SKIN ABRASION GROWTH FACTOR FLUID DELIVERY SYSTEM AND METHOD

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Appl. No.: 10/442,498
Filed: May 20, 2003

Related U.S. Application Data
Continuation-in-part of application No. 10/315,478, filed on Dec. 10, 2002.

Publication Classification

Int. Cl. A61M 37/00
U.S. Cl. 604/140

ABSTRACT
A human growth factor delivery system for use in connection with dermabrasion includes a source of human growth factors in fluid. The growth factor fluid may be applied to the target skin area simultaneously with the step of abrading the skin by a single handpiece. Furthermore, the fluid is caused to penetrate by a combination of the abrasive elements, a vacuum, and a positive pressure applied in bursts, which produces a massaging effect. The fluid source may be contained in a removable cartridge adapted to fit within the handpiece. The fluid is drawn from the cartridge by the vacuum. The vacuum also draws a portion of target skin into a space of the handpiece for contact with an abrasion element. The vacuum furthermore draws excess fluid and removed skin cells into a disposable or reusable canister.
SKIN ABRASION GROWTH FACTOR FLUID DELIVERY SYSTEM AND METHOD

RELATED APPLICATIONS

[0001] This application is a continuation-in-part of U.S. patent application Ser. No. 10/315,478 filed Dec. 10, 2002, and entitled “MICRODERMABRASION FLUID APPLICATION SYSTEM AND METHOD”, which is incorporated herein by reference and which in turn claims priority from U.S. Provisional Application Serial No. 60/361,045 filed on Mar. 1, 2002, entitled “HUMAN GROWTH FACTOR DELIVERY SYSTEM,” which is incorporated herein by reference.

BACKGROUND OF THE INVENTION AND METHOD

[0002] 1. Field of the Invention

[0003] The invention relates generally to skin or surface abrasion apparatus and methods.

[0004] 2. Description of Prior Art and Related Information

[0005] It is often desirable to abrade the outer layer or epidermis of the skin in order to smooth or blend scars, or blemishes caused by acne for example. In a technique known as microdermabrasion, a sand or grit is carried by an air flow which is directed against the skin. The momentum of the grit tends to wear away two to three cell layers of the skin with each pass of a handpiece. Since microdermabrasion is intended to wear away cell layers of the skin, the process tends to create a wound on the target skin area.

[0006] Consequently, a need exists for quickly healing the wounded area caused by the abrasion procedure in order to reduce trauma as well as to yield the desired result skin—that is not only aesthetically pleasing, but healthy as well.

SUMMARY OF THE INVENTION

[0007] In accordance with the present invention, structures and associated methods are disclosed which address these needs.

[0008] In one aspect, a microdermabrasion apparatus comprises a supply of abrasion media, a supply of growth material, at least one handpiece to apply the abrasion media and the growth material to a target area, and a mechanism for removing the abrasion media from the target area. The growth material may be dry and thus mixed in with the abrasion media. The growth material, or additive, comprises growth factors such as vitamins. A source of oxygen is in communication with the handpiece. A valve is provided to control a flow of the oxygen to the handpiece. The mechanism for removal may comprise a vacuum source disposed downstream from the handpiece. The apparatus may further comprise a positive pressure source disposed upstream from the handpiece.

[0009] In another aspect, a microdermabrasion system is provided comprising separate handpieces for the microdermabrasion media and the growth material. The system comprises a first supply of microdermabrasion media and a first handpiece in communication with the first supply of microdermabrasion media. A second handpiece is provided in communication with a second supply of growth material. A mechanism alternatively causes a first flow of the microdermabrasion media through the first handpiece and a second flow of the growth material through the second handpiece. A control unit is coupled to the first handpiece and the second handpiece. The control unit includes a switch to alternate operation of the mechanism between the first handpiece and the second handpiece.

[0010] The second supply of growth material may comprise a liquid having at least one growth factor. A source of oxygen may be coupled to the liquid. A valve is coupled to the source of oxygen and adapted to control a flow of oxygen to the liquid. The mechanism may comprise a vacuum source coupled to both the first handpiece and the second handpiece, which vacuum source may be housed in the control unit. The first supply of microdermabrasion media is also disposed in the control unit. The second supply of growth material may be disposed in the control unit or carried by the second handpiece.

[0011] A fluid delivery apparatus is also provided for applying a fluid to a target skin area. A cartridge is disposed substantially within a handpiece. The cartridge holds a supply of fluid and includes an adapter adapted to apply the fluid to a target skin area. The supply fluid contains at least one growth factor. A vacuum source is coupled to the handpiece and adapted to draw the fluid out of the cartridge and through the applicator. The applicator may comprise a sponge, a roller, a membrane, or any other material suitable for applying fluid onto skin.

[0012] The handpiece comprises a housing adapted to slidingly receive the cartridge and a beveled distal portion adapted to contact the target skin area. The distal portion may include vacuum ports. The distal portion is adapted to form a seal with the target skin area. The housing may include a removable cap to facilitate assembly and removal of the container. A space, or fluid passageway, is defined within the housing exterior to the container. The space is in communication with the vacuum source. The space is sealed off from any area exterior to the handpiece when the housing forms the seal with the target skin area.

[0013] A method is provided for microdermabrating skin. The method comprises the steps of abrading a target skin area with microdermabrasion media, applying growth material to the target skin area, retrieving the microdermabrasion media from the target skin area, and retrieving at least a portion of the growth material from the target skin area. Where the growth material is dry, the method further comprises the step of mixing the dry growth material with the microdermabrasion media prior to the applying step.

[0014] The step of abrading a target skin area with microdermabrasion media comprises the step of applying the microdermabrasion media to the target skin area with a first handpiece. The step of applying growth material to the target skin area comprises the step of applying the growth material to the target skin area with a second handpiece. The method further comprises the step of disposing the growth material in an aqueous solution, and disposing the aqueous solution with the growth material upstream from the second handpiece. The method further comprises the step of carrying the aqueous solution with the second handpiece.

[0015] The step of disposing the aqueous solution with the growth material within the second handpiece comprises the step of retaining the aqueous solution with a cartridge
carried by the handpiece. The method further comprises the step of disposing an applicator on a distal end of the cartridge. The step of applying the growth material to the target skin area with the second handpiece comprises contacting the target skin with the applicator. A sponge applicator, roller applicator, membrane applicator, or other suitable applicators may be employed.

[0016] In summary, a growth factor delivery system for use in connection with microdermabrasion includes a source of growth factors. The growth material may be dry and thus mixed in with the abrasion media. The dry growth material would therefore be applied to the target skin area simultaneously with the abrasion media by a single handpiece. The growth material may comprise a fluid or a gel to be delivered by a separate handpiece. The fluid source may be within the handpiece or external thereto. The fluid source may be contained in a removable cartridge adapted to fit within the handpiece. Thus, a method and system is provided for using disposable cartridges of growth fluids.

[0017] In a further aspect, the invention includes a single handpiece that simultaneously implements dermabrasion, growth factor fluid delivery, and a massage. The massage and dermabrasion improve penetration of the fluid growth factor. The massage is provided by a relatively constant vacuum pressure combined with bursts of positive pressure fluid directed at the target area of the patient’s skin. The positive pressure bursts cause the penetration to go deeper into the skin. They also cause a variation of the overall fluid pressure inside the handpiece when the handpiece is in scaled contact with the target area of the skin. Therefore, a massage is provided by a repeated pushing and pulling effect.

[0018] Alternatively described, the apparatus for providing dermabrasion, growth factor delivery, and a massage comprises a handpiece having a body. The body supports a canister having an internal first pressure and containing a growth factor fluid. The body also defines a chamber. Second and third pressure sources are in fluid communication and provide second and third pressures to the chamber. The second and third pressures may provide a pulsed fourth pressure that is the sum of the second and third pressures. When the fourth pressure is lower than the first pressure, the growth factor fluid flows from the canister and onto the patient’s skin. A low pressure draws the skin of the patient into contact with an abrasion element of the handpiece. Furthermore, the pulsing of the fourth pressure also provides a massage.

[0019] The handpiece that implements massage in addition to abrasion and growth factor fluid delivery, is incorporated into a treatment system. The system includes a vacuum source and a vacuum pressure adjustment mechanism. The system also includes a positive pressure fluid source and a positive pressure adjustment mechanism. Importantly, the system further includes a pressure burst timing adjustment device for controlling a rate and a duration of the positive pressure fluid bursts. The positive pressure bursts in combination with a relatively constant vacuum source pressure result in a massaging effect.

[0020] The invention, now having been briefly summarized, may be better visualized by turning to the following drawings wherein like elements are referenced by like numerals.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] FIG. 1 is a schematic view of a preferred embodiment of a microdermabrasion apparatus;

[0022] FIG. 2 is a schematic view of a further preferred embodiment of microdermabrasion system having a positive pressure pump;

[0023] FIG. 3 is a schematic view of a preferred embodiment of a “wet” growth factor delivery apparatus;

[0024] FIG. 4 is a schematic view of a further preferred embodiment of a wet growth factor delivery apparatus;

[0025] FIG. 5 is an enlarged schematic view of a handpiece of the preferred wet growth factor delivery apparatus illustrated in FIG. 4;

[0026] FIG. 6 is a schematic view of a combined system including a microdermabrasion apparatus and a wet growth factor delivery apparatus;

[0027] FIG. 7 is a schematic view of a further preferred embodiment of a wet growth factor delivery apparatus;

[0028] FIG. 8 is an exploded, perspective view of a handpiece of the preferred system illustrated in FIG. 7;

[0029] FIG. 9 is a partially removed side elevation view of a cartridge having a first preferred applicator;

[0030] FIG. 10 is a partially removed side elevation view of a cartridge having a second preferred applicator;

[0031] FIG. 11 is a partially removed side elevation view of a cartridge having a third preferred applicator;

[0032] FIG. 12 is a cross-sectional view of the preferred delivery apparatus of FIG. 7 in operation;

[0033] FIG. 13 is an axial cross-sectional view of a further preferred handpiece for a fluid delivery system;

[0034] FIG. 14 is a perspective view of a housing of the handpiece of FIG. 13;

[0035] FIG. 15 is a perspective view of a further preferred handpiece for a fluid delivery system;

[0036] FIG. 16 is an axial cross-sectional view of the handpiece of FIG. 15;

[0037] FIG. 17 is an end view of the handpiece of FIG. 15;

[0038] FIG. 18 is a block diagram illustrating various modules that may be combined with microdermabrasion to form a combined system;

[0039] FIG. 19 is an exploded perspective view of a still further preferred handpiece for improved fluid penetration;

[0040] FIG. 20 is an assembled end view of the handpiece of FIG. 19;

[0041] FIG. 21 is a partial sectional view of the handpiece of FIGS. 19 and 20 taken along lines 21-21 of FIG. 20;

[0042] FIG. 22 is a partial sectional view of the handpiece of FIGS. 19 and 20 taken along lines 22-22 of FIG. 20;

[0043] FIG. 23 is a perspective view of the handpiece of FIG. 19; and
FIG. 24 is a diagrammatic view of a growth factor fluid delivery system including the handpiece of FIG. 19.

The invention and some of its embodiments can now be better understood by turning to the following detailed description wherein illustrated embodiments are described. It is to be expressly understood that the illustrated embodiments are set forth as examples and not by way of limitations on the invention as ultimately defined in the claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS AND BEST MODE OF INVENTION

FIG. 1 is a schematic view of a microdermabrasion apparatus 10 according to the invention. The apparatus 10 includes a unique supply 20 of microdermabrasion media that is preferably composed of cutting materials, such as aluminum oxide, crystals or other microdermabrasive materials, and one or more growth factors or vitamins. Unlike conventional microdermabrasion approaches which include a supply that consists of merely cutting material, it will be appreciated that the inclusion of growth factors, such as vitamins, gases and moisturizers, for example, facilitates healing of the treated area. It is to be expressly understood that the growth factors may include any substance or materials that facilitates the healing of a treated skin area. With growth factors mixed in with the cutting materials, the growth factors may be applied to the cut skin area simultaneously with the abrasive materials. By way of example and not by way of limitation, the vitamins may include any combination of vitamins A, C, or E. Further by way of example and not by way of limitation, the growth factor may include a product that can be purchased under the trade name of Nouriel manufactured by Advanced Tissues Sciences.

An oxygen supply 22 provides oxygen which mixes with the incoming flow of media and air from the media supply 20. A control valve 24 is coupled to an oxygen inlet conduit 26 leading from the oxygen supply 22 to a primary inlet conduit 27. A media inlet conduit 28 extends from the media supply 20 to the primary inlet conduit 27 which is coupled to a handpiece 31. A return conduit 33 is coupled to the handpiece 31 and a vacuum pump 35. A valve 34 may be coupled to the return conduit 33. The vacuum pump 35 thus directs the mixed media through the primary inlet conduit 26 to the handpiece 31. The vacuum pump 35 may be provided with a gauge 36 to facilitate monitoring and control of the vacuum pressure. A waste canister 37 is coupled to the return conduit and adapted to receive the waste materials drawn from the handpiece 31.

The handpiece 31 is applied to the target area of a patient to perform microdermabrasion while administering the growth factors. Since the microdermabrasion creates an abrasion wound to the target skin area, the addition of oxygen, in addition to the growth factors, facilitates healing and a quicker restoration of the abraded area. The oxygen can thus be mixed in with conventional microdermabrasion media as well as with other media, such as vitamins and other growth factors.

After microdermabrasion is performed with the administration of the growth factors, the used media is drawn through the return conduit 33 by the vacuum pump 35. The used media may be directed to a storage canister 37.

The first preferred embodiment of the apparatus 10 shown in FIG. 1 thus comprises a dry system and an associated method wherein the growth factors are applied in a dry form.

In FIG. 2, a preferred embodiment of microdermabrasion system 40 is shown in schematic view. The system 40 may include pressurized input provided by a pressure pump 42. The pressure pump 42 is powered by a power source 44 and may be controlled by a switch 46, such as a foot switch or a switch provided on the handpiece 31. In the system 40, the pressure pump 42 is provided upstream from the supply sources 20, 22 so as to add positive pressure. The combination of the downstream vacuum pump 35 and the upstream pressure pump 42 increases the control and velocity capacity of delivering the cutting material. Air drawn in by the vacuum pump 35 may be recirculated in the system 40 to provide positive pressure. The handpiece 31 may include a plurality of venturi nozzles which produce a jet stream venturi effect.

Furthermore, the positive pressure pump 42 and vacuum source 35 may be used to create a pneumatic undulating effect on the target skin area, which facilitates and circulation and healing of the area. In use, a suction force is applied to the target area and forms a seal between the distal end of the handpiece 31 and the target area. The target area and a space within the handpiece thus form a vacuum chamber. With the vacuum source continuously applied, the suction force from the vacuum source 35 draws the target area toward or into the handpiece 31. The suction force also draws blood toward the surface of the skin. Positive pressure from the pump 42 may be simultaneously applied on a target skin, temporarily pushing the area away from the handpiece 31.

The positive pressure is preferably in the form of a jet or stream of pressurized air. The pressurized air is applied in bursts or pulses that impinge on the target area. The pressurized air also enters the space in the handpiece 31 that normally forms the vacuum chamber. Hence, during the bursts or pulses, the pressure in the space rises. The net result is a rise and fall in pressure in the space and vacuum chamber. In fact, when the pressurized air has a large enough flow rate and a high enough pressure, an actual push/pull effect is caused. The resulting undulating effect massages the target skin area and thereby increases the circulation. Massaging in this manner also breaks up fat and promotes the formation of collagen. At the same time, the target area is repeatedly and flexibly brought into contact with the abrasion element. Therefore, while the undulating effect facilitates dermabrasion, it also promotes healing of the skin as well. The jet also massages the target area.

While the undulating effect has been described above as being provided by a specific combination of vacuum and pressurized air applied to the vacuum chamber, it is to be explicitly understood that the undulating effect can be accomplished with any of a variety of combinations of vacuum and pressurized air. For example, the vacuum pressure could be pulsed by itself or in combination with the pressurized air. Thus, the above descriptions are to be taken by way of example and not by way of limitation.

In FIG. 3, a preferred embodiment of a growth factor delivery apparatus 50 is shown in schematic view. In particular, a “wet” delivery apparatus 50 and associated wet method is illustrated in FIG. 3. The apparatus 50 includes an
oxygen source 52 that is coupled to a supply 54 of growth factors in water. A valve 56 is provided along an oxygen inlet conduit 58 to control the inclusion of oxygen. A primary inlet conduit 61 is coupled to the liquid growth supply 54 and a handpiece 63.

[0055] In operation, oxygen is mixed with the liquid growth supply 54. The oxygenated liquid growth supply is then administered through the handpiece 63. A vacuum pump 65 draws the used liquid through a return conduit 67. A waste canister 69 coupled to the return conduit 67 receives waste materials drawn from the handpiece 63. The apparatus 50 may be provided as a stand-alone apparatus or in a combined system with a microdermabrasion apparatus as discussed further below.

[0056] FIG. 4 illustrates a second preferred embodiment of a wet growth factor apparatus wherein the growth factors are housed in a handpiece 63b. In FIGS. 4 and 5, elements of structure similar to those previously discussed are designated by the same reference numeral followed by the letter “a”. Thus, the apparatus 50a includes an oxygen source 52a that is coupled to a water supply 54a. A valve 56a is provided along an oxygen inlet conduit 58a to control the inclusion of oxygen. A primary inlet conduit 61a is coupled to the water supply 54a and a handpiece 63a.

[0057] In operation, oxygen is mixed with the water. The oxygenated water is then administered through the handpiece 63a. A vacuum pump 65a draws the used liquid through a return conduit 67a. A waste canister 69a coupled to the return conduit 67a receives waste materials drawn from the handpiece 63a. The apparatus 50a may be provided as a stand-alone apparatus or in a combined system with a microdermabrasion apparatus as discussed further below.

[0058] FIG. 5 is a close-up, schematic view of the handpiece 63a. In particular, the handpiece 63a includes a growth factor supply 70a that is stored in a vial or cartridge 72. The cartridge 72 is scaled with a membrane 74 that may be punctured by a needle 76, for example. An O-ring 78 may be provided to form a seal with the inserted needle 76. The needle 76 is coupled to a valve 81 that may be adjusted by an external knob 83 to control the rate at which the growth supply 70 is introduced to the water 85 flowing through a primary channel 87, thereby controlling the concentration of growth factors in the water. As an example and not by way of limitation, the growth supply 70 may comprise a liquid that is added to the water via droplets, similar to an intravenous drip line. It should be noted that the external knob 83 may be replaced by a control at any location on the handpiece, or positioned remotely. The handpiece 63a includes a tip portion 90 that facilitates targeted application of the microdermabrasion media and growth factors. In particular, a nozzle 92 directs the materials toward an aperture 94 through which a portion of a patient’s skin 96 enters. After application to the skin 93, the used materials are drawn by the vacuum source 65a through a return line 67a.

[0059] Since growth factors can be expensive, it will be appreciated that the preferred embodiment illustrated in FIGS. 4 and 5 increases efficiency by enabling a precisely controlled amount of growth factors to be applied to the water. The valve 81 may be configured to shut off and seal the cartridge 72 thus saving the unused supply 70 for future use.

[0060] In FIG. 6, a combined system 100 includes a microdermabrasion apparatus 102 and a wet growth factor apparatus 50. The microdermabrasion apparatus 102 includes an abrasion handpiece 104 while the wet growth factor apparatus 50 includes a separate handpiece 63. A common control unit 106 may be employed for the system 100 and coupled to each handpiece 63, 104. The control unit 106 may include a common pump system, which may include a vacuum source and/or a positive pressure source, to alternatively operate each handpiece 63, 104. A switch 108 may be provided on the control unit 106 to alternately operate the pump system between the handpieces 63, 104. The microdermabrasion media may be stored in the control unit 106. The growth media may be stored in the control unit 106 or in the fluid delivery handpiece 63 as described above.

[0061] FIG. 7 is a schematic view of a preferred embodiment of a growth factor fluid delivery system 120 wherein the growth material is disposed in a handpiece 122. In FIG. 7, a preferred embodiment of a stand-alone delivery system 120 is illustrated. As discussed above, however, it is to be expressly understood that the delivery system 120 may be incorporated into a combined system that also includes a microdermabrasion apparatus. A tube 124 couples the handpiece 122 to a vacuum source 126. A water, or fluid, filter 128 is provided on the tube 124. The handpiece 122 includes a removable, ultrasonic tip 131 that is electrically coupled to a ultrasound unit 133. It is to be expressly understood that the ultrasonic tip 131 may be mounted to any of the handpieces disclosed herein.

[0062] FIG. 8 is a close-up, exploded view of the handpiece 122. The handpiece 122 includes a housing 135 that defines a chamber 137 for receiving a cartridge 139. The cartridge 139 stores fluid containing the growth factor(s). The handpiece 122 specifically depicts a vacuum handpiece 122. However, handpiece 122 can be used in any system. For example, the handpiece 122 could be implemented in the system of FIG. 6 in place of handpiece 63. As with the FIG. 6 embodiment, a switch 108 may be provided to enable the user to select vacuum suction handpiece 122, and/or the positive pressure handpiece 104. In the preferred embodiment, the vacuum suction is applied continually while the positive pressure is applied intermittently. An inner portion 142 of the housing 135 is configured to removably secure the cartridge 139 without sealing off the tube 124. For example, the housing inner portion 142 may include axially extending tabs 144 which are radially spaced apart from each other. A fluid passageway 146 is defined between an outer surface 148 of the cartridge 139 and the inner surface 149 of the housing 135, as further shown in FIG. 12. Since the fluid passageway 146 is not sealed from the tube 124, the passageway 146 is in constant fluid communication with the tube 124.

[0063] Prior to assembly, the cartridge 139 may be provided with a removable cap 151 which covers an applicator 153 located at a distal end 155 of the cartridge 139. With the cap 151 removed and the cartridge 139 inserted into the chamber 137, a removable handpiece tip 157 is coupled to the housing 135. As an example and not by way of limitation, the tip 157 may include internal threads that register with external threads 159 on the housing 135. A variety of other securing mechanisms, including for example, snap-fit or bayonet type fasteners, may be used that allow for the tip 157 to be removed. The tip 157 defines a central hole 162
through which the applicator 153 is disposed. A plurality of vacuum ports 164 are disposed radially around the central hole 162.

[0064] FIGS. 9-11 illustrate different applicators 153-1, 153-2, 153-3, respectively, that may be employed. A variety of other applicators may be employed so long as they can apply the fluid within the cartridge onto a target skin area. For example, in FIG. 9, a roller, or ball, 153-1 applicator is provided. A sponge applicator 153-2 is employed in FIG. 10 while a membrane applicator 153-3 is illustrated in FIG. 11.

[0065] For simplicity, elements in the embodiment of FIG. 12, which are analogous to those in the previous embodiment, are designated by the same reference numeral followed by the letter “b”. FIG. 12 is an axial, cross-sectional view of the handpiece 122b in operation. The cartridge 139b is configured within the handpiece 122b such that as the handpiece 122b is applied to a target area 166b, the applicator 153b contacts the skin 166b. In operation, the vacuum source creates a suction force in a proximal direction as indicated by arrow 168b. This helps draw fluid out of the cartridge 139b, which fluid is applied onto the skin 166b by the applicator 153b. The suction force also draws the isolated piece of skin toward the applicator 153b. The ultrasonic tip 157 facilitates absorption of the growth factors by opening the pores of the skin. The vacuum source removes any excess fluid by drawing the fluid along the fluid passageway 146b into the tube 124.

[0066] In FIGS. 13 and 14, the optional ultrasonic tip is omitted in a further preferred embodiment 220. Instead, the housing 222 includes an integral tip 224. In FIG. 14, interior ribs 226 are provided which securely receive the cartridge 139.

[0067] A further preferred embodiment of a handpiece 320 is illustrated in FIGS. 15-17. For simplicity, elements in this embodiment which are analogous to those in the previous embodiment are designated by the same reference numeral followed by the letter “c”. The applicator is generally referenced by the numeral 153c since it may comprise a variety of different structures as described above, for example, in connection with FIGS. 9-11. The handpiece 320 includes a housing 370 that includes an integral tip 372c. The housing 370 defines a lateral slot 374 large enough for inserting and removing a cartridge 139c. Sealing elements 376 provided around the slot 374 form a seal with the inserted cartridge 139c so as prevent leakage of any fluid in the fluid passageway 146c. The distal tip 372 defines vacuum ports 164c. The tip 372c also includes an annular, beveled edge 378. When viewed in profile as shown in FIG. 16, the beveled edge 378 is concave with respect to the skin 366, thereby causing the target area to move closer to the applicator 153 when the handpiece 320 is pressed against the skin 366. In addition to being beveled, the distal-most portion of the tip 372c is rounded to facilitate smooth travel over the surface of the skin while still maintaining a seal.

[0068] With respect to FIGS. 7-17, the growth material has been predominantly described as being stored in the handpieces 122, 320. However, the growth material can be stored remotely such as in the control units 106, 126 as they may be used in combination with the embodiments of FIGS. 7-17.

[0069] A modular microdermabrasion system 400 according to the invention is illustrated in FIG. 18. For example, an apparatus according to the invention may comprise a microdermabrasion module 410 in combination with a growth factor module 420. As discussed above in connection with FIG. 6, the microdermabrasion 410 and growth factor module 420 may be provided in a single unit (shown in FIG. 6). In addition to the microdermabrasion module 410 and the growth factor module 420, an apparatus according to the invention may also comprise an enhancer module 430 that enhances the application and/or absorption of the growth factors. As examples and not by way of limitation, the enhancer module 430 may comprise a vacuum 432, ultrasound 434, and/or a pressure spray 436. It is to be expressly understood that the enhancer module 430 may comprise any mechanism or procedure that can massage the skin, provide an undulating effect, open pores, or affect the target skin area in any other manner so as to enhance the reception of the growth factors in order to promote healing. It is to be further understood that any such mechanism included in the enhancer module 430, such as the vacuum 432 or ultrasound 434, may be employed individually or in combination with other mechanisms. For example, an apparatus according to the invention may include a pressure spray 436 to “push” the skin, a vacuum 432 to “pull” the skin, and an ultrasonic device 434 to open the skin’s pores.

[0070] A still further preferred embodiment of a handpiece 520 is shown in the exploded view of FIG. 19. This embodiment has many features similar to the embodiments described above. Where an element substantially corresponds to one previously described, the same number is used with an appended lowercase “d”. For example, a cartridge 139d of the embodiment of FIG. 19 may be the same as the cartridge 139 shown in FIGS. 8-11. However, some structural differences of particular importance to the embodiment of FIG. 19 are shown.

[0071] The handpiece 520 has a housing 522 comprising a body 525 and an applicator cap 528. The housing 522 has a proximal end 531 and a distal end 534. The body 525 has a chamber 537 defined by inner wall structures of the housing 522 similar to those in the embodiments of FIGS. 8 and 12-14. Thus, the inner chamber 537 is sized and shaped to receive the cartridge 139d, which is held in the housing 522 by the applicator cap 528. This cap 528 has a positive pressure source connection portion 538. This connection portion 538 has a mounting portion 540 with an O-ring 543 supported thereon for sealed mounting of the cap 528 on a distal end 544 of the body 525. The connection portion 538 also has a positive pressure fluid source connector 546 for receiving a pressurized or positive pressure fluid such as air. The applicator cap 528 further has an applicator tip 549 removably mounted on a distal end 552 of the positive pressure source connection portion 538. The mounting portion 540 thus has a size to provide a mating fit with the body 525.

[0072] FIG. 20 shows a distal end view of the assembled handpiece 520 of FIG. 19. As shown, the applicator tip 549 has pressure delivery ports 558 that are in fluid communication with the positive pressure fluid source connector 546 for delivering pressurized air to the distal end 534 of the handpiece 520. The distal end 534 provides an interface between the handpiece 520 and a surface of the patient’s skin 166 similar to that which is shown in FIG. 12.

[0073] The handpiece 520 of FIGS. 13 and 20 also has a vacuum source connection 564 at a proximal end 531. As in
the previously described embodiments, an inner surface of the body 525 is not sealed to an outer surface of the cartridge 139d. Thus, a fluid passageway 573 is provided inside the housing 522 between the housing 522 and the cartridge 139d, as best shown in the partial sectional view of FIG. 21.

[0074] Vacuum delivery ports 576 are provided in the applicator tip 549 and are in fluid communication with the vacuum source connection portion 538 of the applicator cap 528. Thus, the vacuum delivery ports 576, the connecting passageways 579, and the passageways 573 in the body 525 at least in part form a vacuum chamber 582 within the handpiece. This chamber 582 provides for fluid communication between the vacuum source connection 564 at the proximal end 531, and the vacuum delivery ports 576 at the distal end 534 of the handle 520.

[0075] When a vacuum is applied to the handpiece and the distal end 534 is placed in sealed contact with a patient’s skin 166c, a vacuum pressure is established in the chamber that is less than the external atmospheric pressure. A pressure inside the cartridge 139d is also originally at atmospheric pressure. Thus, when a vacuum is applied, the vacuum pressure in the vacuum chamber 582 within the handpiece is also less than the pressure inside the cartridge 139d. Furthermore, the applicator 153d is fluid permeable and is also in fluid communication with the vacuum chamber 582. Therefore, a fluid 585 within the cartridge 139d is drawn through the applicator 153d. Since the vacuum also draws a portion of the skin 166d into a distal portion of the vacuum chamber 582 and into contact with the applicator 153c, this fluid 585 is wiped or otherwise delivered onto the skin 166d. It should be noted that while the applicator 153d is shown as a ball type applicator, the applicator 153d can alternatively comprise any other type of applicator, including a sponge or a membrane type as shown in FIGS. 9-11.

[0076] While the pressure of the vacuum source is adjustable, it is preferably maintained at a constant level. On the other hand, the pressure of the positive pressure fluid source is preferably applied in pulses or bursts of selected intensity, duration, and frequency. The frequency of these bursts will typically be in a range from 0 to 100 bursts per minute. As shown in the sectional view of FIG. 22, the pressure delivery ports 558 are in fluid communication with the distal portion of the vacuum chamber 582. Furthermore, positive pressure channels 591 provide fluid communication between the positive pressure source connection 546 and the positive pressure delivery ports 558. Therefore, the pressure in the vacuum chamber 582 varies as the bursts occur. Particularly, the pressure in the vacuum chamber 582 is generally a summation of the pressure effects from the constant vacuum source and the pulsating positive pressure source.

[0077] Therefore, as the positive pressure fluid is pulsed from the source, the pressure in the vacuum chamber 582 will at least cycle from a low to a high pressure. In one aspect this may mean cycling between one low pressure and a second low pressure. Under conditions of bursts having sufficiently high positive pressures and volumes, the result will be an actual push and pull effect on the portion of the skin 166d that is in direct, sealed fluid communication with the vacuum chamber 582. With even higher volume and pressure bursts, a cycle having a low pressure push and a high pressure push may be achieved. It should be noted that the angle and the configuration of the pressure delivery ports 558 may also contribute to a massage effect by directing jets of the positive pressure fluid onto the skin 166d. Furthermore, a timely adjusted burst of pressurized air through the pressure delivery ports 558 can cause deeper penetration of the fluid 585 into a treated area of the skin 166d.

[0078] Alternatively described with reference to FIGS. 21 and 22, the apparatus of the present invention comprises the body 525 and the cartridge 139d removably supported in the body 525. The cartridge 139d has a first pressure P1 inside. The body 525 also defines the chamber 582. A second pressure source having a second pressure P2 is in fluid communication with the chamber 582. A third pressure source having a third pressure P3 is also in fluid communication with the chamber 582. The second and third pressures P2, P3 combine to provide a fourth pressure P4, which is generally a summation of the second and third pressures P2, P3. The fourth pressure P4 provides a pressure differential relative to the first pressure P1. This pressure differential in turn causes the fluid 585 to flow from the cartridge 139d.

[0079] Preferably one of the second and third pressures sources provides pressure to the chamber in pulses. The other of the pressure sources provides a steady, continuous pressure to the chamber. Thus, the fourth pressure varies or cycles with the pulses over time. This cycling has the advantage of providing a massage to the skin 166d. Preferably, the net effect is a suction effect, even if the skin 166d experiences both push and pull. In this way, the pressure source providing the suction pressure acts to draw the skin 166d into the distal space 588 when the chamber is in sealed contact with the skin 166d.

[0080] The pressure differential can be advantageously adjusted to affect the flow of the fluid 585 out of the canister 139d. It should be noted that in at least one case the fourth pressure P4 rises to a level equal to or greater than the first pressure P1, and thus stops the fluid from flowing out of the canister during pulses. The fourth pressure P4 also falls to a level below the first pressure P1 between the pulses. As can be appreciated, the second and third pressure sources are preferably adjustable, either electrically and/or manually to provide a desired magnitude for each of the second and third pressures P2, P3. Furthermore, the pressure source providing pulsed pressure may be adjusted with regard to the duration and frequency of the pulses. Thus, a flow rate may be selected by the combination of adjustments. Still further, penetration of the fluid 585 into the skin may be advantageously improved by selective adjustment of the pressures, duration, and frequency.

[0081] The pulsing or repeated bursts cause a massaging effect as the fluid 585 is worked into pores of the skin 166d. This massaging action has been found to cause improved penetration of the fluid 585 into the skin. Such penetration is of particular interest when applying a fluid 585 that contains growth factors such as hormones, vitamins, or oxygen, for skin cell regeneration and healing.

[0082] A further advantage of the massaging effect is that it helps to break up fat and promote collagen growth below
the skin 166d. The vacuum component of the massaging effect has the advantage of drawing blood towards the surface of the skin 166c, which also promotes healing.

[0083] As shown in FIG. 20, abrasion elements 593 can be disposed on the applicator tip 549. These abrasion elements are preferably positioned in a distal end 534 and face distally of the vacuum chamber 582. The position and function of the abrasion elements 593 of this embodiment are similar to those disclosed in copending U.S. application Ser. No. 09/699,220 filed on Oct. 27, 2000 and entitled “APPARATUS AND METHOD FOR SKIN/SURFACE ABRASION”, which is incorporated herein by reference. The abrasion elements 593 are disposed for contacting a portion of the skin 166d that is drawn into the distal space 588 when a vacuum is applied to the handpiece 520.

[0084] One purpose of the abrasion elements 593 is to provide an additional means for causing penetration of the fluid 585. Specifically, the abrasion elements 593 remove dead skin cells from the skin 166d and thereby open the surface and the pores of the skin 166d. In this way, abrasion by the abrasion elements 593 facilitates penetration of the fluid 585 into the skin 166d. At the same time, the abrasion elements 593 help apply the fluid 585 on the skin 166d.

[0085] It should be noted that the positions of the applicator 153c, the abrasion elements 593, the pressure delivery ports 558, and the vacuum delivery ports 576 are advantageously selected to provide effective treatment. It should further be noted that the vacuum delivery ports 576 are positioned circumferentially, radially outward from the other ports, abrasion elements 593, and applicator 153d. With the ports 576 thus positioned, any dead or abraded skin cells and excess fluid 585 are more likely to be suctioned into the ports 576 on the trailing side of the handpiece 520 as it is moved over the surface of the skin 166d.

[0086] The vacuum and pressure delivery ports 576, 558 are generally evenly distributed on the distal end 534 of the handpiece 520. However, the pressure delivery ports 558, as a whole, are located more centrally. The applicator tip has a recess generally corresponding to the distal space 588 in the distal end 534. This recess is surrounded by an outer wall 594 having a distal edge 595. This distal edge 595 may be beveled or rounded to improve patient comfort when being passed over the patient’s skin 166d. This edge 595 will typically lie in a plane to promote sealing with the patient’s skin 166d.

[0087] The portion of the skin 166d that is being treated is permitted to oscillate farther in an up and down direction in the center of the recess than at its edges since this central portion is not restricted by the wall 594. The positive pressure ports 558 are thus located radially inward relative to the vacuum ports 576 to advantageously correspond to the central portion of the skin 166d that is permitted to oscillate farther.

[0088] Advantageously, the applicator tip 549 can be removed and replaced by a new applicator tip having new or different abrasion elements 593. Alternatively, the applicator tip can be made integral with the remainder of the applicator cap 528.

[0089] The applicator 153d of the cartridge 139d is located to register with an opening 596 in the center of the applicator tip 549. With the applicator 153d in this center location, the dermabrasion will occur on both the leading and the trailing sides of the applicator 153d as the fluid 585 is delivered to the skin 166d in a given sweep across the skin 166d. Thus, improved abrasion and penetration are provided. Furthermore, the result is simultaneous abrasion, application of the growth factor fluid 585, and a massage with a single handpiece 520.

[0090] FIG. 23 is a perspective view showing the handpiece 520 of the embodiment of FIGS. 19-22 fully assembled with a pressure line 597 connected to the positive pressure source connector 546.

[0091] FIG. 24 is a diagrammatic view showing a system 610 in which the handpiece 520 can be used. The other embodiments or the handpieces described above may alternatively be used in the system 610. However, some of the handpieces may require modification in order to be properly used in the system 610. In particular, the system 610 can be embodied and sold as a kit including one or more of the elements shown in FIG. 24. One preferred embodiment of the kit includes a portion of the system outlined by box 612. This kit will typically include a positive pressure pump 613 providing a positive pressure fluid source, a pressure adjustment mechanism 616, a pressure gauge 619, a positive pressure fluid holding chamber 622, a pressure burst timing adjustment mechanism 625, and the handpiece 520. The kit defined by the box 612 will also include pressure lines 596 for interconnecting elements of the system 610. The kit may also include a filter or collection canister 631 for catching debris including skin cells removed during treatment. The filter 631 may be integral with the handpiece 520, added to the handpiece 520, or placed in a vacuum line 633. The filter 631 may be made to be removable in order to facilitate disposal and replacement of the filter. Alternatively, the filter may be made to be capable of cleaning and reuse. The filter 631 is placed downstream of the applicator tip 549 so as to catch the excess fluid 585 and the skin cells. The kit defined by the box 612 can be retrofitted to existing systems, which already have a vacuum pump.

[0092] Alternatively, a kit may include the whole system 610. Specifically, the kit can include the elements of box 612, and can further include a vacuum pump 634, a vacuum adjustment mechanism 637, and a vacuum gauge 640. Of course, the system will also include vacuum lines 633 when the vacuum pump 634 and associated equipment are included.

[0093] In use, the pressure adjustment mechanisms 516, 537 can be selectively adjusted to provide the desired suction and pressure, respectively. The pressure adjustment mechanisms can also be selectively adjusted to enhance patient comfort during treatment. It is to be understood that these adjustments are preferably effectuated manually. However, automatic or semi-automatic adjustment by electrical or computer means is also contemplated. The pressure burst timing release adjustment mechanism 625 can also be similarly adjusted to produce an effective massage for increasing penetration of the growth factor fluid 585 into the skin 166d.

[0094] It will be appreciated that in these embodiments 120, 220, 320, the cartridge may be easily assembled and disassembled. A system and method is thus provided for employing disposable cartridges in fluid delivery handpieces. Once the fluid growth fluid is depleted, an old cartridge may be easily removed and discarded, and replaced with a new loaded cartridge.
In all the preferred embodiments, it will be appreciated that a method and system is provided for effective delivery of growth materials to an abraded area. Whether the growth material is dry and mixed in with the abrasion media or wet and delivered separately, the abraded skin area is immediately treated with the growth material so that the growth factors enter into pores of the skin. Such instantaneous application of the growth factors leads to more efficacious treatment and, thus, facilitates quicker healing than conventional techniques.

The efficiency provided by the methods and apparatuses according to the invention also leads to cost savings as patients can avoid not only a second trip to the treatment facility, but expensive lotions and vitamins as well. Though patients may be encouraged to follow up an abrasion process with vitamins, lotions, and other skin care products, the necessity of such products will be significantly reduced as the instantaneous application of growth factors provides the most effective healing by penetrating the open pores of an abraded area.

Many alterations and modifications may be made by those having ordinary skill in the art without departing from the spirit and scope of the invention. Therefore, it must be understood that the illustrated embodiments have been set forth only for the purposes of examples and that they should not be taken as limiting the invention as defined by the following claims. For example, notwithstanding the fact that the elements of a claim are set forth below in a certain combination, it must be expressly understood that the invention includes other combinations of fewer, more or different ones of the disclosed elements.

The words used in this specification to describe the invention and its various embodiments are to be understood not only in the sense of their commonly defined meanings, but to include by special definition in this specification the generic structure, material or acts of which they represent a single species.

The definitions of the words or elements of the following claims are, therefore, defined in this specification to not only include the combination of elements which are literally set forth. In this sense it is therefore contemplated that an equivalent substitution of two or more elements may be made for any one of the elements in the claims below or that a single element may be substituted for two or more elements in a claim. Although elements may be described above as acting in certain combinations and even initially claimed as such, it is to be expressly understood that one or more elements from a claimed combination can in some cases be excised from the combination and that the claimed combination may be directed to a subcombination or variation of a subcombination.

Insufficient changes from the claimed subject matter as viewed by a person with ordinary skill in the art, now known or later devised, are expressly contemplated as being equivalently within the scope of the claims. Therefore, obvious substitutions now or later known to one with ordinary skill in the art are defined to be within the scope of the defined elements.

The claims are thus to be understood to include what is specifically illustrated and described above, what is conceptually equivalent, what can be obviously substituted and also what incorporates the essential idea of the invention.

What is claimed is:
1. A fluid delivery handpiece, comprising:
   a body having structure defining a chamber;
   a cartridge containing the fluid at a first pressure, wherein the cartridge is removably supported in the body;
   a second pressure source in fluid communication with the chamber;
   a third pressure source in fluid communication with the chamber, wherein:
   the second and third pressure sources provide a fourth pressure in the chamber during use;
   the fourth pressure creates a pressure differential with the first pressure; and
   the pressure differential causes the fluid to flow from the cartridge.
2. The fluid delivery handpiece of claim 1, wherein:
   at least one of the second pressure source and the third pressure source provides a pressure to the chamber in pulses;
   the other one of the second pressure source and the third pressure source continuously provides a steady pressure to the chamber;
   the chamber has an opening for scaling engagement with a patient’s skin; and
   the fourth pressure is a variable pressure with respect to time and provides a massage to the skin.
3. The fluid delivery handpiece of claim 2, wherein the second pressure source is a vacuum source that continuously provides a steady vacuum pressure to the chamber to draw the skin of a patient into the opening when the chamber is in sealed engagement with the skin.
4. The fluid delivery handpiece of claim 3, wherein:
   the third pressure source is a pressurized source that provides pressurized pulses to the chamber; and
   the fourth pressure is a summation of the second and third pressures, wherein the fourth pressure:
   rises to a level equal to or greater than the first pressure and thus stops the fluid from flowing out of the canister during pulses and
   falls to a level below the first pressure between pulses.
5. The fluid delivery handpiece of claim 4, further comprising:
   means for adjusting the magnitude of the second pressure; and
   means for adjusting a magnitude, duration, and frequency of the pulses;
   wherein the fourth pressure facilitates a flow of the fluid from the canister at a selected rate.
6. The fluid delivery handpiece of claim 3, further comprising an abrasion element disposed in the opening and adapted for engagement by the skin.
7. A growth factor delivery handpiece having a proximal and a distal end, comprising:
   a body having a vacuum source connection for connecting to a vacuum;
a growth factor cartridge received in the body; and
an applicator cap enclosing the cartridge in the body;
wherein:
the applicator cap is at the distal end and has at least one vacuum delivery port for presenting a vacuum pressure at an interface of the handpiece with a patient's skin;
the applicator cap includes a pressurized fluid source connection for receiving a pressurized fluid; and
the body and the applicator cap form an interior vacuum chamber providing fluid communication between the vacuum source connection and the vacuum delivery port of the applicator cap.

8. The handpiece of claim 7, wherein:
the cartridge has a fluid permeable applicator through which a growth factor in a liquid form can pass; and
the applicator is in fluid communication with the vacuum chamber, wherein a vacuum pressure in the vacuum chamber is less than the pressure inside the cartridge during use, wherein the growth factor is drawn out of the cartridge through the applicator by suction.

9. The handpiece of claim 7, further comprising:
at least one pressurized fluid delivery port;
wherein the pressurized fluid delivery port is in fluid communication with the vacuum chamber and with the pressurized fluid source connection.

10. The handpiece of claim 7, further comprising means for causing a growth factor to penetrate a portion of the skin of a patient being treated.

11. The handpiece of claim 7, wherein:
the vacuum delivery port is located on a distal end of the applicator cap; and
the handpiece further comprises:
at least one pressure delivery port on the distal end of the applicator cap; and
at least one abrasion element on the distal end of the applicator cap proximate to the pressure delivery port.

12. The handpiece of claim 11, wherein:
the pressure delivery port is one of a plurality of pressure delivery ports;
the vacuum delivery port is one of a plurality of vacuum delivery ports;
the pressure delivery ports and vacuum delivery ports are positioned on the distal end of the applicator cap;
the vacuum delivery ports are disposed circumferentially at positions radially outward from the pressure delivery ports and the abrasion elements; and
the applicator cap further comprises an opening in which an applicator of the cartridge is disposed.

13. A dermabrasion and growth factor delivery system for treating the skin of a patient, comprising:
a handpiece having a dermabrasion means for abrading the skin and a growth factor delivery means for delivering a growth factor to the skin and for causing the growth factor to penetrate the skin;
a vacuum connected to the handpiece;
a pressurized fluid source connected to the handpiece; and
a control means connected to the vacuum and the pressurized fluid source for independently controlling a pressure of a vacuum fluid and a pressure of a pressurized fluid of the pressurized fluid source.

14. The system of claim 13, the handpiece having a proximal end and a distal end and comprising:
a body having a vacuum source connection, the vacuum connected to the vacuum source connection;
a growth factor cartridge received in the body; and
an applicator cap enclosing the cartridge in the body;
wherein:
the applicator cap is at the distal end and has at least one vacuum delivery port for presenting the vacuum fluid pressure at an interface of the handpiece with a patient's skin;
the applicator cap includes a pressurized fluid source connection receiving the pressurized fluid; and
the body and the applicator cap form an interior vacuum chamber providing fluid communication between the vacuum connection and the vacuum delivery port of the applicator cap.

15. The system of claim 14, comprising:
a disposable or a reusable debris canister downstream of the vacuum chamber; and
wherein the debris canister is in fluid communication with the vacuum chamber for collecting excess growth factor and dead skin cells from the vacuum chamber.

16. The system of claim 14, wherein:
the cartridge has a fluid permeable applicator through which a growth factor in a liquid form can pass; and
the applicator is in fluid communication with the vacuum chamber, wherein a vacuum pressure in the vacuum chamber is less than the pressure inside the cartridge during use, wherein the growth factor is drawn out of the cartridge through the applicator by suction.

17. The system of claim 14, further comprising:
at least one pressurized fluid delivery port in fluid communication with the vacuum chamber and with the pressurized fluid source connection.

18. The system of claim 14, further comprising means for causing a growth factor to penetrate a portion of the skin of a patient being treated.

19. The system of claim 14, wherein:
the vacuum delivery port is located on a distal end of the applicator cap; and
the handpiece further comprises:
at least one pressure delivery port on the distal end of the applicator cap; and
at least one abrasion element on the distal end of the applicator cap proximate to the pressure delivery port.
20. The system of claim 19, wherein:
the pressure delivery port is one of a plurality of pressure
delivery ports;
the vacuum delivery port is one of a plurality of vacuum
delivery ports;
the pressure delivery ports and vacuum delivery ports are
positioned on the distal end of the applicator cap;
the vacuum delivery ports are disposed circumferentially
at positions radially outward from the pressure delivery
ports and the abrasion elements; and
the applicator cap further comprises an opening in which
an applicator of the cartridge is disposed.
21. The system of claim 13, further comprising:
means for adjusting the vacuum fluid pressure and the
pressurized fluid pressure; and
means for pulsing at least one of the vacuum fluid
pressure and the pressurized fluid pressure.
22. The system of claim 13, further comprising a pressure
burst timing adjustment mechanism connected to the pres-
surized fluid source and enabling an adjustment in a fre-
quency of bursts of the pressurized fluid in the range from
0 through 100 bursts per minute.
23. The system of claim 13, further comprising:
means for massaging the skin; and
means for causing the growth factor to penetrate into the
skin.
24. A method for simultaneously abrading skin and pro-
moting healing of the skin, comprising:
delivering a growth factor to a portion of the skin;
abrading the portion of the skin;
massaging the portion of the skin to facilitate penetration
of the skin by the growth factor; and
wherein the steps of delivering, abrading, and massaging
are performed simultaneously.
25. The method of claim 24, further comprising:
providing a handpiece that holds a growth factor car-	ridge;
providing the cartridge with an applicator; and
wherein the delivering step further comprises:
drawing the growth factor out of the applicator by
establishing a vacuum pressure outside the cartridge
relative to a pressure inside the cartridge.
26. The method of claim 24, the step of causing further
comprising massaging the skin by:
applying a vacuum from a first source at a substantially
constant first pressure to the skin; and
applying bursts of pressurized fluid from a second pres-
surized fluid source to the skin.
27. The method of claim 26, wherein the steps of applying
a vacuum and applying bursts further comprise manually
adjusting at least one of the first pressure and the second
pressure.
28. The method of claim 26, wherein the step of applying
bursts comprises applying bursts at a rate not greater than
about 100 bursts per minute.
29. The method of claim 26, wherein the step of massag-
ing comprises causing a repeated push-pull of the skin by a
sum of effects of the vacuum and the pressurized fluid
bursts.
30. The method of claim 26, wherein the step of abrading
comprises bringing the portion of the skin into contact with
an abrasion element.
31. The method of claim 30, wherein the step of deliv-
ering further comprises applying the growth factor at least in
part by the abrasion element.
32. The method of claim 30, further comprising addition-
ally causing the growth factor to penetrate the portion of
the skin by the step of abrading the portion.
33. The method of claim 24, further comprising causing
the growth factor to penetrate deeper by impinging a pres-
surized burst of fluid on the portion.
34. The method of claim 24, wherein the step of causing
further comprises abrading a portion of the skin to which
the growth factor has been applied.
35. The method of claim 24, further comprising removing
skin cells of the skin and at least a portion of the growth
factor by:
abrading the skin cells from the skin; and
suctioning the skin cells and the portion of the growth
factor by a vacuum.
36. The method of claim 34, wherein:
providing a handpiece that holds a growth factor car-	ridge;
providing the cartridge with an applicator; and
the step of delivering further comprises:
establishing a vacuum pressure outside the cartridge
relative to a pressure inside the cartridge, thereby
drawing the growth factor out of the applicator by
the vacuum pressure;
wherein the step of establishing a vacuum pressure
outside the cartridge and the step of suctioning with
the vacuum are accomplished by the vacuum.
37. A dermabrasion and growth factor delivery kit com-
prising:
a first pressurized fluid pump for providing a source of
pressurized fluid;
a pressure burst timing control mechanism; and
a handpiece having a pressurized fluid source connection
and a vacuum source connection.
38. The kit of claim 37, further comprising:
a pressure gauge;
a pressure adjustment mechanism;
a pressurized fluid holding chamber; and
at least one pressure line for connecting the handpiece to
the first pressurized fluid pump, the pressure gauge, and
the pressurized fluid holding chamber.
39. The kit of claim 37, further comprising at least one
replaceable of refillable cartridge containing a fluid growth
factor.
40. The kit of claim 39, further comprising a return fluid
canister for filtering or otherwise collecting skin cells and an
excess of the fluid growth factor.
41. The kit of claim 40, further comprising:
   a second vacuum fluid pump;
   a vacuum adjustment mechanism;
   a vacuum gauge; and
   at least one vacuum line for connecting the handpiece to
   the second vacuum fluid pump, the vacuum adjustment
   mechanism, and the vacuum gauge.