

ered a problem, the finite element method shows that even such small deviations influence the bone underlying the prosthetic, respectively the polyethylene component, even though it has no immediate effect on the clinical outcomes.

DISCUSSIONS

Total knee arthroplasty (TKA) is a surgical procedure that improves knee function, alleviates knee pain, and improves patient's life. The success of TKA depends on factors like soft tissue balancing, post-operative alignment and prosthetic component implantation. Nowadays, approximately 20% patients with TKA are dissatisfied with the clinical results and about 9% have pain because of the tibial component malalignment (13).

Mangiapani et al. found that TKA alignment is a relative concept – meaning it defines both the component alignment and the limb alignment (14).

Coronal tibial component malalignment is associated with higher polyethylene stress and patellofemoral complications, especially clinically - the varus tibial component alignment is highly dissatisfying, with higher stress on the polyethylene than in valgus tibial component alignment (15,16).

Sagittal alignment in TKA is kinematically important, mainly because the most common moves (flexion, extension) occur in this alignment (17).

According to the results we obtained through finite element analysis, unfavourable effects begin to appear in case of proximal tibial cut at 1.5°, which means positioning anterior the tibial component in the sagittal plane. The results from table 2-5 show that equivalent tension and deformation have higher values in the tibia and the polyethylene, which deform faster than cement and the tibial component.

Gromov et al. studied the tibial angle at a value between 0° and 7° and found that a value less than 0° and more than 7° has a failure rate of 4,5 % due to prosthetic knee instability (18).

Some studies support the hypothesis that frontal alignment in varus is associated with higher failure rate (tibial component loosening, faster wear of the polyethylene) and leads to a faster degradation of the medial knee compartment (19,20). It also generates unequal distribution of loads at the level of the two compartments and overall knee instability (19,20).

Jeffcote et al. concluded that in some models of tibial prostheses, the valgus alignment determines a lower contact pressure at the level of the spongy bone underlying the prosthesis, while Green et al. claimed that varus tibial component positioning increases the risk of TKA failure (15,19). Moreover, Green et al. imply that beneath a varus tibial com-

ponent, the tibial bone subsides (especially in the medial compartment) due to the compression overload with radiolucent tibial lines as corresponding radiological result (19).

Perillo-Marcone et al. found that the stress that occurs over the prosthetic underlying bone is taken by the metallic, polyethene and cement components, but even in these conditions the underlying tibia is subjected to increased loads on repeated moves, especially due to sagittal malalignment (20).

Berend et al. (21) suggest that a value > 3° in varus for the tibial component increases the risk of TKA failure, but the results of our finite element analysis show that the degradation of the polyethylene may start from even lower values (-1.5°). This fact may have major clinical implications, thus improving the evolutionary course of TKA, especially in the long-term.

In line with our results, Matsuda et al. also found that a correlation exists between the varus tibial component alignment and polyethylene wear because the varus alignment changes the distribution of tibial loading (22).

Katimani found that in sagittal plane, the proximal tibial cut should never be made with anterior slope, because it could affect flexion and could determine knee instability (23).

In their article, Srivasta et al. (16) conclude that varus tibial component alignment of a mean 1.3 ° can determine fast polyethylene wear, while Suh et al. (9) consider that varus alignment increases the polyethylene wear in the medial compartment leading to joint instability and eventually to TKA failure.

Our experimental study has limitations. Firstly, the simulation was made on a tibia in static conditions (tibia from a cadaveric specimen). Because of this, we were not able to do a simulation during a gait cycle using the same values of simulation to observe the wear during a greater pressure loading on the polyethylene insert.

Second, the tibia was a normal bone (without deformities) and without pathological changes such as osteoporosis. Also, the bone properties and geometry were from a single cadaver specimen, so we did not account for individual variability.

TKA results have improved over time through technological advances, improved and more durable prosthetic components, increased surgical experience, and better operative technique. However, 20% of patients are not satisfied with TKA results, mainly because of the tibial component alignment.

CONCLUSIONS

In our study, we chose to simulate the tibial resection on ± 1.5° angle in the frontal and sagittal planes to find the minimum threshold from which

the tibial component malalignment may begin to determine unfavourable effects (which begin for the polyethylene component at -1.5° in the frontal plane – varus alignment, and the rest of the components at 1.5° in sagittal plane). This finding led to the

proposal of preoperative planning based on personal calculus of predefined angles which may show the surgeon the optimal implantation position of the tibial component.

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