

Corneal Dryness Affects OCT Scan Quality

The drying effects were relatively long lasting, therefore imaging studies should be conducted before automated perimetry.

BY CONNI BERGMANN KOURY, EDITOR-IN-CHIEF

Patients who have optical coherence tomography (OCT) should be instructed to blink frequently or instill artificial tears, according to the results of a report in *Ophthalmology*. The report found that corneal dryness affects OCT scan quality and measured nerve fiber layer (NFL) thickness after a short exposure time.

Gadi Wollstein, MD, from the UPMC Eye Center, Eye and Ear Institute, Ophthalmology and Visual Sciences Research Center, Department of Ophthalmology, University of Pittsburgh School of Medicine, and colleagues, undertook a study to determine the effect of corneal drying on the outcome of OCT.

IMAGE DEGRADATION

“Our clinical experience indicates that the longer the duration of OCT scanning sessions, the more likely it is that the images acquired will be of poorer quality. We also have observed that when the patient is instructed to blink, the scan improves visibly. The corneal tear film serves a key role in the maintenance of a smooth, regular optical surface,” Dr. Wollstein wrote.

The investigators enrolled 17 healthy patients, mean age 39 ± 12 years, in this prospective study. Each patient underwent a baseline fluorescein staining examination and tear break-up assessment in the selected eye using a sterile ophthalmic strip with 0.6 mg fluorescein sodium and a sterile balanced salt solution.

The images were taken with the StratusOCT (Carl Zeiss Meditec, Dublin, Calif) using the Fast Retinal Nerve Fiber Layer scanning protocol. Dr. Wollstein and colleagues said. According to the protocol, three consecutive circumpapillary NFL images at a scanning radius of 3.4 mm centered on the optic nerve head were obtained at each time point. All scans were gathered by the same operator in the study; each patient underwent a series of ≤ 14 OCT

scans in the selected eye. Two baseline scans were taken before any intervention.

TOTAL EXPOSURE TIME

The patients had an anesthetic drop administered, followed by a postanesthesia scan. The investigators taped the patients' upper eyelid to the forehead to prevent blinking, and a stopwatch timer was started at the moment the eye was taped open. Up to eight serial scans were acquired, one every 20 seconds — the total exposure time was up to 2 minutes and 40 seconds. The investigators wrote that the scanning during this drying time was stopped before all eight scans were acquired only in cases where the operator

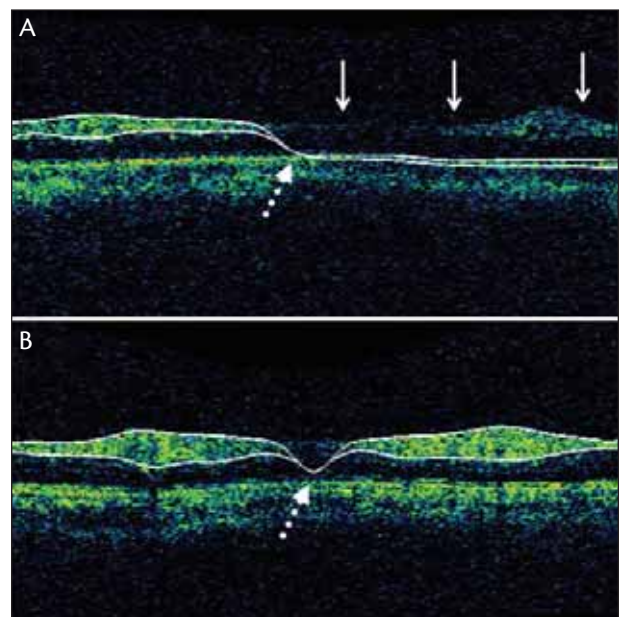


Figure 1. Examples of NFL detection algorithm: Inaccurate border detection (solid arrows) (A). Collapse of the automatically detected NFL borders resulting in a false zero value for NFL thickness (dotted arrows) (B).

Images courtesy of *Ophthalmology*, 2006; 113:985-991

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determined that the scan signal had completely degraded, to ensure that excessive drying of the cornea did not occur.

Following the drying scans, the tape was removed and three more scans were acquired at 1, 2 and 4 minutes after the patient was allowed to blink freely. Then, each patient underwent an additional fluorescein staining corneal exam to evaluate the cornea.

"Images were evaluated for accuracy of the automated NFL border-detection algorithm used by the device to ensure NFL thickness," Dr. Wollstein wrote. The investigators excluded the scans if the images demonstrated one or both of the following: (1) obviously inaccurate border detection for more than a consecutive 15% or additive 20% of the total image or (2) if the automatically detected borders of the NFL collapsed (Figure 1). The mean of at least two qualified scans for each scanning point was used in the analysis.

MAIN OUTCOME MEASURES

The main outcome measures analyzed were scan quality, as defined by signal-to-noise ratio and signal strength provided by the built-in OCT software and mean NFL thickness. The researchers found that significant reductions in signal-to-noise ratio, signal strength and NFL were noted at each scanning point in the drying phase (for each, $P < .015$, paired t -test) except for NFL thickness measurements acquired at 140 and 160 seconds.

"The reduction in NFL thickness exceeded the 95% confidence limit of the reported reproducibility error of StratusOCT after 15 seconds of corneal drying," they wrote. "After 1 and 2 minutes of blinking freely, there was still a significant reduction in NFL thickness compared with the baseline value, which was no longer evident at the 4-minute scan."

The duration of corneal exposure in this study was purposely exaggerated to prove that OCT images can be affected in this manner, the authors noted. Substantial changes appear after very short corneal drying time, emphasizing the importance of this process in routine clinical practice.

"We suggest that interventions aimed to ensure a smooth optical surface, such as instructing patients to blink before scanning or instilling artificial tear drops, could lead to higher-quality scans and more accurate clinical measurements." ■

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Stein DM, Wollstein G, Ishikawa H, et al. Effect of corneal drying on optical coherence tomography. *Ophthalmology*. 2006;113:985-991.