Séminaire
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Division of Cardiology, University of Toronto

Stability of Magnetic Navigation Catheter- Experiments in a Myocardial Phantom Model

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MULTIMEDIA REPORT

Magnetic guidance versus manual control: comparison of radiofrequency lesion dimensions and evaluation of the effect of heart wall motion in a myocardial phantom

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predetermined temperature (70° C) at the catheter tip thermistor by automatic adjustment of delivered power (maximum 100 W). The efficiency-of-heating index was defined as the ratio of steady-state temperature (degrees Celsius) to power (watts). Two-dimensional intracardiac echocardiography was used to evaluate movement of the catheter tip relative to the endocardium. Perpendicular contact was scored as good, average, or poor and lateral catheter sliding as <2, 2 to 5, or >5 mm. Two groups of animals were included: group 1, in which tissue contact was guided by fluoroscopic and electrographic criteria for stability of contact, with intracardiac echocardiography used simply to observe the application; and group 2, in which tiss

(Am Heart J 1997;133:8-18.)

tive of good tissue contact. There was a significant corre tion between echocardiographic evaluation of tissue c tact, parameters of tissue heating (efficiency-of-heat index), and lesion size. In addition, intracardiac echoca ography could be used prospectively to improve the p centage of good contact applications and increase lesion size. (Am Heart J 1997;133:8-18.)

Radiofrequency energy destroys tissue by resist heating of a narrow rim of myocardium that is direct contact with the catheter, while heating

Canine *invivo* study- 20% of ablations were performed in the presence of >5 mm sliding movement

Remote Magnetic Navigation-Assisted Catheter Ablation Enhances Catheter Stability and Ablation Success with Lower Catheter Temperatures

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(PACE 2008; 31:893–898)

Conclusions: *Although the construction of the ablation catheters is similar, ablations with RMN catheters resulted in a lower mean temperature, earlier time to JT, and less variability of temperature during ablation, suggesting greater catheter stability. This study indicates that ablation with RMN can achieve success with lower catheter temperatures. (PACE 2008; 31:893–898)*

Fig. 2 Thermochromic liquid crystal phantom myocardial model. Coronal image demonstrating RF ablation using MC (Thermocool catheter) on the gel surface with related isotherm gradient at 60 seconds. The desired isotherm (50 °C) is highlighted in *yellow*

JICE 2015

Chik et al. **High-Resolution Thermal Mapping of RF Ablation Lesions**

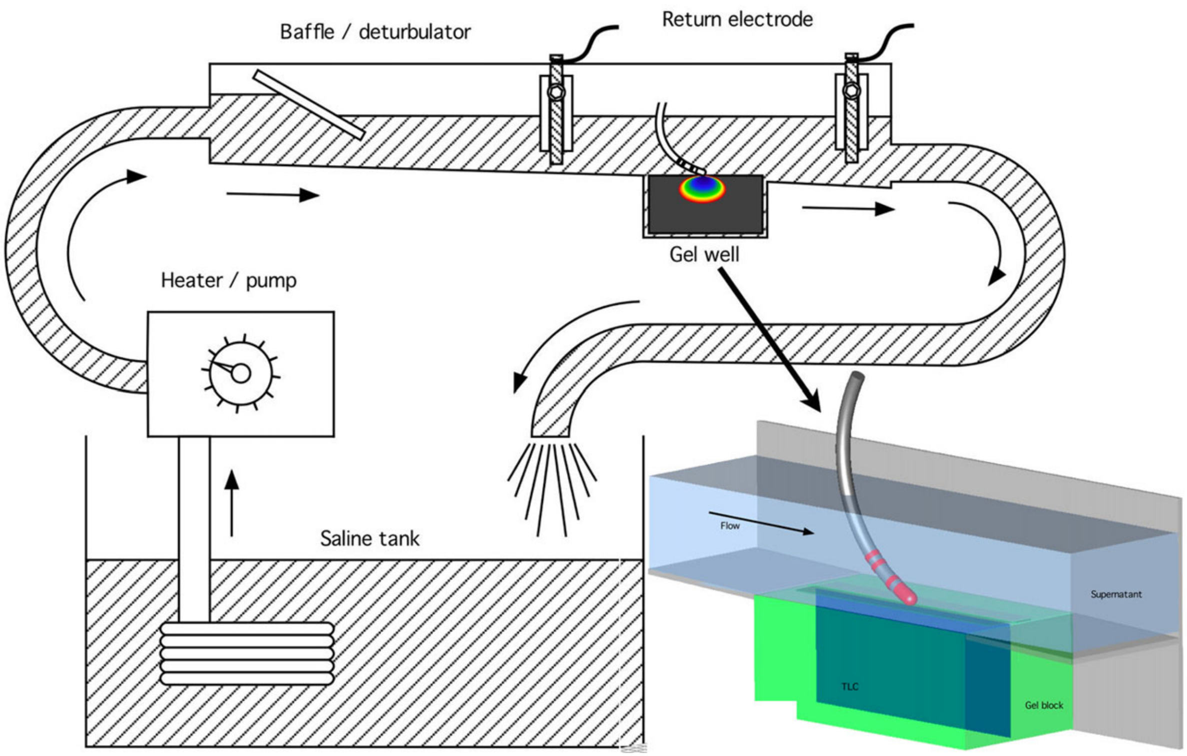

Figure 1. *This illustrates the myocardial phantom model using a vertical sheet of thermochromic liquid crystal (TLC) film that changes color between 50 °C (red) and 78 °C (black). Thermochromic film is embedded within a transparent gel matrix (substrate) with impedance titrated to equal that of myocardium, beneath the electrode-substrate interface. The gel well is immersed in saline (supernatant) with impedance titrated to blood values at 37 °C. The catheter is positioned obliquely between 30° and 60° angle to the gel well plane and perpendicular to the thermochromic film. The RF generator connects to the catheter via conventional patient cables. Two electrodes, 1 on each side of the catheter, made from stainless rods 4 mm diameter in a polycarbonate channel, acted as return electrodes that allowed circuit impedance to be adjusted.*

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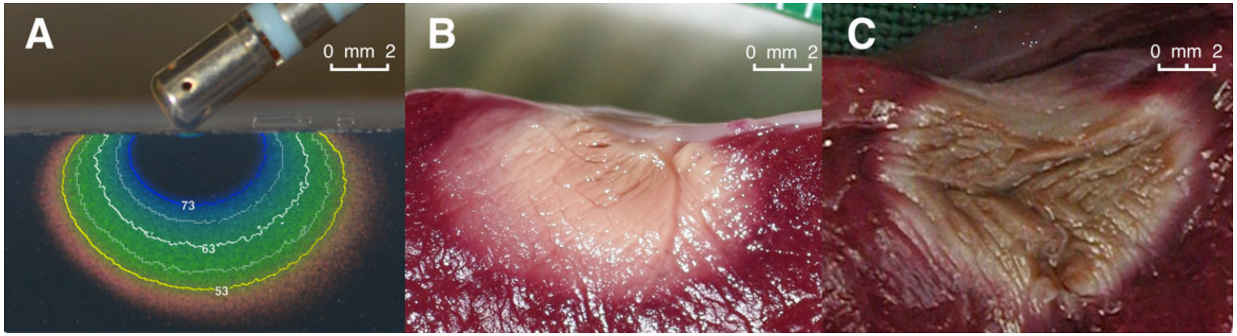

Figure 5. *This composite figure compares the gross appearance of the radiofrequency ablation lesions created in each of the 3 ablation mediums using the same ablation parameters. Panel A outlines the thermochromic gel phantom ablation with automated isotherms drawn at 5 °C increments to delineate the characteristic thermal distribution within the RF lesion. Panel B illustrates the in vitro bovine ablation lesion performed in the myocardial phantom. Panel C depicts a necropsy picture of an in vivo ovine ablation lesion following nitro blue tetrazolium staining.*

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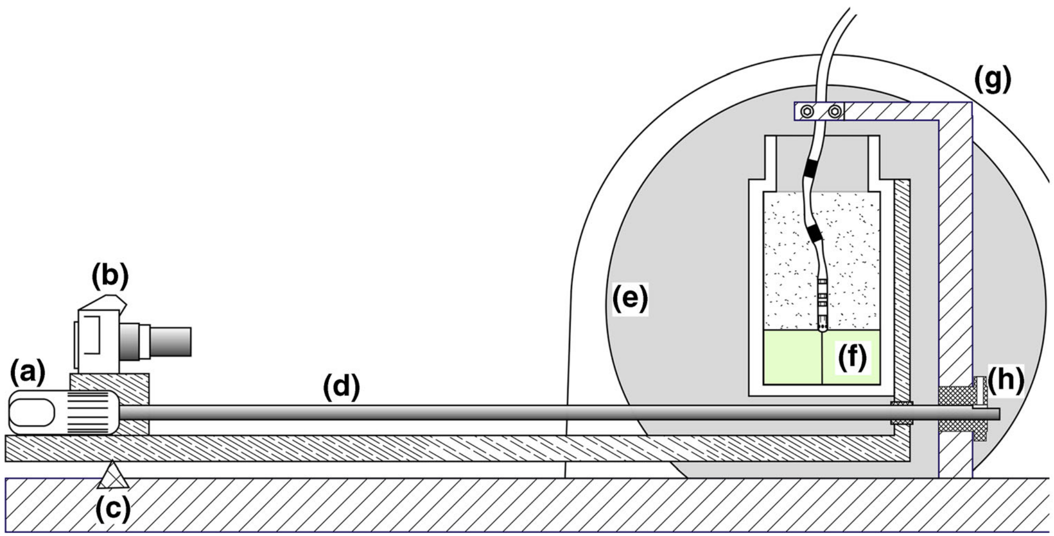
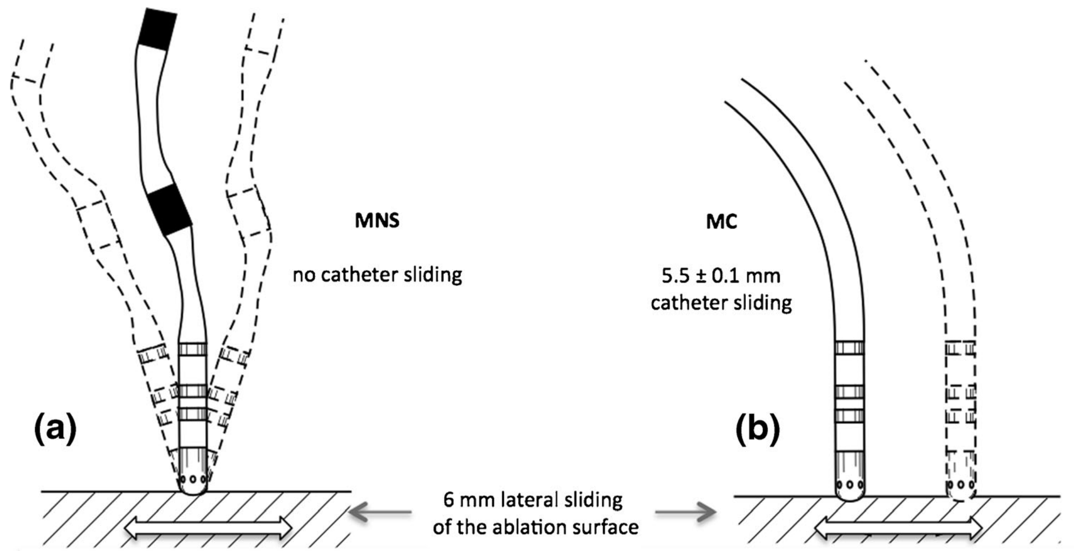
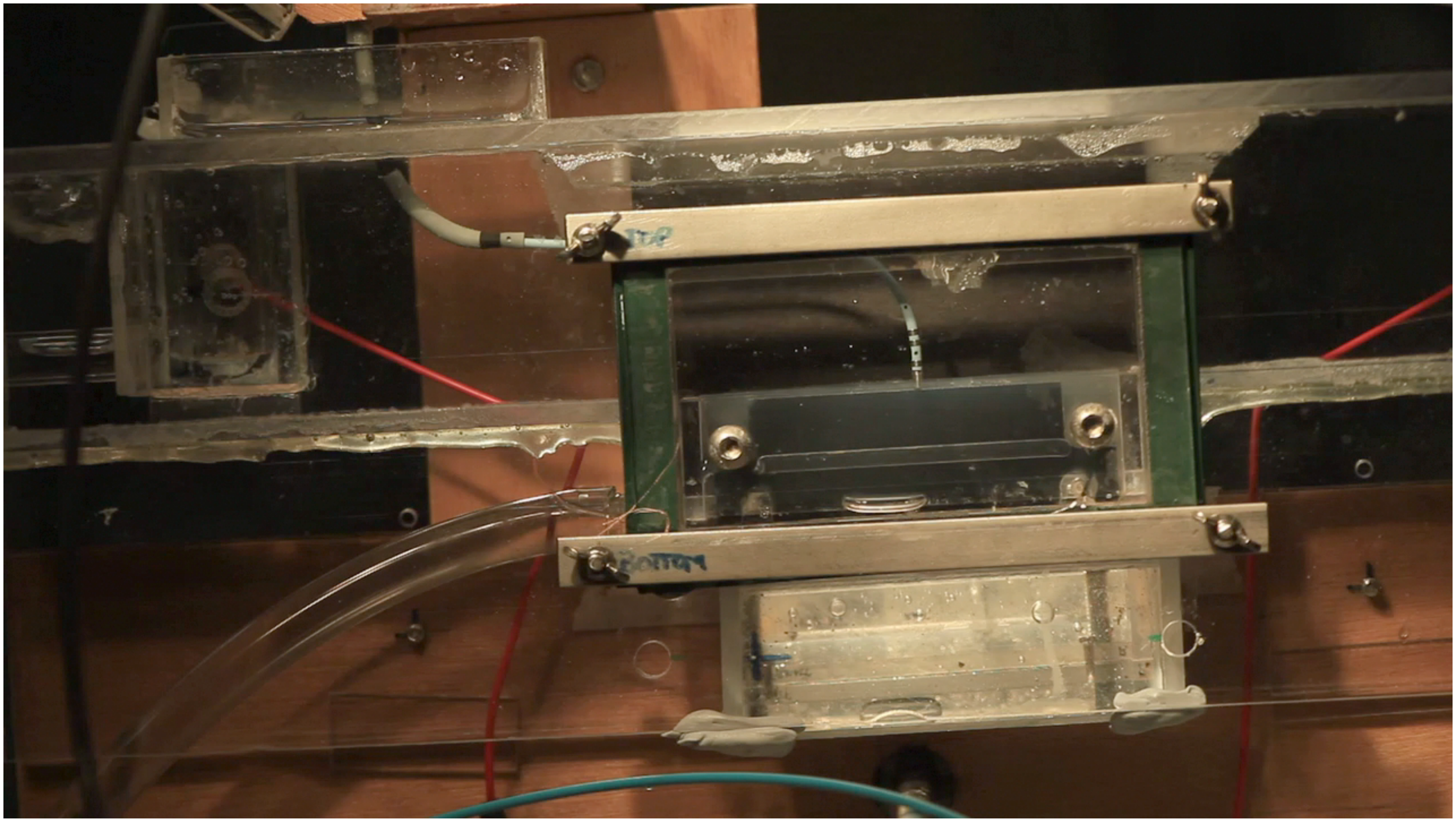


Fig. 1 Schematic representation of the myocardial phantom model. **a** Drive motor for tank oscillation. **b** Camera and flash unit. **c** Fulcrum for tank and camera to oscillate. **d** Non-magnetic motor shaft. **e** Magnet face. **f** Gel well. **g** Catheter support (immobile). **h** Cam to enable oscillation

Fig. 5 **a** No catheter movement at ablation surface with MNS catheter during RF ablation when 6-mm ablation surface sliding was applied in both inferior and superior catheter orientation. This is due to the strong magnetic pull of the MNS on the catheter approximating it to the ablation surface (Refer online video). **b** Significant catheter lateral sliding was observed with MC ablation when 6-mm simulated wall motion was applied. (Refer online video)

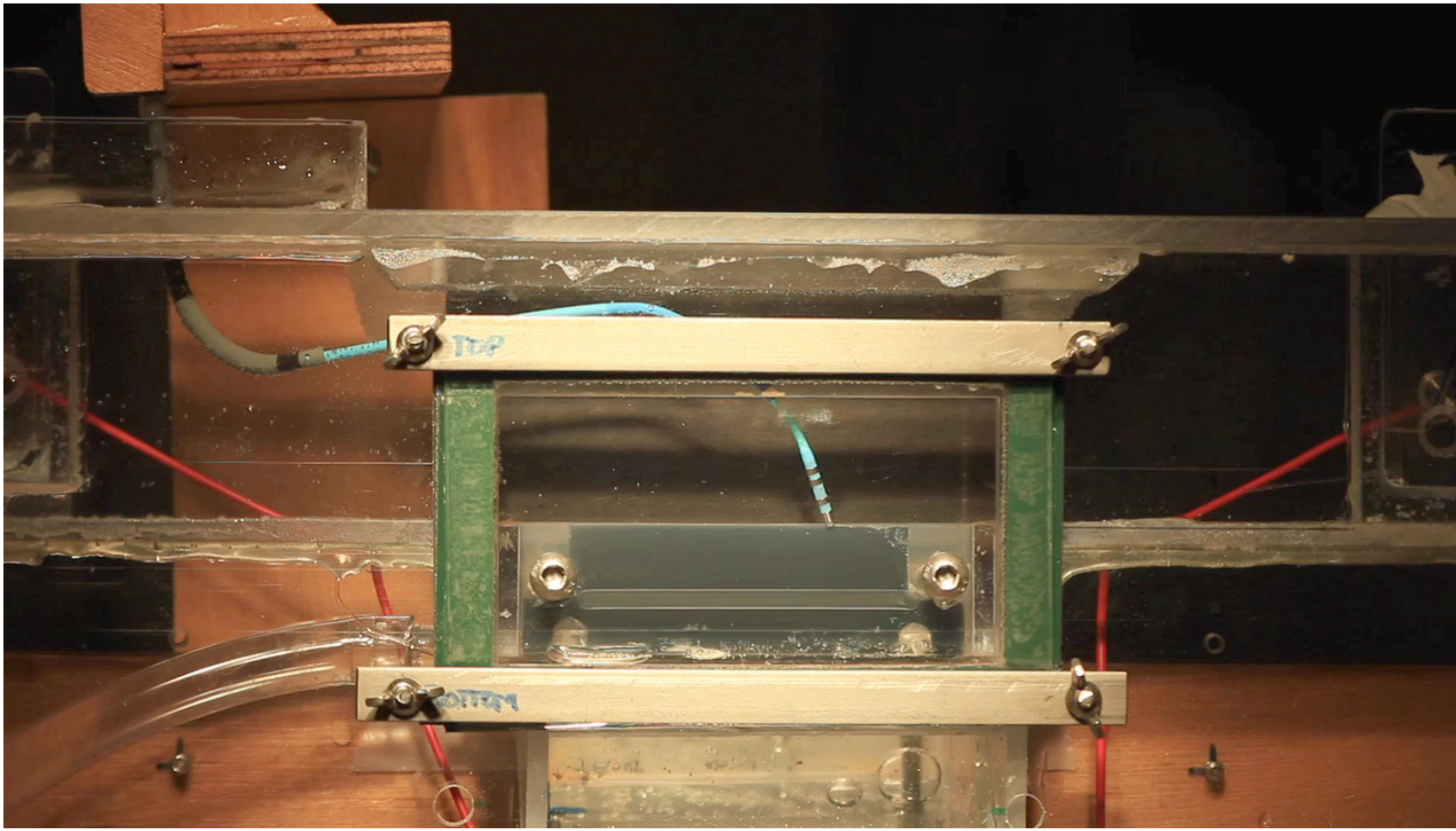


Manual ablation



Magnetic Navigation Ablation

Vector



Magnetic Navigation Ablation

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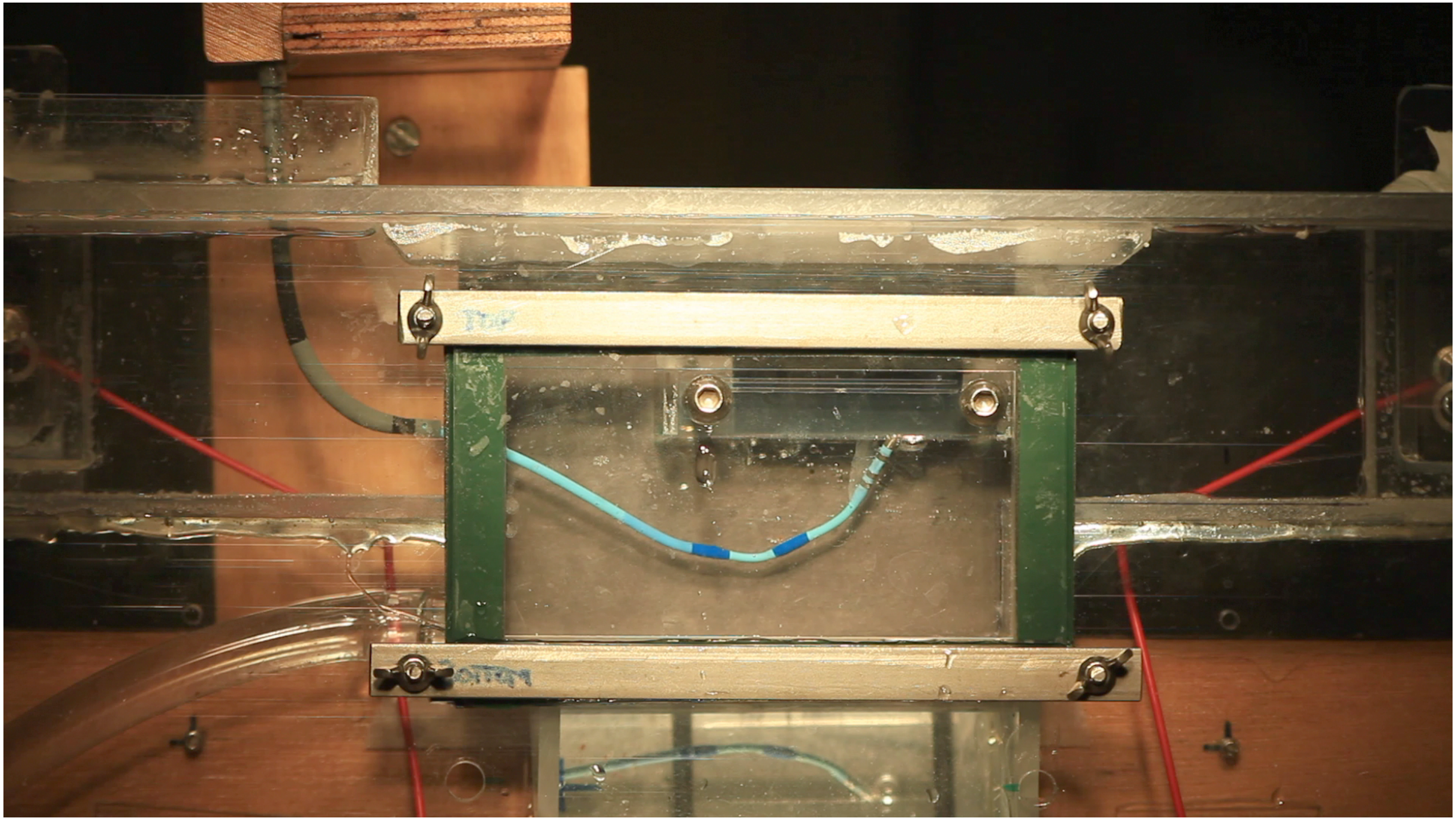
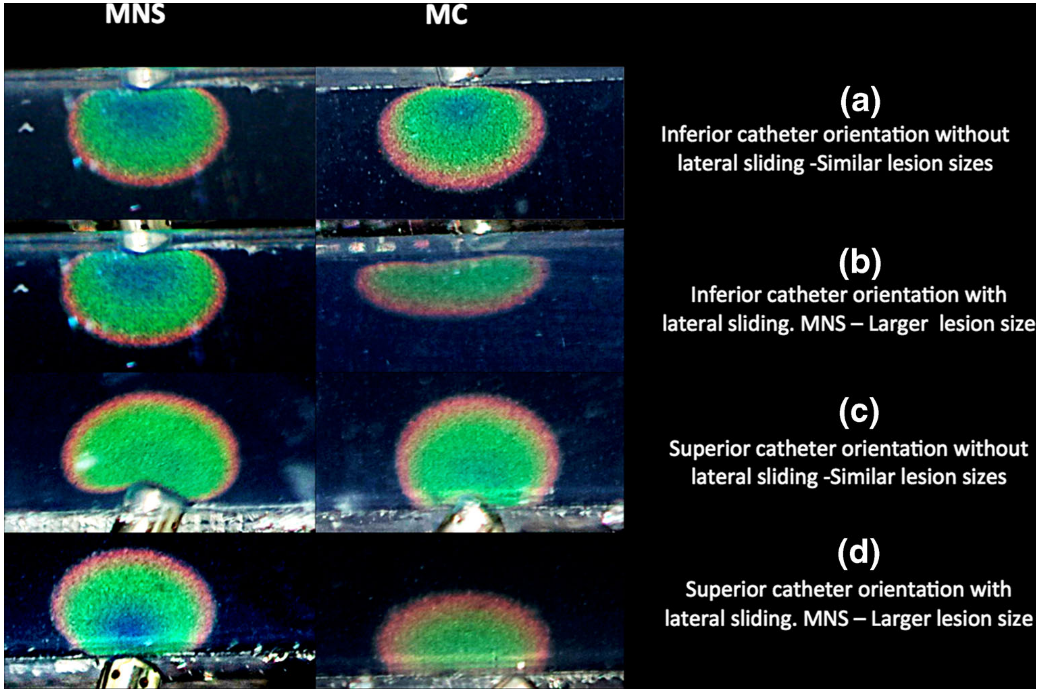


Fig. 6 Colorimetric spatial examination of maximum phantom tissue heating during radiofrequency ablation



Conclusions The lesion dimensions were larger with MNS compared to MC in the presence of simulated wall motion, consistent with greater catheter stability. However, similar lesion dimensions were observed in the stationary model.

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