APPLICATOR FOR FACILITATING DELIVERY OF A SOLUTION TO A SURFACE

The present invention relates to an applicator for facilitating the delivery of a solution to a surface. In particular, the invention relates to an applicator which facilitates the delivery of a therapeutic solution, such as for example a drug containing solution, to the skin of a person or animal.

Although the applicator according to the invention may have a number of different applications, for convenience reference herein will be substantially limited to the primary area of application, delivery of a therapeutic solution.

A number of systems for the delivery of drugs and vaccines are known, the most common of which include delivery via injection and oral administration. Other systems are also known including delivery through the skin via patches and ointments.

The invention advantageously provides an applicator and delivery system which facilitate delivery of a therapeutic solution or drug through the skin. More particularly, the invention advantageously provides an applicator which may be used in conjunction with a laser ablative device for the delivery of a therapeutic solution or drug through the skin.

According to one aspect of the invention there is provided an applicator for facilitating delivery of a solution to a surface, the applicator including:

a receptacle for storage of the solution prior to delivery to the surface, the receptacle being operable between a closed orientation and an open orientation;

an abutting face which in use sealingly abuts the surface, the abutting face including an aperture which facilitates delivery of the solution to the surface and which is in fluid communication with the receptacle when the receptacle is in the open orientation;

wherein as the receptacle is translated from the closed orientation to the open orientation the solution is released from the receptacle to the aperture of the abutting face while the abutting face is maintained in sealing abutment with the surface.

The receptacle for storage of the solution prior to delivery may take any suitable form provided that it may be translated from the closed orientation to the open orientation to facilitate delivery of the solution from the receptacle to the aperture enabling the contact of the solution with the surface, which will be the skin of a patient in the primary field of application, delivery of a therapeutic solution and, drug delivery.

In one embodiment, the receptacle includes a housing having at least one open partition and a threaded cap which threadably engages the housing, the cap including a complimentary partition which engages the partition of the housing when the receptacle is in the closed orientation such that the solution is stored between the partitions, and wherein the cap is rotatable to disengage the partitions of the housing and the cap translating the receptacle to the open orientation, thereby allowing egress of the solution to the aperture of the abutting face.

The housing may include any number of partitions, each of which constitutes a subspace of the receptacle when engaged with the complementary partition of the cap. In a preferred embodiment, however, the housing includes four open partitions which are engaged by four complimentary partitions of the cap when the receptacle is in the closed orientation.

In another embodiment, the receptacle includes a housing having at least one open partition and a cap which engages the housing, the cap including a complimentary partition which engages the partition of the housing when the receptacle is in the closed orientation such that the solution is stored within the receptacle, and wherein the cap includes actuating means to disengage the partitions of the housing and the cap translating the receptacle to the open orientation, thereby releasing the solution to the aperture of the abutting face.

In this embodiment, it is preferred that the at least one open partition of the housing includes a pair of opposing tabs which extend from opposing sides of the housing towards the centre of the housing and the partition of the cap includes a central tab which engages the tabs of the housing and constitutes a gate between the tabs of the housing.

Preferably, the central tab of the cap is engaged by the actuating means such that on actuation of the actuating means the central tab is disengaged from the tabs of the housing to allow egress of the solution to the aperture of the housing.

The cap and the housing may cooperate with each other in any suitable fashion. In one embodiment, the cap is an integral unit which is fitted, preferably snap-fitted, on the housing. In another embodiment, the cap includes a body portion which is hingedly attached to the housing of the receptacle, and an insert portion which includes the central tab and which is sandwiched by the upper portion of the cap and the housing of the receptacle, the insert portion including a press button which engages the central tab and which constitutes the actuating means.

As previously mentioned, it is envisaged that the primary field of application of the applicator will be delivery of therapeutic and drug containing solutions, particularly delivery of such solutions in conjunction with the use of a laser ablative device.

The laser ablation of skin so as to facilitate the delivery of a drug therethrough is known. This involves the application of a laser beam to the surface of the skin so as to ablate the surface of the stratum corneum to render the surface more permeable to a solution containing the drug to be delivered. This technology is considered in depth in a number of patent documents and will not be dealt with in detail here apart from noting that laser ablative devices generally including a firing end which constitutes a tip of the device and through which the laser is fired.

In view of the above, and considering the primary area of application of the applicator in conjunction with a laser ablative device, the applicator is preferably adapted to engage the tip of a laser ablative device and includes a window through which the laser of the ablative device can be fired.

The window of the applicator, or an additional window provided in the applicator may

facilitate viewing of the skin of the patient at the site of ablation. In one embodiment, as will be dealt with hereafter, the applicator is affixed to the skin surface prior to engagement with the laser ablative device. In this case, the window of the applicator facilitates viewing of the skin through the applicator so as to ensure that the applicator is affixed to a desired position on the skin surface. In this case, it will be of no concern whether the skin may be viewed through the applicator after application of the laser ablative device given that the area of skin to be treated is automatically targeted due to the positioning of the applicator.

Notwithstanding the above, in a preferred embodiment the window is located in the cap at a position which is commensurate with the aperture of the housing of the receptacle such that the laser, when fired, passes through the window of the cap and aperture of the housing to the skin of the patient.

The applicator, no matter what field of application, includes an abutting face which in use sealing abuts the surface to which the solution is to be delivered. Preferably, the abutting face is located on the under side of the housing of the receptacle and is preferably provided with an adhesive layer which, on the removal of a protective paper overlaid on the adhesive layer, can be affixed to the surface.

Embodiments of the invention will now be described in more detail with reference to the accompanying drawings in which:

Figure 1 illustrates a first embodiment of the applicator;

Figure 2 illustrates a second embodiment of the applicator; and

Figure 3 illustrates the above first embodiment of the applicator attached to an LAD.

Figure 1 illustrates an embodiment of the applicator (10) which is to be used in conjunction with a laser ablative device. In this regard, the applicator (10) acts as an attachable tip for a laser ablative device.

The applicator (10) includes a housing (11) and a cap (12). The cap (12) is threadably mounted on the housing (11) by means of a thread (13) on the housing (11). The housing (11) and cap (12) constitute a receptacle for storage of the solution prior to delivery to a desired surface.

The housing (11) includes four partitions (14) spaced about its circumference. The partitions 14 define an enclosed space (15) with the outer wall (16) of the housing (11). The inner wall (17) of each partition (14) is circumferentially positioned on an aperture (18) of the housing (11).

The cap (12) includes four complementary partitions (not shown) each of which engages an inner wall (17) of a respective partition (14) of the housing (11). When the complementary partitions of the cap (12) engage the partitions (14) of the housing (11), the space (15) defined by the partitions (14) is closed. It is this closed space which stores solution prior to the delivery of the solution to the desired surface.

The cap (12) may be turned from the closed position, in accordance with the arrow shown on the cap (12), to an open position whereby the complementary partitions of the cap (12) disengage the inner walls (17) of respective partitions (14) of the housing (11). This facilitates the egress of solution held in the spaces (15) through gaps (19) between the inner walls (17) of the partitions (14) to the aperture (18).

In use, the applicator (10) is attached to the surface, particularly the skin of a person to which a drug is to be administered, by removing a protective paper (20) from the applicator (10) to uncover an adhesive strip (21) located on the underside of the housing (11). Once the applicator (10) is secured to the surface of the skin, a laser ablative device is engaged with the cap (12) of the applicator (10), engagement being confirmed by an engagement pin (22) which interacts with the laser ablative device.

Having engaged the applicator (10), the laser ablative device is fired through an aperture (23) in the cap (12), the aperture (23) housing a lens (24). The laser which is fired through

the aperture (23) of the cap (12) then proceeds through the lens (24) and the aperture (18) of the housing (11) to the skin. Thus, the ablation of the skin under the applicator (10), particularly in the area of the aperture (18) is facilitated.

Once a desired amount of ablation has been achieved, firing of the laser of the laser ablative device is halted. The cap (12) is then turned to release solution containing a desired drug from the spaces (15) of the housing (11). The solution egresses to the aperture (18) at which time it comes in contact with the ablated skin surface.

The applicator (10) can be held in place by the adhesive strip (21) as desired and for a time period sufficient to allow permeation of the solution through the ablated skin surface.

Referring to Figure 2, an applicator (30) is provided which again includes a housing (31) and a cap (32). The cap (32) in this instance is hingedly attached to the housing (31) by means of a hinge (33).

The housing (31) includes partitions (34) which define an enclosed space (35) with the outer wall (36) of the housing (31). The space (35) houses the solution to be delivered to the surface of the skin prior to use of the applicator (30).

In this embodiment, the applicator (30) is provided with an insert (37) which is sandwiched by the housing (31) and the cap (32). The insert (37) may alternatively be integrally formed in the cap (32). The insert (37) includes a tab (38) which engages the partitions (34) of the housing (31) by sliding into slots (39) of the partitions (34). The tab (38) is engaged by a press button (40) of the insert (37), the press button (40) projecting through an aperture (41) of the cap (32) when the cap (32) is engaged with the housing (31).

In use, according to this embodiment, a piece of protective paper (42) is removed to uncover an adhesive layer (43) located on the underside of the housing (31). The applicator (30) is then positioned on the area of skin and fixed by the adhesive (43). At that time, the cap 32 is engaged with the housing (31), the press button (40) protruding

through the aperture (41) of the cap (32) and the tab (38) of the insert (37) engaging the partitions (34) of the housing (31).

Once the applicator (30) is secured in place on the skin, a laser ablative device is engaged with the cap (32) and the laser of the device fired. The laser proceeds through an aperture (44) of the cap (32), the aperture 44 housing a lens (45). The aperture (44) and lens (45) are positioned directly above an aperture (46) of the housing (31). As such, the laser of the laser ablative device can be fired through both the aperture (44) of the cap (32) and the aperture (46) of the housing (31) to ablate the skin beneath the aperture (46).

Once a desired degree of ablation has been achieved, the firing of the laser of the laser ablative device is halted. After this, a solution held within the space (35) of the housing (31) is released to the aperture (46) by pressing the press button (40) which causes disengagement of the tab (38) with the partitions (34) of the housing (31).

The applicator (30) is maintained in position over the skin for a desired time period to allow permeation of the solution into the skin. The time frame may be measured by a colour change compound which may be included as a tablet (47) located in the housing (31).

Referring to Figure 3, the applicator (10) may be easily attached to a laser ablative device (50) for use. Attachment may be achieved by any suitable means as described above.

Throughout this specification and the claims which follow, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that that prior art forms part of the common general knowledge in Australia.

Those skilled in the art will appreciate that the invention described herein is susceptible to variations and modifications other than those specifically described. It is to be understood that the invention includes all such variations and modifications which fall within its spirit and scope. The invention also includes all the steps, features, compositions and compounds referred to or indicated in this specification, individually or collectively, and any and all combinations of any two or more of said steps or features.

CLAIMS:

1. A delivery device for facilitating delivery of a solution to a surface, the device including:

a receptacle for storage of the solution prior to delivery to the surface, the receptacle being operable between a closed orientation and an open orientation;

an abutting face which in use sealingly abuts the surface, the abutting face including an aperture which facilitates delivery of the solution to the surface and which is in fluid communication with the receptacle when the receptacle is in the open orientation;

wherein as the receptacle is translated from the closed orientation to the open orientation the solution is released from the receptacle to the aperture of the abutting face while the abutting face is maintained in sealing abutment with the surface.

2. A delivery device according to claim 1, wherein the receptacle includes a housing having at least one open partition and a threaded cap which threadably engages the housing, the cap including a complimentary partition which engages the partition of the housing when the receptacle is in the closed orientation such that the solution is stored between the partitions, and wherein the cap is rotatable to disengage the partitions of the housing and the cap translating the receptacle to the open orientation, thereby allowing egress of the solution to the aperture of the abutting face.

3. A delivery device according to claim 2, wherein the housing includes four open partitions which are engaged by four complimentary partitions of the cap when the receptacle is in the closed orientation.

4. A delivery device according to claim 1, wherein the receptacle includes a housing having at least one open partition and a cap which engages the housing, the cap including a complimentary partition which engages the partition of the housing when the receptacle is in the closed orientation such that the solution is stored within the receptacle, and wherein the cap includes actuating means to disengage the partitions of the housing and the cap translating the receptacle to the open orientation, thereby releasing the solution to the

aperture of the abutting face.

5. A delivery device according to claim 4, wherein the at least one open partition of the housing includes a pair of opposing tabs which extend from opposing sides of the housing towards the centre of the housing and the partition of the cap includes a central tab which engages the tabs of the housing and constitutes a gate between the tabs of the housing.

6. A delivery device according to claim 5, wherein the central tab of the cap is engaged by the actuating means such that on actuation of the actuating means the central tab is disengaged from the tabs of the housing to allow egress of the solution to the aperture of the housing.

7. A delivery device according to claim 6, wherein the cap is an integral unit which is fitted, preferably snap-fitted, on the housing.

8. A delivery device according to claim 6, wherein the cap includes an body portion which is hingedly attached to the housing of the receptacle, and an insert portion which includes the central tab and which is sandwiched by the upper portion of the cap and the housing of the receptacle, the insert portion including a press button which engages the central tab and which constitutes the actuating means.

9. A delivery device according to claim 1, wherein the delivery device is a drug delivery device for delivery of a solution containing a drug to the skin of a patient.

10. A delivery device according to claim 9, wherein the delivery device is adapted to be used in conjunction with a laser ablative device.

11. A delivery device according to claim 10, wherein the delivery device is adapted to engage the tip of a laser ablative device and includes a window through which the skin of the patient can be viewed and though which the laser of the ablative device can be fired.

12. A delivery device according to claim 11, wherein the window is located in the cap at a position which is commensurate with the aperture of the housing of the receptacle such that the laser, when fired, passes through the window of the cap and aperture of the housing to the skin of the patient.

13. A delivery device according to claim 1, wherein the abutting face is located on the under side of the housing of the receptacle and is preferably provided with an adhesive layer which, on the removal of a protective paper, can be affixed to the surface.