Dentistry in space

Interview with former NASA dentist Dr. Michael H. Hodapp

By Dental Tribune International

A toothbrush of Buzz Aldrin, a crew member of Apollo 11, was recently auctioned for $22,705, prompting some renewed interest in dental hygiene in space. Interestingly, more than 40 years after that mission’s historic moon landing, astronauts are using similar everyday oral care products in space. For an update, Dental Tribune spoke with former NASA dentist Dr. Michael H. Hodapp about potential dental emergencies in space and how astronauts will maintain oral health on multiyear missions in the future.

Do you know how many dentists are employed by NASA?

Because of the recent cutbacks of NASA’s budget, they have closed the NASA dental clinic, so there are no dentists contracted by the agency at this point. Astronauts seek dental care by private practitioners and are followed closely by NASA-employed flight physicians.

How did you become involved with the agency?

In 1994, another dentist working for NASA informed me that a position had become available to care for the astronauts and their families at NASA and asked me if I would be interested. After a series of interviews, I was awarded the position. I served NASA as a contractor for over a decade before I went back into private practice in 2004.

Before great dentists practice, they tune up their skills,” is how AGD President Jeffrey M. Cole, DDS, MBA, FAG, explains the AGD’s annual meeting tagline: “Tune Up Your CE in Tennessee.” In addition to a comprehensive selection of C.E. courses, the event features a three-day exhibit hall and an abundance of family-friendly social events, many centered around Nashville’s music scene. Photo/Provided by www.pdphotos.com.

See SPACE, page A2

See page A4

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How important is oral health for astronauts in general? Oral health is a primary concern for astronauts and goes hand in hand with general health. All astronaut candidates are initially screened for dental issues prior to selection, and all those selected are expected to adhere to a meticulous oral hygiene routine and maintain good oral health. The primary goal is prevention. Yet, even with the highest standards in prevention, the potential for a dental emergency in space still exists. A recent analysis of all medical conditions determined that the one condition most likely to result in a dental emergency would be toothache.

During the U.S. Mercury program, the flights were so short that there was no need for an in-flight dental emergency protocol, and prevention was the primary focus. Owing to the extended time spent in space during the Gemini program, a toothbrush was added to the flight kits as a preventative measure. Apollo missions then incorporated a digestible dentifrice and floss, as well as antibiotics. Instrumentation like forcepts and temporary filling materials was first introduced when the Skylab space station was launched into orbit in the early 1970s and has been part of the emergency kits ever since.

How frequently are astronauts given pre-flight checkups? Once applicants are accepted, they undergo a thorough oral exam annually. The astronauts are classified into three categories: Class I astronauts have good oral health and are not expected to require dental treatment or re-evaluation for 12 months, Class II astronauts have some oral conditions that if left untreated are not expected to result in a dental emergency within 12 months, and Class III astronauts have an oral condition that if left untreated is expected to result in an emergency within 12 months. All astronauts are expected to retain a minimum Class II status, and only astronauts with Class I status prior to launch are considered for the International Space Station.

In addition to annual exams, astronauts undergo pre-flight exams 18 to 21 months before launch. During this exam, the astronaut undergoes a thorough clinical and radiographic exam, including bitewing and panoramic X-rays. Applications to conduct the exam are then submitted by the astronaut to be completed 90 days prior to launch. The astronaut undergoes an additional exam to rule out any hidden pathology or any unreported recent oral injuries.

Which dental emergencies are astronauts trained to handle by themselves? There are two crew medical officers (CMOs) aboard every mission. CMOs are trained to perform a number of dental and medical emergency procedures. On board, CMOs have the capability to treat with antibiotics and analgesics and administer anesthetics, place temporary dental fillings, replace a crown with temporary cement, treat exposed pulp, and as a last resort, extract teeth. Any emergency treatment would include communication with ground support flight physicians, as the CMOs are not necessarily physicians or dentists themselves. However, because the International Space Station is in low earth orbit, a true emergency situation would likely result in a return to earth for proper treatment.

Future missions will take astronauts to other planets, such as Mars. What are the main challenges that these long-term flights pose regarding oral health? We still do not know the long-term effects of space flight on the teeth, alveolar bone and periodontal health. It is well-documented that during space flight bone mineral density decreases in weight-bearing bones. It is not clear how this affects the teeth and alveolar bone and whether crew members will be more susceptible to tooth decay or periodontal disease. Skylab oral health studies determined that there were increased counts of caries-producing bacteria.
A glass ionomer restorative material was developed for use in a microgravity environment. Discussion about medications indicated that all drugs would need to be freshly manufactured and would require special packaging to maximize shelf life, especially those medications that are sensitive to moisture and radiation. Software considerations include training videos for the crew members to review and train to keep abreast during their travel.

President Obama speaks of sending humans to Mars as early as 2030. Do you believe these plans are realistic? It is my understanding that there are no definitive plans for a manned mission to Mars in the near future. Recent cuts to NASA’s budget have slowed progress for a manned mission to the red planet. Our closest neighbor is explored using robotics, and there is much to learn about Mars prior to risking the lives of humans to such a distant journey. However, planning and research for manned exploration-class missions is still being conducted, and the Orion project is still in progress. There are so many hurdles to overcome before such a journey could be undertaken.

Currently, NASA is formulating plans for a three-month mission to rendezvous with a near-earth asteroid. This would be a scientific mission requiring a one-month flight to rendezvous with the asteroid, conduct research and fly back to earth.

If NASA offered you the opportunity to go on a three-month mission like that, would you accept it? Since I was a young boy I have looked to the heavens and been fascinated by its beauty and have always dreamed of going into space. Given the opportunity, I would go in a heartbeat.