and reproducible manner.

[0015] In an aspect, the present disclosure provides a dermal injector system comprising an injection device and a separate control unit:

a. the injection device having a plunger, a proximal end, and a distal end, wherein the injection device having an injector arranged for mechanical communication with at least one needle, a cartridge arranged to hold at least one injectable material within a chamber, where the injected material is configured to be injected through the at least one needle, a delivery mechanism which allows the at least one needle to be moved from a retracted position to an extended position and independently change a volume of the chamber to expel the injectable material through the at least one needle, where the delivery mechanism is configured to independently move the plunger and the at least one needle toward the distal end of the device, the delivery mechanism comprising a distal drive that is movable relative to the proximal end of the device, a proximal drive that is stationary relative to the proximal end of the device and a threaded rod that joins the proximal and distal drives and the plunger, wherein the threaded rod extends through the proximal drive and through the distal drive and terminates at its distal end upon contact with the plunger; and wherein the distal drive and the proximal drive are adjacent to one another when the at least one needle is in a retracted position; and wherein the distal drive and the proximal drive are separated from one another when the at least one needle is in an extended position, a first sensor arranged to detect information associated with a position of the at least one needle, a second sensor arranged to detect information associated with the cartridge, and communication interface; and

b. the control unit, the control unit in communication with the injection device through the

communication interface, the control unit including a processor, and a memory arranged to store processor-executable instructions.

Optionally, the injection device may be fitted with a plurality of needles, such as 4, 9, 16 or 25. Also optionally, the injection device may incorporate a cooling feature which will contact tissue adjacent to the tissue that will receive the injection, and cool the contacted and adjacent tissue, so that the injection is less painful to the patient. Preferably, the injection device incorporates both a plurality of needles and a cooling feature, each as described in detail herein. For example, in one embodiment, the at least one needle of the dermal injector system includes a needle array. In another embodiment, the cartridge includes a form of Digital Rights Management, e.g., an identifiable tag or marker. Examples include RFID tags (and alternatives such as HP Memory Spot and RuBee (IEEE 1902.1)), ink markings, QR codes and barcodes. The Digital Rights Management (e.g., identifiable tag or marker) can be arranged to store information about material in the cartridge, where such information may include, for example, the composition to be delivered, manufacturer, date of manufacture, lot number and/or serial number). In yet another embodiment, the dermal injector system further comprises a cooling tip coupleable to the injection device, where the cooling tip is optionally arranged to provide temperature information to the control

CLAIMS

What is claimed is:

1. A dermal injector system, comprising an injection device and a separate control unit:
    a) the injection device having a plunger, a proximal end, and a distal end, wherein the injection device having an injector arranged for mechanical communication with at least one needle, a cartridge arranged to hold at least one injectable material within a chamber, where the injected material is configured to be injected through the at least one needle, a delivery mechanism which allows the at least one needle to be moved from a retracted position to an extended position and independently change a volume of the chamber to expel the injectable material through the at least one needle, where the delivery mechanism is configured to independently move the plunger and the at least one needle toward the distal end of the device, the delivery mechanism comprising a distal drive that is movable relative to the proximal end of the device, a proximal drive that is stationary relative to the proximal end of the device and a threaded rod that joins the proximal and distal drives and the plunger, wherein the threaded rod extends through the proximal drive and through the distal drive and terminates at its distal end upon contact with the plunger; and wherein the distal drive and the proximal drive are adjacent to one another when the at least one needle is in a retracted position; and wherein the distal drive and the proximal drive are separated from one another when the at least one needle is in an extended position, a first sensor arranged to detect information associated with a position of the at least one needle, a second sensor arranged to detect information associated with the cartridge, and a communication interface; and
    b) the control unit, the control unit in communication with the injection device through the communication interface, the control unit including a processor, and a memory arranged to store processor-executable instructions.
2. The dermal injector system of claim 1, wherein the at least one needle includes a needle array.

3. The dermal injector system of claim 1, wherein the cartridge includes at least an RFID or a barcode, the RFID or barcode arranged to store information about material in the cartridge.
4. The dermal injector system of claim 1, further comprising:
   c) a cooling tip coupleable to the injection device.
5. The dermal injector system of claim 1 wherein the injection device is connected to the control unit by way of a cable.
6. The dermal injector system of claim 1 wherein the injection device is wirelessly connected to the control unit.