

Eye Plaque Radiation Therapy Preserves the Sight of Patients With Invasive Carcinoma

New York Eye and Ear Infirmary of Mount Sinai (NYEE) started its eye radiation therapy program in the early 1990s. Since that time, its ophthalmologists have offered eye- and vision-sparing treatments with great success for more and more complex cases. In two such cases, patients who each had squamous cell carcinoma that grew from the conjunctiva into the eye illustrate the breadth of skills, training, and decision-making required for these delicate procedures.

The first patient was a 56-year-old severe diabetic, with secondary glaucoma and multiple corneal transplants. To make things worse, he was diagnosed with squamous cell carcinoma that had invaded through his corneal transplant wound into his only functioning eye. Here the surgeons were not only challenged by the unusual intraocular invasion, but also by the knowledge that failure of treatment would result in total blindness.

The solution? Sewing a disc-shaped radiation source on the cornea to cover the tumor. “Years ago surgeons would have tried to cut these tumors out of the eye. Then in 1993, we published a study showing that intraocular tumors in the iris and ciliary body could be treated through the cornea with radioactive plaques,” says Paul T. Finger, MD, FACS, Founding Director of the Ocular Oncology Service at NYEE. “This approach has enabled us to avoid large sight-threatening surgeries and preserve both the patient’s eyes and eyesight.”

In the case of the monocular patient, Dr. Finger used plaque brachytherapy with palladium-103 radioactive seeds—a low-energy gamma source. The seeds are affixed within a gold, dime-size device placed on the cornea over the area that needed treatment. The gold seed carrier blocks the radiation in every direction except into the eye, directly at the tumor, thus sparing healthy tissues. “The beautiful part of the procedure is that it’s a very localized treatment to just the front part of the eye, precisely where the tumor is situated,” explains Dr. Finger.

After seven days of continuous plaque radiation at a dose of 84.5 Gy, the device was removed from the cornea, leaving

the tumor destroyed. The NYEE surgeons, who included Dr. Finger and Ekaterina Semenova, MD, PhD, then an ophthalmic clinical research fellow, and a radiation oncologist, achieved local tumor control and preservation of the patient’s vision. Specifically, examination with slit-lamp photographic and high-frequency ultrasound imaging at eight years’ follow-up showed a reduction of the tumor to a scar, and mild hazy opacity of the corneal transplant, but only within the targeted zone.

Dr. Semenova has since become the newest member of the Ocular Oncology Service team as an Assistant Professor of Ophthalmology (after completing an ophthalmology oncology fellowship program at Duke University), which also includes Robert D. Stewart, MD, Assistant Professor of Radiation Oncology at the Icahn School of Medicine at Mount Sinai, who supervises dosimetry and plaque construction. Dr. Semenova quickly put her surgical skills and training to work on the latest squamous cell carcinoma case. It involved a 49-year-old woman whose tumor on the surface of the cornea was shown by high-frequency ultrasound to be growing down into the eye from a penetrating keratoplasty (PK) wound. The patient was referred to NYEE where Drs. Finger and Semenova initially reduced the size of the tumor on the ocular surface with chemotherapy eye drops. However, knowing that chemotherapy eye drops are not effective beyond the surface of the eye, Dr. Semenova now faced a critical decision: how to treat the residual invasive tumor.

“It became a choice of using radiation to preserve or alternatively to remove the eye to ensure the tumor didn’t return,” she explains. “I decided to go with radiation, and sutured a plaque loaded with radioactive palladium-103 onto the surface of the entire cornea.” The plaque was sutured to the front of the eye and left there for a week to deliver a treatment dose of 70 Gy to the intraocular tumor cells. While longer-term results from the procedure (performed last year) are not yet available, initial findings are extremely favorable. “The patient’s pressure is normal, the eye looks good, and the corneal transplant is clear,” reports Dr. Semenova. “Her vision was 20/50 before and continues after the treatment, supporting our decision to use radiation therapy to spare the eye.”

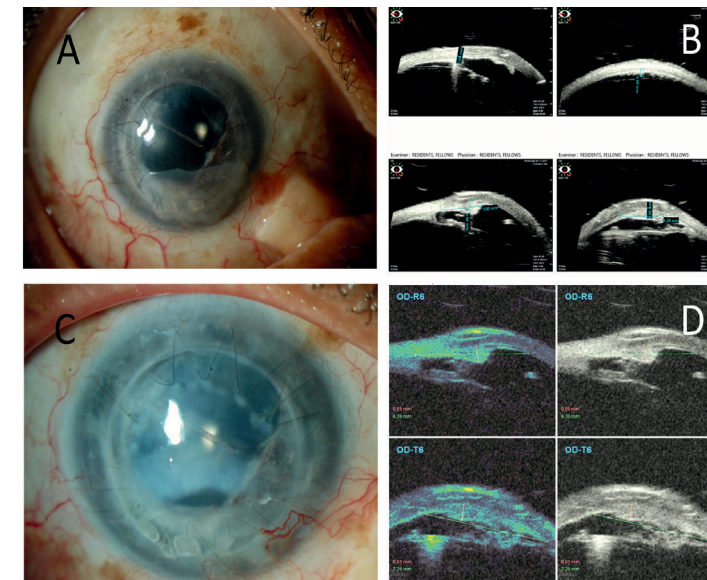


Fig. 1: 2014 Patient Case
A: Squamous carcinoma transplanted cornea with tumor invasion through corneal transplant wound (arrows)
B: Ultrasound imaging showing tumor invasion through corneal transplant wound (arrows)
C: Slit lamp picture showing regression of the cancer and formation of stromal opacity of the corneal transplant within the targeted zone
D: Ultrasound imaging reveals regression of the tumor

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—Paul T. Finger, MD

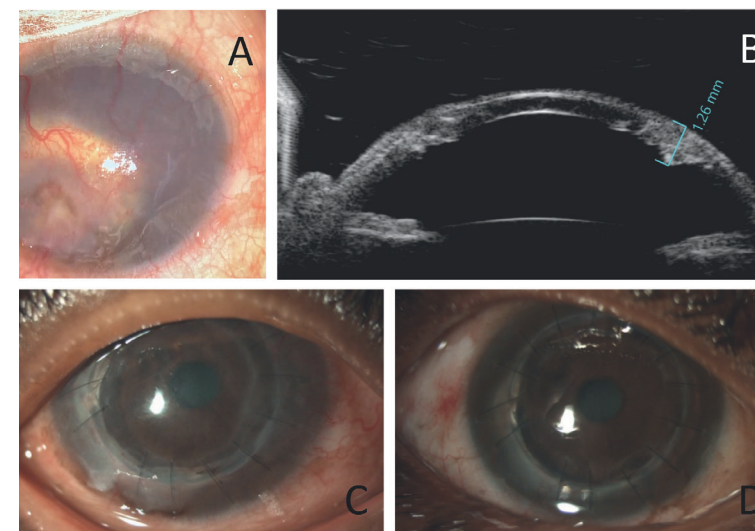
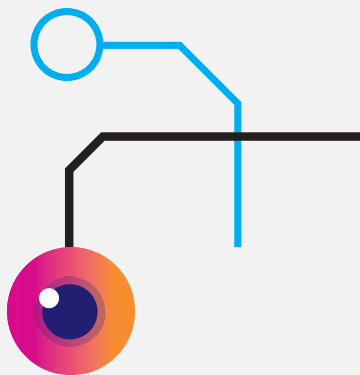


Fig. 2: 2022 Patient Case
A: Intraoperative picture of the corneal opacity with corneal and conjunctival tumor of the right eye prior to penetrating keratoplasty
B: Ultrasound imaging showing tumor invasion through corneal transplant wound
C: Slit lamp picture showing residual corneal and conjunctival tumor infero-temporally
D: 3 months post plaque radiation therapy with regression of corneal and conjunctival tumor and clear corneal transplant