Indicating Shortcomings in Surgical Lighting Systems

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Ergonomic problems of surgical lighting systems have been indicated by surgeons. However, the underlying causes are not clear. The aim of this study is to assess the problems in detail. Luminaire use during 46 h of surgery was observed and quantified. Furthermore, a questionnaire on perceived illumination of and usability problems with surgical luminaires was issued among OR-staff in 13 hospitals. The results showed that every 7.5 min a luminaire action (LA) takes place, intended to reposition the luminaire. Of these LAs, 74% was performed by surgeons and residents. For 64% of these LAs the surgical tasks of OR-staff were interrupted. The amount of LAs to obtain a well-lit wound, illumination level, shadows, and illumination of deep wounds were most frequently indicated lighting aspects needing improvement. Different kinematic aspects of the pendant system of the lights that influence usability were also mentioned: high forces for repositioning, ease of focusing and aiming, ease of moving, collisions of the luminaire, entangling of pendant arms, and maneuverability. Based on these results, conclusions regarding to improvement of surgical lighting systems are formulated. Focus for improvements should be on minimizing the need for repositioning the luminaire, and on minimizing the effort for repositioning.

Miniature Implantable Pressure Sensors for Medical Applications

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Pressure sensors are requisite for many medical implantable devices to monitor physiological pressures or fluid pressure and flow from a subsystem. Size, power consumption, accuracy, sensitivity, stability, and biocompatibility are all key considerations in the design and fabrication of such sensors. Conventional designs, based on piezoresistive technologies, are power consuming with significant drift and temperature error, whereas capacitive solutions are often cumbersome when packaged for biocompatibility. Tronics Microsystems has developed absolute pressure sensors, which achieve the benefits of both technologies. Miniaturization is achieved using a MEMS sensing element and a multifunction ASIC with small form factors. Low power consumption, low drift, high resolution, and waveform capture capability are obtained by using a capacitive MEMS coupled with a sigma-delta, direct capacitance to digital converter. Biocompatibility is achieved with grade II titanium packaging in two form factors (“tubular” or “pancake”) for incorporation into various applications. These sensors have been fabricated, calibrated, and tested extensively over physiologic temperature ranges. The design has achieved power consumption lower than 500 μW at 100 Hz and a drift lower than 0.5% full scale per year. An accuracy of +/-1% full scale, over the temperature range is obtained by on-ASIC nonlinearity and temperature compensation. The two packaging configurations allow analysis of the trade-offs on the temperature range, sensitivity, volume, sterilization, etc. Different feed-through materials permit optimization of the form factors for the tube and the flat sensor and wired or wireless communication.