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HEALTH MAINTENANCE FACILITY — DENTAL EQUIPMENT REQUIREMENTS

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TEST OBJECTIVES:

1. Test the effectiveness of the HMF dental suction/particle containment system, which controls fluids and debris generated during simulated dental treatment, in microgravity.
2. Test the effectiveness of fiber-optic intraoral lighting systems in microgravity, while simulating dental treatment.
3. Evaluate the operation and function of off-the-shelf dental handheld instruments, a portable dental hand drill, and temporary filling material during microgravity.

TEST DESCRIPTION:

A mannequin head with teeth will be restrained at the head of the table of the HMF patient restraint device. A prototype laminar flow/suction and particle containment device and an instrument tray with restraint devices, dental instruments and dental hand drill, will be mounted and deployed "above" the mannequin head. Portions of minor dental procedures will be simulated during microgravity parabolas. Particles normally generated during dental procedures will be simulated with small amounts of a fine mist, and the drilling of small areas of the mannequin's teeth. Various portions of the laminar flow/suction device will be sequentially turned on, while particles are being generated.

TEST SET-UP AND FLIGHT EQUIPMENT:

Space required: Full width of KC-135, and 10 feet of length

1. HMF prototype Patient Restraint Device
2. Fiber-optic light source (a model currently used in dental practice)
3. 2 HP Vacuum cleaner and small (3/4 HP) compressor for the suction containment device
4. A cardboard fold-out suction/containment chamber attached to a vacuum hose
5. A 1/4" plastic tube with holes drilled in attached to the air compressor to create a laminar air flow
6. Mannequin head and torso
7. Instrument tray with small elastic restraint strings at right angles to restrain various hand held instruments and dental supplies
8. Dental instruments restrained with bungees to a plastic tray
9. A NiCad battery-powered drill restrained onto the tray

DATA ACQUISITION SYSTEM:

1. In-flight paper recording
2. Postflight debriefings of experimenters
3. Video and still photography (video by J. Young, stills by NASA)

IN-FLIGHT TEST PROCEDURES WITH PERSONAL OBSERVATIONS:

Video and still photography pending. Most of the procedures were viewed through the video camera lens.

1. A mannequin head with teeth will be restrained at the head of the table of

the HMF patient restraint device.

- Approx. 20 inches apart
 - Adequate room for both JY and RB to get both forearms and hands on and into the mouth.
2. A prototype laminar flow / suction and particle containment device and an instrument tray will be mounted and deployed "above" the mannequin head.
 - Both could easily be adapted to deploy above any well defined area (20 inch by 20 inch) on the patient, for other medical/surgical procedures
 3. Small amounts of water mist (< 2cc) will be sprayed "through" the mouth of the mannequin, with no suction devices used. (control)
 - Spray extrudes in a geyser-like fashion and "hangs" in a volume around the mannequin head (approx 30"x30"x30")
 4. A small battery-powered dental drill will be used to drill on the plastic teeth, with no suction devices used. (control)
 - Plastic particles extrude rapidly in several directions (<2mm size), and a dust "hangs" in a volume around the patient (as above)
 5. Both of the above actions will be repeated with the suction/laminar flow device in use to entrain the mist or particles.
 - 90-95% of water and plastic tooth particles are entrained into the suction collector.
 6. The suction collector will be reconfigured with a absorbant cloth over it (called a "camel cloth" chamois), and water sprayed into the laminar air flow.
 - The initial water spray/particles "bounce" off the dry camel cloth, with only some of them being soaked into the cloth.
 - As the camel cloth gets wet, most of the water spray/particles are soaked in, with few "bouncing away".

7. A handheld fiber optic light will be used to visualize areas of the teeth that are drilled.
 - This light source is easy to handle, and adequately illuminates the areas of the teeth and mouth.
8. The operator will utilize the dental hand drill to prepare the drilled plastic teeth for a temporary filling, using the light source and mirror.
 - No inherent problems encountered
 - Two sets of hands are required to hold the drill, mirror, light probe, and local "tip" suction.
 - Some unsteadiness of the operator's hands may be caused by inadequate or poorly positioned foot and waist restraints.
9. Zinc-Oxide Eugenol and Composite temporary filling materials will be placed upon the holes in the plastic teeth. Blue light and water are used, respectively, to "set" the material.
10. Both of these fillings were trimmed and "polished" with the dental drill.
 - No problems noted here

NASA PHOTO REFERENCE

S90-28208

Demonstration of suction tip

S90-28220

Dental tray and assembly with laminar flow/particle containment system

S90-28223

Dental technique in zero-gravity

S90-28211

Demonstrating dental technique in zero-gravity