

as eccentric jet mitral regurgitation. For central jet regurgitation, the edges of the leaflets do not meet in the middle. Therefore, the valve does not close and regurgitation is present.

[0007] 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 edges of the leaflets together like the surgical stitching method. However, this clip has shortcomings, since it can only be used to clip the middle edges of the leaflets where they overlap by 2mm or more. Alternately, it has been attempted to use multiple clips on the commissures of the mitral valve, where there may be more overlap. This results in a longer operation time and the patient's leaflets are joined at the sides, restricting blood flow. Both the surgical and clip treatments are thought to create stress on patient leaflets.

[0008] Despite these prior techniques, there is a continuing need for improved devices and methods for treating mitral valve regurgitation.

SUMMARY

[0009] An exemplary valve repair device for repairing a native valve of a patient includes a pair of paddles, a pair of gripping members, and a spacer element. The paddles are movable between an open position and a closed position. The paddles and the gripping members are configured to attach to the native valve of the patient. The spacer element is configured to close a gap in the native valve of the patient when the valve repair device is attached to the native valve.

[0009a] An aspect of the disclosure provides a valve repair device for repairing a native valve of a patient, the valve repair device comprising a base assembly comprising a plurality of pivoting links and a shaft, wherein the pivoting links are moved by the shaft, a pair of paddles attached to the base assembly, wherein the movement of the pivoting links moves the paddles between an open position and a closed position, a pair of gripping members attached to the base assembly, wherein the paddles and the gripping members are configured to attach to valve leaflets of the patient, and at least one spacer element that surrounds the shaft and is disposed between the pair of gripping members. The spacer element fills a space between the gripping members when the paddles are in the closed position.

[0009b] Another aspect of the disclosure provides a valve repair system for repairing a native valve of a patient during a non-open-heart procedure, the valve repair system comprising a delivery device having at least one lumen and a valve repair device. The valve repair device is configured to be delivered through the lumen of the delivery device, and configured to attach to a native valve of a patient, the valve repair device comprising a base assembly comprising a plurality of pivoting links and a shaft, wherein the pivoting links are moved by the shaft, a pair of paddles attached to the base assembly, wherein the movement of the pivoting links moves the paddles between an open position and a closed position, a pair of gripping members attached to the base assembly, wherein the paddles and the gripping members are configured to attach to valve leaflets of the patient and at least one spacer element that surrounds the shaft and is disposed between the pair of gripping members. The spacer element fills a space between the gripping members when the paddles are in the closed position.

[0009c] Another aspect of the disclosure provides a valve repair device for repairing a native valve of a patient, the valve repair device comprising a pair of paddles, wherein the paddles are movable between an open position and a closed position, a pair of gripping members, wherein each gripping member of the pair of gripping members is directly attached to a corresponding paddle of the pair of paddles, and wherein the paddles and the gripping members are configured to attach to the native valve of the patient and a spacer element configured to close a gap in the native valve of the patient when the valve repair device is attached to the native valve.

[0010] A further understanding of the nature and advantages of the present invention are set forth in the following description and claims, particularly when considered in conjunction with the accompanying drawings in which like parts bear like reference numerals.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] 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.

CLAIMS

1. A valve repair device for repairing a native valve of a patient, the valve repair device comprising:
 - a base assembly comprising a plurality of pivoting links and a shaft, wherein the pivoting links are moved by the shaft;
 - a pair of paddles attached to the base assembly, wherein the movement of the pivoting links moves the paddles between an open position and a closed position;
 - a pair of gripping members attached to the base assembly, wherein the paddles and the gripping members are configured to attach to valve leaflets of the patient;
 - at least one spacer element that surrounds the shaft and is disposed between the pair of gripping members;
 - wherein the spacer element fills a space between the gripping members when the paddles are in the closed position.
2. The valve repair device according to claim 1, wherein the spacer element is made from at least one material selected from the group of materials consisting of braided mesh, fabric, biocompatible material, foam, and pericardial tissue.
3. The valve repair device according to claim 1, wherein the base assembly of the valve repair device further comprises:
 - a coupler movably attached to the shaft such that the coupler can be moved along the shaft;
 - wherein the pair of paddles are pivotally attached to the coupler;
 - wherein movement of the coupler in a first direction along the shaft causes the pair of paddles to move to the closed position, and movement of the coupler in a second direction causes the pair of paddles to move to the open position.
4. The valve repair device according to claim 1, wherein the spacer element includes a first spacer member attached to a first gripping member of the pair of gripping members and a second spacer member attached to a second gripping member of the pair of gripping members.

5. The valve repair device according to claim 1, wherein the spacer element extends past one or more side edges of the gripping members.
6. The valve repair device according to claim 1, wherein the spacer element comprises a main portion extending between the gripping members and extending portions that extend past the side edges of the gripping members.
7. The valve repair device according to claim 6, wherein the extending portions have a semicircular shape.
8. The valve repair device of claim 1, wherein the spacer element is configured to fill at least a portion of a gap between mitral valve leaflets of the patient.
9. A valve repair system for repairing a native valve of a patient during a non-open-heart procedure, the valve repair system comprising:
 - a delivery device having at least one lumen;
 - a valve repair device configured to be delivered through the lumen of the delivery device, and configured to attach to a native valve of a patient, the valve repair device comprising:
 - a base assembly comprising a plurality of pivoting links and a shaft, wherein the pivoting links are moved by the shaft;
 - a pair of paddles attached to the base assembly, wherein the movement of the pivoting links moves the paddles between an open position and a closed position;
 - a pair of gripping members attached to the base assembly, wherein the paddles and the gripping members are configured to attach to valve leaflets of the patient;
 - at least one spacer element that surrounds the shaft and is disposed between the pair of gripping members;
 - wherein the spacer element fills a space between the gripping members when the paddles are in the closed position.

10. The valve repair system according to claim 9, wherein the spacer element is made from at least one material selected from the group of materials consisting of braided mesh, fabric, biocompatible material, foam, and pericardial tissue.
11. The valve repair system according to claim 9, wherein the base assembly of the valve repair device further comprises:
 - a coupler movably attached to the shaft such that the coupler can be moved along the shaft;
 - wherein the pair of paddles are pivotally attached to the coupler;
 - wherein movement of the coupler in a first direction along the shaft causes the pair of paddles to move to the closed position, and movement of the coupler in a second direction causes the pair of paddles to move to the open position.
12. The valve repair system according to claim 11, wherein the spacer element includes a first spacer member attached to a first gripping member of the pair of gripping members and a second spacer member attached to a second gripping member of the pair of gripping members.
13. The valve repair system according to claim 9, wherein the spacer element extends past one or more side edges of the gripping members.
14. The valve repair system according to claim 9, wherein the spacer element comprises a main portion extending between the gripping members and extending portions that extend past the side edges of the gripping members.
15. The valve repair system according to claim 14, wherein the extending portions have a semicircular shape.
16. The valve repair device of claim 9, wherein the spacer element is configured to fill at least a portion of a gap between mitral valve leaflets of the patient.
17. A valve repair device for repairing a native valve of a patient, the valve repair device comprising:

a pair of paddles, wherein the paddles are movable between an open position and a closed position;

a pair of gripping members, wherein each gripping member of the pair of gripping members is directly attached to a corresponding paddle of the pair of paddles, and wherein the paddles and the gripping members are configured to attach to the native valve of the patient;

a spacer element configured to close a gap in the native valve of the patient when the valve repair device is attached to the native valve.

18. The valve repair device according to claim 17, further comprising a base assembly that comprises:

a shaft; and

a coupler movably attached to the shaft such that the coupler can be moved along the shaft;

wherein the pair of paddles are pivotally attached to the coupler;

wherein movement of the coupler in a first direction along the shaft causes the pair of paddles to move to the closed position, and movement of the coupler in a second direction causes the pair of paddles to move to the open position.

19. The valve repair system according to claim 18, wherein the gripping members comprise a barbed portion for attaching the gripping members to the native valve of a patient.

20. The valve repair device according to claim 19, wherein the gripping portions comprise a barbed portion for attaching the gripping members to the native valve of a patient, and wherein the barbed portion for each of the gripping members has only a single row of barbs.

21. The valve repair device according to claim 17, wherein the gripping members each comprise only a single row of barbs.

22. The valve repair device according to claim 21, further comprising a spacer element configured to close a gap in the native valve of the patient when the valve repair device is attached to the native valve.
23. The valve repair device of claim 17 wherein each gripping member of the pair of gripping members is extendable in length to prevent tearing of the native valve of the patient when the gripping members are removed from the native valve.
24. The valve repair device according to claim 23, further comprising a spacer element configured to close a gap in the native valve of the patient when the valve repair device is attached to the native valve.
25. The valve repair device according to claim 24, wherein the gripping members comprise a barbed portion for attaching the gripping members to the native valve of a patient, and wherein the barbed portion of each of the gripping members has only a single row of barbs.
26. The valve repair device according to claim 24, wherein the pair of gripping members comprises a flexible material such that the gripping members can peel back from tissue of the native valve when the gripping members are detached from the tissue of the native valve.