

Monitoring of Progress After Total Hip Replacement in Dogs Using Walkway™

by Mila Friere-Gonzalez, DVM & B. Duncan X. Lascelles, PhD

This case report describes sequential assessment of hind limb use in a case of bilateral total hip replacement in a dog, and demonstrates how Tekscan's Walkway™ allowed for objective evaluation of changing limb use as the total hip replacements were performed.

January 2005: Visit Evaluation of Hip Dysplasia

A 9 year old female spayed German Shepherd Dog presents to the NCSU orthopedic service for hip dysplasia.

Reported problems: The owner has observed that the dog is primarily using its forelimbs to get up. The owner has starting to notice the dog has trouble getting into the car, is not generally as active and has gained weight. Up until this time, the owner has not ever noticed any problems (no pain, no lameness).

Orthopedic exam: Bilateral hind limb muscle atrophy. Weight shifting to forelimbs. Short weight bearing phase of gait.

1. Left forelimb:
 - a. Elbow 1/3 crepitus, no pain, no effusion, minimal loss of flexion.
2. Right forelimb:
 - a. Elbow 1/3 crepitus, no pain, no effusion, minimal loss of flexion.
3. Left hind limb:
 - a. Stifle: 1/3 crepitus, no pain, no effusion.
 - b. Hip: 2/3 crepitus, loss of extension and abduction, 2/3 pain. Thigh circumference of 42.5 cm.
4. Right hind limb:
 - a. Stifle: 1/3 crepitus, no pain, no effusion, medial sub-luxation of patella (3-4 mm).
 - b. Hip: 2/3 crepitus, 2/3 pain on extension, decreased extension and abduction. Thigh circumference 42 cm.

Neurologic exam: Decrease in conscious proprioception left hind limb, that could be attributed to pain. No spinal pain. No LS pain.

Overall Assessment: Bilateral hip dysplasia with severe DJD (Figure 1) and significant pain, as a consequence.

Treatment Plan: Medical management consisting of increasing exercise facilitated by NSAID administration (carprofen) and glucosamine/chondroitin sulphate combination.

Figure 1 (right). Ventro-dorsal radiograph of coxofemoral joints at initial visit. Note the lack of extension of both hind limbs that was possible.



February 2005: Re-evaluation

Although the medical management had improved the dog's ability to move around, there was still significant impairment of daily activities reported by the owner. The dog was lame on both hind limbs, and subjective assessment of pain on manipulation resulted in similar pain scores (2/3 being assigned to each hip joint). To determine which hip was more severely functionally affected, the Tekscan pressure sensitive walkway (PSW) was used.

At each visit to the clinic, static (and dynamic) kinetic parameters were collected using the *Walkway* system (Model HRV4). The methods have been described¹, but briefly, for static weight distribution data the dog was walked onto the PSW at a velocity of approximately 1 m/s and then abruptly stopped. This resulted in the dog assuming an approximately square stance with the head held directly in front. After the dog had maintained that position for 3 to 5 seconds, data collection began, and recordings continued for 13 seconds (ie, for 600 frames of data). Data were retained if the dog stood still and relaxed without visibly shifting weight, lifting or off-loading a limb, turning, or lifting or dropping the head. The consistency of data over the 13 seconds was visually evaluated to ensure that there was a 5-second period of steady force recordings. The data set was cut down to a 5-second period of steady force distribution, and readings of average percent weight distribution through each foot were calculated from this. A summary of the mean readings at each visit and expected normal weight distribution is included at the end (Table 1).

Using the *Walkway*, it was determined the left limb was most impaired (Figure 2). We have found that static parameters are very sensitive indicators of limb use, and are a straightforward way to quickly collect useful data in the clinic environment.

Figure 2a: Representative bodyweight distribution profile showing decreased use of both hind limbs, but particularly the left. In this profile (and all others shown), the dog is facing the left, and the limb positions are as labeled at right.

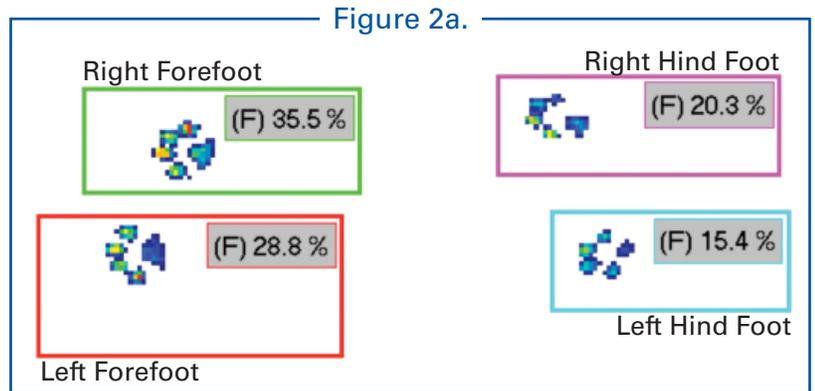
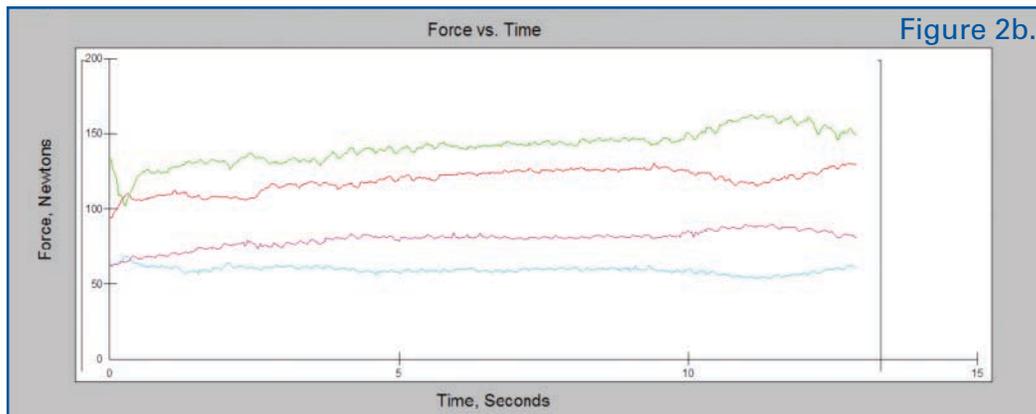


Figure 2b: The graph is used to determine what part of the 13 seconds of data recording will be used for data analysis. In this case, steady standing can be seen to occur between 4 and 9 seconds. This 5-second-long segment is used for data calculations.



Following Tekscan evaluation, an uncemented BFX total hip replacement (BFX THR) was performed on the left coxofemoral joint using a 26 mm Cup and #6 Stem with a +9mm head.

Progress at 3 Months Following Left THR

At 3 months, the owners reported the dog was doing well on the left hip. Static evaluation on the Tekscan force pad confirmed increased weight bearing on the operated limb (Figure 3).

Figure 3: Representative bodyweight distribution profile showing good use of the left hind limb 3 months following THR.



Progress at 6 Months Following Left THR

The owner reported that the dog was doing well at home and did not seem to be painful on the left hind limb and had very good function of the left hind limb. However, the owner reported the right hind limb appeared to be more problematic. Orthopedic examination confirmed pain free function of the left coxofemoral joint, but significant pain associated with the right. BFX THR of the right coxofemoral joint was planned in 3 – 4 months.

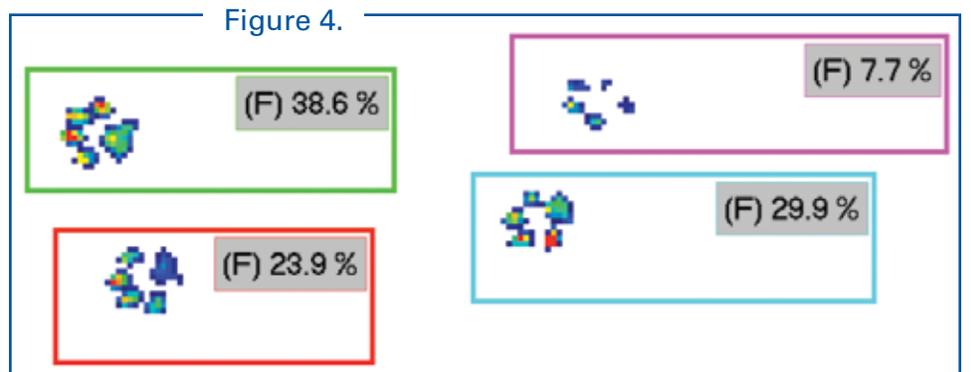
Presentation at 10 Months Following Left THR

History: The owner reported that the dog was progressively restricted in right hind limb function. Although the dog was currently on no medication, the owner reported that medication (NSAID) appeared to make little difference to right hind limb function. The owner reported left hind limb function was excellent.

Orthopedic exam: Right hip joint: decreased range of motion on extension and flexion. Marked pain and crepitus on extension. Marked crepitus and mild pain on flexion. Angles of movement were measured: flexion: 450; extension 1370 (normals for GSDs: flexion: 440; extension: 1550)²
 Left hip: no abnormalities (flexion: 370; extension: 1470)

Tekscan Pressure sensitive walkway was used to evaluate limb use, and confirmed limited use of right hind limb (Figure 4).

Figure 4: Representative bodyweight distribution profile at 10 months following left THR, and just prior to performing right THR.



Following Tekscan evaluation, an uncemented BFX THR was performed on the right using a 26 mm Cup with a #7 Stem and a +0mm head.

Follow-up at 3 Months Following Right THR (13 Months Following Left THR)

History: The owner reported the dog was recovering very well. The dog has been allowed limited free exercise in a large kennel and has not required any analgesic medications.

Orthopedic exam: The dog was found to be in excellent condition with no obvious lameness. Mild muscle atrophy was present in the right hind limb (to be expected at that stage following THR surgery). Radiographic evaluation confirmed that there were no problems with the prostheses (Figure 5).

Figure 5: VD radiograph of the coxofemoral joints showing good placement of both BFXTHRs, and no radiographically apparent implant related problems.



Figure 5.

Tekscan evaluation was performed, and equal normal standing weight-bearing¹ was found for both hind limbs (Figure 6).

Full activity was recommended at this stage, and the dog went on to do very well on the hind limbs.

Figure 6.

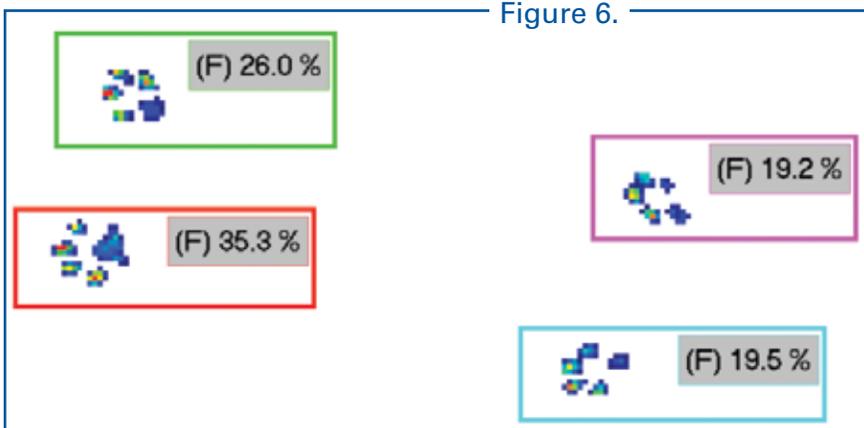


Table 1 (below). Summary of mean % bodyweight distribution values for each limb at each visit, and the expected normal distribution¹.

| Visit | Right Forefoot | Left Forefoot | Right Hind Foot | Left Hind Foot |
|-------------------------------|----------------|---------------|-----------------|----------------|
| Initial Evaluation (Feb 2005) | 34.1 | 27.9 | 23.2 | 14.8 |
| 3 months post - left THR | 34.5 | 25.4 | 16.8 | 23.3 |
| 6 months post - left THR | 29.5 | 30.0 | 15.8 | 24.6 |
| 10 months post - left THR | 37.2 | 25.7 | 9.8 | 27.4 |
| 3 months post - right THR | 26.8 | 33.6 | 20.5 | 19.1 |
| Expected Normal Values | 31 | 31 | 19 | 19 |

Summary

The use of the Tekscan pressure sensitive walkway aided in treatment decisions, allowed the owner to have an objective, visual confirmation of decreased limb use, and also allowed for the collection of objective data as part of the evaluation of this surgical procedure.

References

1. Lascelles BD, Roe SC, Smith E, et al. Evaluation of a pressure walkway system for measurement of vertical limb forces in clinically normal dogs. Am J Vet Res 2006;67:277-282.
2. Thomas TM, Marcellin-Little DJ, Roe SC, et al. Comparison of measurements obtained by use of an electrogoniometer and a universal plastic goniometer for the assessment of joint motion in dogs. Am J Vet Res 2006;67:1974-1979.

*Acknowledgements: Lead surgeons on this case were Drs. Marcellin-Little and Roe.