Development of an Electrocautery Surface Coating Method to Suppress Surgical Smoke

Takayuki TOKOROYAMA※(1)
Motoyuki MURASHIMA※(2)
Koki OGAWA※(3)
Noritsugu UMEHARA※(4)
Hosei NAGANO※(5)
Takayuki YOROZU※(6)
Junichi UCHIDA※(7)

Abstract

Background: The effectiveness of silicone coatings in preventing coagulated blood adhesion has already been established; however, the coatings' influence on the generation of surgical smoke has yet to be elucidated, and their effectiveness in preventing surgical smoke has yet to be examined.

Methods: In an electrical circuit model, a proposed model of increased electrical resistance due to coagulated blood adhesion encompasses the electrode, silicone coating, and discharge target. To investigate the viability of an electrocautery surface coating that suppresses surgical smoke, smoke generation was analyzed via discharge experiments using electrocautery tip electrodes with different cross-sectional shapes and electrodes with no coating. The effect of increasing electrical resistance on the amount of smoke generated was also investigated by using a high-speed infrared camera to measure the temperature change in the area of the electrode tip during the discharge.

Results: The different coated electrodes A (fully covered and thicker than B), B (fully covered), C (side exposed), and uncoated electrode D were evaluated for the amount of smoke generation during discharge. The particle counts for coated electrodes A, B, C, and D showed approximately 5236, 10328, 812, and 5032 counts/L in 5 s, respectively. Conversely, electrode C showed approximately 812 counts/L, which was 92% lower than the other electrodes.

Conclusions: The electrical circuit model was suggested, and the side exposed electrode can limit the generation of surgical smoke.

Keywords

electrocautery, side exposed type electrode, silicone coating, suppression of coagulated blood, surgical smoke

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※(1) Nagoya University Department of Mechanical and Aerospace Engineering Associate professor
※(2) Tohoku University Department of Mechanical Systems Engineering Associate professor
※(3) Nagoya University Department of Mechanical and Aerospace Engineering
※(4) Nagoya University Department of Mechanical and Aerospace Engineering Professor
※(5) Nagoya University Department of Mechanical System Engineering Professor
※(6) Central Research Laboratories R&D Center IV
※(7) Central Research Laboratories R&D Center IV Manager