

WHAT IS CLAIMED IS:

- 1 1. An instrument for implantation of a flexible, ultra-thin substrate onto a
2 target tissue, comprising:
3 a handpiece;
4 a tubular sheath extended in a distal direction from said handpiece;
5 an internal shaft nested within said tubular sheath and anchored with said
6 handpiece, wherein the internal shaft comprises:
7 a) a fixed tine that is parallel to the tubular sheath, the fixed tine
8 having a clamp head; and
9 b) a movable tine with a clamp head that is configured to move
10 inwardly with respect to the clamp head of the fixed tine, the movable tine including
11 an arch configured to variably interact with an inner wall of the tubular sheath and
12 close the clamp heads to within a zero or predetermined distance from one another
13 when the clamp heads retract inside the tubular sheath;
14 a movement control mechanism configured to cause a longitudinal
15 movement of said tubular sheath with respect to said handpiece and thus cause the arch to
16 variably interact with the inner wall of the tubular sheath.
- 1 2. The instrument of claim 1, wherein the arch has a height that is at least
2 half of a height of an inner diameter of the tubular sheath.
- 1 3. The instrument of claim 1, wherein the arch of the movable tine
2 includes a combination of a slope, a curve, and/or a wave pattern.
- 1 4. The instrument of claim 1, wherein the predetermined distance
2 between the closed clamp heads is between 2 microns and 12 microns.
- 1 5. The instrument of claim 4, wherein the predetermined distance
2 between the closed clamp heads is between 4 microns and 8 microns.
- 1 6. The instrument of claim 1, further comprising:
2 a substrate having a handle with a thickness;
3 wherein the predetermined distance is between 10% and 100% of the substrate
4 handle thickness.

- 1 7. The instrument of claim 6, further comprising:
2 cells on or within one or more surfaces of the substrate.
- 1 8. The instrument of claim 1, wherein a cross sectional area of the clamp
2 heads is less than 10% of an internal cross sectional area of the tubular sheath.
- 1 9. The instrument of claim 1, wherein a width of the clamp heads is less
2 than 20% of an inner diameter of the tubular sheath.
- 1 10. The instrument of claim 1, wherein the tubular sheath is tapered at a
2 distal portion.
- 1 11. The instrument of claim 1, wherein a cross section of the arch of the
2 movable tine includes a curvature matching an interfacing inner circumference of the tubular
3 sheath.
- 1 12. The instrument of claim 1, wherein the tubular sheath is a first tubular
2 sheath, the instrument further comprising:
3 a second tubular sheath nested within at least a portion of the first tubular
4 sheath, within which the internal shaft is further nested.
- 1 13. The instrument of claim 1, wherein the clamp heads include an
2 orientation confirmation feature.
- 1 14. The instrument of claim 13, wherein the orientation confirmation
2 feature includes a bump.
- 1 15. The instrument of claim 1, wherein the tubular sheath has a circular or
2 oval cross-section.
- 1 16. The instrument of claim 1, wherein the tubular sheath is transparent or
2 translucent.
- 1 17. A method of loading an instrument for implantation of a substrate, the
2 method comprising:

3 longitudinally actuating a tubular sheath in order to cause a variable contact
4 interaction between an inner wall of the tubular sheath and a curvature of one or more
5 flexible tines, causing at least one of the flexible tines to move and grasp a substrate;
6 further longitudinally actuating the tubular sheath to induce a folding of the
7 substrate;
8 yet further longitudinally actuating a tubular sheath to slide the folded
9 substrate within the tubular sheath.

1 18. A method of using an instrument for implantation of a substrate, the
2 method comprising:

3 longitudinally actuating a tubular sheath in a proximal direction in order to
4 slide a folded substrate out of the tubular sheath;

5 further longitudinally actuating the tubular sheath in a proximal direction to
6 induce an unfolding of the substrate by removing an interaction between said substrate and
7 said tubular sheath;

8 yet further longitudinally actuating the tubular sheath in a proximal direction
9 to cause a variable contact interaction between an inner wall of the tubular sheath and a
10 curvature of one or more flexible tines, causing at least one of the flexible tines to move and
11 release the substrate.

1 19. A method of loading an instrument for implantation of a substrate, the
2 method comprising:

3 longitudinally actuating an internal shaft in order to cause a variable contact
4 interaction between an inner wall of a tubular sheath and a curvature of one or more flexible
5 tines, causing at least one of the flexible tines to move and grasp a substrate;

6 further longitudinally actuating the internal shaft to induce a folding of the
7 substrate;

8 yet further longitudinally actuating the internal shaft to slide the folded
9 substrate within the tubular sheath.

1 20. A method of using an instrument for implantation of a substrate, the
2 method comprising:

3 longitudinally actuating an internal shaft in a distal direction to slide a folded
4 substrate out of a tubular sheath;

5 further longitudinally actuating the internal shaft in a distal direction to induce
6 an unfolding of the substrate by removing an interaction with said substrate and said tubular
7 sheath;

8 yet further longitudinally actuating the internal shaft in a distal direction to
9 cause a variable contact interaction between an inner wall of the tubular sheath and a
10 curvature of one or more flexible tines located distally on the internal shaft, causing at least
11 one of the flexible tines to move and release the substrate.

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