Use of the ComPact UniLock System for ventral stabilization procedures of the cervical spine
A retrospective study

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Summary
This study evaluates clinical application of the ComPact UniLock* System for ventral stabilization of the cervical spine. Patient material included 13 consecutive cases, 12 dogs and one cat, with cervical spinal instabilities secondary to disc-associated wobbler syndrome (six dogs), traumatic, iatrogenic, and disc-associated cervical spinal instability of small dogs (four cases), cervical spinal fractures (one dog and one cat), and congenital atlantoaxial instability (one dog). The 2.0 system was used in smaller patients and the 2.4 system was applied in large dogs. Implant failure was observed on follow-up radiographs in one dog with a healed C2 fracture and screw pullout occurred in one dog with caudal cervical spondylomyelopathy, necessitating revision surgery. Implants remained stable throughout the follow-up period in the other cases. ‘Good’ or ‘excellent’ clinical outcome was achieved in 12 patients, including the dog with revision surgery. One dog had to be euthanized due to postoperative deterioration of neurological status and development of pneumonia. The ComPact UniLock system was found to be a suitable implant for treating cervical instabilities of different origin in both small and large patients with lesions from C1/C2 to C6/C7. Some problems were encountered in the dogs with disc-associated Wobbler syndrome, such as lack or slow rate of vertebral fusion and partial collapse of the distracted intervertebral space on follow-up radiographs. A lack of adequate fusion was most likely related to grafting techniques used.

Keywords
UniLock, cervical spine

Introduction
Different implants have been used for ventral stabilization procedures of the cervical spine in small animals. Their choice is mainly based on size of the animal, localization of the lesion, type of instability, preference of the surgeon, and availability of implants. Transarticular pins or screws, plates, and pins combined with polymethylmethacrylate (PMMA) have been applied in attempt to fuse unstable atlantoaxial joints in miniature breeds (5, 15, 18, 20, 24). Cervical spinal fractures are usually stabilized with pins and PMMA (2). Vertebral distraction and fusion for treatment of caudal cervical spondylomyelopathy associated compression and instability have been performed using a screw and washer techniques (13), interbody screw fixation (3), plastic plates (3), pins and PMMA (4), and screws and PMMA (6). Overall, pins or screws and PMMA is probably the most widely used ventral cervical stabilization technique, despite its potential for cement related complications.

Spinal locking plate systems are available for anterior stabilization of the cervical spine in human surgery. Screws of locking plate systems are less likely to loosen than conventional screws and can be inserted monocortically with sustained stability (14, 17, 22), thus reducing the risk for iatrogenic damage of the spinal cord and respecting blood supply to the vertebral bodies. Human cervical spine plate systems may be used in large-breed dogs (21), but are too large for smaller patients. A locking plate system designed for maxillofacial surgery, the ComPact UniLock* System, is available in smaller sizes. Possible applications in small animal surgery, including spinal instabilities, have been described recently (10, 25). The present study evaluates retrospectively the clinical use of the ComPact UniLock System for treating cervical spinal instabilities in 13 consecutive patients.

Material and methods
Thirteen consecutive cases, 12 dogs and 1 cat, treated by stabilization or distraction and stabilization of the cervical spine with the ComPact UniLock System, were evaluated retrospectively (Table 1). Diagnosis was made based on the neurological examination, plain radiographs, myelography, and/or computed tomography. The preoperative neurological status were graded as follows: grade 1 included animals with neck pain only, grade 2 represented animals with ambulatory tetraparesis, and grade 3 was used for animals with non-ambulatory tetraparesis and intact deep pain sensation. In paraparetic animals, it was further distinguished between animals with normo- or hyperreflexia of the forelimbs (a), and animals with hyporeflexia of one or both forelimbs (b).

The surgical procedure varied according to the diagnosis, but involved stabilization or distraction and stabilization with the ComPact UniLock System in all of the cases. A ventral midline approach to the cervical spine was used. A ventral slot was performed in animals with disc-associated lesions. Distraction was performed manually or by using a modified Gelpi retractor placed into the ventral slot opening if the myelogram revealed a traction-responsive
Table 1  Summary of patient details, surgeries, and clinical and radiological outcome. Cases 1 to 6 are the patients with disc-associated-wobbler syndrome. A partial ventral slot was performed and distraction was achieved with Gelpi retractors placed into the slot. The vertebrae were stabilized with two 2.4 UniLock plates. Either a cancellous autograft from the proximal humerus, or a combination of a cancellous dowel and cancellous autograft were placed into the ventral slot. Cases 7 to 10 include the small dogs with disc-associated, iatrogenic, or traumatic cervical instabilities. Reduction and/or distraction was achieved by manual manipulation of the head. Two 2.0 UniLock plates were applied across the lesion. No bone graft was used in these patients. Cases 11 and 12 were patients with cervical fractures, stabilized with the 2.0 UniLock system after fracture reduction by manual manipulation of the head. Arthrodesis and stabilization of the atlantoaxial joint was performed with the 2.4 UniLock system in case 13, a dog with congenital atlantoaxial instability. *The cases marked have already been described in another report (10).

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Patient</th>
<th>Preoperative neurological grade</th>
<th>Radiological diagnosis</th>
<th>Surgery</th>
<th>Postoperative period</th>
<th>Clinical outcome (time of last follow-up)</th>
<th>Radiological outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1*</td>
<td>Great Dane, male, 5-year-old</td>
<td>Grade 2b</td>
<td>Caudal cervical spondylo-myelopathy C6/C7</td>
<td>Distraction and stabilization with UniLock 2.4, cancellous autograft</td>
<td>Grade 3b Grade 2b after 10 days</td>
<td>Good (5 months)</td>
<td>Implants stable Ongoing fusion Collapse IVS</td>
</tr>
<tr>
<td>2</td>
<td>Doberman Pinscher, male, 3-year-old</td>
<td>Grade 2b</td>
<td>Caudal cervical spondylo-myelopathy C6/C7</td>
<td>Distraction and stabilization with UniLock 2.4, cancellous autograft</td>
<td>Grade 3b</td>
<td>Develops pneumonia, euthanasia after 10 days</td>
<td>Poor</td>
</tr>
<tr>
<td>3</td>
<td>Labrador Retriever, male, 8-year-old</td>
<td>Grade 2a</td>
<td>Caudal cervical spondylo-myelopathy C6/C7</td>
<td>Distraction and stabilization with UniLock 2.4, cancellous autograft</td>
<td>Grade 2a</td>
<td>Excellent (3 months)</td>
<td>Implants stable No fusion Collapse IVS</td>
</tr>
<tr>
<td>4</td>
<td>Doberman Pinscher, female, 5-year-old</td>
<td>Grade 2a</td>
<td>Caudal cervical spondylo-myelopathy C6/C7</td>
<td>Distraction and stabilization with UniLock 2.4, cancellous autograft and cancellous dowel</td>
<td>Grade 2a</td>
<td>Good (6 months)</td>
<td>Implants stable Ongoing fusion</td>
</tr>
<tr>
<td>5</td>
<td>Doberman Pinscher, spayed female, 8-year-old</td>
<td>Grade 2a</td>
<td>Caudal cervical spondylo-myelopathy C6/C7</td>
<td>Distraction and stabilization with UniLock 2.4, cancellous autograft and cancellous dowel</td>
<td>Grade 3a</td>
<td>Implant loosening after 1 week, revision with pins and PMMA</td>
<td>Poor with Uni-Lock Good after revision (6 weeks)</td>
</tr>
<tr>
<td>6</td>
<td>Doberman Pinscher, female, 9-year-old</td>
<td>Grade 3a</td>
<td>Caudal cervical spondylo-myelopathy C6/C7</td>
<td>Distraction and stabilization with UniLock 2.4, cancellous autograft and cancellous dowel</td>
<td>Grade 3b Grade 2a after 4 weeks</td>
<td>Good (3 months)</td>
<td>Implants stable Nearly fused Collapse IVS</td>
</tr>
<tr>
<td>7</td>
<td>Dachshound, female, 12-year-old</td>
<td>Grade 2b</td>
<td>Vertebral subluxation after ventral slot for cervical disk disease C5/C6</td>
<td>Stabilization with UniLock 2.0</td>
<td>Grade 2b</td>
<td>Excellent (6 weeks)</td>
<td>Implants stable No fusion</td>
</tr>
<tr>
<td>8</td>
<td>Jack Russell, male, 10-year-old</td>
<td>Grade 3a</td>
<td>Cervical disc disease C4/C5</td>
<td>Ventral slot and stabilization with UniLock 2.0</td>
<td>Grade 3a Grade 2a within 4 days</td>
<td>Excellent (2 months)</td>
<td>Implants stable No fusion</td>
</tr>
<tr>
<td>9</td>
<td>Miniature Poodle, castrated male, 7-year-old</td>
<td>Grade 3b</td>
<td>Vertebral subluxation after bite injury C5/C6 and C4/C5</td>
<td>Manual distraction and stabilization of C4 to C6 with UniLock 2.0</td>
<td>Grade 3b Grade 2b within 4 days</td>
<td>Good (6 weeks)</td>
<td>Implants stable No fusion</td>
</tr>
<tr>
<td>10</td>
<td>French Bulldog, male, 6-year-old</td>
<td>Grade 2a</td>
<td>Cervical disc disease with subluxation C3/C4</td>
<td>Ventral slot and manual distraction and stabilization with UniLock 2.0</td>
<td>Grade 2a</td>
<td>Excellent (9 months)</td>
<td>Implants stable Ongoing fusion</td>
</tr>
<tr>
<td>11*</td>
<td>German Shepherd, spayed female, 4-year-old</td>
<td>Grade 3a</td>
<td>Oblique fracture of cranial vertebral body C2</td>
<td>Fracture reduction and stabilization with UniLock 2.0</td>
<td>Grade 3a Grade 2a within 2 days</td>
<td>Good (7 months)</td>
<td>Fracture healed, but breakage and pullout of several screws</td>
</tr>
<tr>
<td>12</td>
<td>Domestic shorthair cat, female, age unknown</td>
<td>Grade 3a</td>
<td>Vertebral body fracture C3</td>
<td>Fracture reduction and stabilization with UniLock 2.0</td>
<td>Grade 3a Grade 2a within 3 days</td>
<td>Excellent (7 weeks)</td>
<td>Implants stable Fracture healed</td>
</tr>
<tr>
<td>13</td>
<td>Doberman Pinscher, female, 8-month-old</td>
<td>Grade 2a</td>
<td>Congenital atlantoaxial instability</td>
<td>Arthrodesis and stabilization with pins and UniLock 2.4, cancellous autograft</td>
<td>Grade 2a</td>
<td>Excellent (6 months)</td>
<td>UniLock plates stable Aligment of 1 pin Joint fused</td>
</tr>
</tbody>
</table>

IVS = Intervertebral space. Neurological grades: Grade 2a: Ambulatory tetraparesis with normo-/hypermobility of the forelimbs; Grade 2b: Ambulatory tetraparesis with hyporeflexia of one or both forelimbs; Grade 3a: Non-ambulatory tetraparesis with normo-/hypermobility of the forelimbs; Grade 3b: Non-ambulatory tetraparesis with hyporeflexia of one or both forelimbs.
lesion. For traumatic instabilities, fractures or luxations, reduction was achieved by manipulation or traction of the head of the patient, with the atlanto-occipital joint held in flexion.

Two ComPact Uni-Lock plates were then applied parallel to each other in both vertebral bodies adjacent to the lesion. Plate size was chosen empirically. For the cat and the smaller dogs the 2.0 system was used, and for larger dogs the 2.4 System. The 2.4 system also accepts 3.0 screws, which were chosen in five out of eight large dogs. Vertebral body height was measured on laterolateral radiographs in order to estimate the depths of the drill hole to avoid penetration into the vertebral canal. The plates were bent intraoperatively. The screws were inserted perpendicular to the plate with the help of a special drill sleeve, in order to achieve locking of the screw heads in the plate holes. As the drill sleeve was secured to the plate, it could be used to hold the plate to control the orientation of the drilling for the first screw hole. An oscillating drill mode was used in all cases. Depending on the size of the vertebrae, one to three self-tapping screws of appropriate length were inserted per plate, cranial and caudal to the lesion. Cancellous autograft from the proximal humerus, or a cancellous dowel combined with cancellous autograft was inserted into the ventral slot or joint space and below the implants in seven of the cases (Table 1).

Radiographs were obtained postoperatively to evaluate restoration of the spinal canal and positioning of the implants. The patients were treated according to their general and neurological status, with control of bladder function, frequent turning of non-ambulatory animals, and physiotherapy. Postoperative pain control was either achieved with morphine, fentanyl-patches, or a constant rate infusion of morphine, lidocaine and ketamine combined. A neck brace was not applied postoperatively.

Follow-up examinations were performed between six weeks and nine months after surgery, and included a neurological examination and control radiographs. Computed tomography was performed in one dog (case 4). The clinical outcome was graded excellent if complete resolution of pain and neurological deficits was achieved, and was graded ‘good’ if pain relief and/or neurological recovery were not achieved, or if the animal was euthanized. The implant stability and vertebral fusion were evaluated from the control radiographs.

**Results**

The patients included eight large breed dogs, four small breed dogs, and one cat. The body weight of the patients ranged from 4 to 46 kg and they were between eight months and 12 years old. Preoperatively, all of the patients had neck pain. Eight of them had grade 2 and five of them grade 3 neurological deficits. The diagnosis was a disc-associated ‘Wobbler’ syndrome in six large dogs, cervical instabilities related to different causes in four small dogs, cervical spinal fractures in one dog and one cat, and congenital atlantoaxial instability in one dog (Table 1). Overall, significant intraoperative problems were not encountered during application of the implants. Drilling of the first screw hole through the plate was found to be a critical matter because the screws have to be inserted perpendicular to the plate. The direction of insertion of the first screw dictates the position and angle of the plate, and the direction of the following screws. Measuring the height of the vertebral bodies on laterolateral radiographs allowed insertion of monocortical screws in the dogs, with the screw tips ideally located just ventral to the cortical lining of the vertebral canal (Fig. 1). In the cat with a C3 fracture even the shortest screws (6 mm) were too long to be inserted monocortically and their tips reached the vertebral canal (Figs. 2A, B).

A traction-responsive lesion was diagnosed myelographically at the C6/C7 intervertebral space in all six dogs with disc-associated Wobbler syndrome (Table 1, cases 1 to 6). Preoperative neurological state was grade 2 in five dogs, and grade 3 in one dog. Treatment consisted of a ventral slot, distraction of the intervertebral space with Gelpi retractors, and stabilization of the affected C6/C7 vertebrae with the 2.4 Uni-Lock system (Figs. 3A, B). Bone grafting was performed in all six cases. Either an autogenous cancellous bone graft from the proximal humerus, or a cancellous dowel in combination with cancellous autograft was used (Table 1). The clinical outcome with the UniLock stabilization was ‘excellent’ in one case, ‘good’ in three cases, and ‘poor’ in two cases. One Doberman Pinscher had deterioration of neurological symptoms postoperatively, developed pneumonia, and was euthanized 10 days postoperatively (case 2). Incomplete pullout of the caudal screws was suspected radiographically in another Doberman Pinscher and was confirmed at revision surgery (case 5). Revision with pins and PMMA resulted in good clinical and radiographical outcome. Evidence of vertebral fusion was only present in three out of five cases at the final control. Subjectively, insertion of a cancellous dowel seemed to result in better bony fusion compared to insertion of autogenous cancellous bone graft alone. Some degree of collapse of the stabil-

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b Veterinary Transplant Services, Seattle, WA, USA.

c Morphin HCl, Sintetica S.A. Mendrisio, Switzerland.

d Durogesic®, Janssen-Cilag AG, Baar, Switzerland.

e Lidocain HCl 2%, Kantonsapotheke Zurich, Switzerland.

f Narketan®, Vetoquinol AG, Baar, Switzerland.
ized intervertebral space was found on follow-up radiographs in all dogs with disc-associated Wobbler syndrome, compared to postoperative radiographs (Fig. 3C). In some dogs, the screws seemed to have bent slightly just below the plate. Bone lysis around the screws was also observed.

Four small dogs with different causes of cervical spinal instabilities were included in the study (Table 1, cases 7 to 10). Instability was secondary to a ventral slot in two cases. Vertebra! subluxation was diagnosed radiographically four days after the ventral slot procedure in one of these dogs (case 7). The affected vertebral segment was considered unstable intraoperatively in another dog with cervical disc disease after having performed a ventral slot (case 8). One dog suffered traumatic disc extrusion with vertebral subluxation (case 9), and one brachycephalic dog had a distraction-responsive disc-associated lesion (case 10). Preoperatively, two dogs were ambulatory and two dogs were non-ambulatory. Manual reduction or distraction was performed if necessary prior to stabilization with the 2.0 Uni-Lock system. Bone grafts were not applied in any of these cases. In the dog with traumatic subluxation three vertebrae were incorporated in the fixation, as the clinically relevant lesion could not be determined on radiographs or myelography. Stabilization of the affected vertebra resulted in relief of neck pain and significant improvement of neurological deficits within two to four days in all of the patients in this group. Three dogs had an ‘excellent’ outcome, and one dog a ‘good’ outcome. Complications were not encountered. The follow-up radiographs displayed signs of vertebral fusion in just one dog.

Other conditions treated with ventrally placed UniLock plates were: cervical spinal fractures in a cat and one dog, and congenital atlantoaxial instability in one dog (Table 1, cases 11 to 13). Both fracture patients had severe neck pain and grade 3 neurological deficits before surgery. An ‘excellent’ clinical and radiological outcome was achieved in the cat. In the dog with an oblique fracture of the cranial body of C2, the cranial fragment was too small to insert a sufficient number of screws and the fixation therefore incorporated the atlantoaxial joint. Breakage or pullout of several screws was detected radiographically seven months after surgery, although the fracture had healed. Clinical outcome was good. In the Doberman Pinscher with atlantoaxial instability and hypoplasia of the dens of the axis (Fig. 4A) stabilization and fusion of the atlantoaxial joint was achieved by removing the articular cartilage with a high-speed pneumatic drill, placement of cancellous bone graft, and stabilization with cross pins and two 2.4 UniLock plates (Fig. 4B). The clinical outcome was excellent and on radiographic assessment the plates were stable (Fig. 4C).

**Discussion**

Ventral stabilization of the cervical spine is indicated in several disease conditions, such as atlantoaxial instability, caudal cervical spondylomyelopathy, and fractures/subluxations of the cervical spine. A variety of techniques are available for stabilization of the cervical spine and the choice of implants usually depends on the anatomical site, cause and stability of the disorder, and surgeon’s preference. The current most widely used method is probably cervical ventral stabilization with pins or screws and bone cement (2,4,6,20,27). The advantages of the technique include a low implant cost and the ability to angle the pins or screws as required. The disadvantages of using bone cement include: an increased risk of infection, possibility of pin migration, compres-
sion of adjacent structures if excessive amounts of cement are used, and difficulties if revision surgery if such is required (27).

In theory, these disadvantages could be avoided with plate fixation, but ventral cervical spinal plating has been infrequently used in veterinary surgery (1, 3, 10, 21, 23). Plastic plates have been used in dogs with caudal cervical spondylomyelopathy, but the implants were considered too weak, especially in non-ambulatory dogs (3). Anterior plate fixation is an established method for stabilizing cervical spinal instabilities in human surgery. Screw loosening can be a problem with conventional plates, therefore the use of locking plate systems is considered preferable to conventional plating (1). The main advantage of locking plate systems is the inherent angular stability between plate and screws. Biomechanical data from human studies suggest that locking plates offer more stability than non-locking plates. In one study, resistance to large angular bending displacement was shown to be inferior with a conventional system due to screw loosening, when compared to a locking plate system (22). Another study showed comparable stability of the two systems after cyclical loads, but screw loosening was also seen more frequently with the conventional system (17). Additionally, the locking system allows the use of monocortical screws (22), thus reducing the risk for iatrogenic damage to neural and vascular structures during implant application.

The clinical application of the UniLock plates was considered feasible in different locations of the cervical spine of animals weighing between 4 and 46 kg. The locking mechanism allows placement of the plate at a small distance to the bone, and the plate does not have to match the bony surface exactly, facilitating plate bending (10). The drill guide can be screwed in the plate holes, granting precise interlocking of the screw heads in the plate holes. It also assists in manipulation of the plate during insertion of the screws. The screws are self-tapping, thus enhancing holding power and reducing surgery time. The need to insert the screws perpendicular to the plate is a slight disadvantage of the UniLock system when applied to the spine because it reduces freedom for placing the screws. Careful checking of the position of the plate holes before the plate is applied is crucial for achieving sufficient bone anchorage, avoiding screw placement.

![A) and B) Laterolateral and ventrodorsal postoperative radiographs of a dog with a traction responsive lesion at the C6/C7 intervertebral space (case 3). After a ventral slot and distraction of the intervertebral space with Gelpi retractor, two 2.4 UniLock plates with two 3.0 mm screws each were applied parallel to each other across the lesion. The screws were inserted monocortically. Although not visible radiographically, cancellous bone graft was inserted into the slot. C) Laterolateral follow-up radiographs of the same dog three months postoperatively. The intervertebral space is collapsed by around 3 mm (estimation by measuring length of L6 and L7). Some of the screws are angled minimally towards the intervertebral space and radio lucency is visible around screws. One plate seems to be backed off the bone caudally, but this may be partially due to rotational malpositioning of the dog compared to postoperative radiographs. Obvious signs of fusion are not present. The dog had an ‘excellent’ clinical outcome.](image)
allow an overall statement on implant stability. Gross implant failure only occurred in the dog with a fracture of the cranial body of C2. It was assumed that implant failure occurred after the fracture had healed because no loss of reduction was observed on follow-up radiographs. One reason for implant failure could have been that the plates crossed the atlantoaxial joint in order to allow insertion of a sufficient number of screws cranially. An attempt was not made to fuse the atlantoaxial joint. Therefore continuous motion of the joint might have caused repetitive stress and metal fatigue, leading later to screw breakage. Additionally, the 2.0 system was used in this case, which seems undersized retrospectively. In one study, comparing different locking plate systems, the ComPact UniLock System was the only one where screw breakage occurred (12). In large dogs it seems therefore more appropriate to use the 3.0 mm instead of 2.4 mm screws with the 2.4 plate system.

Overall, the clinical outcome was good to excellent in 11 out of 13 patients. Most problems were encountered in the group of dogs with disc-associated Wobbler syndrome (Table 1, cases 1 to 6). Postoperative deterioration of neurological symptoms in case 2 was probably not implant related, but due to intraoperative bleeding, insufficient distraction, or iatrogenic spinal cord injury. However, implant loosening, necessitating revision occurred in one dog (case 5) and the other four dogs also showed some degree of collapse of the intervertebral space at the final control compared to postoperative radiographs. Although the implants remained in their original position and were judged to be grossly stable in these cases, collapse of the intervertebral space, slight screw bending, and radiolucency around screws in some cases are signs of instability. Due to the locking mechanism, between screw heads and plate holes, continuous motion or stress at the implant-bone surface may cause bone resorption and subclinical instability of the implants with time, rather than screw pull-out and gross implant failure. Insertion of a rigid spacer into the intervertebral space would probably help to prevent collapse.

Vertebral fusion was attempted in six large dogs with Wobbler syndrome and in one small dog with disc-associated vertebral instability. The rate and incidence of bony fusion in the present study was judged to be insufficient. Further improvement of grafting techniques is necessary, as continuous stress on the implants may lead to implant failure or loosening with time if fusion does not take place. Progressed vertebral fusion...
was only observed in one, and signs of ongoing fusion were seen in four of the patients at the time of follow-up, which was between three and nine months postoperatively. In another study, radiographic evidence of bony fusion occurred in a time period of nine to 24 weeks in most of the dogs after distraction and fusion with screws and bone cement and insertion of a corticocancellous bone block in between the vertebrae (6). Insuffcient surgical preparation of the intervertebral space or insuffcient amount of cancellous bone graft placed into the ventral slot might have prevented complete and rapid fusion in the cases of the present study. A cancellous dowel was therefore inserted into the ventral slot in addition to cancellous autograft in the last three operated dogs with wobbler syndrome. Subjectively, bony bridging appeared to be occur faster in these cases.

A lack of complications and a ‘good’ to ‘excellent’ clinical and radiological outcome was achieved in four small dogs with cervical spinal instability, in the cat with the C3 fracture (Fig. 3), and in the Doberman Pinscher with congenital atlantoaxial instability (Fig. 4). UniLock stabilization was performed in two small dogs with Hansen type I cervical disc extrusion after instability following a ventral slot procedure. Although a ventral slot followed by retrieval of disc material is often sufficient for patients with Hansen type I cervical disc extrusion, instability may occur at the affected site. Especially dogs with disk extrusions in the caudal cervical spine, and dogs in which a broad slot has been performed, are at risk of vertebral subluxation, collapse of the intervertebral space, and subsequent compression of the nerve roots (7, 9, 11). Reduction of postoperative morbidity and improvement of clinical results was demonstrated in dogs with caudal cervical disk disease when distraction and stabilization was performed additionally to a ventral slot (7).

Congenital atlantoaxial instability is a syndrome occurring mostly in miniature or small breed dogs. Only a few cases have been described in large breed dogs, including a Doberman Pinscher, two Rottweilers, a Basset hound, and a Weimaraner (8, 9, 16, 18, 26). Radiographic features of the Doberman Pinscher in the present report were absence of the dens and atlantoaxial malarticulation, similar to the description of the condition seen in a Rottweiler (26). The most successful outcomes for atlantoaxial stabilization in small dogs have been described with lag screw fixation and pins embedded in PMMA (5, 20). The disadvantages with the pins and PMMA fixation include: the bone cement bulk does not permit closure of the longus colli muscle, can lead to deviation of the larynx and oesophagus, and radiographic evaluation of vertebral fusion or fracture healing is not possible, at least in small dogs (20). None of these problems were encountered in the dog described herein.

In summary, the ComPact UniLock system was found to be a versatile implant for ventral stabilization of different disease conditions of the cervical spine in a cat and both small and large breed dogs. Larger case numbers and longer follow-up periods are necessary to give objective criteria for selecting plate and screw size. Based upon the findings of the present study the 2.0 system seems appropriate for cats and smaller dogs. In large dogs the 2.4 plates should be used in conjunction with 3.0 mm screws. The technique for vertebral distraction and fusion in dogs with caudal cervical spondylolomyelopathy must be improved. Avoiding excessive distraction and inserting a rigid spacer into the intervertebral space may help to prevent collapse of the intervertebral space. Different bone grafting techniques should be evaluated in larger studies to determine their effectiveness on rate of vertebral fusion.

References


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