Shining a New Light on Surgical Procedures

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Maintaining a well-lit field of view during surgical procedures has traditionally been accomplished with Xenon bulb technology. However, this solution brings with it a number of concerns that impacts both the surgical team and the patient. LED technology offers a preferable alternative as it eliminates these disadvantages of the Xenon bulb systems.

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Advancements in medicine are important in providing better healthcare for patients. This forward thinking goes beyond the development of treatments for patients to include the tools and equipment for medical professionals.

One area of transition is in facilities and application lighting, where designers are moving away from inefficient traditional light sources and exploring LED solutions. Medical applications utilizing LEDs are becoming a billion-dollar industry worldwide.

Traditional Lighting

What about the tools used during operations such as open-heart surgery? A successful surgery is not just dependent upon the skills of the surgeon, but also the reliability of the surgical equipment available. In the past, surgeons performing delicate and complicated procedures wore a headlight that operated with a Xenon bulb, which posed certain risks to the surgical environment. The bulb was housed in a separate 30 lb. box and the metal headlight optic on the surgeon's head was connected to the box via the fiber optic cable. The bulb itself could reach up to 260°C, consumed 400 watts of power, and generated noise, which was a potential distraction for the surgeon. There was also the potential for hazardous overheating

and other electrical problems.

Additionally, the Xenon bulb was powered through a fiber optic cable that was bulky and constricted movement around the operating table. The heat transmitted through the fiber optic cable to the luminaire on the headpiece could cause the metal luminaire to heat up to dangerous levels, causing third-degree burns if touched or held. Nurses had to continuously monitor the cable's location in relation to the patient and the surgeon to be sure it did not get tangled or unplugged, which could lead to light failure during a surgery where every second is critical.

Advantages of LEDs

Designing-in LED lamps has revolutionized this surgical tool and eliminated the concerns and distractions that were created by the traditional Xenon bulbs. Similar to most products in the medical field, there are stringent design requirements that the headlamp must meet to ensure the safety of the patient as well as the user. LEDs have proven to be a safe and economical solution in place of traditional Xenon bulbs.

First and foremost, the LED unit dramatically decreased the size and weight of the headlamp and eliminated the surgeon's discomfort and other distractions caused by Xenon bulbs. Through the use of active cooling and constant current modulation technology in combination with LEDs, engineers were able to eliminate the heat factor, which could have affected the surgeon's performance. Previous headlamps had to be equipped with sweatbands and expensive heat resistive materials in order to prevent overheating or electrical issues. There are FDA incident reports of patients actually burned by overexposure of highly-focused Xenon light.

Engineers also developed a streamlined rechargeable battery unit to power the LEDs so the headlamp could operate continuously through long surgeries. In addition, surgeons no longer have to carry a bulky battery pack, allowing for more freedom in the operating room.

In addition, LEDs were the ideal solution to the challenge of finding the correct white lighting devices for the surgical headlamp, which requires a stable source of high-quality (high CRI) white light that does not impart heat onto the examination area and is compact, safe, and energy efficient. The human eye's most efficient

image processing occurs in daylight and the pure white light produced by the LEDs at 6,500 K most closely replicates natural sunlight. The optimized output assists the eye in processing color and contrast to deliver a sharper image to the surgeon's optical nerves. This is of tremendous importance to the surgeon when performing a complex operation such as open-heart surgery, where there is a weak or heavy blood supply, as the color temperature can be altered for optimal contrast and differentiation.

Another benefit of the LEDs is their longer life, particularly when product failure directly affects the patient's well-being. Xenon bulbs last between 600 to 1,000 hours, while various types of LEDs are designed for an extended lifetime of between 8,000 to 50,000 hours, so there is reduced risk of lamp failure during a critical moment of a surgery. Another benefit of converting to LEDs is that the light output provides a high-level of brightness throughout the life of the product, while a Xenon bulb's life can only maintain maximum brightness up to 50 hours. Power consumption is reduced to 1/8 that of the traditional headlamp, allowing for these longer lifetimes and eliminating costs associated with bulb and cable maintenance. Reduced power consumption has not affected the performance level of the light, however. As a result of the switch to LEDs, the headlamps can offer a 40% longer product life. The longer life also can make the LEDs more cost-effective, as it can greatly reduce maintenance costs.

As the light quality, energy-savings, and overall product efficiency of LEDs continues to be demonstrated in such applications, doctors, nurses, surgeons, and other medical professionals will see the transition of other traditional medical tools into new solutions that will have a positive impact for both themselves and their patients.

Online

For additional information on the technologies and products discussed in this article, see *MDT* online at www.mdtmag.com [2] and the following websites:
• www.cree.com [3]
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