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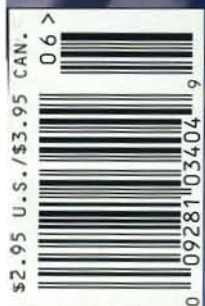
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The New World of Dental Care

At last, truly painless dentistry is at hand. It's just one of the high-tech innovations that are going to change dental visits forever.

BY LOU JOSEPH

Imagine enjoying root canal treatment, oblivious to the procedure, because you're too involved watching your favorite movie in your own personal cinema. Or studying your image on a split-screen computer monitor to find out what you would look like before and after cosmetic dentistry. And heading off future dental trouble through the use of an electric current sent through a tooth to ferret out a tiny decayed spot too small to be detected by X-ray.

It sounds fantastic, like something from a futuristic story about ultramodern space-age dentistry. The facts are, however, that today's dentistry has already

crossed the threshold into the 21st Century and is integrating many of these advanced treatment techniques into everyday practice.

Take the personal movie theater, for instance. At the offices of Fullerton, Calif., dentist Richard T. Hansen, "3-D i-glasses" provide "virtual reality" right in the dentist's chair. "The virtual-reality glasses engulf the patients in sight and sound, distracting them from even the lengthiest of procedures," Hansen asserts. "And when patients are fearful of a procedure, they welcome any distraction whatsoever."

The 3-D i-glasses consist of two small television screens placed before the eyes of the patient. They are part of a lightweight, portable headset that moves with head gestures and entralls the wearer in a total three-dimensional experience. It can be worn over regular glasses. Watching the movie puts patients at ease and makes the dental treatment pleasant for the patient as well as the dentist.

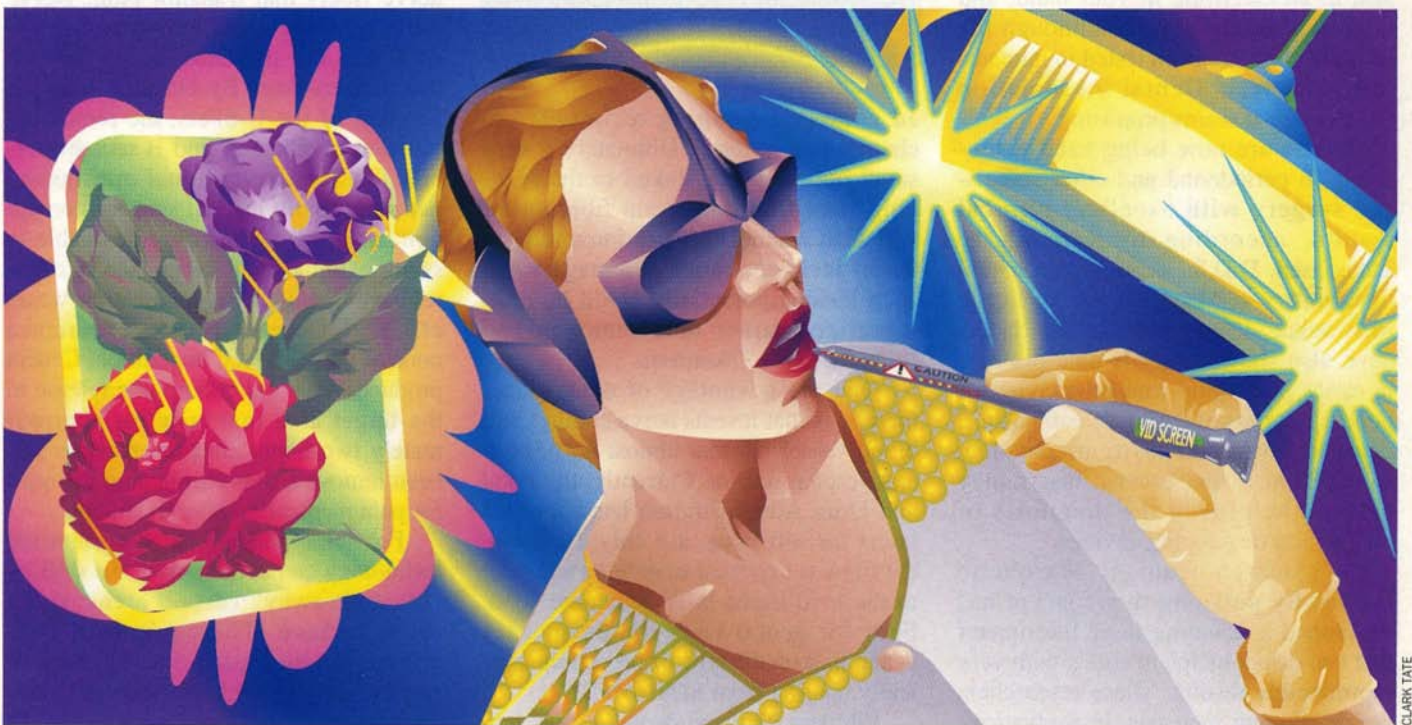
Personal Video And Patient Education.

Showing the patient in advance how his or her mouth and facial lines will look after treatment has already become a routine procedure in many dental offices. Computerized workstations, voice-recognition software, imaging and other high-tech developments directly involve patients in their own treatment, improve dentist-patient communication and enhance prevention and treatment.

This kind of "Information Superhighway" in dentistry is achieved though so-called "smart" workstations right in the dental operator. Dental-examination data such as periodontal (gum) disease findings, the location of cavities and pictures of the patient's teeth and smile are fed into the computer. The computer then generates a color printout to show the patient the condition of his or her mouth and the treatment needed. Voice-activated software and the computer's ability to create graphics enable the dentist to call up the patient's records without ever using or removing a glove.

With an intraoral camera attached to the workstation, the dentist can illustrate the inside of the mouth for the patient's benefit. A small "wand" (a miniature intraoral video camera) is inserted into the mouth, transmitting a signal to a TV monitor at the chairside. You can see for yourself what needs to be corrected.

Intraoral cameras can be helpful in three key areas: educating new patients about treatment, reactivating the cases



CLARK TATE

of former or long-absent patients and performing routine continuing care.

Today's patient education is also reinforced through multimedia programs presented on a CD-ROM player. Viewing high-quality illustrations, patients can now see and understand implants, extensive crown and bridge work and surgical procedures. Furthermore, with computer imaging you can view simulated cosmetic dental changes on a split screen that shows "before" and "after" pictures. This enables you to visualize results before treatment begins. It all leads to better-informed patients, and that means healthier mouths.

New Detection Tools. Prevention is a key word in dentistry, and researchers continue to focus on ways to discover disease at its earliest stages. This prompted scientists at the University of Dundee Dental School in Scotland to test a procedure in which an electric current is shot through a tooth to detect tiny pores signaling the earliest sign of decay. Theoretically, a dentist could then take steps, such as supplying fluoride or a sealant, to stop the decay process and perhaps even reverse it.

The device detects pores by passing an alternating current through the tooth and comparing the input and output frequencies. The difference indicates the extent of porosity. The dentist would slip an electrode between teeth or put it on the biting surface. The tiny current would go into the tooth and down your arm to an electrode in your hand, and then back to the device. Although the technique has not been tested in humans, the American Dental Association (ADA) says it seems promising.

Lasers are now being used extensively in periodontal and other soft-tissue surgery with excellent clinical results, according to Kenneth L. Zakariassen, D.D.S., dean of the School of Dentistry at Marquette University in Milwaukee. In research studies, lasers have also shown considerable promise in caries prevention, enamel etching for bonding purposes, curing of composites, decay removal and cavity preparation. In addition to these uses, lasers may become helpful in the diagnosis of incipient or developing cavities.

A research team at Marquette University pursuing this concept has developed a scanning laser fluorimeter that can detect incipient caries with very reproducible results. These researchers are developing increasingly sophisticated

BREAKTHROUGHS ON THE HORIZON

The ADA offers an optimistic look at what is in store for further advances in dental technology and treatment over the next five years:

- Bone putties that will be used to repair bone defects caused by advanced periodontal disease and severe damage to bones that don't bear heavy weight or stress. Already, scientists at the ADA's Paffenbarger Research Center have developed a calcium-phosphate compound that can, for example, repair a chin that was destroyed in a car accident.

- An antimicrobial gel that will make it easier to apply antibiotics to areas of gum affected by the bacteria that cause periodontal disease.

- Diagnostic techniques that will assist the dentist in identifying specific strains of bacteria responsible for gum disease. DNA tests will enable dentists to determine which strain of bacteria is causing the gum disease, thus permitting dentists to select appropriate antibiotic treatment.

- New applications for lasers to seal off the tooth roots during a root-canal procedure, making the process quicker and much less uncomfortable.

- Remineralization of tooth cavities by mouth rinse or toothpaste. Currently, dentists can use aggressive fluoride treatment to reverse small surface cavities, but they may eventually be able to reverse larger surface cavities, thus decreasing the need for tooth fillings.

ed computer-imaging techniques to characterize lesions. "Ultimately, a very small optical probe linked to the scanning laser fluorimeter via fiber optics will scan enamel surfaces intraorally to detect incipient caries at a stage when such lesions potentially could be remineralized rather than removed and restored," says Zakariassen.

One big advantage of dental laser therapy is that it seals nerve endings and blood vessels so that almost no postoperative pain occurs. Currently, the Food and Drug Administration has approved lasers for soft-tissue use only. However, the FDA is expected to give its approval to the hard-tissue laser sometime soon. Fees for dental laser treatment vary depending on the type of procedure, typically ranging from \$150 to \$400.

Filmless digitized dental X-rays rep-

resent another technology whose time has arrived. Digital radiology captures X-ray images on a digital non-film receptor that is connected to a computer, where images can be stored electronically in the memory file. The image can be displayed immediately and can be manipulated or processed to provide the dentist with an immediate interpretation.

Dealing With Pain And Anxiety. If you are still somewhat apprehensive about going to the dentist, researchers are testing new methods that may help you overcome such feelings. A good way to calm patients awaiting dental treatment may be to let them smell flowers, researchers at Case Western Reserve University in Cleveland found. A study involving 42 patients used aerosolizing devices to produce scents of flowers, spices or no fragrance in rooms where patients were awaiting root-canal treatments. The researchers found that patients exposed to low levels of floral scent were the least anxious.

Another promising method to curb anxiety is Cedeta, or Targeted Electronic Anesthesia. This would eliminate novocaine—and absolutely all patient pain—for almost all dental procedures. Developed in England, Cedeta anesthetizes without the use of needles. There is no numbness, so you won't accidentally bite your lips afterwards. A small, thin strip—a receptor—is placed on the gum at the tooth site where treatment is to be performed. The receptor works by isolating and neutralizing the nerve fibers that transmit pain. Nerve fibers are categorized into three types—A, B and C—the latter being the one that delivers pain. By blocking only the function of the C fibers, the remaining function of fibers A and B remain normal. Under conventional anesthesia, patients usually lose all sensory perception in the mouth and may be unable to swallow liquids and experience swollen, rubbery lips until the medication wears off. With Cedeta, patients experience none of these effects. In addition, Cedeta produces a natural endorphine release in the target area that lasts for approximately two hours after the receptor has been removed, thus eliminating the need for pain medication after treatment.

For some patients, new air-abrasive technology can even replace the drill by "blasting away" certain areas of the tooth surface. The equipment uses minute alumina particles, almost too small to be seen with the naked eye, that are carried to the tooth by a stream of

air. Because the particles spray away some of the tooth at high speeds with no drilling sound, no vibrations or need for anesthesia, patients "view the service as extremely valuable," says Ronald E. Goldstein, D.D.S., of the Medical College of Georgia School of Dentistry in Augusta. It is a conservative way to remove some portions of the tooth, allowing the possibility of diagnosis of decay at the earliest possible moment.

The ADA views the technology as one whose primary value is for diagnosis. The dentist can blast alumina particles on suspicious-looking darkened areas in the pits and fissures of the chewing surfaces of the back teeth, the areas where decay is most often seen, especially among American teens and children. Goldstein contends that with this equipment the dentist can remove stains and organic debris for the application of sealants (protective plastic coatings) on the teeth and can also remove areas of early caries for replacement with resin fillings.

He notes, however, that air-abrasion is "not well-suited for removing all decay. Moist or soft dentin (the layer beneath the tooth enamel) cannot effec-

tively be removed with air-abrasion." He sees the technology as offering promise not only for diagnosis but also for the treatment of pit and fissure decay. Fees for air-abrasive therapy, plus placing either plastic sealant or composite materials in the treated tooth, range from \$45 to \$175.

Want A Prettier Smile? On the cosmetic front, a technique called "rapid orthodontics" is gaining attention. However, "rapid orthodontics" is not really orthodontics but a cosmetic procedure, says Mervin W. Graham, D.D.S., a Denver orthodontist and spokesperson for the American Association of Orthodontists (AAO). With rapid orthodontics, four front teeth (top or bottom) are moved slightly and then held in place for several weeks with a fixed retainer.

"In contrast, orthodontists don't just make your teeth straight; they position the teeth in each jaw so that they work together in a natural way. In rapid orthodontics, a dentist moves the teeth and holds them without regard to how you chew," says Graham.

In traditional adult orthodontics, for which fees range from \$1,500 to \$5,000,

treatment is focused on the fit and stability of all the teeth, and treatment takes longer because much more is being done. When the teeth assume their correct position, a removable retainer is worn as needed. Active orthodontic treatment typically lasts 12 to 36 months, after which you wear a retainer for approximately two years.

In other words, rapid orthodontics is something of a misnomer, first because the procedure does not move teeth any faster than traditional orthodontics—your body dictates the speed at which your teeth will move—and second because the procedure is essentially cosmetic. Traditional orthodontics provides comprehensive movement that is long-lasting. That movement is achieved by a physiological change of the fibers that connect the tooth to the jaw and changes in the bone that surrounds the teeth.

In the widespread quest for nicer smiles, cosmetic rapid orthodontics also can be combined with tooth-whitening systems, according to Edward B. Walk, D.D.S., a general practitioner of Newton, Mass. Dentists try to opt for the most conservative procedure for cosmetic patients. For instance, if a patient

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wants brighter teeth, the recommendation may call for dentist-supervised home or in-office bleaching, a process that utilizes a hydrogen peroxide gel. Not everyone's teeth will whiten at the same rate. "Yellowish-hued teeth will probably bleach well, brownish-colored teeth will bleach less easily and grayish-hued teeth may not bleach well at all," says Walk.

The dentist may advise you to forget about the whitening treatment and may instead recommend another procedure such as porcelain veneers, or a combination of veneers and bleaching. Veneers resemble "false fingernails" that are placed directly over the discolored tooth surface to whiten the teeth. Porcelain veneers can also be used to yield "instant orthodontics" in which the teeth are not actually moved but the veneer is used to "build up" the teeth to make an apparent but not an actual position change. Fees for bleaching teeth are approximately \$275 per arch, and installing porcelain veneers ranges from \$600 to \$2,100 per single tooth.

Replacing Teeth—Permanently. Perhaps most exciting of all, genetically engineered and cloned bone grafts may soon lead to a breakthrough in implant dentistry. These new biological materials have been successfully tested in laboratory studies to augment the deficient bony masses in the jaw that frequently jeopardize long-term retention of oral implants, according to A. Hari Redi, Ph.D., of the Johns Hopkins School of Medicine in Baltimore.

Today's dental implants are changing the way people live. With them, people are discovering increased comfort and confidence to eat, speak, laugh and enjoy life. Dental-implant use has nearly tripled since 1986. Dental implants are made of materials that are compatible with human bone and tissue. The implants are surgically placed directly into or on top of the jawbone. Small posts are then attached to the implants which protrude through the gums. These posts provide stable anchors for artificial replacement teeth.

The key ingredient that enables the new experimental bone matrix to integrate into the existing bony foundation is a molecular cell initiator consisting of a family of seven morphogenetic proteins (BMPs). Researchers are making considerable progress in identifying and cloning these BMPs. In addition to benefiting dental implants, the use of BMP-induced bone formation will improve

many medical treatments for damaged or diseased bones.

Another dental-implant procedure involves using porous bone mineral grafts to augment shrinking jawbone to enhance long-term retention of dental implants. The amount of bone density in the implant recipient site markedly affects the success of the device. Traditional autogenous (usually from the patient's rib or hip bone) grafts to restore missing jawbone usually meet with initial success but long-term retention is doubtful. Grafts of porous bone mineral (derived from purified bovine sources), when added to the patient's own bone-graft particles, tend to resist jawbone resorption or shrinkage three times better than the conventional grafts.

Periodontal disease, which is considered the second major cause of tooth loss (after dental decay), can now be controlled with antibiotic-containing fibers capable of delivering to infected gum tissues 60 to 100 times the amount of medication that oral medication can deliver. At first glance, it appears to be just a thread, somewhat similar to dental floss. But that thin thread is actually a new effective weapon in the fight against periodontal disease. Marketed under the name Actisite, the ethylene vinyl acetate (EVA) copolymer fibers containing the antibiotic tetracycline hydrochloride are manufactured by ALZA Corporation and marketed jointly by ALZA and Procter & Gamble. Systemically delivered tetracycline sometimes is prescribed in conjunction with nonsurgical tooth-root scaling and planing as well as periodontal surgery. The antibiotic is effective against several oral bacteria considered major culprits in periodontal disease.

Investigators at the University at Buffalo School of Dental Medicine implanted the fibers—each containing 12.5 milligrams of antibiotic per fiber—and a placebo fiber in two nonadjacent periodontal pockets of 5 mm depth or greater around affected teeth in 10 patients three weeks after root planing and scaling. All of the fibers were removed seven days later, and periodontal surgery was then performed. Results showed that mechanical and chemical removal of colonies of the disease-causing bacteria reduces their numbers and reduces pocket depth around teeth to allow more effective brushing and flossing after treatment. ■

Chicago-based Lou Joseph is a veteran science and medical journalist.