## Remotely actuated Endoluminal lancet device.

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#### **KEYWORDS**

ENDOLUINAL

- □ MICROSURGERY
- □ MINIMAL INVASIVE SURGERY
- Università degli Studi di Genova 15%. CAROTID STENOSIS
- □ ENDOSCOPIC POLYPECTOMY

□ BIOMEDICAL

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#### AREA

Industrial & Commercial Reference Surgery, Biomedical.

#### Time to Market

Patent Type

Ownership

Inventors

Pio.

Patent for invention.

The device is composed of parts that have been tested in laboratory with success at TRL 5, while the whole system has been simulated with numerical methods at TRL 3.

Sapienza Università di Roma 15%,

Università degli Studi di Roma Tre 70%,

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#### **Availability**

Licensing, Research, Development, Experimentation and Collaboration.



# Fig. 1 The adopted selective compliance The adopted system in its packaging (endoarterial) configuration.

system.

Fig. 2

### Abstract

The new device consists in a remotely actuated lancet that is suitable for endoluminal treatments. The invented scalpel device could be used in minimally invasive surgery which, as is known, remains promising but still not sufficiently explored, precisely because of a still not properly adequate instrumentation. The proposed scalpel finds its preferred and advantageous application in carotid stenosis surgery and in endoscopic polypectomy, provided that it can be used also for more general purposes.



#### Fig. 3 Numerical finite element analysis simulation.

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## Technologies & Advantages

The invention is a selective compliance mechanical system (Fig. 1) encapsulated in a packaging suitable for navigating within a lumen. There are two types of application, endo-artery and gastric endoscopy. The affected area is reached via a catheter, the mechanism removes diseased tissues or plaques or a small sample of tissue for subsequent analysis (biopsy). During active phase the tip of the scalpel is guided by a selective compliance system with a degree of freedom, illustrated in Figures 1, 2, 3 and 5, in such a way that the trajectory of the tip itself is parallel to the part of the vessel or lumen. The mechanism corresponds to a "pseudorigid body equivalent mechanism" (see Fig. 4) obtained from the kinematic chain of Stephenson, made up of 6 kinematic members, 6 rotoidal couples and a prismatic pair.

**Technical Description** 

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The invention has advantages over current devices in the fields of vascular surgery and intestinal tract surgery.

The Vascular surgery: the device restores the the original lumen by mechanical (or or electromechanical and chemical) for removal and avoids the compression of the blaques, the crushing of the fat and d by the dilation of the artery. A filter in the gree catheter head allows blood flow.

> Intestinal tract surgery: endoscopic polypectomy. Small polyps (3-5 mm) are removed with biopsy forceps. Pedunculated polyps are cutted at the base of the peduncle with a loop, diathermic or cold. The sessile polyps adhered to the wall are detached by lifting the surface layer from the deeper layers, avoiding the perforation of the bowel. Large-based polyps are removed in multiple parts, in multiple sessions.

The device avoids the perforation of the **Fig.5** walls of the lumen and always allows the Kinematic Anlysis of the removed parts, unlike equivalent other traditional techniques.

#### Applications

In the endovascular mode, the system acts as a miniaturized electrosurgical unit, also robotic, by integrating small electric currents or drug flows in physiological solution. The capsule is mounted and guided at the head of a catheter in which fluids and cables for mechanical and electrical potential control will move. The capsule is at the head of a catheter in which fluids and cables will flow for mechanical and electrical potential control. The capsule head has a filter that holds thrombi. An O-ring before the filter seals the compartment between the catheter and the internal walls of the artery/vein. The system provides fluid suction in the operating field to block thrombi. An example of configuration of the system in the vessel is in Figure 3 and 5. In the endoscopic version, the mechanism in the capsule can be scaled to allow numerous other more complex operations. The capsule

can accomodate a miniaturized endoscopic

800 Initial configuration 700 inal configuration Anlysis of the 600 mechanism. 500 [un] 400 K 300 200 100 200 400 600  $x [\mu m]$ 



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vision system.