Comparison of Combined Transepithelial Phototherapeutic Keratectomy and Mechanical Debridement During Corneal Cross-linking

We read with great interest the study by Gaster et al. in the October 2016 issue regarding the comparison of the effect of epithelial removal by transepithelial phototherapeutic keratectomy (PTK) or manual debridement on corneal cross-linking (CXL) for progressive keratoconus. Their results indicated that epithelial removal by transepithelial PTK yielded similar visual, refractive, and keratometric outcomes to manual debridement; a similar degree of change was noticed for almost every parameter evaluated for both the PTK and mechanical groups. However, it is remarkable that mean corrected distance visual acuity (CDVA) improved significantly at 24 months only in the PTK group (0.23 ± 0.20 logMAR from 0.33 ± 0.25 logMAR preoperatively, P = .032). CDVA improved in the manual debridement group at 24 months (0.22 ± 0.25 logMAR from 0.30 ± 0.026 logMAR preoperatively, P > .10), but not significantly.

As the authors reported, their results are in contrast with the ones in our relevant study, which was a prospective, comparative analysis of well-matched groups and showed that transepithelial PTK during CXL resulted in better visual and refractive outcomes in comparison with mechanical epithelial debridement. A possible explanation for this discrepancy could be the difference in the preoperative maximum keratometry readings, which were higher in the PTK group of our case series (53.07 ± 7.20 diopters [D]) in comparison to the PTK group of Gaster et al.’s study (51.50 ± 5.00 D). However, apart from the maximum keratometry, the preoperative epithelial thickness distribution along the cornea, even though not evaluated in either of these two studies, is another (if not the most) significant parameter that could affect the effect of transepithelial PTK during CXL. Specifically, consistent with the doughnut pattern, described by Reinstein et al., the thinner the corneal epithelium (especially at the apex of the cone) is, the more stromal tissue will be removed from the apex of the cone via transepithelial PTK, inducing greater corneal smoothening and improvement in keratometric and visual values. Nevertheless, it is necessary to point out that the removal of a greater amount of stromal tissue could decrease the corneal thickness significantly, jeopardizing the corneal biomechanical stability and CXL effectiveness. Moreover, the preoperative corneal pachymetry, although similar between the PTK groups in these two studies, could be another possible variable for the effect of this combined treatment. Thus, the procedure of transepithelial PTK during CXL could be more effective in patients with more advanced stages of keratoconus. In addition, the effect of the transepithelial PTK could be different in a central cone as compared to an eccentric cone.

Another possible parameter affecting the effect of transepithelial PTK during CXL could be the laser ablation profile. Gaster et al. used the VISX Star S4 excimer laser (Advanced Medical Optics, Santa Ana, CA), whereas we used the Allegretto WaveLight (WaveLight Laser Technologies, Erlangen, Germany); therefore, the different excimer laser platform could be another reason for the different results.

Since our first case in 2010, as Gaster et al. also reported, all studies until now support the conclusion that transepithelial PTK during CXL is an effective and safe combined treatment for keratoconic patients. In our opinion, this combined technique (Cretan protocol) should be performed in any case of CXL aiming to better visual and refractive outcomes, especially in cases in which photorefractive keratectomy cannot be combined with CXL due to low corneal thickness. Furthermore, the customization of transepithelial PTK and CXL and its parameters (ablation depth and zone of transepithelial PTK) according to the preoperative epithelial map and corneal profile of the patient with keratoconus could maximize the effect of this combined treatment. Future prospective comparative studies taking into account several preoperative parameters, such as mentioned above, are necessary to evaluate the outcomes of combined transepithelial PTK and CXL and mainly the cases in which the effect of this combined procedure could be greater with minimal risk.

REFERENCES


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**Reply**

We appreciate the careful review of our article by Grentzelos et al. They address several important points in their letter.

The preoperative epithelial thickness may be a significant parameter that neither the authors nor we evaluated preoperatively. As they stated, that parameter may be significant and could affect the transepithelial phototherapeutic keratectomy (PTK) effect during corneal cross-linking (CXL), especially if the corneal epithelium is thinned at the apex of the cone. Furthermore, transepithelial PTK during CXL could be more effective in patients who have more advanced keratoconus, and this variable needs to be studied carefully.

With regard to the excimer laser used for the transepithelial PTK in our study, we were required by U.S. Food and Drug Administration regulations to use the VISX Star S4 (Advanced Medical Optics, Santa Ana, CA) because the Allegretto WaveLight (WaveLight Laser Technologies, Erlangen, Germany) was not approved for PTK in the United States at the time of our study.

We agree with Grentzelos et al. that transepithelial PTK during CXL in patients who have corneas too thin for photorefractive keratectomy (where it is approved) may result in better refractive outcomes and that future prospective studies are needed to confirm this treatment modality.

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