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.

Academy of General Dentistry Annual Meeting, June 27–30, Nashville

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• Greater New York Dental Meeting redesigns exhibit floor, adds tech pavilions
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• Pacific Dental Conference combines education, networking, scenic locale

Interview with former NASA dentist Dr. Michael H. Hodapp

Dentistry in space

By Dental Tribune International

Dr. Michael H. Hodapp
Lunar toothbrush: $22,705

If you missed out on the bidding on a toothbrush Buzz Aldrin took to the moon, you can still make an offer. The winning bidder, who got the piece of space memorabilia for $22,705 in the late-April auction, immediately put it up for resale.

Details are available through Heritage Auctions (www.ba.com). Here’s how the auction house describes the item, which was among an extensive collection of space memorabilia auctioned from the estates of Steven R. Belasco, who was a top executive at Colegate for much of his business career. “A light blue Lactona S-19 model ‘Tooth Tip’ toothbrush, 6 ½ long. Included also is the original 8” x 5” plastic pouch in which it flew with a piece of Velcro on the back for ease of storage. Used throughout the mission, including in the Lunar Module Eagle while on the moon. Copies of two pages from the Apollo Operations Handbook showing information on the contents of the Oral Hygiene Set are included. The very point of the attachment has been broken off but is present in the case. Signs of use, otherwise very fine condition.”

(Source: Heritage Auctions)

30 to 90 days before launch. The astronaut is also expected to follow a meticulous oral hygiene routine during flight.

No in-flight dental emergency has ever been reported by NASA. What problems do you think are most likely to occur? While the chances of a dental emergency occurring in space are low, the potential is always there. For instance, when astronauts move large objects, the inertia of mass and velocity can result in facial injuries and result in either a medical or dental emergency or both. Besides breaking a tooth, other considerations include luxation, grieving, splitting teeth or fracturing of a cusp while chewing. Even with the most meticulous dental exam and hygiene program, there is always a possibility that a tooth abscess could form due to trauma, hidden caries or a failing root canal.

Which dental emergencies are astronauts trained to handle by themselves? There are two crew medical officers (CMOs) on 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, administer anesthetics, place temporary 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.
such as Streptococcus mutans among crew members. It was concluded that this was due to the dehydrated diet that astronauts consume. This could be a potential contributor to oral health issues during extended missions, especially if a crew member begins to lapse in proper oral health care.

Dental emergencies in space would be challenging to handle as well. A mission to Mars would require a one-way flight duration of six to nine months. Owing to the alignment of Earth and Mars, the nominal mission would need to spend either 30 days or a year and a half on the Martian surface. Were an oral emergency to occur during the outbound flight, there would not be a safe-return-to-earth capability. Not enough fuel could be carried to counteract all the forces of launch that propel the crew on their voyage. In essence, all emergencies would have to be handled by the CMOs either in flight or on a planet with a little more than one-third of the gravity of Earth.

In space, "for every action, there is an opposite and equal reaction" has special meaning to the treating CMO and the crew member receiving treatment. Just the act of giving an injection would send the crew member and CMO darting away from each other if proper techniques were not followed. The luxury of gravity does not exist, and simple procedures can become major challenges without it. Consider for a moment trying to give CPR without the force of gravity holding you in place.

Working in the oral cavity poses special concerns, since the very act of breathing can be countered by gravity would have a tendency to draw anything loosely held within the oral cavity back into the lungs.

There is also the concern of the limited medical skills of CMOs, and the one-way communication delay with ground support of 20 to 25 minutes. In other words, it could take 45 minutes for a flight physician to deliver instruction to the treating CMO. Prayers would be in order for the afflicted crew member.

What measures are being considered to overcome these problems?

Recent discussions in relation to exploration-class missions have proposed instrumentation for semi-annual dental exams and cleaning for each crew member, as well as additional equipment for the diagnosis and treatment of dental emergencies. Some of the equipment considerations include a high-definition intraoral camera system, a method for detecting interproximal decay and osteous infections while limiting radiation, as well as a battery-operated dental handpiece and headlight.

Material considerations include an intermediate restorative material that is easy to use, does not require special equipment for mixing or curing, releases fluoride, and could last for the duration of an exploration-class mission. The U.S. Navy is currently conducting research on a restorative material for field use that fits this description.

A glass ionomer restorative material is also under consideration, although this would require special packaging to allow for controlled mixture by hand 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 that 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 its inhabitants.

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.