In addition, the dose is limited to the amount of local anesthetic coated on or contained in the microneedles. After penetrating the stratum corneum, the local anesthetic in the coating on the microneedles dissolves in the tissue underlying the stratum corneum. In the case of dissolvable microneedles, the local anesthetic in the microneedles dissolves in the tissue. As such, the dose may be controlled without fear of delivering more than is needed or toxic levels.

Accordingly, in one aspect~~embodiment~~ there is provided a medical device, comprising:

an array of microneedles, and

a coating disposed on the microneedles,

wherein the coating comprises:

a local anesthetic selected from the group consisting of lidocaine, prilocaine, and a combination thereof; and

a local anesthetic dose-extending component selected from the group consisting of tetracaine, ropivacaine, bupivacaine, procaine and a combination thereof;

wherein the local anesthetic is present in an amount of at least 1 wt-% based upon total weight of solids in the coating, and

wherein the local anesthetic and dose-extending component are in a non-eutectic weight ratio.

In another embodiment, there is provided a method of extending a topically delivered local anesthetic dose in mammalian tissue, the method comprising:

contacting the tissue with a local anesthetic-coated microneedle device,

wherein the device comprises:

an array of microneedles, and

a coating disposed on the microneedles,

wherein the coating comprises:

a local anesthetic selected from the group consisting of lidocaine, prilocaine, and a combination thereof; and

a local anesthetic dose-extending component selected from the group consisting of tetracaine, ropivacaine, bupivacaine, procaine and a combination thereof;

wherein the local anesthetic is present in an amount of at least 1

wt-% based upon total weight of solids in the coating, and

wherein the local anesthetic and dose-extending component are in a non-eutectic weight ratio.

In another aspect~~embodiment~~, there is provided a method of making a local anesthetic-coated microneedle device comprising:

providing an array of microneedles,

providing a composition comprising:

a local anesthetic selected from the group consisting of lidocaine, prilocaine, and a combination thereof;

a local anesthetic dose-extending component selected from the group consisting of tetracaine, ropivacaine, bupivacaine, procaine and a combination thereof; and

a volatilizable carrier;

contacting the microneedles with the composition, and

volatilizing at least a portion of the carrier to provide a coating disposed on the microneedles;

wherein the coating comprises the local anesthetic in an amount of at least 1 wt-% based upon total weight of solids in the coating, wherein the local anesthetic and dose-extending component are in a non-eutectic weight ratio; and

wherein the device comprises the array of microneedles with the coating disposed on the microneedles.

In another aspect~~embodiment~~, there is provided a medical device, comprising an array of dissolvable microneedles, the microneedles comprising:

a dissolvable matrix material;

at least 1 wt-% of a local anesthetic selected from the group consisting of lidocaine, prilocaine, and a combination thereof; and

a local anesthetic dose-extending component selected from the group consisting of tetracaine, ropivacaine, bupivacaine, procaine and a combination thereof;

wherein the local anesthetic and dose-extending component are in a non-eutectic weight ratio, and

wherein wt-% is based upon total weight of solids in all portions of the dissolvable microneedles which contain the local anesthetic.