



Summary

The subject invention pertains to a method and apparatus for generation and/or delivery of x-ray irradiation. The subject method and apparatus provides for the controlled delivery of x-ray radiation to specific parts of a patient's body. The subject invention can be used in the treatment or prevention of restenosis to aid in the prevention of arterial clogging. Additionally, the subject invention is particularly advantageous in situations requiring precise maneuvering due to the lack of radiation generating sources that are introduced into the body as taught by the prior art. Accordingly, there is a need for a method and apparatus for providing a non-invasive procedure which can deliver a highly controlled dose of x-ray radiation to a specific area of the body. In a specific embodiment, the subject invention can be used to deliver x-ray irradiation to an artery in order to prevent restenosis in the artery.

Applications

- The subject method and apparatus can use hollow waveguides for delivery of short pulse laser generated x-rays through arteries to a target site. The use of short pulse x-rays can allow energy to be precisely delivered, and can reduce diffusion of the energy to nearby normal tissue during the exposure. Compared to radiation in the visible wavelength range, the absorption of radiation in the x-ray region by surrounding tissues can be much lower. For example, the absorption of x-ray radiation can be on the order of 1000 times less. During delivery of x-rays for prevention of restenosis, the lower absorption can allow the x-rays to uniformly penetrate and irradiate the arterial walls.

Advantages

- In a specific embodiment, the arterial walls can be irradiated from a cylindrical or conical symmetric mirrored reflective end tip mounted on the end of a hollow waveguide. The technique can allow the irradiation wavelength to be modulated to achieve a dose which can inhibit plaque growth, instead of limiting the irradiation wavelength based on the maximum voltage the cable can withstand.

The Technology

Heart and coronary disease is one of the leading causes of mortality in the United States and other parts of the world. When partial or complete closure of a coronary artery occurs a balloon angioplasty is commonly performed to re-open the artery. In this procedure, a catheter is introduced into the coronary artery by access through a small opening in the patient's femoral artery above the thigh. The tip of the catheter has a cylindrical balloon, which is inflated at the site of the blockage and expands the artery, usually compressing the plaque resulting in a substantial increase in blood flow. However, in many cases the plaque quickly accumulates to reclose the artery. This phenomena is called restenosis. It is generally accepted that the most important contributors to restenosis are elastic recoil of the dilated artery, neointimal proliferation, which leads to the thickening of the vessel wall, and unfavorable vascular remodeling, which causes contraction of the artery. Restenosis, after successful coronary angioplasty, is the major limitation to long-term success of the balloon angioplasty.

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