A second chance — worth a smile!

Dentists use stem cells to regenerate tissue in children’s teeth
Advancing laboratory discoveries to the patient’s side has but one purpose: to make lives better

At the recent luncheon of the President’s Council – at which we annually honor and thank our donors – guests at every table were engaged in conversation by our brightest and most committed researchers about their ongoing work in science and health care.

We are most grateful for the support we receive from these – and all – donors, as it is essential in enabling these investigators – across our five schools, on eight campuses, in four cities – to conduct intensive research that is not only innovative and imaginative, but highly relevant and life changing.

Additionally, gifts made by members of the President’s Council this year are funding the recruitment of outstanding new scientists to our Health Science Center; scholarships for deserving students; professorships for remarkably accomplished members of our faculty; and, for the next three years, the Voelcker Biomedical Research Academy, attended by promising and motivated high school students.

By the end of the President’s Council luncheon, the large and enthusiastic audience was vividly reminded of the undeniable necessity for research in the basic sciences and that such research is the very foundation of clinical treatments that save lives and change the world forever.

Here, at the UT Health Science Center San Antonio, we pledge our fullest energies and endeavor to translating discoveries in science into the most competent and compassionate of clinical care. This issue of Mission describes several specific and successful examples of taking basic science discovery to the bedside.

Ours is a setting in which basic-science researchers push the new frontier of epigenetics by understanding how interactions between genes and the environment turn genetic products on and off.

The Health Science Center is also the place where something as unusual as the bark of the Amur cork tree, long used in Chinese herbal medicine, is studied for its powers to sensitize cancer cells to the point where they succumb more completely to radiation, offering hope and life to prostate cancer patients.

Benchmark technology is a hero in the story of how our UT Medicine San Antonio cardiothoracic surgeons, plastic surgeons and radiologists have pioneered an innovative reconstruction technique that resolves chronic pain and disconcerting movements for patients living with unstable breastbones.

And, finally, we look to our cover story to define translational science at its best. It describes how – for the first time ever in a clinical setting – researchers in our Department of Endodontics have found that stem cells, abundant in the soft tissue surrounding children’s teeth, can be used to regenerate the tooth’s own tissue and cells. Today, our 12-year-old cover subject can again chew gum, eat apples and do what he most enjoys – ride his bike. Now that’s certainly worth a smile.

I thank you for all you do that supports our Health Science Center. Your partnership ennobles our work every day. You are the reason we can continue to make lives better.

Sincerely,

William L. Henrich, M.D., MACP
President
Professor of Medicine
UT Health Science Center at San Antonio
A second chance –
worth a smile!

BY NATALIE GUTIERREZ

The X-ray revealed a black void. What was once colonized by lively cells, tissue and nerves was vacant and still. The pulp tissue (nerves) inside 12-year-old Cody Nelson’s tooth was dead – the result of a biking accident. He’d been speeding down a hill when his tire hit a bump, sending the handlebars into his face.

“I touched my mouth and saw this white stuff. Then, I felt my front tooth and half of it was gone,” he said. He’d fractured his right permanent front tooth, a central incisor that assists in chewing and is one of the most visible in the mouth.

Accidents like Cody’s are common. The American Dental Association estimates that one-third of all dental injuries are related to sports or recreational activities. In addition, other sources indicate that more than 7.3 percent of U.S. children, by age 17, have lost at least one permanent tooth to decay.

Normally, a child might live with an injured or infected tooth. Even if a dentist rebuilds the missing portion of a chipped tooth, using a tooth-colored resin, the interior of the tooth’s root remains lifeless and vulnerable to infection. Root canal therapy would be the only option, but this treatment means that the root of the tooth will no longer develop, and will be at risk for further fractures for the remainder of the patient’s life.

Researchers in the Dental School at the UT Health Science Center at San Antonio are helping to solve the problem. For the first time ever in a clinical setting, researchers in the Department of Endodontics, have proven that stem cells, abundant in the soft tissue surrounding children’s teeth, can be used in an endodontic procedure to regenerate the tooth’s own tissue and cells.

Cody Nelson was one of 12 patients ages 7 to 16 who participated in the study led by Anibal Diogenes, D.D.S., M.S., Ph.D., assistant professor in the Department of Endodontics at the Health Science Center.

When a child loses a portion of tooth to a cavity, or as in Cody Nelson’s case, to an injury, inflammation and bacteria can be present. The first step in the Health Science Center study was to disinfect the tooth canal and administer antibiotics.

Cody returned to the Dental Clinic in a month where clinician’s flushed and cleaned the tooth canal. After applying an anesthetic, dentists used a special technique to evoke bleeding in the apical papilla, which is the soft tissue surrounding the end of the root in developing permanent teeth. The apical papilla is the precursor tissue to the pulp of adult teeth. Unlike the pulp in adult teeth that may undergo necrosis due to infection, the apical papilla resists advanced infections.

Thus, stem cells can be released from this structure and brought into the interior of a tooth to re-populate and restore the damaged tissue.

Standard blood samples were also drawn from each study participant.

“We needed to answer several questions,” Dr. Diogenes said. “If we caused blood cells from within the apical papilla to emerge, would they carry with them stem cells? And could those stem cells stimulate the regeneration of dead tissues in a tooth? We compared the blood samples from the teeth with the standard blood samples drawn from each patient.”

What they discovered was exciting. After one month of treatment, blood carried from the apical papilla into the tooth had a concentration of stem cells up to 700 times higher than in the systemic blood samples.

“We found that by causing bleeding in the apical papilla, we were able to release stem cells resulting in their delivery to the tooth canal. In addition, we demonstrated that the cells originated from the apical papilla and that they did not come from anywhere else in the body.”

Dr. Diogenes said the process...
Dr. Diogenes said the tooth is immunocompetent, meaning it can defend itself from infection.

"The further development seen means a stronger reliable tooth that functions as an uninjured tooth," Dr. Diogenes said. "The process takes several months, but positive vital responses have been seen in as little as six months."

The study was funded by the American Association of Endodontists Foundation and by the Department of Endodontics at the UT Health Science Center and was published in the Journal of Endodontists. The American Dental Association is creating treatment codes for this new procedure that Dr. Diogenes hopes will become widely used in dental clinics across the country.

Co-investigators on the study from the Department of Endodontics at the Health Science Center were Kenneth Hargreaves, D.D.S., Ph.D., Michael Henry, D.D.S., Ph.D., and Tyler Lovelace, D.D.S.

Dr. Diogenes and his team are now studying the same process in adult patients.

"We are excited about these findings because not every child is a
candidate for a root canal," he said. "If an affected tooth is not fully formed, further development is not viable after conventional root canal therapy. During a root canal, dentists fill a tooth with an inert material. Therefore, the tooth can no longer develop," Dr. Diogenes said. "Only regenerative endodontics can restore vitality in the tooth. Instead of having to live with tooth loss and limited therapy options, we may now be able to offer this minimally invasive procedure, which costs about one-quarter of root canal surgery."

Kenneth Hargreaves, D.D.S., Ph.D., professor and chair of the Department of Endodontics at the Health Science Center, said Dr. Diogenes' research represents translational science at its best.

"Anibal and his team are the first to demonstrate a clinical procedure that delivers a high concentration of mesenchymal stem cells into the root canals of disinfected teeth that literally regenerate tissue in actual patients." Dr. Hargreaves said. "These findings provide a foundation that will be incredibly important in guiding the translation of tissue engineering from the bench to the chair side. He and his team are among the leaders in this effort."

Laura Nelson, mother of study participant, Cody Nelson, said she was glad her son was among the first to benefit from this procedure.

"It's amazing what the dentists at the Health Science Center's Dental Clinic can do," Mrs. Nelson said. "We are lucky this research and these specialists are here in San Antonio. Cody can chew gum and eat apples just like before. He recently got braces too."

Cody said he thinks it's "pretty cool," especially since he's back to being an active 12-year-old and doing what he loves to do best - riding his bike.

To become a patient in the UT Health Science Center Dental Clinic, call 210-567-3217 or visit www.dentalscreening.com.

COMING IN 2014

New facility for Dental School clinics approved

The University of Texas System Board of Regents this year authorized a $95 million oral health care center at the UT Health Science Center San Antonio. The new four-level 172,000 gross-square-foot building will be named the Center for Oral Health Care at the MARC and will be constructed adjacent to the university's Medical Arts & Research Center (MARC) on Floyd Curl Drive.

The facility will improve dental education and training, and enable the Dental School to sustain its top-tier ranking, said William L. Henrich, M.D., MACP, president of the Health Science Center.

The proximity of the facility to the MARC outpatient medical care clinics will assist referrals and management of patients with oral health conditions, said Kenneth L. Kalkwarf, D.D.S., M.S., dean of the Dental School. The MARC is the flagship location of UT Medicine San Antonio, the clinical practice of the School of Medicine at the Health Science Center.

"The Health Science Center's schools work together to educate the entire health care team, and we are excited about the opportunity to care for the region's oral health needs and conduct clinical research studies in a new facility that is closely interrelated with our medical colleagues," Dean Kalkwarf said.

The project is expected to be completed by the end of 2014.

NOW OPEN

New Implant Clinic opens in Dental School

The Dental School recently opened The Implant Clinic offering state-of-the-art affordable dental and implant therapies with an emphasis on the expeditious completion of patient care. The clinic, under the direction of Ilse Turkyilmaz, D.D.S., Ph.D., assistant professor in the Department of Comprehensive Dentistry, augments dental implant services in the Dental School and provides additional dental services such as dentures and crowns. The new clinic will also be an important training facility for post-graduate residents and fellows. For more information or an appointment for an evaluation, call 210-567-5433.