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MacDessi SJ, Griffiths-Jones W, Harris IA, Bellemans J, Chen DB. Coronal Plane Alignment of the Knee (CPAK) classification: a new system for describing knee phenotypes. *Bone Joint J*. 2021;103-B(2):329-337.

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Sir,

We read this paper with interest.[1] The classification of Coronal Plane Alignment of the Knee (CPAK) in this paper is comprehensive and easy to understand. Though nine theoretical different phenotypes of knees are possible, only types I to VI are clinically relevant. Nevertheless, we believe that arithmetic hip-knee-ankle angle (aHKA) is a very useful tool for predicting the pre-arthritic type of constitutional knee alignment.

In this paper, the authors use the concept of joint line obliquity (JLO) to classify CPAK. However, we question the algorithm for JLO. In the case of a neutral knee with an apex distal JLO, which has its mechanical axis (MA) vertical to the ground (Figure 1), the α angle formed by the transection of the femoral condylar line and the horizontal line can be calculated from the equation: α = 90° - lateral distal femoral angle (LDFA). The β angle formed by the intersection of the line of the articular surface of the proximal tibia and the horizontal line can be calculated from the equation: β = 90° - medial proximal tibial angle (MPTA). When the α angle and the β angle are added, the apex distal JLO has been counted twice. We suggest that the JLO should be expressed as the mean value instead of the sum of α angle and β angle. In other words, the α angle and β angle each contribute to half of the apex distal JLO, so the obliquity of joint line to the ground should be calculated as (α+β)/2, which is 90° – (LDFA+MPTA)/2. For example, when the LDFA is 87° and the MPTA is also 87°, then the α angle is 3° and the β angle is 3°. The JLO should be 3°, not 6°. Hence, we suggest that the equation should read JLO = 90° – (LDFA+MPTA)/2.

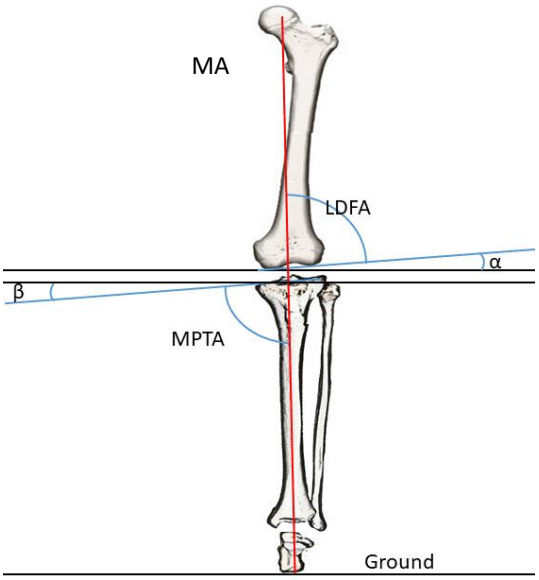

Figure 1. The relation of the joint line obliquity and knee alignment angles (α and β)

We also suggest that the boundaries of neutral alignment for aHKA should be 180° ± 3°. There are two reasons for this. First, 180° ± 3° is a consensus value for the definition of mechanical neutral alignment and has been reported to have a better long-term implant survival rate.[2,3] Second, modern surgical instruments enable the surgeon to position a prosthesis with an accuracy of around 1.5°, and thus when the mean alignment angle of a phenotype is set as a target, the resulting alignment would be within the range of the phenotype after procedures on the femur and tibia (1.5° x 2 = 3°). A value of 3°, i.e. when both the boundaries of neutral aHKA and JLO are within 3°, is easy to remember and is likely to be readily accepted in clinical practice.

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1. **MacDessi SJ, Griffiths-Jones W, Harris IA, Bellemans J, Chen DB.** Coronal Plane Alignment of the Knee (CPAK) classification: a new system for describing knee phenotypes. *Bone Joint J*. 2021;103-B(2):329-337.
2. **Howell SM, Shelton TJ, Hull ML.** Implant Survival and Function Ten Years After Kinematically Aligned Total Knee Arthroplasty. *J Arthroplasty*. 2018;33(12):3678-3684.
3. **Parratte S, Pagnano MW, Trousdale RT, Berry DJ.** Effect of postoperative mechanical axis alignment on the fifteen-year survival of modern, cemented total knee replacements. *J Bone Joint Surg Am*. 2010;92-A(12):2143-2149.

Conflicts of Interest: None