

**Noncontact Catheter Ablation Therapy**  
**Thomas Cavaliere**  
**ELE 482 Biomedical Engineering Seminar III**  
**Biomedical Engineering, University of Rhode Island**  
**Kingston RI 02881**  
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Ablation Therapy is a procedure that corrects arrhythmias in the heart by destroying the tissues in the area of the abnormal signals. The area that is causing the signals is pinpointed by endocardial mapping, and then small lesions are made to destroy or stop the tissue from sending the abnormal signals.

Catheter ablation therapy was first introduced in the early 1980's and has been generally very successful at treating some types of arrhythmias, replacing many open-heart surgeries. However, ventricular tachycardia is one type of arrhythmia that catheter ablation therapy has proven not to be successful against.

**Ventricular tachycardia** is a rapid heart rhythm originating from the ventricles. The rapid rate prevents the heart from filling with blood; therefore, less blood is able to pump through the body. This can be a serious arrhythmia, especially in people with heart disease, and may be associated with more symptoms.

For catheter ablation to be successful with ventricular tachycardias, the lesions created must be deeper. To accomplish this, more power must be delivered through the electrode and/or the duration of the ablation must be increased.

By increasing the power and length of the ablation, the surface temperature of the endocardium increases rapidly causing the liquid in it to vaporize, producing a popping sound. This damages the endocardium and causes charring. It also causes the surrounding blood to coagulate.

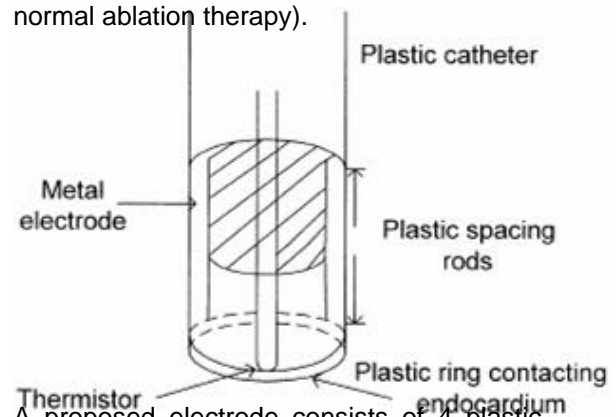
Current methods of remedying this include a cooling electrode method and a method of redesigning the electrode to reduce the heat produced. The former method works by carrying the heat away using a saline irrigation system. The latter coats the electrode with a material of different electrical property to reduce the current density where the metal meets the plastic on the electrode. Both methods increase the risk of popping and require a rather complicated technique to practice.

However, by pulling the electrode back a few mm from the endocardium, the temperature has been found to be reduced to safe levels, allowing more power to be used for a longer time. (The temperature is reduced due to convection by the flowing blood).

SAFE DISTANCE RANGES TO PREVENT POPPING WITH DIFFERENT FLOW RATES

Distance ( mm )	0.0	0.5	1.0	1.5	2.0
1 L/min	popping	popping	no	no	no
3 L/min	popping	popping	no	no	no
5 L/min	popping	no	no	no	no

Power can now be raised to 120w and the ablation can last up to 120s without producing any negative results (up from 40w for 60s, producing the negative results of normal ablation therapy).



A proposed electrode consists of 4 plastic spacing rods controlling the distance, a plastic ring that contacts the endocardium (and prevents penetration), and a thermistor that measures endocardium temperature.

Further research is needed to test the experiment *in vivo* (all other tests have been performed *in vitro*). The *in vivo* experiments will be successful if they can deliver 120w of power for 120s. It is expected that this will be accomplished and the procedure will be in practice in the near future. The success of Noncontact catheter ablation therapy will provide a treatment for Ventricular tachycardias, a leading cause of sudden cardiac deaths in the United States.