Light-Emitting Diode (LED) Arthroscopes Reduce Combustion Potential During Arthroscopy: A Laboratory Study

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INTRODUCTION: Operating room fires and thermal injuries are rare but potentially devastating events experienced during arthroscopy. LED light sources are believed to offer safety benefits over traditional incandescent sources, yet a direct comparison has not been performed. The purpose of this study was to investigate temperature and combustibility differences between LED and incandescent light sources in arthroscopy.

METHODS: In a controlled laboratory setting, we compared temperature profiles and combustion potential of LED and incandescent arthroscopy systems. Temperatures of light cords and small (2.7 mm) and large (4.0 mm) arthroscope sheaths were recorded every 30 seconds for 10 minutes using infrared thermometry. Combustion testing was conducted by exposing surgical drape components (paper, plastic, elastic) to each light source at 0–2.0 cm in 0.5 cm increments. Ten trials per condition were analyzed (n = 150). Data comparison utilized unpaired t-tests ($\alpha = 0.05$).

RESULTS: The LED light cord reached a peak temperature of 125.6 ± 2.9°F versus 216.8 ± 1.8°F for the incandescent cord ($P < 0.001$). LED-connected small and large arthroscope sheaths were 17% and 26% cooler, respectively, then their incandescent counterparts ($P < 0.001$). Combustion occurred only with the incandescent light source at distances ≤1.5 cm from paper and elastic drapes; no combustion was observed with LED equipment under any condition.

DISCUSSION AND CONCLUSION: LED arthroscopy systems operate at 42.1% lower peak temperatures than incandescent systems and in this trial, eliminated the risk of drape combustion. Their routine use may enhance intraoperative safety and reduce the risk of thermal injury as well as incidence of operating room fires.