



New corneal cross-linking method appears effective

Higher fluence, shorter duration UV exposure provide additional oxygen to the collagen matrix, optimizing the reaction, surgeon says.

Corneal cross-linking with shorter duration, higher fluence UV light exposure appears to be a safe and equally effective approach.

The key concept is the oxygen, which is the third and, so far, most underestimated component of cross-linking, A. John Kanellopoulos, MD, said at the European Society of Cataract and Refractive Surgeons meeting.



**A. John
Kanellopoulos**

Oxygen is necessary to cause the photochemical reaction that, in the riboflavin-soaked cornea irradiated with UV light, leads to structural changes of the collagen fibers.

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This new approach raises the irradiancy level of the UVA laser from 3 mW/m² to 7 mW/m² and fractions the doses of the energy delivery with a “pulse” irradiation using cycles of 30 seconds on and 30 seconds off. The method should provide more oxygen into the collagen matrix than the standard procedure, leading to optimization of the collagen oxidative delamination reaction, Dr. Kanellopoulos said.

“To prepare the cornea to a more effective penetration of the photosensitizing agent, we remove the epithelium and perform a partial topo-guided PRK. With the Bowman’s off and

some superficial ablation, the solution of riboflavin rapidly diffuses into the cornea within seconds,” he said.

Study results

At the Laservision Institute of Athens, the differences between this new method and the traditional procedure were evaluated in a group of 30 keratoconus patients. Half of them were cross-linked with 7 mW/cm² for 15 minutes and half with the traditional 3 mW/cm² for 30 minutes. The same 0.1% riboflavin solution was used in all of the corneas, and only one eye per patient was treated.

“No difference was found in the results of the two groups in terms of visual gain and refraction. At 18 months of follow-up, the keratoconus is stable, while it has evolved in the fellow untreated eye,” Dr. Kanellopoulos said.

No significant complication was found with either procedure, and the increased irradiancy levels are not phototoxic for the cornea, he said. The shorter procedure may, in fact, result in less keratocyte loss because fibroblasts are more resistant to higher energy exposure and shorter interval rather than low energy at higher intervals.

“The amount of UV light to which an eye is exposed in the early afternoon in Athens is, on average, 10 mW/cm². So the amount of UV light is not something we should be worried about. It is the interaction with riboflavin that can make it potentially dangerous, but the better penetration of the photosensitizing agent and the shorter laser time with pulse delivery effectively compensates for the increased fluence,” Dr. Kanellopoulos said.

He is currently evaluating the effects of applying the riboflavin solution intracorneally by utilizing a femtosecond laser pocket. He is also starting to use this shorter procedure as a prophylactic measure in refractive surgery patients who may be at risk of developing ectasia. – by *Michela Cimberle*

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PERSPECTIVE

This study is indeed interesting and stimulating for any surgeon who performs corneal cross-linking (CXL) for keratoconus and knows very well how lengthy (almost 1 hour per eye) the procedure is. Reducing the duration of CXL UVA laser exposure to half the time (15 minutes) seems to be possible, according to Dr. Kanellopoulos' data.

It is interesting to note that the total irradiancy is, in fact, lower than in the standard procedure, and that the shorter time of UVA exposure could reduce keratocyte apoptosis.

Clinical results, which are comparable to those of the standard procedure, are promising. Of course, they will have to be confirmed by further prospective studies in order to be more confident in the safety and efficacy of this new protocol.

One aspect that this study highlights very well is the need of a better understanding of the biochemical reactions of CXL into the corneal collagen matrix.

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