

CLAIMS

1. A system, for use with a tissue of a subject, the system comprising:
an anchor, comprising:
an anchor head, and
5 a tissue-engaging member, coupled to the anchor head, extending distally away from the anchor head until a distal tip of the tissue-engaging member, and configured to anchor the anchor to the tissue;
an anchor driver, comprising:
a longitudinal shaft, having a flexible distal portion and a distal end,
10 a deployment element at the distal end of the shaft, reversibly lockable to the anchor head, and reversibly movable between (i) a locked state that retains locking between the deployment element and the anchor head, and (ii) an unlocked state that unlocks the deployment element from the anchor head, and
a tissue-piercing lance, reversibly movable between:
15 an extended state in which (i) the lance extends distally from the shaft, (ii) while the deployment element is locked to the anchor head, the lance extends distally past a distal tip of the anchor, and (iii) the lance retains the deployment element in the locked state, and
a retracted state in which the deployment element automatically
20 moves into the unlocked state.
2. The system according to claim 1, wherein in the retracted state, the lance does not extend distally past the distal tip of the anchor.
- 25 3. The system according to claim 1, wherein in the retracted state, the lance does not extend distally from the shaft.
4. An apparatus, for use with a tissue of a subject, the apparatus comprising:
an anchor, comprising:
30 an anchor head, having a proximal side and a distal side, and defining an aperture from the proximal side to the distal side,

a tissue-engaging member, coupled to the anchor head, extending distally away from the anchor head until a distal tip of the tissue-engaging member, and configured to anchor the anchor to the tissue;

an anchor driver, comprising:

5 a longitudinal shaft, having a flexible distal portion and a distal end,
 a tissue-piercing lance, reversibly extendible distally from the shaft,
 a deployment element coupled to the distal end of the shaft, and reversibly
couplable to the anchor head in a position in which extension of the lance distally
from the shaft moves the lance through the aperture and past the distal tip of the
10 anchor; and

a catheter system, comprising:

 a catheter:

 through which the anchor driver is intracorporeally advanceable (i)
 while the deployment element is coupled to the anchor head, and (ii) such
15 that the distal portion of the shaft extends distally out of the catheter, and

 having a distal segment that is intracorporeally deflectable with
respect to another segment of the catheter immediately proximal to the
distal segment, and

 an extracorporeal controller configured, while the distal portion of the shaft
20 is extended distally out of the catheter, and the lance is extended distally from the
shaft and is disposed in the tissue, to cause deflection of the distal segment with
respect to the other segment, such that the distal portion of the shaft deflects with
respect to another portion of the shaft immediately proximal to the distal portion,

the anchor driver being configured to drive the tissue-engaging member into the tissue
25 while the distal portion of the shaft is deflected with respect to the other portion of the
shaft.

5. The apparatus according to claim 4, wherein:

 the deployment element is reversibly movable between (i) a locked state that
30 retains locking between the deployment element and the anchor head, and (ii) an unlocked
state that unlocks the deployment element from the anchor head, and

 the lance has:

 an extended state in which the lance extends distally from the shaft, and
retains the deployment element in the locked state, and

a retracted state, the deployment element being configured to automatically move into the unlocked state upon movement of the lance into the retracted state.

6. The apparatus according to claim 5, wherein:
5 the deployment element comprises one or more detents,
in the extended state, the lance holds the detents in a locking position in which the detents engage the anchor head, and
upon movement of the lance into the retracted state, the detents automatically move out of the locking position.
- 10 7. The apparatus according to claim 5, wherein, while the deployment element is locked to the anchor head, in the extended state the lance extends distally past the distal tip of the anchor.
- 15 8. The apparatus according to claim 7, wherein the lance has a partly-retracted state in which:
the lance retains the deployment element in the locked state, and
while the deployment element is locked to the anchor head, the lance does not extend distally past the distal tip of the anchor.
- 20 9. The apparatus according to claim 4, further comprising an implant, wherein the anchor driver is configured:
to advance the anchor through the catheter to the implant, and into a position in which the lance is extendible out of the implant and into the tissue, and
25 to anchor the implant to the tissue by driving the tissue-engaging member through the implant and into the tissue.
10. The apparatus according to claim 9, wherein:
the implant comprises a flexible sleeve, and
30 the anchor driver is configured:
to advance the anchor into a position inside the sleeve in which the lance is extendible through a wall of the sleeve and into the tissue, and
to anchor the implant to the tissue by driving the tissue-engaging member through the wall of the sleeve and into the tissue.

11. The apparatus according to claim 10, wherein the implant further comprises a flexible elongated contraction member that extends along the sleeve, and wherein tensioning of the contraction member contracts the sleeve.
- 5
12. The apparatus according to claim 11, wherein the implant further comprises an adjustment mechanism, coupled to the sleeve and to the contraction member, and wherein actuation of the adjustment mechanism adjusts tension of the contraction member.
- 10
13. The apparatus according to claim 12, wherein the adjustment mechanism comprises a spool, and a housing that houses the spool, the spool being coupled to the contraction member such that rotation of the spool within the housing adjusts the tension of the contraction member.
- 15
14. The apparatus according to claim 12, wherein the implant is advanceable to the tissue while (i) at least the sleeve is disposed within the catheter, and (ii) the adjustment mechanism is disposed distally from the sleeve, in front of a distal end wall of the sleeve.
- 20
15. The apparatus according to claim 14, wherein the wall of the sleeve is the distal end wall of the sleeve, and wherein:
- the anchor driver is configured:
- to advance the anchor into a position inside the sleeve in which the lance is extendible through the distal end wall of the sleeve and into the tissue, and
- to anchor the implant to the tissue by driving the tissue-engaging member
- 25
- through the distal end wall of the sleeve and into the tissue, and
- the adjustment mechanism is movably coupled to the sleeve, and is movable away from the distal end wall to become disposed laterally from the sleeve, after advancement of the implant to the tissue, and before advancement of the lance through the distal end wall.
- 30
16. The apparatus according to claim 11, wherein:
- the adjustment mechanism is disposed outside of the sleeve, and wherein the contraction member extends outside of the sleeve at a connection point and extends between the connection point and the adjustment mechanism,

the implant defines a non-contracting portion of the sleeve, between the connection point and a distal end of the sleeve, the contraction member not being disposed in the non-contracting portion,

the non-contracting portion being 10-15 mm long, and

5 the adjustment mechanism is movable, while coupled to the sleeve, between the distal end of the sleeve and the connection point.

17. A system, for use with a tissue of a subject, the system comprising:

an anchor, comprising:

10 an anchor head, and

a tissue-engaging member coupled to the anchor head and configured to anchor the anchor to tissue;

an anchor driver, comprising:

a longitudinal shaft, having a flexible distal portion and a distal end,

15 a deployment element at the distal end of the shaft, releasably coupled to the anchor head;

a tissue-piercing lance, reversibly movable between:

an extended state in which the lance extends distally from the shaft,

and

20 a retracted state in which the lance is proximal of the extended state;

wherein the system further comprises an implant, and wherein the anchor driver is configured:

25 to advance the anchor through a catheter and into a position in which the lance is extendible into the tissue, and

to anchor the implant to the tissue by driving the tissue-engaging member into the tissue.

18. The system according to claim 17 further configured such that when the tissue-piercing lance transitions to the retracted state, the deployment element automatically releases the anchor head.

19. The system according to claim 17, wherein in the extended state, while the deployment element is locked to the anchor head, the lance extends distally past the distal

tip of the anchor, and wherein the lance retains the deployment element in a locked state coupled to the anchor head.

20. The system according to claim 17, further comprising an implant, wherein the
5 anchor driver is configured:

to advance the anchor through the catheter to the implant, and into a position in which the lance is extendible out of the implant and into the tissue, and

to anchor the implant to the tissue by driving the tissue-engaging member through the implant and into the tissue.

10

21. The system according to claim 20, wherein the implant includes at least one of a volute spring, a contraction-member protecting band, and a primary and secondary sleeve.

22. The system according to claim 17, further comprising an adjustment mechanism
15 actuatable to change a dimension of the implant.

23. The system according to claim 22, wherein the adjustment mechanism comprises a lock, the lock:

20 having a locked state in which the lock inhibits actuation of the adjustment mechanism,

having an unlocked state in which the adjustment mechanism is actuatable, and

reversibly movable between the locked state and the unlocked state.

25 24. The system according to claim 22, further comprising an adjustment indicator configured to provide an indication of change of the dimension of the implant upon actuation of the adjustment mechanism.

25. The system according to claim 24, wherein the adjustment indicator comprises at
30 least one of an adjustment-indicator band, a shape-deforming element, a receptacle and plug, and an adjustment indicator spring.

26. The system according to claim 17, wherein the anchor driver comprises a force gauge configured to measure magnitude of a force applied to tissue at an implant site.