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PRINCIPLES AND PHYSIOLOGY
The canine hip joint has a ball-and-socket anatomy and its range of motion is three-dimensional. It is weight bearing 10 million cycles annually, capacitating several times the body weight of the animal. For a durable joint, low function bearing has to result from ground reaction creating internal joint forces, and muscles action and co-contraction. The joint lubrication results from a valve effect rather than a bearing, and pathological degradation from the sealing effect leads to loss of cartilage, creating bone bone-to-bone contact, leading to hyperthermia and pain for the dog.1

PROSTHESIS AND IMPLANTS
Total hip replacement (THR) is an accepted method of treatment for dogs with disabling diseases of the hip joint such as: hip dysplasia, coxarthrosis, coxofemoral luxation and fractures of the femoral head and neck. Zurich cementless hip prosthesis (Kyon Inc., Zurich, Switzerland) was developed at the Vetsuisse Faculty of Zurich in the late 1990s. The important characteristic of this prosthesis is the anchorage of the stem with locking screws to the medial cortex of the femur. This avoids the coupling effect of the medial and lateral femoral cortices. It approximates the stress distribution of the proximal femur and later allows bone remodeling around the screws. The initial fixation of the cup is obtained by press fit. The porous design of the cup and its elasticity allow for fluid convection and long-term osseointegration. Various generations of models have been developed to address problems related to luxations, to increase the press fit of the cup, and to reinforce the stem. The cup has been flattened at its pole, and 3 parallel ridges were added to the periphery of the shell. The polyethylene liner has been extended to lateralize the center of motion, resulting in 100° head coverage. Redesign of the peg to avoid stress failure and shot-peening to the stem have been applied, increasing its resistance. All these measures decreased greatly the complications observed with the first generation of prosthesis.2,3,4

MATERIAL AND METHODS
Different sizes of stems and cups exist. Preoperative transparencies on radiographs allow preoperative planning of the proper size of implants. After craniolateral approach, a biplanar osteotomy resection of the femoral head and neck to the level of the lesser trochanter is performed. Preparation of the proximal femur including the area of the fossa intertrochanterica is made using different reamers and broaches acting as template for the stem. The preparation of the acetabulum is the most challenging part of the procedure. Removal of the subchondral sclerotic bone and uniform preparation of the cavity is made with reamers of progressive sizes, respecting the ventral border of the acetabulum. The cup is impacted, respecting the expected lateral opening and inclination, and aligning its periphery with the caudal acetabular lip. Protruding osteophytes are removed, using rongeurs and the level of femoral resection is controlled to facilitate later the reduction of the prosthesis. The femoral component is fixed to the guide and inserted into the proximal femur with the desired anteversion (about 30°). Maintaining the stem in correct position, access holes and then screw holes are drilled and fixed with screws in the medial cortex. After a femoral head and neck of desired length is impacted on the stem, the prosthesis is reduced. Stability of the hip prosthesis is tested and improved with intraoperative changes, if necessary. The surgical wound is reconstructed. Templates can evaluate the position of the cup on postoperative radiographs.2,4

RESULTS
Zurich cementless proved to be reproducible in our first series of 65 cases weighing 32 ± 9.77 kg (range 18-64 kg), and an age of 3.8 ± 2.43 years (range 7 months - 8.2 years). The complication rate was 17%. After resolution of the complications, a successful outcome was achieved in 97% of the THR after an average of 2 years postoperatively.4

CONCLUSIONS
The Zurich cementless prosthesis has now been implanted in about 10’000 dogs. Implantological improvements have been made, such as double shell to improve the osseointegration of the cup or ADLC coating of
the head to reduce significantly friction and formation of particles (Figures 1, 2). A similar system has also been successfully introduced for human patients needing total hip replacement.

Figure 1: Lateral view of the Zurich Cementless THR implanted in a plastic bone model

Figure 2: Same model with sagital view of the cup showing the double titanium shell and the fossa inlay.

REFERENCES