

CLAIMS

1. A system for aligning an elongated tool to an occluded target, the system comprising:

an adjustment mechanism configured to adjust an angular orientation of the elongated tool relative to a pivot point spaced from the target;

an imaging device configured to capture one or more X-ray images of the elongated tool and the target; and

a processor communicatively coupled with the adjustment mechanism and imaging device, wherein the processor is configured to:

extract Euclidean vector data of the elongated tool based on image data of an X-ray image received from the imaging device; and

control the adjustment mechanism to iteratively adjust the angular orientation of the elongated tool based on the Euclidean vector data to align a longitudinal axis of the elongated tool with the target and the pivot point.

2. The system as claimed in claim 1, wherein the Euclidean vector data comprises an image length of the elongated tool on an X-ray image and wherein the processor is configured to determine said image length.

3. The system as claimed in claim 2, wherein the processor is configured to: determine the image length of the elongated tool based on the X-ray image of the elongated tool at a first angular orientation; and

automatically control the adjustment mechanism to adjust the elongated tool to a second angular orientation based on the image length if the image length is not approximately equal to a minimum, to iteratively align the longitudinal axis of the elongated tool with the target and the pivot point.

4. The system as claimed in claim 1, wherein the adjustment mechanism comprises a base and a platform, wherein the platform is configured to be parallel to the base.

5. The system as claimed in claim 4, wherein the adjustment mechanism further comprises a plurality of arms linking the base with the platform, the plurality of arms being configured to move the platform along a plane parallel to the base to adjust the angular orientation of the elongated tool relative to the pivot point.

6. The system as claimed in claim 4, wherein the platform comprises a ball joint compliance for supporting the elongated tool, the ball joint compliance comprising a hole configured to allow sliding movement of the elongated tool therethrough.

7. The system as claimed in claim 6, wherein the base of the adjustment mechanism is made of a radiopaque material and wherein remaining components of the adjustment mechanism are made of one or more radiolucent materials.

8. The system as claimed in claim 1, wherein the imaging device is a C-arm fluoroscope configured to capture real-time X-ray images.

9. The system as claimed in claim 1, wherein the adjustment mechanism further comprises at least one actuator communicatively coupled with the processor, the actuator being configured to operate the arms.

10. A method of aligning an elongated tool to an occluded target, the method comprising the steps of:

capturing one or more X-ray images of the elongated tool and the target;
extracting Euclidean vector data of the elongated tool based on image data of an X-ray image; and

iteratively adjusting an angular orientation of the elongated tool relative to a pivot point based on the Euclidean vector data to align a longitudinal axis of the elongated tool with the target and the pivot point.

11. The method as claimed in claim 10, wherein the Euclidean vector data comprises an image length of the elongated tool on an X-ray image.

12. The method as claimed in claim 11, wherein adjusting an angular orientation comprises the steps of:

determining the image length of the elongated tool based on the X-ray image at a first angular orientation; and

automatically controlling the adjustment mechanism to adjust the elongated tool to a second angular orientation based on the image length if the image length is not approximately equal to a minimum, to iteratively align the longitudinal axis of the elongated tool with the target and the pivot point.

13. The method as claimed in claim 10, further comprising a step of calibrating a geometrical relationship between an imaging device capturing the one or more X-ray images and an adjustment mechanism adjusting the angular orientation of the elongated tool.

14. The method as claimed in claim 13, wherein the step of calibrating comprises determining the number of iterations to reach the minimum from an initial image length.

15. The method as claimed in claim 13, wherein the adjustment mechanism comprises a base and a platform parallel to the base, and the step of calibrating comprises fixing a height of the platform from the base.

16. A method of striking an occluded target using an elongated tool, the method comprising the step of:

iteratively advancing the elongated tool toward the target, wherein iteratively advancing the tool comprises aligning the tool to the target at each iteration using the method as claimed in claim 10.

17. The method as claimed in claim 16, further comprising a step of determining a distance between a tip of the tool and target after a predetermined number of iterations.