# Caudal approach and Mini TightRope system (mTR) application for the treatment of craniodorsal hip luxation in a cat: a case report

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**ABSTRACT**: The aim of this study was to evaluate the clinical and radiographic outcome of traumatic craniodorsal hip luxation in a cat, treated with the application of a Mini TightRope (mTR) implant. A caudal approach was carried out in order to expose the hip joint and the sciatic nerve preserving the muscle masses. Clinical follow-up and radiographic recheck were performed at 10 days, one, three, six and 12 months after surgery. Orthopaedic examination was normal 1 month after surgery while the revisit radiographs showed only mild to moderate signs of osteoarthritis (OA) one year later.

**Keywords**: hip; luxation; cat; TightRope; Mini TightRope

Traumatic coxofemoral luxation is a common joint disease in small animal practice (Fry 1974; Duff and Bennett 1982). In most cases the luxation is in a craniodorsal direction, most likely due to contraction of the gluteal muscles (Basher et al. 1986). The dislocation of the femoral head associated with the round ligament and joint capsule injury is responsible for pain and lameness of the affected limb. Clinical signs and radiographic examination are required to confirm the diagnosis. Closed reduction associated with an Ehmer sling, carried out within 72 h, is the traditional treatment for hip luxation but a reluxation rate of 50–70% has been described (Trostel et al. 2000). In addition, the Ehmer sling can be responsible for vascular injury, severe muscle atrophy and joint stiffness (Duff and Bennett 1982; Sissener et al. 2009). In cases of longer standing trauma surgery has been indicated (Trostel et 2000). The goal of the surgical treatment is to restore joint stability by reducing the luxation in order to control the pain and lameness and also to reduce the formation of OA. Many different open surgical techniques for the treatment of hip luxation in dogs and cats including intra- and extra-articular procedures have been described in the veterinary literature (Bennett and Duff 1980; Hammer 1980; Lubbe and Verstraete 1990; Meij et al. 1992; McLaughlin and Tillson 1994; Beckham et al. 1996; Bjerring Mehl 1998; Douglas 2000; Martini et al. 2001; Ozadyn et al. 2003; Pozzi et al. 2004; Spranklin et al. 2006; Cetinkaya and Olcay 2010; Venturini et al. 2010; Rochereau and Bernarde 2012). The variety of techniques and materials suggests that no single method is entirely satisfactory (Lubbe and Verstraete 1990). In cats transarticular pinning, toggle pin fixation and extra-articular stabilisation have been proposed (Bennett and Duff 1980; Hammer 1980; Lubbe and Verstraete 1990; Meij et al. 1992; Bjerring Mehl 1998; Sissener et al. 2009; Rochereau and Bernarde 2012).

The aim of this study was to evaluate the long term clinical and radiographic outcomes of a craniodorsal luxation in a cat treated using the Mini TightRope System.

## Case description

A six year old male domestic short hair cat of 3.8 kg, was referred for the consequences of a road traffic

accident. The patient underwent clinical stabilisation to manage the injury: analgesic (methadone 0.2mg/kg *i.v.* q6h) and antimicrobial (cephoazoline 30 mg/kg *i.v.* q8h) therapy were performed.

Orthopaedic examination revealed pain and lameness of the right hip joint; ventrodorsal and lateral radiographic views of the pelvis showed a unilateral, craniodorsal luxation of the right hip without any evidence of other bone diseases. Closed reduction was performed but evidence of immediate reluxation and subsequent relapse led to the decision to perform surgery. The cat was premedicated with Acepromazine (0.03 mg/kg *i.m.*) and Ketamine (2 mg/kg *i.m*), induced with Propophol (4 mg/kg *i.v.*) and general anaesthesia was maintained with isoflurane and oxygen. The patient was positioned in lateral recumbency with the left limb placed uppermost. The hip joint was exposed using a caudal approach and the skin was incised vertically from the greater trochanter. The biceps femoris muscle was retracted caudally and the sciatic nerve was protected. The joint was exposed by an incision in the cranial edge of the intact gemelli muscles in order to identify the damaged capsule. Bone-holding forceps were attached to the region of the trochanter to expose the femoral head and the acetabulum. Debris, round ligament residue, and other soft tissues in the acetabulum were removed. The hip luxation was reduced and the Mini TightRope implant was used as proposed by Ash and colleagues (Ash et al. 2012). Post-operative radiographic examination confirmed the correct joint position with seated position of the toggle and no bandage was applied (Figure 1). The patient was given cephoazoline (30 mg/kg *i.v.* q8h) and morphine (0.1 mg/kg *i.m* q6h) to manage the post-operative pain. The owners were instructed to limit the physical activity for two weeks but cage rest was not required. Post-operative recheck was performed 10 days, one, three, six and 12 months after surgery (Table 1). Radiographic examinations (medio-lateral and ventrodorsal views) were performed at these times to evaluate the implant position and the possible evolution of degenerative joint disease (DJD). At 10 days after surgery, the weight bearing was acceptable on the limb and the


Figure 1. Post-operative radiographic examination (ventrodorsal view) showing the reduction of the luxation and correct position of the toggle


Figure 2. Radiographic recheck performed one year after surgery: hip reduction, good toggle position and the presence of mild to moderate OA are evident. An increased opacity of the femoral tunnel is also visible

Table 1. Scoring system

| Examination time (days) | 0 | 10 | 30 | 90 | 180 | 360 |
|---|---|---|---|---|---|---|
| Lameness | 4 | 2 | 1 | 0 | 0 | 0 |
| Muscle mass | 0 | 2 | 1 | 0 | 0 | 0 |
| Pain | 4 | 1 | 0 | 0 | 0 | 0 |
| Crepitus | 3 | 1 | 0 | 0 | 0 | 0 |
| ROM | 4 | 1 | 0 | 0 | 0 | 0 |

0 = normal, 1 = slight, 2 = mild, 3 = moderate, 4 = severe

overall lameness was reduced (score of 1 out of 4). There were signs of slight pain; however, there was no crepitus or swelling. After 30 days, lameness had disappeared and there was no pain or crepitus. The muscular mass of the thigh had returned to normal and range-of-motion was similar to that of the controlateral limb. Furthermore, radiographic examination showed no difference with the immediate post-op view. The femoral tunnel was evident and the hip joint surfaces were congruent. At three months a small osteophyte was visible at the cranial effective acetabular rim; at the six months revisit no radiographic differences were observed in comparison with the last recheck. One year after surgery orthopaedic examination was within the normal limits and according to the owner's comments, the patient showed an excellent physical activity. However, a ventrodorsal radiograph of the pelvis showed that the acetabulum was shallower compared to the first post-op radiograph and slightly misshapen due to the remodelling of the cranial effective acetabular rim on the affected side, where the osteophyte was present and was now more evident (Figure 2).

## DISCUSSION AND CONCLUSIONS

The TightRope (TightRope CCL® Arthrex Vet Systems, Naples, FL) system with the use of the novel material FiberWire® was introduced in 2010 as a novel technique for the treatment of cranial cruciate ligament insufficiency and coxofemoral luxation in dogs (Hammer 1980; Bjerring Mehl 1988; Cetinkaya and Olcay 2010). The mTR was introduced in 2012 and consists of a single strand of FiberWire looped twice through the toggle and titan button. In 2012 Ash and colleagues described a novel correction of craniodorsal coxofemoral luxation in four cats and five small breed dogs using a modified knowles technique with the braided polyblend TightRope systems (Ash et al. 2012). The clinical outcome of this report was very encouraging confirming coxofemoral joint congruity six weeks postoperatively and the patients returned to their previous level of activity. Median lameness score at six weeks after surgery was 0/5 while the radiographic examination showed the quality of the hip reduction with the toggle pin in the right position and absence of signs of OA. Follow-up by telephone performed at 16 weeks revealed that all patients returned to their previous level of activity. In addition minimal complications were observed and no revision surgery was required (Ash et al. 2012).

Encouraged by these results, we decided to evaluate the outcome of a modified TightRope surgical technique using a caudal approach for stabilisation of the coxofemoral joint. In our case, clinical examination showed a satisfactory outcome just 10 days after surgery. Furthermore, at one, three, six and 12 months after surgery the orthopaedic examination was normal and radiographic recheck showed no signs of reluxation. In comparison to the first application of the mTR system, we followed up for one year after surgery and the clinical examination performed at this juncture showed no signs of crepitus or pain. In addition, the muscles were similar to the contralateral limb. Radiographs confirmed the hip reduction, good toggle position and mild to moderate signs of OA.

We think it is possible that the OA may have been due to the presence of the device in the joint because no instability was elicited during the orthopaedic examination.

An increased opacity of the femoral tunnel was also observed: we hypothesise that it is a consequence of the mTR inside the bone. We performed a different surgical approach to the hip joint than the one reported by Ash et al. (Venturini et al. 2010). The most common is a cranial approach, as it provides a better approach to the acetabulum. However, it involves injury to the muscular tissue (Piermattei and Johnson 2004; Venturini et al. 2010).

We performed a caudal approach for two main reasons: firstly, to obtain good visualisation of the femoral head and acetabulum without damaging the muscles of hip joint. Secondly, using this technique it is possible to visualize the sciatic nerve so that it may be protected during the procedure

(Venturini et al. 2010). No complications were observed during the course of the treatment and afterwards. One of the most important complications could be implant failure and infection but the TR system is characterised by high resistance, and has superior mechanical properties with respect to creep, stiffness, yield load and load at failure (Burgess et al. 2010; Cook et al. 2010; Tonks et al. 2010; Tamburro et al. 2012). Regarding infection, it is very important to work in a clean environment and to open the system only at the correct moment so as to reduce possible contamination.

In conclusion, whilst no surgical techniques can be considered the gold standard for the treatment of craniodorsal coxofemoral luxation, we believe that application of the mTR system and the use of a caudal approach can be considered a very good solution for restoration of joint stability.

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