

[0019] In addition, it is desirable to provide devices and methods that can be utilized in a variety of implantation approaches. Depending on a particular patient's anatomy and clinical situation, a medical professional may wish to make a determination regarding the optimal method of implantation, such as inserting a replacement valve directly into the heart in an open procedure (open heart surgery or a minimally invasive surgery) or inserting a replacement valve from veins and via arteries in a closed procedure (such as a catheter-based implantation). It is preferable to allow a medical professional a plurality of implantation options to choose from. For example, a medical professional may wish to insert a replacement valve either from the ventricle or from the atrial side of the mitral valve.

[0020] Therefore, embodiments of the present invention seek to provide devices and methods that address these and other challenges in the art.

Summary

[0020a] An aspect of the present invention provides a system for replacing a native heart valve. The system comprises an expansible helical anchor and an expansible heart valve prosthesis. The expansible helical anchor has at least three coils in an unconstrained state. A first coil of the helical anchor has a first diameter in the unconstrained state, and is expandable to a second diameter larger than the first diameter upon application of radial outward force from within the first coil. The first coil is configured such that it can encircle native leaflets of the native heart valve while a second coil does not encircle the native leaflets. The expansible heart valve prosthesis is capable of being delivered into the helical anchor and expanded inside the first coil to move the first coil from the first diameter to the second diameter while trapping at least a portion of the native leaflets between the first coil and the heart valve prosthesis.

[0020b] Another aspect of the present invention provides a system for replacing a native heart valve. The system comprises a helical anchor comprising a plurality of middle region coils, an upper coil extending from an upper end of the plurality of middle region coils and a lower coil extending from a lower end of the plurality of middle region coils. In a relaxed state, at least one of the plurality of middle coils has a first diameter and the lower coil has a second diameter that is greater than the first diameter. Upon application of an outward radial force, the first diameter expands to a third diameter. The system

also comprises a radially expanding prosthetic heart valve configured to be inserted within the plurality of middle coils. The upper coil is configured to remain in the atrium, and the lower coil is configured to encircle the mitral valve leaflets and/or the chordae in the left ventricle. When the prosthetic heart valve is expanded within the plurality of middle coils, at least a portion of native leaflets of the native heart valve are trapped between the helical anchor and the prosthetic heart valve.

[0021] In one illustrative embodiment, a system for docking a heart valve prosthesis is provided and includes a helical anchor formed as multiple coils adapted to support a heart valve prosthesis with coil portions positioned above and below the heart valve annulus and a seal coupled with the helical anchor. The seal includes portions extending between adjacent coils for preventing blood leakage through the helical anchor and past the heart valve prosthesis.

[0022] The system can further include a heart valve prosthesis capable of being delivered to a native heart valve position of a patient and expanded inside the multiple coils and into engagement with leaflets of the heart valve. The seal is engaged with both the helical anchor and the heart valve prosthesis. The coils of the helical anchor may be formed of a superelastic or a shape memory material, or other suitable material. The seal may be a membrane or panel extending over at least two coils of the helical anchor. The membrane or panel is moved between an undeployed state and a deployed state, the undeployed state being adapted for delivery to a site of implantation and the deployed state being adapted for implanting the system and anchoring the heart valve prosthesis. The undeployed state may be a rolled up state on one of the coils of the helical anchor or any other collapsed state. The membrane or panel may include a support element affixed therewith, such as an internal, spring-biased wire. The seal may further include one or more seal elements carried by