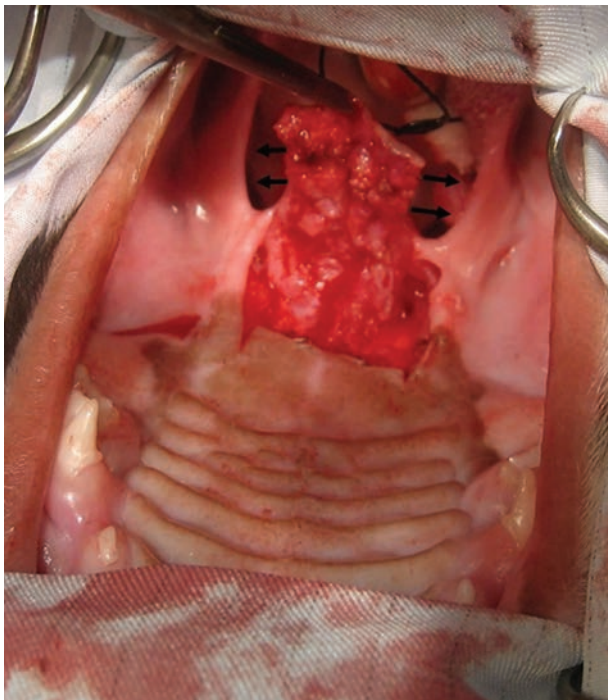
rane<sup>d</sup> in oxygen. The pharynx was packed with gauze swabs, and the oral cavity was prepared for surgery with a 1% povidone-iodine solution. Perioperative prophylactic antimicrobials, in the form of cefuroxime sodium<sup>c</sup> (20.0 mg/kg [9.1 mg/lb], IV), were administered 30 minutes prior to incision and every 90 minutes intraoperatively.

Surgery was performed with the dog in dorsal recumbency, with the hard palate approximately parallel with the operating table top. A transoral approach was used with the mouth fixed in a wide gape to facilitate access to the surgical site. The pharynx was packed with 2 sterile swabs and the surgical site isolated with sterile drapes to ensure that the endotracheal tube, which was secured to the lower jaw, was excluded from the surgical field. A split-thickness flap was elevated from the oral surface of the rudimentary soft palate, with the base of the flap remaining attached to the caudal margin of the soft palate. Briefly, an initial transverse incision was made at the junction between the hard and soft palates. Two parallel inci-

sions were made from the lateral limits of the transverse incision to the palatoglossal arches (Figure 1). Bilateral incisions were made in the lateral pharyngeal walls, extending from the remnant of the soft palate to a point caudal to the palatoglossal arch on either side. The flap was then reflected caudally so that the mucosal surface faced the nasopharynx, with the cor-



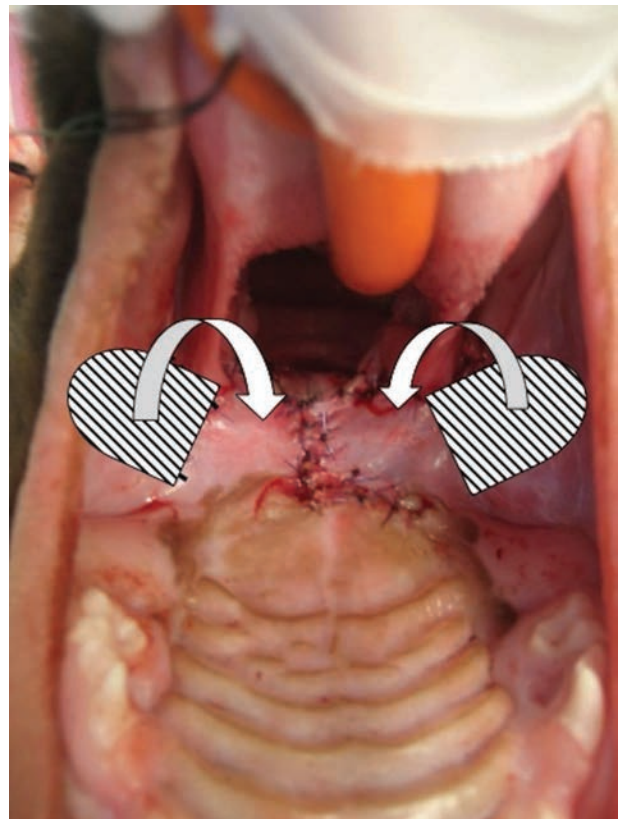
**Figure 1**—Preoperative image of the oral cavity of a 14-week-old 8.5-kg (18.7-lb) sexually intact female Springer Spaniel with chronic rhinitis and bilateral mucopurulent nasal discharge. The dog had a history since birth of sneezing and oronasal reflux of food and liquid. Bilateral soft palate hypoplasia (clefts) and absence of a prominent pseudouvula are evident. The outline of the split-thickness soft palate hinged flap is indicated (dotted line). The direction that the flap will be reflected is also illustrated (arrow).



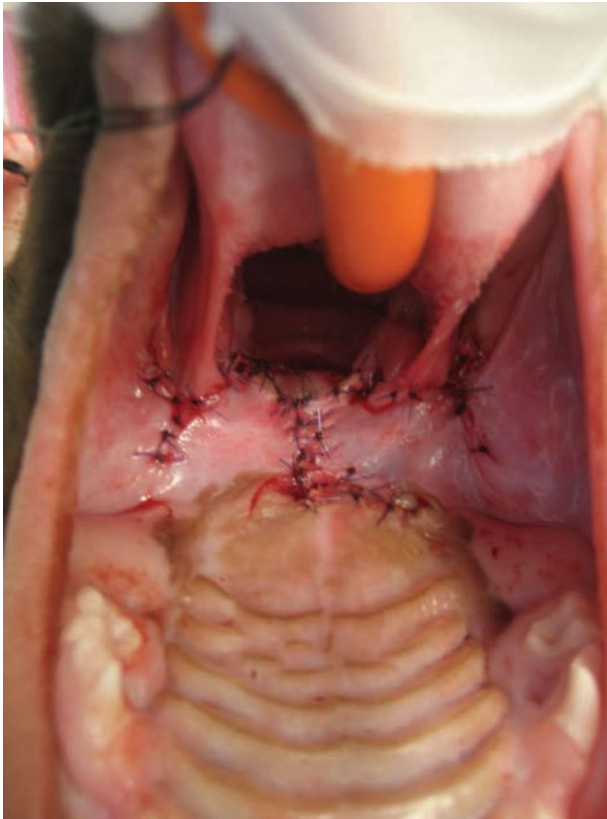
**Figure 2**—Intraoperative image of the same dog in Figure 1. Notice the creation and reflection of the split-thickness soft palate hinged flap. The lateral margins will be sutured to the pharyngeal wall incisions (arrows).

ners subsequently attached to the caudal extent of the pharyngeal incisions by means of 4-0 poliglecaprone 25<sup>f</sup> simple interrupted sutures. The flap was secured along its lateral margins to the pharyngeal wall incisions (Figure 2). An inverted U-shaped flap of buccal mucosa was created on the left side and rotated medially onto the hinged flap, such that the mucosal surface was ventral (Figure 3) and the submucosal surface of each flap was in direct apposition. When the flap was sutured into position without tension by means of poliglecaprone 25<sup>f</sup> simple interrupted sutures, the buccal mucosal flap covered the left half of the hinged flap. The mucosal defect resulting from buccal flap creation was primarily closed by means of 4-0 poliglecaprone 25<sup>f</sup> simple interrupted sutures. A similar flap was created on the opposite side, elevated, rotated into position, and secured as described, covering the right half of the hinged flap. The apex of each buccal mucosal flap was then sutured together along the midline of the newly created soft palate. This resulted in a 2-layer, tension-free, 1-stage reconstruction of the deficient soft palate (Figure 4).

Recovery from anesthesia was uneventful, and food and water were withheld for approximately 24 hours. The following morning, the dog was observed to eat and drink without difficulty and was discharged later that day. Follow-up consultation was recom-



**Figure 3**—Intraoperative image of the same dog in Figure 1. Notice the outline of the buccal mucosal flaps (hashed areas) and the direction that the flaps have been rotated (arrows).



**Figure 4**—Postoperative image of the same dog in Figure 1. The soft palate is reconstructed with obliteration of the bilateral clefts.

mended at 2 to 4 weeks after surgery; however, the owner failed to return. Long-term follow-up obtained by consultation with the owner 3 years following surgery revealed the dog to be in good general health, with resolution of oronasal reflux during eating and drinking. Substantial improvement in body condition was reported within weeks following surgery. No difficulties associated with swallowing or breathing were reported; however, occasional episodes of mild sneezing and nasal discharge persisted. Evaluation of the soft palate with the dog under sedation revealed attenuation of the bilateral clefts; however, a normal length had not been achieved on the basis of the standard landmarks for assessment (ie, caudal pole of the palatine tonsils).

## Discussion

Bilateral soft palate hypoplasia has been sporadically reported in the literature, with only 14 affected dogs described since 1972.<sup>2-8</sup> Affected animals are examined for various combinations of chronic rhinitis, nasal discharge of variable character, sneezing, poor growth, aspiration pneumonia, and coughing as a result of repeated oronasal reflux of food and liquid.<sup>2,5,7</sup> The condition involves a defect in the formation of the secondary palate and is characterized by the presence of a shortened soft palate, often with a central uvula-

like structure (pseudouvula), which extends caudally from the hard palate.<sup>6,7</sup> The exact mechanism for this condition remains incompletely understood; however, there are several theories. These include failure of fusion of the lateral palatine processes to the tissues that will form the tonsillar crypts, palatine tonsils, or cranial and caudal tonsillar pillars.<sup>9</sup>

Attempted surgical reconstruction of the soft palate has been performed with variable success in 12 of the affected dogs in the literature.<sup>2-7</sup> A variety of surgical techniques have been described, including the use of 2- and 3-layer appositional techniques,<sup>7,9</sup> a nasal pharyngeal flap technique,<sup>7</sup> a bilateral buccal mucosal flap technique,<sup>5</sup> and pharyngeal flaps derived from the tonsillar crypts.<sup>4</sup> Repair has been documented in both staged and single procedure manners. Most surgical techniques described take advantage of the typical presence of a prominent pseudouvula; however, this may not be present in all affected dogs. The presence of a marked central pseudouvula was not a prominent feature in the dog of the present report. This uvula-like structure, when present, consists of the palatine muscles (the tensor and levator veli palatini) as well as connective tissue and mucosa.<sup>5,10</sup> In the absence of this structure in the dog of the present report, the use of a 2- or 3-layer appositional repair<sup>7,9</sup> or a nasal pharyngeal flap technique<sup>7</sup> was not considered possible and was deemed unlikely to offer any substantial increase in the length of the soft palate. The potential disadvantage for the dog of the present report in not having a prominent central pseudouvula was that although an effective length of palate could be reconstructed, it did not contain any palatine muscle and therefore postoperative function would be uncertain.

Headrick and McAnulty<sup>8</sup> described the successful repair of a bilateral hypoplastic soft palate in a cat by means of a hard palate mucoperiosteal flap and bilateral pharyngeal wall flaps. The pharyngeal flaps extended dorsolaterally into the nasopharynx, caudal to the palatoglossal arches; were raised as single pedicle flaps; and were positioned so that they could be advanced directly across the newly positioned mucoperiosteal flap in the form of an H-plasty, maintaining epithelial cover on the oral surface. The relative differences in skull and pharyngeal conformation in the dog of the present report, compared with that of a cat, meant that there was concern this approach would artificially narrow the nasopharyngeal orifice and predispose to nasopharyngeal stenosis. Also, the risk of inducing longitudinal tension through the flaps to an extent that would result in ischemic compromise was considered. For this reason, the buccal mucosal flaps in the dog of the present report were created so that their base was adjacent to the hinged flap to allow rotation through approximately 90° without tension into their new location, aiming to cover half of the hinged flap with each buccal flap. Bilateral buccal mucosal flaps alone could potentially have been used in the dog of the present report to recreate the soft

palate<sup>5</sup>; however, the use of a soft palate hinged flap combined with buccal mucosal flaps was deemed to offer a stronger, more robust 2-layer reconstruction that would be more suitable for the dog of the present report.

Dehiscence is the most commonly reported post-operative complication following soft palate reconstruction.<sup>3,5,7,8</sup> Tensile forces across suture lines may be the result of not only surgical technique but also a rostromedial pulling effect of the palatine muscles.<sup>11</sup> In the dog of the present report, buccal mucosal flaps covered the bulk of the soft palate defect created by raising the hinged flap, with a small central portion left to heal by second intention. It was suspected that excessive tension would result from attempted primary apposition, while minimal risk was deemed likely by allowing second-intention healing.<sup>12</sup> Follow-up evaluation of this dog revealed attenuation of the bilateral clefts; however, a normal soft palate length was not achieved. This was suspected to be the result of tissue retraction associated with wound healing and the rostromedial pulling effect of the palatine muscles. However, on the basis of the clinical improvement observed, the increase in length achieved appeared to have facilitated a functional soft palate, with resolution of oronasal reflux in this dog. Headrick and McNulty<sup>8</sup> observed dehiscence when attempting to use their direct advancement nasopharyngeal flaps to cover the hard palate defect in addition to reconstructing the soft palate. The greater size and mobility achieved by creating rotation flaps may have been beneficial in the dog of the present report and would have substantially reduced tension across the healing wounds. Concurrent tonsillectomy, performed in an attempt to reduce lateral tension and thereby reduce the risk of subsequent dehiscence, has been described in a recent case series; however, its effectiveness was deemed disappointing by the authors.<sup>7</sup> Tonsillectomy was not performed in the dog of the present report, as it was felt it would not substantially alter tension across the buccal mucosal flaps.

A high incidence of middle ear effusions, considered secondary to Eustachian tube dysfunction or obstruction, has been reported for children with congenital palatine defects.<sup>13-18</sup> In humans, dilation of the Eustachian tube, which occurs actively during episodes of swallowing, requires a normally functioning tensor veli palatini muscle.<sup>19-21</sup> A similar relationship between congenital palatine defects and middle ear disease has been described in dogs and cats.<sup>6,7,22</sup> Gregory<sup>6</sup> demonstrated radiographic evidence of middle ear disease and bulla malformation in dogs with various congenital palatal defects. Similar findings were documented in a more recent case series by White et al.<sup>7</sup> No abnormalities were detected on otoscopic examination of the external ear canals and tympanic membranes in the dog of the present report. Further investigations in the form of bulla radiography, bulla CT, tympanocentesis, or brain-evoked auditory response may have proven beneficial in investi-

gating possible associated middle ear disease in this dog; however, these procedures were not performed because of financial constraints.

For the dog of the present report, a broad-spectrum antimicrobial<sup>e</sup> was administered IV to reduce the perioperative intraoral bacterial load in this clean-contaminated site and in light of the patient's chronic mucopurulent nasal discharge. Antimicrobials were not administered to the dog postoperatively, considering the rich blood supply that the oral mucosa possesses and the resistance to infection that this confers.

This report describes the use of a split-thickness soft palate hinged flap and bilateral buccal mucosal flaps to reconstruct a bilateral hypoplastic soft palate in a dog in which a pseudouvula was not a prominent feature. To the authors' knowledge at the time of writing, this 1-stage technique has not been previously described as a means of soft palate reconstruction in dogs. On the basis of the favorable outcome in the dog of the present report, we suggest consideration of the use of this technique for management of similarly affected dogs with bilateral soft palate hypoplasia. Compared with previously described techniques, it offers the possibility of 1-stage reconstruction of the soft palate, rather than having 2 staged procedures,<sup>7</sup> and a robust tissue combination that is expected to be less prone to trauma.<sup>5</sup> This technique may be particularly suitable for affected dogs in which a pseudouvula is not a prominent feature and is applicable to a variety of skull morphologies. Owners should be made aware that the absence of normal palatine muscle within the reconstructed palate may affect function, but even where normal function is not regained, a good quality of life with minimal clinical signs can be achieved.

## Footnotes

- a. ACP injection, Novartis Animal Health, Camberley, Surrey, England.
- b. Morphine sulfate injection BP, Martindale Pharmaceuticals Ltd, Romford, Essex, England.
- c. Alfaxan, Vetoquinol, Buckingham, Buckinghamshire, England.
- d. Vetflurane, Virbac Animal Health, Bury St Edmunds, Suffolk, England.
- e. Zinacef, GlaxoSmithKline, Cork, Ireland.
- f. 4-0 Monocryl, Ethicon, Somerville, NJ.

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#### From this month's AJVR

### Effects on indicators of tissue perfusion in dogs anesthetized with isoflurane at two multiples of the minimum alveolar concentration

Beatriz P. Floriano et al

#### OBJECTIVE

To investigate the effects of isoflurane anesthesia administered at 2 multiples of the minimum alveolar concentration (MAC) on tissue perfusion in dogs.

#### ANIMALS

8 healthy young adult Beagles.

#### PROCEDURES

A randomized crossover design was used. Dogs were anesthetized with isoflurane at 1.5 or 2.0 times the MAC for 2 hours, a 7-day washout period was provided, and dogs were reanesthetized with the opposite treatment. Various physiologic variables were monitored before anesthesia (baseline), at 20-minute intervals during anesthesia, and after anesthetic recovery. Variable values were compared between MAC multiples by means of repeated-measures ANOVA, with the Tukey test used for multiple comparisons.

#### RESULTS

During anesthesia, mean arterial blood pressure, cardiac output, and mixed venous oxygen saturation were significantly greater when isoflurane was administered at 1.5 versus 2.0 times the MAC. Cardiac output gradually increased during anesthesia at 1.5 times but not at 2.0 times the MAC. Arterial blood lactate concentration did not differ between MAC multiples at any point; however, this concentration decreased with increasing anesthetic duration at both MAC multiples. Oxygen delivery differed between MAC multiples, and oxygen consumption differed from baseline during anesthesia at 2.0 times the MAC. Oxygen extraction was higher at 2.0 versus 1.5 times the MAC. Heart rate differed between MAC multiples only after anesthetic recovery.

#### CONCLUSIONS AND CLINICAL RELEVANCE

Isoflurane anesthesia impaired tissue perfusion in dogs, but these changes would not be clinically relevant with oxygen delivery at 100%. Peripheral tissue perfusion was maintained or improved with time. (*Am J Vet Res* 2016;77:24-31)



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