Microneedle arrays can be used in conjunction with an applicator device capable of being used several times or as a single-use device. The microneedle arrays are generally used once and then discarded.

SUMMARY

The present inventors recognized that issues related to applying microneedles include the ability to effectively and consistently insert the needles to a desired depth in the skin, the ability to reliably hold the microneedles in proper contact with the skin during the period of administration, and the ability to apply consistent force for delivery.

The present disclosure generally relates to an adhesion assembly, or system, for use with a transdermal microneedle injection apparatus that is used to treat skin, deliver an active agent to the skin and/or withdraw fluid from the skin. The adhesive assemblies of the present disclosure provide improved skin adhesion of the microneedle injection apparatus, which can hold the microneedles in proper contact with the skin (and to a desired depth) and minimize leakage of fluid onto the skin surface during fluid delivery and/or withdrawal.

Some aspects of the present disclosure provide a microneedle injection apparatus. The apparatus can include a housing having a base and an opening formed in the base, the opening defining an area. The apparatus can further include an applicator comprising a microneedle array, the microneedle array comprising a first major surface and a plurality of microneedles that protrude from the first major surface. The applicator can be movable between (i) a first position in which the microneedle array is recessed within the housing such that the microneedle array does not extend beyond the base of the housing, and (ii) a second position in which at least a portion of the microneedle array extends through the opening in the base and beyond the base of the housing. The apparatus can further include an adhesive assembly adhered to the base of the housing, the adhesive assembly including one or more adhesive extensions that extend at least partially into the area defined by the opening, such that when the applicator is in the second position, at least a portion of the first major surface of the microneedle array is in contact with the one or more adhesive extensions of the adhesive assembly.

The phrase "injection apparatus" refers to an integrated device capable of delivering or extracting a fluid over a certain period and is not limited to devices intended solely for an infusion. Accordingly, an injection apparatus may be used, for example, for injecting fluid into the dermis or extracting fluid from tissue.

The term "transdermally," and variations thereof, is generally used to refer to any type of delivery of an active ingredient that crosses any portion of skin. That is, transdermally can generally include systemic delivery (i.e., where the active ingredient is transported across, or substantially through, the dermis such that the active ingredient is delivered into the bloodstream), as well as intradermal delivery (i.e., where the active ingredient is transported partially through the dermis, e.g., across the outer layer

What is claimed is:

1. A microneedle injection apparatus comprising:

a housing having a base and an opening formed in the base, the opening defining an area;

an applicator comprising a microneedle array, the microneedle array comprising a first major surface and a plurality of microneedles that protrude from the first major surface, the applicator movable between

a first position in which the microneedle array is recessed within the housing such that the microneedle array does not extend beyond the base of the housing, and

a second position in which at least a portion of the microneedle array extends through the opening in the base and beyond the base of the housing; and

an adhesive assembly adhered to the base of the housing, the adhesive assembly including one or more adhesive extensions that extend at least partially into the area defined by the opening, such that when the applicator is in the second position, at least a portion of the first major surface of the microneedle array is in contact with the one or more adhesive extensions of the adhesive assembly.

2. The apparatus of claim 1, wherein the one or more adhesive extensions extend only partially into the area defined by the opening.

3. The apparatus of claim 1 or 2, wherein the one or more adhesive extensions are in the form of an annulus and define an opening therein, the opening sized to contain the plurality of microneedles.

4. The apparatus of any of claims 1-3, wherein the adhesive assembly includes a first side configured to adhere to the base of the housing, and a second side configured to adhere to a skin surface.

5. The apparatus of any of claims 1-4, wherein the adhesive assembly includes a first side positioned toward the base of the housing and a second side opposite the first side.

6. The apparatus of claim 5, wherein the one or more adhesive extensions of the adhesive assembly include adhesive on at least the second side.

7. The apparatus of claim 5 or 6, wherein the one or more adhesive extensions of the adhesive assembly include adhesive on the first side and the second side, such that the first side of the one or more adhesive extensions is configured to adhere to the first major surface of the microneedle array and the second side of the one or more adhesive extensions are is configured to adhere to the skin, when the applicator is in the second position.

8. The apparatus of any of claims 1-7, wherein the adhesive assembly comprises:

a first layer configured to be coupled to the base of the housing and including an opening that aligns with the opening in the base of the housing, and

a second layer comprising the one or more adhesive extensions and including a skin-contact adhesive.

9. The apparatus of claim 8, wherein the first layer includes a shock-absorbing layer.

10. The apparatus of claim 8 or 9, wherein the first layer includes a first side configured to be coupled to the base of the housing and a second side opposite the first side, and wherein the second layer includes at least one layer of adhesive.

11. The apparatus of claim 10, wherein the first side of the first layer includes an adhesive configured to adhere the first side of the first layer to the base of the housing.

12. The apparatus of claim 10 or 11, wherein the second layer includes a first adhesive layer configured to adhere to the second side of the first layer and the first major surface of the microneedle array, and a second adhesive layer comprising a skin-contact adhesive.

13. The apparatus of claim 12, wherein the one or more adhesive extensions are formed by the first adhesive layer and the second adhesive layer of the second layer.

14. The apparatus of any of claims 1-13, wherein the one or more adhesive extensions are continuous about a periphery of the opening.

15. The apparatus of any of claims 1-13, wherein the one or more adhesive extensions are discontinuous about a periphery of the opening to define a plurality of vents between discontinuous portions of the one or more adhesive extensions.

16. The apparatus of any of claims 1-13 and 15, wherein the one or more adhesive extensions are discontinuous and include a plurality of portions, and wherein each portion of the one or more adhesive extensions is separated by a vent.

17. The apparatus of claim 15 or 16, wherein each vent extends outwardly from the microneedle array.

18. The apparatus of any of claims 1-13 and 15-17, wherein the one or more adhesive extensions include a plurality of portions that each extend from a location adjacent a periphery of the opening at least partially into the area defined by the opening.

19. The apparatus of any of claims 1-18, wherein the first major surface of the microneedle array contacts the adhesive assembly when the applicator is moved to the second position.

20. The apparatus of any of claims 4-7, wherein the one or more adhesive extensions include pressure sensitive adhesive on both sides.