Efficiency of a Novel Nano-Cardiac Device for Atherectomy of Coronary Artery Occlusion

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The purpose of this experiment was to compare seven coronary rotational atherectomy device head designs (spherical with 3, 4, or 5-holes, conical with 3, 4, or 5-holes, & control with no holes) with varying speeds (2, 4, 6, 8, & 10 KRPM) to measure which provides the highest volume occlusion extracted, as well as lowest peak temperature difference in a simulated total coronary artery occlusion. The procedure included assembling the rotational atherectomy device apparatus, and constructs the seven device heads. Then, artificial occlusion was developed and poured into 175 plastic tubes (in batches of 25) to mimic coronary arteries with total occlusion at around 10x the size. Then, the experimental occluded coronary arteries were placed one by one into the experimental chamber to be tested using the different device heads with various speeds, five experiments per device head per speed. The data was gathered by measuring and recording the volume occlusion extracted and peak temperature difference before and after each experiment. In conclusion, the results established that the 5-holes spherical at 8KRPM is the optimum solution with highest volume occlusion extracted and the lowest peak temperature difference. In conclusion, the results did not fully support the hypothesis because the 8KRPM is the best compromise, since it generated less heat during the procedure, but provided higher volume occlusion extracted than the other device heads tested. The results of this study are significant as it can help improve the quality of life of heart disease patients by providing cardiac surgeons an efficient way to conduct a coronary rotational atherectomy in a minimally invasive procedure.

Awards Won:
Third Award of $1,000