Tomographic and Biomechanical Index (TBI) for Screening in Laser Refractive Surgery

In the article "Bilaterally Asymmetric Corneal Ectasia Following SMILE With Asymmetrically Reduced Stromal Molecular Markers,"[1] the authors develop an interesting analysis about extracellular matrix regulators and inflammatory factors in a patient who developed ectasia after small incision lenticule extraction (SMILE). As the authors mention, the majority of ectasia cases after SMILE had a high Randleman's ectasia risk score preoperatively or forme fruste keratoconus. The authors classified the preoperative evaluation as "normal" in the case they report in this article on the basis of the Corvis Biomechanical Index (CBI)/Tomographic and Biomechanical Index (TBI) scores (values below 0.5), with values of 0/0.13 for the right eye and 0.12/0.38 for the left eye.

The CBI and TBI are relatively new tools and new evidence is continuously emerging for the classification of keratoconus, especially in forme fruste keratoconus, which can be a risk factor for the development of ectasia after laser refractive surgery. Ambrósio et al.[2] demonstrated how the area under the curve (AUC) can be increased in forme fruste keratoconus from 0.839 for the Belin-Ambrósio Deviation (BAD-D) or 0.822 for the CBI to 0.985 for the TBI, establishing a TBI cut-off value of 0.29 for which the sensitivity was 90.4% and the specificity was 96%. A cut-off value of 0.295 with sensitivity of 89.5% and specificity of 91% (AUC = 0.96) was also reported in a later study.[3]

Other authors have confirmed the superiority of the TBI in terms of keratoconus diagnostic ability in comparison to the CBI or BAD-D, but establishing a lower cut-off value of 0.16.[4,5] For this last cut-off value, Chan et al.[4] reported sensitivity of 84.4% and specificity of 82.4%, whereas Kataria et al.[5] reported sensitivity of 84% and specificity of 86%. Steinberg et al.[6] also compared the outcomes (sensitivity = 63% and specificity = 83%) for the cut-off value of 0.291, with the optimized value of 0.11 according to their data, obtaining sensitivity of 72% and specificity of 71%.

Although the cut-off values for detecting forme fruste keratoconus can vary depending on the sample used, the most recent evidence shows a range for this value from 0.11 to 0.29. The current case, which developed ectasia after SMILE, showed TBI values of 0.13 and 0.38 for the right and left eyes, respectively, which means that the normality for the preoperative tomographic and biomechanical data cannot be ensured. Although the TBI can improve the detection of forme fruste keratoconus, it is also important to note that there is still a risk of obtaining false-positive or false-negative results because neither sensitivity nor specificity has been shown to achieve the value of 100%.

According to the current evidence, the TBI has demonstrated the highest AUC. The authors should be cautious in interpreting this case as "normal" because the TBI is in the range of the reported cut-off values for forme fruste keratoconus for the right eye and above this range for the left eye. The Corvis ST (OCULUS Optikgeräte GmbH, Wetzlar, Germany) correctly integrates a color scale with yellow indicating "suspicious" above 0.25 that agrees with the current evidence. In our opinion, this case might be better classified as an ectasia after SMILE in a "suspicious" forme fruste keratoconus of a patient with high myopia.

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Editor's Note: At the time of publication, the authors could not be reached for a response.