

**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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## **Authors' reply:**

*Sir,*

We thank Dr Sugita and colleagues for their interest in our paper.<sup>1</sup> The question posed is whether there is a side-to-side alignment difference in a population of healthy subjects that may predispose to windswept deformity (WSD) of the knee, that is, constitutional valgus in one knee and constitutional varus in the other.

We reviewed the Coronal Plane Alignment of the Knee (CPAK) dataset to examine side-to-side differences in the radiological measurements that define constitutional alignment and knee phenotypes. The mean angular differences between sides were remarkably similar, with an arithmetic hip-knee-ankle angle (aHKA) difference of  $0.07^\circ$  (SD  $1.9^\circ$ ), joint line obliquity (JLO) angle difference of  $-0.02^\circ$  (SD  $2.4^\circ$ ), medial proximal tibial angle (MPTA) difference of  $0.02^\circ$  (SD  $1.6^\circ$ ), and lateral distal femoral angle (LDFA) difference of  $-0.05^\circ$  (SD  $1.5^\circ$ ).

When comparing the percentages of side-to-side differences, 84% and 85.6% of subjects had an MPTA and LDFA within  $2^\circ$  of the contralateral side, respectively. Extending this range to  $3^\circ$ , 94.4% and 94.8% of subjects were within this range when comparing MPTA and LDFA between sides. The percentage of individuals with a side-to-side difference within  $2^\circ$  for mechanical HKA was 74%, and 88% when the range was extended to  $3^\circ$ .

If windswept alignment pattern is defined as having a constitutional varus knee of less than  $-2^\circ$  in one knee (CPAK Types 1, 4, 7), and a constitutional valgus knee of greater than  $2^\circ$  in the other (CPAK Types 3, 6, 9), only 0.8% (2 of 250) of individuals had a windswept alignment.

The above data indicate that most healthy knees have a similar coronal plane phenotypic pattern on each side, particularly when the range difference is within  $3^\circ$ . Further, the incidence of WSD in the dataset was uncommon, with only 0.8% displaying this trait. Without longitudinal data to examine changes in this study sample over time, however, we cannot definitively comment on causation for windswept knees. It is likely that constitutional alignment may be one cause, but the contribution of traumatic and other environmental factors remains uncertain and warrants further investigation.

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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.