Author's response to reviews

Title: The association between Femoral Tilt and impingement-free range-of-motion in total hip arthroplasty

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Author's response to reviews: see over
Dear Madame/Sir,

Thank you for three reviews regarding our manuscript submission “The association between Femoral Tilt and impingement-free range-of-motion in total hip arthroplasty” (MS: 1360867705922677).

We found all comments very helpful and would like to give a point-by-point response to the discussion raised by the reviewer and editor:

Reviewer 1
“The manuscript represents a numerical study concerning association between femoral tilt and impingement-free range-of-motion in total hip arthroplasty based on CT data of patients obtained from a clinical study. The study investigates well-known effects of the interaction between implant position-related parameters and range of motion / impingement of total hip replacement. The objective of the study is well defined and for this the methods are appropriate and clearly described. The data of the study seems sound and the results shown are informative for clinicians and engineers in research and development of total hip replacement systems. The chapters discussion and conclusion are well balanced and adequately supported by the data calculated. Furthermore, the limitations of the study are clearly stated. The title is appropriate and the abstract described well the aim of the study, the methods used and the data what has been found. In general, the paper is written in a good quality, besides few inadequate citations in the manuscript. The language is of high quality and clear to understand.”
We thank the reviewer for his detailed and competent comment. The referee demands no changes within the manuscript and recommends acceptance without any revisions.

Reviewer 2

“The authors have conducted a robust and thorough study on an aspect of prosthetic component orientation that has not been considered before. The abstract and background to the paper provide a clear introduction to the topic and a good overview of the results. The methods section is clear to a point. Description of the patient recruitment and computer simulation are easy to understand and concise. However, the description of the second part of the analysis needs more work. I would suggest breaking down the stages of this analysis into separate paragraphs with a topic sentence to introduce each stage”

In order to clarify the different parts of your analysis, we have now broken down the stages of the analysis into five parts and we have introduced each stage with a topic sentence as recommended by the referee:

“The discussion section addresses the implications of the findings well and also discusses its limitations. I would say there is only one omission that could be commented upon - There are three factors that affect femoral stem orientation, femoral tilt which is the topic of the authors’ study, femoral antetorsion which is well commented upon in the literature and femoral varus/valgus. The authors have not acknowledged how this later factor can affect range of motion. It is the reviewer’s opinion that this merits being noted in the discussion and will strengthen the author findings that femoral stem orientation is a multi-faceted problem which has a significant effect upon post-operative range of motion”

This is indeed an important point and we have now included the following (limiting) statement within the discussion section and included an additional reference:

“Third, in addition to the influence of femoral tilt and stem antetorsion on post-operative ROM, stem tilting in the frontal plane (varus/valgus angle) influences the relationship between the shaft axis and the femoral coordinate system which defines the reference for assessing ROM [19].”
Reviewer 3

“Some details should be better placed in the “Results”: Average patient age was 69 (±4.8) years and average body mass index (BMI) 26.4 (±3.7) kg/m² (...) 16 male and 24 female, 17 left and 23 right hips. None of the patients had a THA on both sides.“

Following the author instructions, we need to present the patient characteristics in the “Methods” section. However, in order to clarify, we have now summarized this data under the heading “study population”.

“Minor Essential Revisions: Page 7 line 11: postoperatice > postoperative”
Has been changed

Editor’s comment

“The manuscript is generally well-written and describes the study procedures and results clearly, however the authors need to do a better job at explaining how this particular study makes a unique contribution to the literature. There is a need to clearly indicate how the results of the current study differ from previous works and to delineate how the results of their previous and current work can be collectively interpreted.”

In order to clarify and delineate the methodical differences between our study and other results in the literature we have expanded the following section in order to meet the editor’s needs:

“Apart from our previous work on this topic [15] there is only one study so far that has addressed the issue of sagittal femoral stem alignment [16]. This analysis with another cementless stem type was based on a different coordinate system, i.e. proximal femoral axis instead of mechanical axis which was used as a reference for neutral alignment of the leg in our study. In this study by Mueller, sagittal tilt was calculated as the deviation between the shaft axis of the proximal femur and the stem. The anterior bow of the femur, i.e. deviation between the proximal or stem shaft axis and mechanical axis of the femur, was neglected and only a comparison between the pre- and postoperative situation was performed. Additionally, antetorsion was defined according to a connecting line between the center of the femoral head and the proximal shaft axis in this study. Thus, these calculations by Mueller did not directly represent the orientation of the stem neck axis.
Based on this definition, the effect of sagittal tilt on antetorsion did not only depend on the sagittal tilt of the stem but also on the rotation point, which was used for the comparison between the neutral reference position and the final orientation of the stem. In particular, the translational difference of the point at the top of the stem shaft axis then influences the antetorsion calculation. Such translations may be relevant for addressing bone-to-bone impingements since the position of the stem in the femoral canal may influence this. The definition of antetorsion in our study was directly based on the orientation of the stem neck axis, because the analysis was directed to the determination of ROM according to implant-to-implant impingement. Because of these differences, the effect of sagittal tilt on antetorsion was approximately 2-to-1 to 3-to-1 (for 131° neck-shaft angle) according to Mueller18, i.e. 1° change in sagittal tilt changes the (effective) antetorsion by 2°-3°, whereas the relationship was approximately 1-to-1 (for 135° neck-shaft angle) and a bit lower (for 125° neck-shaft angle) in our study. Therefore, the results of our analysis and study by Mueller cannot be directly compared."

Once again, we would like to thank the three referees and the editor for their detailed reviews.

Regards

PD Dr. med. T. Renkawitz

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