REMOVAL TOOL FOR MAGNETIC LOCALIZATION MARKER

Cross-Reference to Related Applications

[0001] This application claims priority to U.S. Provisional Application No. 63/382,071, filed on November 2, 2022, now pending, the disclosure of which is incorporated herein by reference.

Field of the Disclosure

[0002] The present disclosure relates to radiological localization using a magnetic marker, and more particularly to the ability to remove a magnetized marker (e.g., a magnetic localization marker) non-surgically or with minimally invasive techniques.

Background of the Disclosure

[0003] During localization procedures, such as breast localization procedures, there is a need to mark lesions with a localization marker in radiology for identification during surgery and later removal. To date, a magnetic marker has been used to achieve this goal and a customized system is then used to identify the position and remove the marker and associated lesion with accuracy (*e.g.,* MOLLI Marker and System).

[0004] The accuracy of the surgical removal of the lesion is predicated on the implantation of the magnetic marker at its intended target. However, due to unforeseen events that may occur in radiology (*e.g.,* communication gap in terms of appropriate target, challenging imaging, complex anatomy, etc.), this placement may be sub-optimal. There is a need for the ability to remove an implanted magnetic marker and/or correct the position of an implanted magnetic marker.

[0005] Current marker removal techniques require a surgical approach, which places an undue burden on patients. To date, no markers can be removed from the patient after implantation minimally-invasively.

Summary

[0006] In an aspect, the present disclosure refers to a device for retrieving a magnetic marker implanted in an individual. The device includes an introducer having a tip. An

obturator is disposed within the introducer. The obturator has a magnetic end. The obturator is operable such that the magnetic end is enclosed within the introducer in a first position of the obturator and the magnetic end extends at least partially beyond the tip of the introducer in a second position of the obturator.

[0007] In some examples, the obturator has a shaft and a permanent magnet affixed to the shaft at the magnetic end of the obturator. For example, the permanent magnet may be adhered at an end of the shaft. The permanent magnet may be adhered at the shaft using an ultraviolet light-curable adhesive, a cyanoacrylate-based adhesive, an epoxy, an acrylic adhesive. The permanent magnet is adhered to the end of the shaft. In some examples, the end of the shaft is cup-shaped. A portion of the permanent magnet may be shaped to correspond with the cup-shaped end of the shaft.

[0008] In some examples, the shaft is hollow and the permanent magnet is at least partially disposed within an end of the hollow shaft. In some examples, a rod is disposed within the hollow shaft.

[0009] In some examples, the permanent magnet is mechanically affixed at an end of the shaft. For example, the permanent magnet may be mechanically affixed using screw threads, a dovetail fitting, an interference fit, or other technique or combinations thereof.

[0010] The permanent magnet may be made from or include neodymium. In some examples, the permanent magnet comprises a bio-compatible material. For example, the permanent magnet may include an enclosure (such as, for example, a coating) made from a bio-compatible material. The bio-compatible material may be, for example, surgical stainless steel, titanium, nitinol, polycarbonate, an acetyl-copolymer, PEEK, or combinations thereof.

[0011] In some examples, the device includes an ejector arranged through the obturator and operable to extend beyond the magnetic end of the obturator. For example, the ejector may be coaxial with the obturator. The ejector may be made from a bio-compatible material, such as, for example, surgical stainless steel, titanium, nitinol, polycarbonate, an acetyl-copolymer, PEEK, or combinations thereof. In some examples, the ejector is made from a non-magnetic material.

[0012] The shaft may be made from a bio-compatible material, such as, for example, surgical stainless steel, titanium, nitinol, polycarbonate, an acetyl-copolymer, PEEK, or combinations of thereof.

[0013] In some examples, the permanent magnet is made up of two or more magnets.

[0014] In another example, the present disclosure may be embodied as a method for removing a magnetic marker from a location (i.e., a first location) within an individual. The method includes inserting an introducer into an individual. The introducer has an obturator with a magnetic end. The introducer, obturator, and/or magnetic end may be of any configuration disclosed herein.

[0015] The method includes attracting, magnetically, the magnetic marker using the obturator such that the magnetic marker attaches to the obturator. The obturator is retracted into the introducer such that the magnetic marker is at least partially within the introducer. In some examples, the method includes repositioning the introducer to move the magnetic marker to a second position within the individual. An ejector may be extended (*e.g.*, from the introducer, from the obturator, etc.) to detach the magnetic marker from the obturator (*e.g.*, by pushing the magnetic marker away from the magnetic end of the obturator). In some examples, the method includes removing the introducer from the individual.

Description of the Drawings

[0016] For a fuller understanding of the nature and objects of the disclosure, reference should be made to the following detailed description taken in conjunction with the accompanying drawings, in which:

Figure 1 depicts a device according to an embodiment of the present disclosure;

Figure 2 depicts an obturator according to an embodiment of the present disclosure, wherein a permanent magnet abuts an end of a shaft;

Figure 3 is a cross-sectional view of an obturator according to another embodiment of the present disclosure, wherein the shaft of the obturator has a cup-shaped end;

Figure 4 is a cross-sectional view of an obturator according to another embodiment of the present disclosure, wherein the permanent magnet has a shape corresponding to a cupped end of the shaft;