Zurich cementless hip prosthesis and other modern trends in orthopedic surgery

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1 *Zurich cementless* hip prosthesis

First generation hip prosthesis were fixed with PMMA to the bone, often leading to heat necrosis of the bone and subsequent loosening of the implants. Therefore, total hip replacements (THR) were only recommended for elderly dogs, thereby reducing the risk for a second intervention.

New concepts disclaim the use of cementum. They either use press fit or screw fixation to anchor the implants.The most important characteristics of the *Zurich Cementless* hip prosthesis, developed between 1993 and 2001, is avoidance of the coupling effect of the medial and lateral femoral cortices, and stress shielding due to compliance mismatch. The stem is fastened to the medial cortex with 4 to 5 screws. This instantly provides a stable fixation, which approximates the normal physiological stress distribution on the proximal femur. It allows bone remodeling around the screws.

The initial fixation of the cup is attained by a press fit insertion. The porous design of the cup allows fluid convection and its fixation by osseointegration. The cup was originally also fixed with a central screw. The new design with double shell cups allow the acetabular bone to grow easily into the holes of the outer shell, without contact to the polyethylene of the inner cup.

Head neck components, coupled onto the peg of the stem, complete the prosthesis. All implants come with different sizes and are modular.

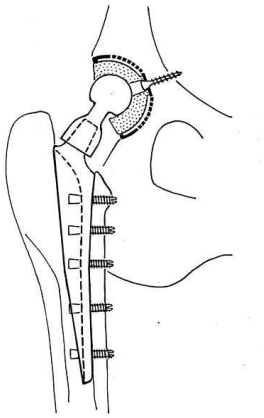

Fig 1: Original design of the Zurich cementless hip prosthesis

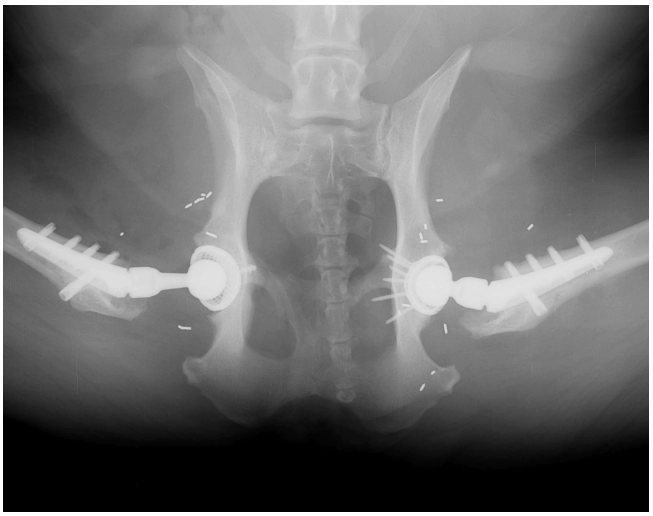

Fig 2: Overweight Rottweiler with both sided hip replacement. The left hip was fixed with a standard double shell cup, whereas the right hip received a revision cup after acatebular fracture

The *Zurich cementless* hip prosthesis is indicated in hip dysplasia, coxarthrosis, hip luxation or trauma to the femoral head from 10 months of age. The surgery is demanding and requires excellent anatomical and biomechanical knowledge. Surgeons willing to perform THR with *Zurich cementless* hip prosthesis must follow an initial 2 days course and are accompanied during their first surgeries.

2 Patellar groove

Instead of rearranging the quadriceps mechanism to correct medial or lateral patellar luxation, this new concept provides a new and stable bed for the patella on its natural position. The femoral trochlea is flattened with an oscillating saw and the new patellar groove, made from titanium, is fixed to the bone. Different sizes for dogs ranging from 2 to 50 kg are available. The first dog with intermediate time result was operated in summer 2009, after four unsuccessful previous surgeries. He still has no problems and is currently presented without lameness.

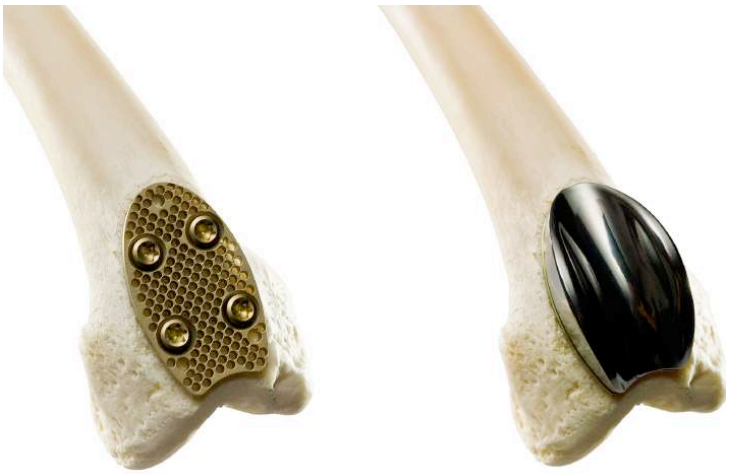

Fig. 3: Patellar groove, consisting of a plate and a groove, made from titanium

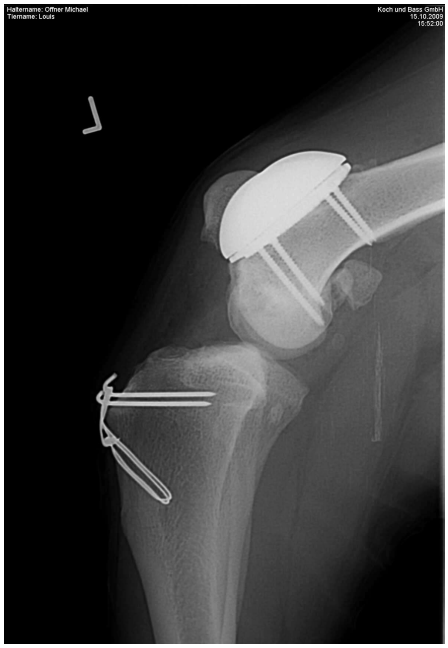

Fig. 4: Postoperative radiograph (the tension band was made in a previous surgery)

3 Internal fixators for osteosynthesis

3.1 Biomechanics of internal fixators

The introduction of locking bone plate/screw systems has generated certain advantages in fracture fixation over other plating methods. Locking plate/screw systems should rather be called internal fixators. The stability is given by the locking mechanism between the screw and the plate. The plate does not need to have intimate contact with the underlying bone, making exact plate contouring less crucial. A diminished contact between the plate and the bone may also preserve the

periosteal blood supply, thereby reducing the extent of bone resorption under the plate. Internal fixators are used in neutralization or buttress mode. Bone healing under internal fixators is indirect.

Experimental studies have shown, that internal fixators offer greater stability than standard reconstruction plates without locking screws. The screws must only be inserted in the cis-cortex. This increases the versatility of internal fixators, which become extremely helpful in acetabular fractures, carpal or tarsal fractures, or double plating.

3.2 LCP and UniLock

For veterinary use, the locking compression plate (LCP) und the UniLock are available (Synthes, Solothurn, Switzerland). They both have a locking system with threads. The LCP has a so called combination plate hole, which can accommodate either a conventional screw or the new locking head screw. All standard AO plates from 2.7 to 4.5 are available with the combination hole. The UniLock comes as 2.0mm or 2.4mm system, together with locking screws, non-locking screws and emergency screws. All screws are self-tapping. The locking screws are inserted perpendicular to the plate. A special drill guide, which is screwed into the hole und centers the drill precisely, facilitates the locking mechanism between screw and plate.

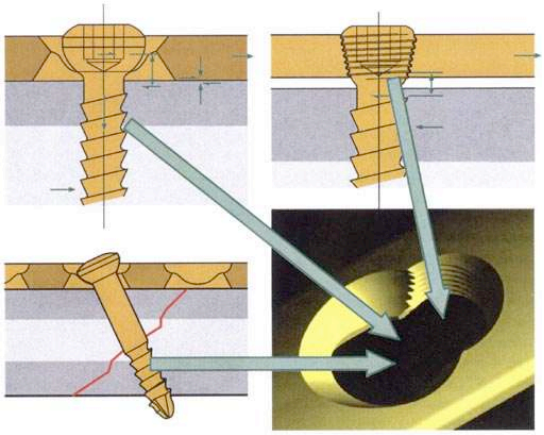

Fig. 5: Locking mechanism and standard screw placement in the combi hole of the locking compression plate (Synthes, 2009).

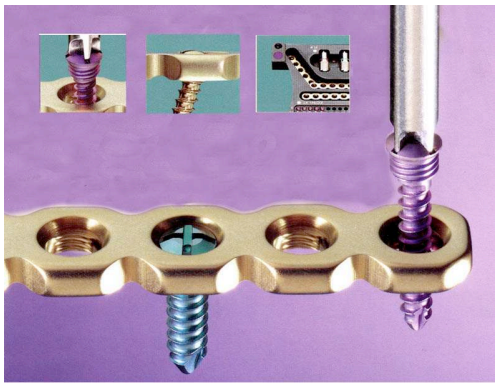

Fig. 6: Uni-Lock plates with angular stability, originally made for human maxillofacial surgery (Synthes, 2009).

4 Clamp rod internal fixator (CRIF)

The CRIF was developed for veterinary use. CRIF is a flexible system consisting of a rod, standard screws and clamps to fix the screws to the rod. It is used for diaphyseal and metaphyseal fractures in different sizes of dogs and cats. The clamps can be arranged along the rod, which is contoured to the outline of the bone. Because the clamps may be situated on both sides of the rod, there is an advantage for solid anchorage even in small main fragments. While tightening the screws, the clamp is fixed to the rod. The clamps are the only implants lying directly on the bone, which favours vascularity for rapid indirect bone healing. Vet Fix is purchased with 2.7mm, 3.5 and 4.5mm screws.

Fig. 7: Special clamp, clamp introducer and rod for use of the CRIF, together with standard screws.

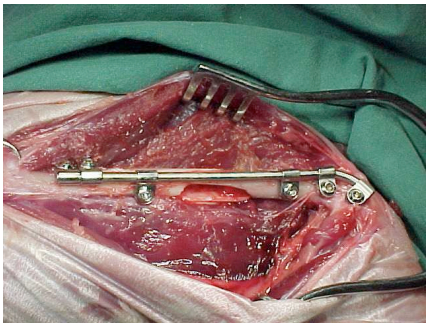

Fig. 8: Clinical application of a CRIF on a canine femur

Selected references

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