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Commentary

Re-Inhaling Occurs when the Internal Pressure of the Emu is Lower than the Ambient Pressure

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DESCRIPTION

Exploring the moon's surface and operating outside of a spaceship are both considered Extravehicular Activities in space (EVA). Astronauts must put on a space suit or EVA suit in order to conduct EVA in the vacuum of space. Hand and upper-extremity needs during EVA were understood early on in the space programme, and many astronauts trained in these movements in preparation for their missions. Many tools and heavy objects, which lack weight in zero gravity but still have mass and velocity, must be used by astronauts during EVA. Attention to hand and upper-extremity issues grows along with the frequency of EVAs. Because the lower extremities are free to float in zero gravity in space, the upper extremity performs the majority of EVAs.

Astronauts are at danger for developing decompression sickness, which is brought on by the production of gas bubbles in tissues as a result of inert gas supersaturation, and gas embolism, which is brought on by the entrance of gas into blood vessels. A pressurized Extravehicular Mobility Unit (EMU) is the name of the current USA space suit. The oxygen pressure on Earth and within the International Space Station is 0.21 atm in accordance with the law of partial pressure, since oxygen has a partial pressure of 21% in the air and the standard atmospheric pressure is 1 atm. Hence, to breathe and maintain life, at least 0.21 atm of oxygen is required. Rebreathing or denitrogenation occurs because the interior pressure of the EMU is lower than the ambient pressure. The interstitial tissues and blood when breathing pressure decreases, blood gas, particularly nitrogen, diffuses from capillaries into alveoli and is exhaled. Nitrogen diffuses into the blood from the interstitial tissue when the blood's gas pressure is reduced. Rebreathing lowers the astronaut's body's nitrogen content, preventing the development of nitrogen bubbles in body tissues and surface veins and preventing DCS. Because the EMU is pressured with pure oxygen as previously mentioned, the oxygen pressure is enough for breathing. The suit is rigid, inhibits mobility, and is exhausting to operate in even with this low pressure due to the pressure differential caused by expansion between the inside and outside of the suit. Decompression sickness is not brought on since the inner suit pressure is the same as the air pressure of the International Space Station, which is 1 atm.

The greater pressure differential, however, hinders the suit's flexibility and, consequently, mobility. A fabric tube that is inflated and is bent by the hand can simulate the structure surrounding the finger joint in a pressurized space suit glove.

According to the straightforward model, the glove's maximum bending resistance is equal to pr3, where p is the pressure difference between the gloves's interior and outside, and r is the radius of the radius glove portion. Hence, if the material and length are the same, increased pressurization and glove size are the dominating determinants in glove mobility. Acute onychosis, fingertip abrasions, bruised and sore knuckles, subungual hematoma, paronychia and fingertip infection, frostbite, dislocations, and compressive neuropathies are all common injuries that astronauts get during extended space walks (EVA).

As supplies and devices are frequently fastened using hook-and-loop fasteners in zero-gravity environments, some astronauts have reported small cuts and abrasions on their fingertips from releasing supplies and instruments from the plastic hook part of the Velcro. Without a difference in pressure between the interior and outside of the glove, the glove is soft and readily deforms when being moved. But, as previously mentioned, the pressure difference makes the groove rigid, and the glove does not adapt to the contour of the joint.

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