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FFKC, KCS, Sub clinical KC: The need for an objective classification system.

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Dear Editor,

Arbelaez et al¹ reported the use of a support vector machine for the detection of keratoconus and subclinical keratoconus by topographic and tomographic data. The authors defined subclinical keratoconus as corneas presenting topographic and tomographic pattern of localized steepening in the posterior or anterior corneal surface or paracentral corneal thinning, with a best corrected visual acuity of 20/20 or better, without clinical (keratometric, retinoscopic or biomicroscopic) signs of keratoconus.

This definition is wide-ranging, remains qualitative, and does not give enough information to allow other authors to perform similar studies for comparison. For a better definition of the Keratoconus Suspect (KCS) topographically, the use of multiple quantitative parameters is desirable. For example, Rabinowitz et al² proposed a KISA % value between 60 and 100% for the diagnosis of KCS, KISA being derived from 4 indices, the K value, the I-S (measuring the superior-inferior dioptric asymmetry), the AST which quantifies the degree of regular astigmatism and the SRAX which quantifies the irregular astigmatism. Other quantitative parameters are also available such those developed by Maeda and Klyce³. In this paper, the authors did not use any quantitative indices for the classification which makes it difficult to define the patients being evaluated in the study.

The authors reported finding a sensibility and a specificity for the detection of Forme Fruste Keratoconus (FFKC) similar to the ones we described in a previous work⁴. However a comparison between the two studies is not possible as the training sets were not selected in the same way. In our opinion, to describe the characteristics of the earliest form of KC and avoid any biases in the training sample, it is crucial to objectively select patients in each studied group.

Our FFKC group consisted of corneas presenting 0% similarity with KCS or KC, based on a neural network that calculates various objective indices of corneal shape characteristics. The contralateral eye of our FFKC group presented a clear clinical KC. Because both eyes of “unilateral” KC have the same genetic makeup, the less affected eye - even though appearing “normal” based on the neural network system - is known to have keratoconus and some longitudinal studies showed that, if observed for a sufficient period of time, signs of KC will develop in this eye. Our group of FFKC did not present marked localized steepening on topography (otherwise, it would have been detected as KCS by the neural network) and represent an earlier form of the disease based on current Placido detection criteria. Figure 1 (B,C) presented by the authors shows sample topographies of the subclinical keratoconus group revealing skewed astigmatism or asymmetric curvatures on the anterior topography (with 1.46D and 1.8D respectively of front curvature asymmetry) which clearly would have rejected those corneas from our FFKC group. We showed some examples of our FFKC in figures A1 to 8 of a previous work⁵ and figure 2⁴.

In addition, the subclinical keratoconus group selected by the authors included eyes presenting an evident keratoconus in the contralateral eye (named by the authors *Forme Frustre Keratoconus (FFKC)*) and eyes without clinical signs of Keratoconus in the contralateral eye (named *Keratoconus suspect (KCS)*). However, a pattern of bilateral KCS may occur in patients with normal corneal structure who are stable for many years and who had LASIK with stable results. Hence including these patients in the same training sample with patients presenting an evident KC in the contralateral eye may lead to a confounding group because it may mix cases with mild ectasia with cases corresponding to normal variants and structure.

We do believe that in addition to using common subjective definitions, objective combination of corneal indices should be used to select the training sample in order to perform an accurate analysis and to allow comparison with previous or future work in the field.

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