Cornea NanoPunch and Retina Velcro Surgical Instruments

Spanning the Frontiers of Medicine

Sponsors: ORNL Laboratory Directed Research and Development and Maturation Funds.

Features:
Uniform nanosharpness micro-cone arrays used to treat cornea abnormalities.

Uniform angled micro-cone arrays used to treat retina scarring.

Arrays can be fabricated to have virtually any size, aspect ratio, or spacing.

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Researchers at the Department of Energy's Oak Ridge National Laboratory (ORNL) in Oak Ridge, Tennessee, in conjunction with the University of Tennessee's Hamilton Eye Institute have developed a set of novel, microfabricated surgical instruments (Figure 1). These include the Cornea NanoPunch (Figure 2), used to enhance the healing of acute corneal abrasions and recurrent cornea erosions, and Retina Velcro (Figure 3), designed to remove scar tissue from the surface of the retina**.**

These devices represent an entirely new paradigm in surgical instrumentation for diseases of the eye. These novel microfabricated arrays significantly enhance the current techniques of retinal surgery and advance the technical limits of safe, reproducible, and reliable retinal surgery. The disposable design permits the application of *patient-specific instrument design*, in which the instrument used is tailored for the patient's unique pathology (e.g., 30-micron height for a 30-micron thick membrane) to reduce the risk of retinal injury, making the surgery safer and easier.

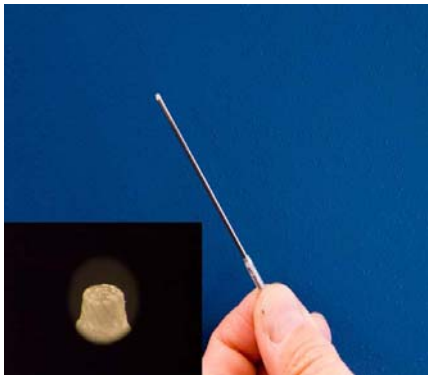

Fig. 1. Microfabricated surgical instrument.

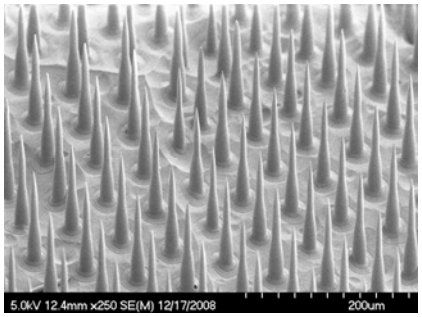

Fig. 2. Cornea nanopunch array.

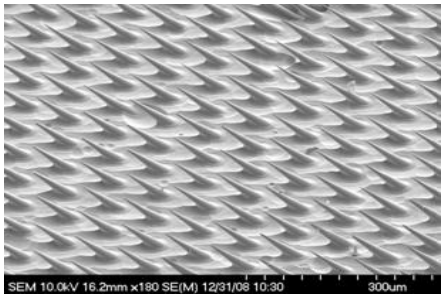

Fig. 3. Retina velcro.

Current treatment for corneal erosions creates deep perforations in the corneal tissue with formation of visible scars (Figure 4). Contiguous treatment may induce a large region of scarring with significant refractive and optical consequences for vision. The glass array spikes penetrate the corneal surface at a specified depth and density, creating thousands of microscopic sites for cell adhesion, improving the treatment result and minimizing the risk of vision loss from the current methods.

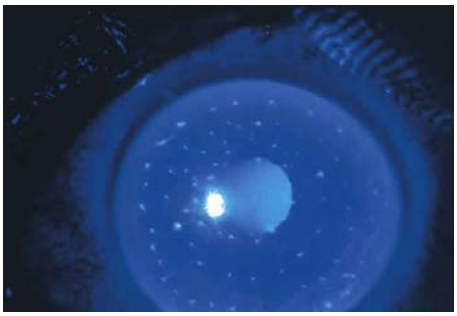

Fig. 4. Corneal scarring from anterior stromal puncture using a 25-gauge needle.