Reply to the Letter to the Editor

Reply to the Letter to the Editor: Editor's Spotlight/Take 5: No Benefit after THA Performed with Computer-assisted Cup Placement: 10-year Results of a Randomized Controlled Study

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To the Editor,

Thank you for giving us the opportunity to answer the Letter to the Editor concerning our recently published paper on computer-assisted cup placement in THA [9]. I must start by saying I have

considerable respect for Dr. Dorr, who is an excellent surgeon and a visionary in hip reconstructive surgery.

As mentioned in the first sentence of our *Take-5* interview [5], our group is convinced that computer technology will improve our ability to perform THA in primary arthritis and complex cases, even if our paper does focus on the long-term outcome of THA performed for primary arthritis and osteonecrosis. We do agree with Dr. Dorr concerning the potential limita-

tion of our paper regarding the number of patients included. During the last century, THA has been described as one of the most successful operations in large part due to our improved surgical techniques [4]. Because there are relatively low complication rates in THA, showing clinically relevant differences is particularly difficult [4, 11]. For example, to show a 1% decrease of a dislocation rate with 0.8 power, the number of patients included should be approximately 2000 in each arm, which simply is not practical [11]. As mentioned by Dr. Leopold in his *Editor's Spotlight* [5], we can either perform prospective randomized studies powered for a particular goal or do larger studies with less robust study design and larger sample size. These limitations have been clearly outlined in our paper [9].

It is important to read our conclusion, which states that “the robotic era of THA should take into account these actual limitations and further studies are required to integrate the static and

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dynamic parameters to define an individual optimal component positioning in THA” [9]. Our message is not to minimize the potential of computer-assisted surgery, particularly not for THA. However, it is important to evaluate every new technology before promoting its general systematic use. The first step is to make sure that the technology is accurate and can reach clearly defined targets that are safe and reproducible. We have the ability to accomplish this for computer-assisted THA, but it remains unclear just what our target alignment should be to improve the clinical results of each individual patient [1, 7]. It is our responsibility as surgeons, teachers, and researchers to make sure that the use of a novel technology works in the clinical setting. The danger would be to spread a technology without any previous robust validation. To illustrate this fact, we will describe the actual limitations of cup navigation for patients who are considered obese, patients presenting spine problems with specific pelvic tilt, and patients with complex post-traumatic cases.

First, the limitation for patients who are obese relates to the plane of reference used for most of the imageless systems—the so-called “anterior pelvic plane” [7, 8]. This plane is based on bony landmarks: The two superior iliac spines and the symphyses [7, 8]. But the acquisition of this plane is done

percutaneously during the surgery [7, 8]. In a previous cadaveric study [9], we demonstrated that the percutaneous acquisition in patients who are obese may lead to more than 10° of inaccuracy on the final cup anteversion. This variance is likely due to the difference of the soft-tissue thickness between the iliac spines and the symphysis in patients who are obese [9]. Surgeons can avoid this limitation by using the femur as the reference to properly place the cup [2], but an inaccurate anteversion of the stem will lead to an inaccurate position of the cup. This concept does not consider the acetabular bone stock to properly implant the cup, neither the pelvic tilt.

Concerning the pelvic tilt and the potential interest for the patients with abnormal pelvic tilt, we clearly demonstrated in our Hip Society Award-winning paper [10] that the pelvis is a moving target, and that pelvic orientation changes may occur after arthroplasty. Therefore, the preoperative integration of the pelvic tilt is interesting but may not be accurate as changes greater than 5° were observed in more than 25% of the patients with potential consequences on the functional anteversion of the cup [10].

The third limitation is related to the use of computer-assisted surgery for complex post-traumatic cases. Theoretically, the use of computer-assisted surgery is ideal to overcome the

complexity of the anatomy, just as it could be for navigation in TKA for complex extra-articular deformities [3]. This principle is true for a surgeon trained for the use of navigation and using it regularly for simple cases [3].

Additionally, these cases do require preoperative imaging and the use of a CT-based navigation system [3]. Using an imageless-system is not appropriate for these cases as the imageless systems are based on the bone morphing principle, which is the deformation of a statistical bone model without any integration of a post-traumatic deformity [7]. Using a CT-based system still requires a process of recalibration to match the preoperative CT-model with the intraoperative reality. This process is time consuming and may increase the risk of infection, which is already high in post-traumatic cases [3, 6]. However, sophisticated 3-D preoperative planning is likely to happen, as outlined in Dr. Dorr’s Letter to the Editor.

We do agree with Dr. Dorr that we as surgeons should “stay tuned” and this message has been sent to our group and to our younger surgeons. We have to keep working and searching for every potential solution to improve the clinical results of our patients. We believe some of these solutions will require the use of computer-assisted systems. But it is also important to realize that there are probably two levels of use for

Reply to the Letter to the Editor

computer-assisted systems. The first level is limited to high-volume and well-trained surgical teams who can conduct properly designed studies that evaluate the interest and limits of these systems in order to adequately define their clinical usefulness. The second level of use is the daily use of a system in the routine practice for a more generalized orthopaedic practice.

Though computer-assisted and robotic systems are here (and likely here to stay), questions still remain. Can we afford these tools? Should we be promoting their use without knowing if these tools are ready and robust enough to improve our patient outcomes in a routine daily practice? Orthopaedic surgeons will have to answer these challenging questions through well-conducted studies and pertinent debates like this one.

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