

[0006] Some prior techniques for treating mitral regurgitation in patients include surgically stitching the edges of the native mitral valve leaflets directly to one another. A catheter delivered clip has been used to attempt to clip the sides of the leaflets together at the end portions of the leaflets, similar to the surgical stitching method. However, this clip has shortcomings, since it can only be used to clip the middle of the leaflets where they overlap by about 2 mm or more. Alternately, attempts have been made to use multiple clips on the commissures of the mitral valve, where there may be more overlap of the leaflets. This technique results in a longer operation time and also joins the patient's leaflets at the sides, restricting blood flow. Additionally, both the surgical and clip treatments are thought to create stress on patient leaflets.

[0007] Despite these prior techniques, there is a continuing need for improved devices and methods for treating mitral valve regurgitation.

SUMMARY

[0008] An aspect of the present disclosure provides a valve repair device for repairing a native heart valve of a patient. The device includes a pair of clasps, where each clasp is configured to attach to native valve leaflet. The device also includes pair of paddles, and each clasp is fixed to one of the paddles. The paddles are connected between a cap and a coaption element, and the cap can be actuated to permit the paddles and clasps to pivot. The ends of the pair of clasps are configured to move away from one another to a partially open position when the native valve leaflets open during a diastolic phase of a cardiac cycle, and the ends of the pair of clasps are configured to move toward one another when the native valve leaflets close during a ventricular systole of the cardiac cycle.

Another aspect of the present disclosure provides a valve repair device for repairing a native valve of a patient. The valve repair device comprises a pair of paddles and a pair of clasps. Each pair of clasps comprises an inner clasp member, an outer clasp member, and an end. The inner clasp member of each clasp is connected to one of the paddles and each clasp is configured to attach to a leaflet of the native valve. The paddles are connected between a cap and a coaption element, and the cap can be actuated to permit the paddles and clasps

~~to The paddles and attached clasps are moveable move~~ between a closed position and an open position, and the paddles are configured to be implanted on the native valve leaflets in a partially open position.

Another aspect of the present disclosure provides a valve repair device for repairing a native heart valve of a patient. The valve repair device comprises a pair of flexible clasps, wherein each clasp is configured to attach to a native valve leaflet. The device also includes pair of paddles, and each clasp is fixed to one of the paddles. The paddles are connected between a cap and a coaption element, and the cap can be actuated to permit the paddles and clasps to pivot. The clasps are configured to flex such that ends of the pair of clasps move away from one another to a partially open position when the native valve leaflets open during a diastolic phase of a cardiac cycle, and are configured to flex such that ends of the pair of clasps move toward one another when the native valve leaflets close during a ventricular systole of the cardiac cycle.

[0009] These and other aspects of the exemplary embodiments will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the various exemplary embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] To further clarify various aspects of embodiments of the present disclosure, a more particular description of the certain embodiments will be made by reference to various aspects of the appended drawings. It is appreciated that these drawings depict only typical embodiments of the present disclosure and are therefore not to be considered limiting of the scope of the disclosure. Moreover,

Claims

WHAT IS CLAIMED IS:

1. A valve repair device for repairing a native heart valve of a patient, the valve repair device comprising:

a pair of clasps, wherein each clasp is configured to attach to a native valve leaflet;

a pair of paddles, wherein each clasp is fixed to one of the paddles;
wherein the paddles are connected between a cap and a coaption element,
wherein the cap can be actuated to permit the paddles and clasps to pivot;

wherein ends of the pair of clasps are configured to move away from one another to a partially open position when the native valve leaflets open during a diastolic phase of a cardiac cycle; and

wherein ends of the pair of clasps are configured to move toward one another when the native valve leaflets close during a ventricular systole of the cardiac cycle.

2. The device of claim 1, wherein the ends of the clasps are angled away from one another when the clasps are in the partially open position.

~~3. The device of claim 1 or 2, further comprising a pair of paddles, wherein each clasp is fixed to one of the paddles.~~

~~43.~~ The device of claim 1 or 2 ~~any of claims 1-3~~, wherein the paddles move toward and away from one another during the cardiac cycle to move the ends of the clasps toward and away from one another during the cardiac cycle.

~~54.~~ The valve repair device of any of claims 1-~~43~~, ~~further comprising a coaption element connected to the pair of clasps,~~ wherein the movement of the clasps causes the native valve leaflets to coapt against the coaption element

when the native valve closes and causes the native valve leaflets to separate from the coaption element when the native valve opens.

65. The valve repair device of any of claims 1-~~54~~ wherein the device further comprises a pair of biasing members, wherein the biasing members bias the clasps toward one another.

76. A valve repair device for repairing a native valve of a patient, the valve repair device comprising:

a pair of paddles; ~~and~~

a pair of clasps, where each pair of clasps comprises an inner clasp member, an outer clasp member, and an end,

wherein the inner clasp member of each clasp is connected to one of the paddles;

wherein each clasp is configured to attach to a leaflet of the native valve;

wherein the paddles are connected between a cap and a coaption element, wherein the cap can be actuated to permit the paddles and the clasps and
~~attached clasps are moveable to move~~ between a closed position and an open position, and

wherein the paddles are configured to be implanted on the native valve leaflets in a partially open position.

87. The device of claim **76**, wherein the paddles are configured to remain in the partially open position when a force is applied to the clasps by the leaflets closing during systole.

98. The device of claim **76** or **87**, wherein the paddles are configured to remain in the partially open position when a force is applied to the clasps by the leaflets opening during diastole.

~~109~~. The device of claim ~~76~~, wherein the paddles are configured to further open from the partially open position when a force is applied to the clasps by the leaflets opening during diastole.

~~1110~~. The device of claim ~~76~~, wherein the paddles are configured to further open from the partially open position when a force is applied to the clasps by the leaflets opening during diastole and wherein the paddles are configured to return to the partially open position when a force is applied to the clasps by the leaflets closing during systole.

~~1211~~. The valve repair device of any of claims ~~76~~, ~~109~~, or ~~1110~~ further comprising a coaption element connected to the pair of paddles, wherein the movement of the paddles and clasps causes the native valve leaflets to coapt against the coaption element when the native valve closes and causes the native valve leaflets to separate from the coaption element when the native valve opens.

~~1312~~. The valve repair device of any of claims ~~76~~, or ~~109-1211~~, wherein the device further comprises a pair of biasing members, wherein the biasing members bias the paddles toward one another.

~~1413~~. A valve repair device for repairing a native heart valve of a patient, the valve repair device comprising:

a pair of flexible clasps, wherein each clasp is configured to attach to a native valve leaflet;

a pair of paddles, wherein each clasp is fixed to one of the paddles;
wherein the paddles are connected between a cap and a coaption element,
wherein the cap can be actuated to permit the paddles and clasps to pivot;

wherein the clasps are configured to flex such that ends of the pair of clasps move away from one another to a partially open position when the native valve leaflets open during a diastolic phase of a cardiac cycle; and

wherein the clasps are configured to flex such that ends of the pair of clasps move toward one another when the native valve leaflets close during a ventricular systole of the cardiac cycle.

1514. The device of claim 1413, wherein the ends of the clasps are angled away from one another when the clasps are in the partially open position.

1615. The valve repair device of claim 1314 or 1415, ~~further comprising a coaption element connected to the pair of clasps,~~ wherein the movement of the clasps causes the native valve leaflets to coapt against the coaption element when the native valve closes and causes the native valve leaflets to separate from the coaption element when the native valve opens.

1716. The valve repair device of any of claims 1413-1516 wherein the device further comprises a pair of biasing members, wherein the biasing members bias the clasps toward one another.