



Florida Institute of Technology

NEW DEVICE FOR INHIBITING ARTERIAL PLAQUE GROWTH

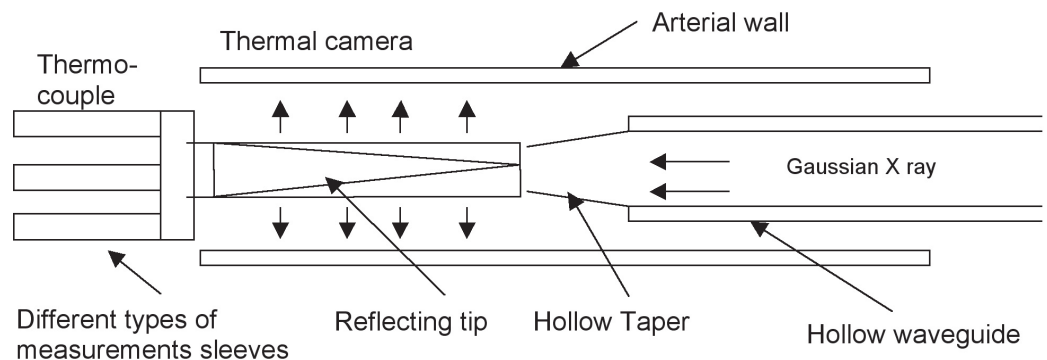
**AVAILABLE
TECHNOLOGY**

Summary

When partial or complete closure of a coronary artery occurs, angioplasty is commonly performed to reopen the artery. However, the frustration of laser and balloon angioplasty is that in many cases the plaque quickly accumulates to reclose the artery and this phenomenon is called restenosis. A device has been developed to deliver externally generated ionizing dose of pulsed x-ray irradiation to the arterial wall to prevent restenosis. This device can be also used for other therapeutic applications such as irradiation of tumors with minimal damage to surrounding healthy tissues.

The Technology

The most common technique that is currently used for restenosis treatment is placement of stents in arteries after balloon angioplasty. Though use of stents reduces the restenosis rate, at the same time, stents, as foreign objects in the body, increase cellular proliferation in surrounding tissue and make the neointimal component of restenosis even worse. Short pulse laser generated ionizing dose of x-ray irradiation can be effectively delivered to the arterial wall using hollow waveguides to prevent restenosis, and by adjusting the accelerating voltage, the photon energy can be adjusted for different depths of penetration and maximum effectiveness at minimal dose.



For prevention of restenosis, radiation dose of ten to twenty millijoules per gram (equivalent to 10 – 20 Gray) is needed. Compared to optical waves in the visible wavelength, the absorption of tissues at x-ray region is 1000 times less, allowing the x-rays to penetrate and irradiate uniformly the arterial walls. Hollow waveguides and tapered non-imaging elements are used to deliver x-ray irradiation. Tapered non-imaging elements can collect the emission of x-ray and reduce the beam spread until it fits into a small (500 μm) hollow waveguide where it propagates a few meters. The end reflective device delivers the x-ray energy in a spatially uniform cylindrical manner. There is a considerable merit to production of the radiation outside the patient and delivering it through hollow waveguides. These systems rival conventional optics in both efficiency of delivery and in cost. In this technique, no high voltage cables need to be inserted into a patient and thereby no possibility of harm from high voltage exits for doctors and patients. The short exposure pulse will also not cause temperature migration and the penetration of x-rays will dose uniformly the arterial wall exposing very little normal tissue.

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