and reproducible manner.

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

a. ~~an~~ 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~~an electromechanical drive device arranged to advance and retract the at least one needle~~, and communication interface; and

b. ~~a~~ the control unit, the control unit in communication with ~~communicatively connectable to~~ the injection device through the

communication interface, the control unit including a processor, and a memory arranged to store processor-executable instructions~~, and a plurality of sensors, a first sensor arranged to pass information associated with a position of the at least one needle, and a second sensor arranged to pass information associated with the cartridge~~.

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) ~~an~~ 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~~an electromechanical drive device arranged to advance and retract the at least one needle~~, and a communication interface; and

   b) ~~a~~ the control unit, the control unit in communication with ~~communicatively connectable to~~ the injection device through the communication interface, the control unit including a processor, and a memory arranged to store processor-executable instructions~~, and a plurality of sensors, a first sensor arranged to~~

~~pass information associated with a position of the at least one needle, and a second sensor arranged to pass information associated with the cartridge~~.

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~~4,~~ wherein the injection device is connected to the control unit by way of a cable~~the cooling tip is arranged to provide temperature information to the control unit~~.
6. The dermal injector system of claim ~~4~~1~~,~~ wherein the injection device is wirelessly connected to the control unit~~the cooling tip includes a Peltier element~~.

~~7. The dermal injector system of claim 1, wherein the control unit is arranged to receive user input directing at least one of needle depth, material volume, and needle speed.~~

~~8. A non-transitory computer-readable storage medium whose stored contents configure a computing system to perform a method, the method comprising:~~

~~a) communicatively coupling an injection device to a control unit, the control unit having a processor arranged to execute instructions stored in the non-transitory computer-readable storage medium;~~

~~b) receiving first user input at the control unit, the first user input directed to a depth of a needle of the injection device during an injection;~~

~~c) receiving second user input at the control unit, the second user input directed to a volume of material delivered through the needle during the injection;~~

~~d) receiving third user input at the control unit, the third user input directed to a speed of the needle during the injection; and~~

~~e) receiving an indication at the control unit that the injection was performed.~~

9. The non-transitory computer-readable storage medium of claim 8 whose stored contents configure a computing system to perform a method, the method further comprising at least one of:

f) receiving temperature information associated with a cooling tip coupled to the injection device during the injection;

g) providing at least one audible output or at least one visual output associated with a status of the injection;

h) providing at least one audible output or at least one visual output directing performance of the injection by a clinician;

i) accumulating in the control unit data indicating how many injections have been performed; and

j) receiving at the control unit information identifying a material delivered to a patient during the injection.

10. An injection device (10) having a proximal end and a distal end, the distal end for introducing a liquid substance into the body of a subject, the injection device comprising:

a) an injector (14) comprising at least one needle (24) and a housing (26) for the at least one needle;

b) a cartridge (16) comprising at least one chamber (20) to hold the liquid substance, and a plunger (48) which moves within the chamber to change a volume of the chamber; and

c) a delivery mechanism (40) to independently move the plunger and the needle toward the distal end of the device (10), the delivery mechanism comprising a distal drive (42) that is movable relative to the proximal end of the device, a proximal drive (44) that is stationary relative to the proximal end of the device and a threaded rod (46) that joins the proximal and distal drives and the plunger.

11. The device (10) of claim 10 wherein the distal drive (42) and the proximal drive (44) are adjacent to one another when the needle is in a retracted position, and wherein the distal drive (42) and the proximal drive (44) are separated from one another when the needle is in an extended position.

~~12. The device (10) of claim 10 having more than one needle (24), where the more than one needle are configured to penetrate simultaneously into the body of the subject.~~

~~13. A method of delivering cells into tissue, the method comprising placing the cells into the injection device of claim 1 and then injecting the cells from the device and into the tissue.~~

~~14. A method of delivering hyaluronic acid into tissue, the method comprising placing the hyaluronic acid into the injection device of claim 1 and then injecting the hyaluronic acid into the tissue.~~

~~15. A method comprising:~~

~~a) selecting a first exterior surface of skin of a patient, the first surface comprising a surface area and a first average temperature;~~

~~b) cooling the first surface to a second average temperature;~~

~~c) penetrating the first surface with a plurality of needles, the plurality of needles extending from the first surface by a uniform distance into the patient; and~~

~~d) withdrawing the plurality of needles from the patient while also ejecting a material out of the needles and into the patient.~~