Corneal treatment a priority

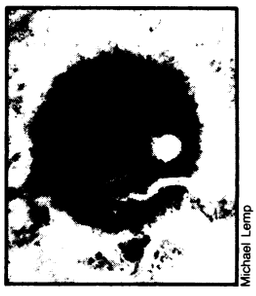
There is little doubt that cataracts (the clouding of the lens of the eye) and glaucoma (the building of pressure in the eyeball) are more common eye problems than are diseases of the cornea. But patients afflicted with diseased corneas can suffer excruciating or chronic pain and loss of vision that is not inherent in the more common eye disorders. Many ophthalmologists throughout the world are concentrating their efforts to help these patients. Last week they reported advances at a press conference in Washington in conjunction with the Second World Congress on the Cornea. The Congress was sponsored by the International Eye Foundation and the Society of Eye Surgeons.

Many of the latest advances in corneal treatment have depended on advances in electronics and chemistry. Virtually all corneal surgery, for instance, is now conducted under the microscope—actually through binoculars that magnify the patient's eye. (This is even the case in mainland China, reports Ridha Mabrouk of the Institute of Ophthalmology in Tunis, Tunisia, who has just returned from assessing the state of eye surgery in China. One difference: In China ophthalmologists may combine corneal microsurgery with acupuncture anesthesia.) What's more, microsurgery on the cornea is often taped and played back on color television for ophthalmology residents.

Ten or 15 years ago, the corneal transplant success rate was only 30 percent, Michael Lemp, an ophthalmologist at Georgetown University Medical School, points out. Now it's around 80 percent, he says, and one reason is that doctors started using microscopic-sized sutures made of nylon that don't react with eye tissue and invite transplant rejection.

Chemical technology has boosted corneal surgery in another way—through development of soft contact lenses. Such lenses, as most people know, can be worn instead of eye glasses to correct light-refractive errors in the cornea. But what most people don't realize is that soft contact lenses are also being used to help patients with corneal diseases. If a patient has a buckling cornea, for example, a soft contact lens can be put on it to keep it from buckling. Or if a cornea is eroding, a soft contact lens can be put on it to serve as a splint and keep it in place. Soft contact lenses are better than bandages for treating diseased corneas because they let the patient see. Also, medications can be applied to the lenses, and they'll leach through to the cornea.

Plastic corneas are still another spinoff from chemical technology, but their use is controversial. Hernando Cardona of Columbia-Presbyterian Hospital in New York City is a pioneer in this area. Cardona is the first to agree with other ophthalmologists that giving patients a new, living, healthy cornea to replace a diseased one is ideal. But if such transplants don't work, as is often the case in older patients, then a plastic cornea is an alternate solution. Plastic corneas, he says, also show promise for patients whose corneas and surrounding eye tissue have been burned, or for patients with a rare, but devastating disease called ocular pemphigoid, which inflames the cornea and leads to total blindness.



Michael Lemp

Diseased cornea: Microsurgery and chemical technology assist in efforts to save sight.

Plastic surgery is difficult, though, Cardona admits. For a patient whose cornea and surrounding tissue has been burned, for example, tissue has to be taken from the patient's leg and grafted into the eye cavity to stabilize the plastic cornea. (The patient's own tissue is used so that it won't be rejected.) For the patient with ocular pemphigoid, the patient's eyelid must be sewn over the plastic cornea to provide blood vessels and nourishment for healing. A tiny hole is made through the eyelid to enable the patient to see. Tiny artificial tear pumps must be implanted under the eyelid to provide the plastic cornea with moisture.

Even with these drawbacks, though, Cardona says, some 700 patients throughout the world have a plastic cornea and are doing reasonably well. Patients with ocular pemphigoid, for instance, can read a day or two after receiving a plastic cornea.

Finally, another achievement in corneal treatment deriving from chemical technology was reported by Edward Maumenee, an ophthalmologist at Johns Hopkins School of Medicine. The most frequent complication resulting from cataract operations is that patients' corneas cloud. Bernard McCarey of the University of Florida and several other ophthalmologists, Maumenee says, have found that if the gelatinous mass comprising the eyeball of such patients is replaced with a chemical solution, the corneas won't cloud. □

Deep well wastes may be water hazards

The unrestricted dumping of sewage and chemical wastes deep into the earth might not be such a good idea, a new study finds. Strict surface water pollution laws have left more and more cities and industries with big waste disposal problems. Many have tried injecting liquid wastes into 1,000-foot wells. More than 300 such wells had been dug at last count, in fact. At those depths, the wastes often flow into aquifers, porous water-holding rock formations. But a team of hydrologists now reports that these wells may be a hazard to subsurface environments and may damage both the aquifer formation and the potential drinking water sources they contain.

Hydrologists Jerry A. Leenheer, Ronald L. Malcolm and William R. White of the U.S. Geological Survey in Lakewood, Colo., made a case study of wells dug by a North Carolina chemical company. Hercules, Inc. of Wilmington, N.C., a producer of polyester fiber feedstocks and explosives, dug a deep waste well several years ago for liquid wastes, mostly acetic and formic acids. Early clogging problems attracted the team of government hydrologists and the company agreed to dig 14 observation wells at sites near the original so the team could monitor water flow and chemical changes at various distances from the point of initial waste discharge. They found several evidences that the dumped acids were unstable and reactive underground, quite in contrast to the common assumption that injected wastes do not react or pollute subsurface waters.

During their three-year study, the team reports in the May ENVIRONMENTAL SCIENCE AND TECHNOLOGY, they detected original wastes and reaction by-products in the observation wells 1,400 to 2,700 feet from the injection well. There was evidence, Malcolm told SCIENCE NEWS, that the acids were causing clay minerals and iron oxides from the aquifers to dissolve and move away through the underground formation. As the water migrates and its initial acidity decreases, he says, these dissolved inorganic constituents, reprecipitate, forming a gel-like material that plugs the pores of the aquifer. Not only does such chemical activity tend to ruin the aquifer formation, Malcolm says, but wastes could migrate and break through into zones of drinking-quality water, destroying their future utility.

"There has been such a long history of water flooding to bring oil to the surface, then reinjecting the brine in deep wells, that it has influenced the whole philosophy of deep water disposal. They figure," says Jerry Leenheer, "that if brine is OK, anything is OK. That's why subsurface chemistry has been ignored."

The team recommends initial testing to determine the compatibility of the wastes with aquifer water and sediments from a proposed well site. If adverse chemical reactions occur during testing, the wastes should be pretreated and injected in a form that will not harm the environment, they advise. □