Degenerative lumbosacral stenosis (DLSS), cervical spondolomyelopathy (CSM) and thoraco-lumbar intervertebral disc protrusion are all chronic debilitating conditions of the canine spine. Multiple disparate treatment modalities have been proposed, primarily constituting decompression and stabilization techniques. A novel intervertebral spacer device (FITS, Fitz Intervertebral Traction Screw, patent pending) has been described for intervertebral distraction and when used with adjunctive fixation elements can distract and stabilize neuroforaminal dimensions and alleviate spinal canal stenosis. Maintenance of clinical improvement following such surgical intervention has been documented for the lumbosacral and cervical regions, and at the time of writing, validation for thoraco-lumbar spinal applications is ongoing.

The initial clinical study population of dogs affected by DLSS consisted of 23 dogs presented January 2007 - December 2008. Signalment, duration of clinical signs, pre-operative and 12 week post-operative radiography, MRI, complications and one year post-operative clinical and owner visual analog scale (VAS) scores were recorded. All presented with clinical signs attributable to lumbo-sacral and sciatic nerve pain and MRI-documented abaxial neuroforaminal impingement. Standard T2 sagittal and transverse MRI scans were performed in addition to 40-45° angled para-sagittal oblique T2 and T1 images of the neuroforaminae. Standard dorsal laminectomy without facetectomy was followed by intervertebral disc annulectomy and nuclear extirpation. The FITS was inserted manually into the IVD space at the site of annulectomy to a level below the cauda equina nerve roots. Negative profile 2-5-3mm threaded pins were placed across the LS facets, into the vertebral body of L7 bilaterally and into the sacro-iliac junction bilaterally. All pins were “notched” with an appropriate cutter and enshrouded in a bolus of polymethylmethacrylate cement applied dorsal to L7-S1 with the laminectomy site protected using autogenous muscle/fat.

Breeds included Labrador Retriever (30.43%), German Shepherd (21.73 %) and Rottweiler (17.39%). Male dogs constituted 60.86%. The median duration of clinical signs was 3 months (range 3 weeks-17 months). Lumbo-sacral and sciatic nerve pain were present for all cases, whilst abnormal gait or behaviour, lameness, reduced myotactic reflexes, altered tail carriage and micturition functionality varied. All except one dog were able to micturate and defaecate normally by 3 days post-operatively, with one exception taking 10 days to voluntarily urinate. Pelvic limb function deterioration was noted in one patient and resolved over 16 weeks, whilst three others took up to 8 weeks to recover normal ambulation. Mean time to resolution of pain and lameness in 21 dogs, by clinical examination and owner VAS score was 4.2 weeks (range 2-16 weeks).

Clinical outcome was evaluated for 15 patients by telephonic interview at mean 495 days post-operatively (range 300 – 780 days). For exercise level, one owner answered that it was sub-optimal, 66.6% answered high (n=10) and 26.6% moderate (n=4). For degree of pain by “whole number” scale of 1 to 10 with 1 being no pain and 10 being severe pain, 60% answered 1 (n=9), 26.66% said 2 (n=4) and 13.3% said 3 (n=2). Radiography performed at twelve weeks postoperatively for all cases revealed mean magnitude of intervertebral distraction 3.4mm (range 2-6mm) and maintenance of distraction position for all cases, with implant integrity for 20 dogs. Three cases were affected by clinically inconsequential migration of a threaded pin, which was removed and one further case was affected by a seroma and superficial licking associated with self-trauma.

Surgical intervention for DLSS is indicated when neurologic deficits are present, pain is severe, quality of life is affected or there is no response to medical management or physical therapy. Addressing exit zone impingement of the L7 nerve roots even with radical foraminotomy and a trans-ilial approach is difficult because of propensity for iatrogenic trauma and encroaching soft tissue and bone may grow back over time. Furthermore, without adequate stabilisation, dynamic components of deformity may continue to cause clinically relevant pain, especially with respect to the L7 nerve roots in a definitive subgroup of
patients. This clinical data supports application of the technique and documents resilient maintenance of distraction and lasting amelioration of clinical signs. Complications were largely attributable to operator error in that the tips of the pins should be imbedded within and not traverse the trans-cortex. Our results indicate positive and sustainable clinical improvement following application of the FITS device in conjunction with dorsal pins and polymethylmethacrylate in DLSS cases where static or dynamic neuroforaminal impingement is documented. Most recent application of the technique has dispensed with dorsal pins and cement in favour of an internal pedicle screw and fixator system (the Spinal Fitzateur, patent pending). This system is lower profile than pins and cement and is potentially more mechanically robust though biomechanical studies are pending.

The initial clinical study population of dogs affected by CSM consisted of 16 dogs presented for DAWS between 2007 and 2009. MRI confirmed the diagnosis in all cases, and spinal cord compression was caused by intervertebral disc protrusion alone or with one or more of the following lesions: bone-related compression; soft tissue compression and vertebral canal stenosis. A minimum follow up term of 12 months was required as an inclusion criterion. Neurological status was assessed according to a previously described scoring system (Rusbridge et al). Surgical intervention consisted of a routine ventral midline approach with fenestration of the disc followed by removal of the nucleus pulposus. The dorsal annulus was not removed, the FITS device was inserted to affected disc spaces and one or two appropriately contoured 3.5mm locking String of Pearls (SOP™) plate(s) were applied to bridge the affected disc space(s) with monocortical screws, avoiding screw penetration of the spinal canal. Cancellous bone graft harvested either from the proximal humeri or illii was packed along the scarified ventral aspect of all plated vertebrae.

Of the 16 dogs, 5 had one 3.5mm SOP™ plate applied and 11 dogs had two. Mean age at surgery was 75 ±38.1 months and mean weight 33.5±7.1 Kg. there was a significantly significant improvement in neurological status comparing pre-operative and 6 week post-operative scores (paired t-test p-value=0.01). Single disk associated wobbler disease (SDAWS) was diagnosed in 62.5% (n=10), with n=8 affecting C6-C7 and n=4 affecting C5-C6. Multiple disk associated wobbler disease (MDAWS) was found in 37.5% (n=6). Pre and post-operative radiographic assessment showed significant distraction. Pre and 6 week post-operative distraction was not significantly different. Bone bridging was obvious in 12/16=75%. Bone bridging was significantly more prominent for two by comparison with one SOP™ plates (Chi-square p-value=0.02). Domino effect was observed in n=1 and measurable reduction in distraction distance between endplates was found in 8/16=50%. Implant loosening was also found in 8/16=50%. Complications occurred in n=4. Three minor complications (wound infection, collapse with acute pain and left thoracic limb nerve root signature, and intraoperative regurgitation). One case had a major complication, a Doberman with Von Willebrand disease, which required post-surgical blood transfusion.

In spite of short term complication in 4 patients and reduction in magnitude of distraction achieved in 8 patients, significant improvement in neurological score was achieved and maintained to one year for all patients. Bone bridging was significantly improved by using two SOP™ plates. Given that DAWS with some secondary compressive components was the primary presenting feature for all cases, achieving stability via bone bridging in and neutralizing the dynamic component of myelopathy in these cases, notably produced a favorable outcome. In an effort to reduce the magnitude of subsidence of vertebral endplates into the FITS-induced distraction gap, modifications to the ancillary fixation devices have been proposed and are at the time of writing being implemented. CT scans are currently used to more accurately document bony fusion of adjacent vertebral segments. Distraction and sustainable fixation and resolution of clinical signs are possible over several diseased disc sites simultaneously at this time.

At the time of writing, investigation of application of the FITS device to the thoraco-lumbar spine is ongoing and early in vitro and in vivo application is promising, the system involves lateral application of the FITS device to affected discs in association with a limited hemilaminectomy. Customized FITS linkage units are attached to a dorsolaterally applied rod and clamp mechanism to ensure distraction and stability of the construct. A similar construct has been successfully applied to cases of thoracolumbar and lumbosacral discospondylitis.
References: