UHMS Position Statement

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Title: **The potential impact of UV-C Disinfection on acrylic surfaces of hyperbaric chambers**

INTRODUCTION

Sunlight is known to adversely affect plastic surfaces. Sunlight includes ultraviolet (UV) radiation, the majority of it being in the range 290 – 400 nanometers (nm) (referred to UV-B and UV-A). The material degradation caused by UV radiation can often be seen in the fading and embrittlement of exposed plastic surfaces.

Hyperbaric chamber windows are commonly constructed using acrylic, a transparent plastic material with outstanding strength, stiffness, and optical clarity. The UV component of sunlight does not significantly penetrate acrylic, only about 25 – 50 microns. Wavelengths below 320 nm damage the surface of the acrylic boundary acting as the primary cause of crazing and discoloration. Small amounts of UV pass through acrylic starting at 300 nm and increase as the wavelengths shorten. It is these shorter wavelengths that degrade acrylic strength including destroying UV stabilizers used in some products. This has been demonstrated to cause an unacceptable reduction in strength/integrity of the acrylic that can be seen after 10 years of exposure to sunlight.[1]

With the recent COVID-19 pandemic, there has been a movement of hospitals to use UV disinfecting techniques to combat the spread of viral pathogens. Many hospitals now use UV-C robots to disinfect patient rooms. UV-C wavelengths range between 100 – 280 nm. With a wavelength between 254 - 265 nm, UV-C acts as a germicidal agent killing or inactivating bacteria, fungi, and viruses with 265 nm being the optimum wavelength. [2] Many commercial UV devices produce UV radiation at a peak of 254 nm, while wavelengths at 265 nm are safer for humans.[3] These devices are shown to be especially effective against viruses like COVID-19 but require that the space being cleaned be unoccupied by humans, [4,5]

ABSTRACT

1) With the rise of the COVID-19 pandemic, hospitals are more commonly utilizing UV-C methods of disinfecting patient care areas.

2) All types of UV radiation can cause a photochemical effect within the polymer structure of acrylic which can lead to degradation of the material. Acrylic does not reflect UV-C, so the surface boundary tends to absorb radiation at this wavelength.

3) When absorbed by plastics, UV energy can excite photons creating free radicals. This can lead to degradation as catalyst residues will often act as receptors. The free radicals can cause breaks in the polymer bonds.
4) The acrylic materials used in hyperbaric chambers are at risk for decreased life span and degradation of integrity when exposed to UV-C radiation.

RATIONALE

As UV-C radiation is known to cause degradation of the integrity of the acrylic boundaries used in hyperbaric chambers, concern arises with its increased use as a germicidal technique in hospitals.

It is known that HBO_2 acrylic cylinders can gain an extra 10 years of service life after their design life of 10 years when used and stored in a benign environment (indoors – away from sunlight). However, even small amounts of UV-C in sunlight, (anything below 320 nm), results in degradation of acrylic strength when exposed over a period of 10 years or longer. The long-term impact of higher UV-C doses is not specifically known, but there is enough theoretical concern by the UHMS HBO_2 Safety Committee to state that high-intensity UV-C in the same vicinity of acrylic chambers is likely to cause a decrease in the life span and integrity of any acrylic forming part of the pressure boundary of hyperbaric chambers.

CONCLUSIONS/RECOMMENDATIONS

The UHMS HBO_2 Safety Committee does not endorse the use of UV-C disinfection in areas where acrylic surfaces of a hyperbaric chamber can be exposed. We furthermore would like to stress that a simple sheet, blanket, or other covering permeable to light will likely not provide sufficient protection of the acrylic. The covering needs to be impervious to UV light.

REFERENCES

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