Title: Modular reconstruction systems - viable biomechanical options after oncologic or critical bone defects surgery

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The significant advances in ortopedic oncology, implant materials and design have established the reconstructive procedures using modular endoprosthetic systems as reliable management options for limb salvage after wide bone resections performed for malignant bone tumors. The good primary mechanical stability and versatility of the modular reconstruction systems allowed the conversion to universal systems and the expansion of the indications to nonneoplastic conditions like severe bone loss due to trauma, infection and revision surgery, critical bone defects caused by nonunions, malunions, implant failure or periprosthetic fractures.

When compared to primary arthroplasty procedures the survival rate of the megaprostheses still remains problematic despite all the advancements, with difficult revision surgeries for implant failure being required. Overall the endoprosthetic failure has been classified into five major modes: mechanical failure as soft-tissue failure, aseptic loosening or structural breakage and nonmechanical failure as infection or tumor progression. There are many variable factors that influence the risk for failure with some distinctive characteristics for neoplastic or nonneoplastic conditions. While much attention has been given to the improvement of the biomechanical characteristics and survival of the modular implants the problem posed by infection remains a very challenging and devastating complication. That makes the infection prophylaxis a determining factor for succes.

Because in the phisiopathology of periprosthetic infection the biofilm, created by the bacteria, represents a key point, various implant surface modification techniques have been developed with different approaches: pharmacological surface modification (antibiotic coating), responsive surface modification, textural (biomimetic) surface modification (lotus effect, dragonfly wings) and chemical functionalization (silver coating). A recent, modified silver coating techique stands out with promising results in the fight against infection. It is the multi-layer coating techique using a basic silver layer (~ 1µm) and hard top ceramic type layer (~ 100 nm) with porous structure which ensures the controled release of silver ions. The modified implant surface presents a good antimicrobial effect without any expense to biocompatibility (low cytotoxicity).

The lecture illustrates the surgical reconstruction possibilities for musculo-skeletal neoplastic and nonneoplastic conditions with the focus on the efforts made trough material surface modifications to tackle the challenge of one catastrophic complication represented by perimegaprosthetic infection.