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ATTACHMENT FOR LASER EMITTING DEVICE

The present invention relates to an attachment for use on a laser emitting device. More particularly, the invention provides an attachment which is adapted to engage a laser emitting device and thereby facilitate activation of the device to enable firing of the device. The invention also relates to a laser ablation system which involves the use of such an attachment.

The laser ablation of the skin of a patient in order to increase permeability of the skin and thereby allow permeation of a drug containing solution through the skin is known. Laser emitting devices may take any suitable form. Recent trends see such devices becoming more portable and more easily operated. Activation of laser emitting devices is generally achieved through a trigger mechanism. In this regard, the devices are generally aimed at the area of skin to be ablated and fired by a user as desired at the site.

During the ablation process, debris is produced in the form of particles of the stratum corneum which has been ablated and/or interstitial fluid permeating through the ablated skin. Such debris can cause contamination of the laser emitting device during firing of the device. As such, it is generally considered desirable to provide the device with a protective cap or attachment for protecting the firing end of the device.

The present invention advantageously provides an attachment for use on a laser emitting device which is disposable and which protects the device from contamination by debris and which facilitates activation of the device to minimize the risk of misfiring of the emitting device.

According to one aspect of the invention there is provided an attachment for a laser emitting device, including: a body having a first end configured to detachably engage the laser emitting device and further having a second end; and a cap associated with the second end of the body, wherein said body includes engagement means adapted to facilitate preliminary engagement with the laser emitting device which enables energising of the device and secondary engagement with the laser emitting device which enables firing of the device.

In a preferred embodiment, a first tab, preferably having a bevelled face, is located on the first end of the body of the attachment which, on initial engagement of the attachment on the laser ablation device, engages a lever of the laser emitting device. It is

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preferred that a second tab is located on an opposing side of the first end of the body relative to the first tab, the second tab engaging a switch of the laser emitting device as the attachment is inserted into the laser emitting device to a final operating position so as to activate the laser emitting device.

5 The engagement of the disposable attachment with the laser emitting device facilitates activation of the device. Generally, it is preferable that some form of electronic recognition be provided between the disposable attachment and the laser emitting device such that when the attachment is engaged with the device, the device is electronically activated to facilitate firing of the device. More particularly, in a preferred embodiment
10 the body includes electronic identification means, preferably an electronic chip, which in use cooperates with a sensor of the laser emitting device. That is, the cooperation of the electronic identification means with the sensor facilitates firing of the laser emitting device.

More particularly, it is preferred that the second tab of the body, as discussed
15 above, includes electronic identification means which is readable by the laser emitting device on insertion of the attachment into the device to the final operating position.

In an alternative embodiment the engagement means includes an annular retaining lip, preferably with a bevelled face, on the first end of the body of the attachment.

Given that debris is produced during the ablation process and that this debris may
20 collect on the disposable attachment, it is preferred that the disposable attachment be a "single use" attachment. That is, when ablation is complete, either on halting firing of the emitting device or on the removal of the attachment from the device, the attachment is altered so that it cannot be reused.

Single use may be achieved by any suitable means. For example, the disposable
25 attachment may be mechanically altered on removal from the emitting device so that it cannot be re-engaged with the device. However, in a preferred embodiment the electronic identification means is adapted to be altered on firing of the laser emitting device, such as by the application of reverse voltage, such that the electronic identification means no longer cooperates with the sensor, thereby preventing further firing of the laser emitting
30 device. The disposable attachment may also, or alternatively be encoded to ensure single use of the attachment. That is, on engagement with the emitting device the attachment effectively registers with the device whereby any subsequent engagement will not activate

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the device.

The body and cap may be integral with each other. Alternatively, the body may be adapted to engage the cap. In this regard, whether the two portions are integral or whether they engage each other, it is preferred that the body includes a passage extending between the first and second ends and the cap includes a substantially central aperture, the passage and aperture being commensurate so as to enable passage of the laser beam of the laser emitting device through the attachment. Preferably, a transparent membrane or lens is positioned between the passage of the body and the aperture of the cap. The lens may take any suitable form and is made from any suitable material. For example, the lens may have a layered structure. However, the lens is preferably formed from teflon.

In many instances, the laser is advantageously directed to a very specific site on the skin to be ablated. In this regard, it is preferable that the laser beam emanating from the emitting device be well defined without any substantial halo effect. With this in mind, in a preferred embodiment, the aperture of the cap is such that the laser beam of the laser emitting device is clipped on firing of the laser beam through the aperture. As will be understood by those skilled in the art, the term "clipped" refers to the masking of the laser beam to ensure that the beam which is emitted from the end of the attachment, and therefore the device, to the target area is well defined.

As mentioned above, it is preferred that the body engage the cap, such as by a mechanical engagement. In this regard, in a preferred embodiment the body includes at its second end a flange which is received by the cap of the attachment. The flange may be retained within the cap by any suitable means. For example, the flanges may be adhered or welded within the cap. Preferably, the flange is ultrasonically welded within the cap.

It may be desirable in some instances to provide a mark on the skin to clearly indicate the target site for ablation. This may be so as to ensure that any further ablation is

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carried out on the same site, or to clearly indicate the area of ablation for drug administration or interstitial fluid collection. In this regard, in a preferred embodiment the proximal end of the body of the attachment includes a recess which houses an ink pad, the ink pad including an aperture which is aligned with the apertures of the body and the cap
5 and including a plurality of projections which, when the body is engaged by the cap, project through a plurality of complimentary apertures in the cap. It will be appreciated that the marking material need not be limited to ink, but may be any material which can apply a mark to the skin.

Although references made to an inkpad above, it will be appreciated that any other
10 suitable marking means may be provided to facilitate marking of the skin as desired. In any event, it is preferred that the plurality of apertures of the cap include a plurality of slits which extend outwardly from the substantially central aperture of the cap.

In a preferred embodiment the body of the attachment further includes a control device that is configured to control the operation of the laser emitting device when the first
15 end of the body is engaged with the laser emitting device. The control device may be associated with or separate to the engagement means of the attachment. In a preferred embodiment, the control device comprises an electric circuit.

The electric circuit may be configured to allow a laser element located in the laser emitting device to draw an electric charge from a power source associated with the laser
20 emitting device when the first end of the body is engaged with the laser emitting device. Furthermore, the electric circuit may comprise a fuse element configured to cease operating after a predetermined amount of electric charge has passed through the electric circuit to prevent the laser element from drawing electric charge from the power source.

In a particularly preferred embodiment, the electric circuit comprises a memory
25 containing a predetermined code sequence. More preferably, the electric circuit is configured to communicate the predetermined code sequence to the laser emitting device. Still further, the electric circuit may be configured to delete the predetermined code sequence from the memory upon operation of the laser emitting device.

As previously stated, the body includes a first end that is configured to detachably
30 engage a laser emitting device. In a preferred embodiment, the body is configured to detachably engage the laser emitting device for movement therein when at least a

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minimum amount of pressure is applied to the cap by contact with the skin to actuate a mechanism in the laser emitting device for operation of the laser emitting device. In particular, it is preferred that the cap is positionable substantially in a focal plane of the laser emitting device when at least the minimum amount of pressure is applied to the cap by contact with the skin.

5 In an alternative embodiment of the invention there is provided an attachment for a laser emitting device, comprising: engagement means configured to detachably engage the laser emitting device; a contact surface attached to the engagement means and configured to contact the skin of a patient; and control means configured to control the operation of the laser emitting device when the attachment is engaged with the laser emitting device,
10 wherein said engagement means is adapted to facilitate preliminary engagement with the laser emitting device which enables energizing of the device, and secondary engagement with the laser emitting device which enables firing of the device.

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

15 Figure 1 illustrates a first embodiment of the disposable attachment;
Figure 2 illustrates a second embodiment of the disposable attachment;
Figures 3A and 3B illustrate third and fourth embodiments of the disposable attachment;

Figure 4 illustrates a first stage of insertion of the attachment into a laser emitting
20 device;

Figure 5 illustrates a second stage of the attachment inserted into the laser emitting device; and

Figure 6 illustrates the attachment being ejected by the laser emitting device.

Referring to Figure 1, the disposable attachment 10 is illustrated in its assembled
25 form and in an exploded view. The disposable attachment 10 includes a body 11 and a cap 12 which cooperate with each other. As mentioned above, these portions may be integral with one another.

The body 11 includes a first tab 13 located on the distal end 14 of the body 11. As best illustrated in Figure 4, the tab 13 is provided to engage a laser emitting device to
30 facilitate engagement of the disposable attachment with the device. In this embodiment, the first tab 13 is located on a longitudinally extending ridge 15 of the body 11.

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The body 11 also includes a second tab 16 located on an opposing side of the body side 11 relative to the first tab 13. The second tab 16 extends longitudinally along the underside of the body 11 and is adapted to engage the laser emitting device to activate the device (as best illustrated in Figure 5).

5 The body 11 includes an aperture 17 which is aligned with an aperture 18 of the cap 12. A lens 19 is also provided and is housed between the aperture 17 of the body 11 and the aperture 18 of the cap 12. This arrangement facilitates firing of the laser through the body 11 and cap 12 and also ensures firing through the lens 19. In certain embodiments, the aperture 17 of the body 11 and/or the aperture 18 of the cap 12 may be
10 sized so as to facilitate clipping of the laser beam as it is fired through the disposable attachment 10. Generally, the cap 12 will provide a comfortable and effective contact surface with the skin of the patient. Also, the attachment 10 is advantageously designed to allow the passage of at least 92% of the laser burst energy.

Referring to Figure 2, in an alternative embodiment the disposable attachment 20
15 includes a smart chip 21 which cooperates with a sensor of the laser emitting device. The smart chip 21 may be incorporated to ensure that the firing of the laser emitting device is prevented if the disposable attachment is damaged, or it may act as a registration device so that only attachments including a smart chip 21 can be used in conjunction with a particular laser emitting device. The smart chip 21 may further provide a means of
20 ensuring single use of the disposable attachment. In this regard, as previously mentioned, on firing of the laser emitting device the smart chip 21 may be electronically altered to prevent refiring of the laser emitting device.

As illustrated in Figure 2, the disposable attachment 20 is also provided with an inkp pad 22 which includes a plurality of projections 23. The projections 23 are positioned
25 so that they can protrude through apertures 24 of the cap 12 when the body 11 engages the cap 12. In this embodiment, the disposable attachment may be used to mark the skin at the target area during the ablation process, thereby ensuring that the target site is easily identified on removal of the laser emitting device from the skin. The disposable attachment 20 may also be provided with a cap 25 which is removable from the cap 12.

30 Referring to Figures 3A and 3B, further embodiments of the disposable attachment are illustrated. In these embodiments, the cap 12 is integral with the body 11. The integral

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form of the attachment as illustrated may be formed by conventional moulding techniques and includes a lens 19 which may be positioned and set during moulding of the disposable attachment.

5 Figures 4-6 illustrate the initial engagement, full engagement and ejection of the disposable attachment relative to a laser ablation device 30 in cross section.

Referring firstly to Figure 4, the disposable attachment 10 initially engages the device 30 as the first tab 13 of the body 11 engages a lever arm 31 of the device 30. The lever arm 31 includes a press button 32 which is biased by a spring 33. Therefore, as the attachment 10 is forced into the end of the device 30, the first tab 13 engages the lever arm
10 31 compressing the spring 33 until the first tab 13 is engaged by the lever arm 31. Advantageously, the attachment 10 is configured such that it can only be inserted into the device 30 in one position or orientation. Even in the initial engagement position illustrated in Figure 3, the attachment 10 is securely held on the device 30, minimizing the risk of the attachment 10 becoming detached during charging of the laser emitting device 30.

15 At this initial engagement, the smart chip 21 is located in a front portion of the device 30. At this position, a sensor 34 of the device 30 cannot read the smart chip 21. However, in particular embodiments the attachment 10 may be provided with an identification means which is electronically accessible by the emitting device on initial engagement. This may be physically embedded in the attachment 10. Further, the
20 identification means, such as a code, may advantageously be electronically wiped or altered on use to ensure that the attachment 10 can be identified by the device 30 and used only once, thus rendering the attachment with a "single-use" functionality.

On further insertion of the disposable attachment 10 into the laser emitting device 30, as illustrated in Figure 5, the attachment 10 may be moved into a final engagement
25 position. During this movement, the second tab 16 of the attachment 10 forces a shutter 41 to rotate away from the attachment, while the smart chip 21 slides over the sensor 34 allowing the sensor 34 access to the chip 21. The attachment method advantageously ensures reliable connection between the sensor and the chip. The rotation of the shutter 41 allows the second tab 16 to engage an ejector plate 42 which moves backwards to
30 compress an interlock switch 43. This action and further insertion of the attachment 10 into the device 30 facilitates activation of the device 30. Thus, on full insertion of the

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attachment 10 into the device 30 to the position illustrated in Figure 5, enables firing of the device 30. That is, the movement of the ejector plate opens a laser shutter (not shown) of the device 30. The laser shutter, when closed, is capable of absorbing a substantial amount of the laser operating wavelength of the laser emitting device 30. For example, the shutter
5 is preferably capable of absorbing 99.9% of the operating wavelength of the laser.

From Figures 4 and 5 it will be readily understood that on initial engagement, as illustrated in Figure 4, the attachment can be maintained in position while the laser emitting device 30 remains deactivated. It is only on movement to the second position illustrated in Figure 5 that the full engagement of the attachment 10 with the laser emitting
10 device 30 enables firing of the device 30. In certain embodiments, there may be a firing time limit, that is firing must occur within, for example, 5 seconds after full engagement of the attachment 10 with the device 30. The time limit may of course be selected as desired. The attachment protrudes from the end of the device at a desired distance, such as about 6mm at a minimum. This advantageously ensures that the laser focal point is correct and
15 that subsequent ablation is performed as desired.

Once the firing of the device has been conducted, the attachment 10 can be released and ejected from the laser emitting device 30 by pushing on the exposed button 32 of the lever arm 31. Advantageously, removal of the attachment 10 is achieved without requiring the user to touch the attachment. On ejection, the shutter 41 returns to its original position.
20 When there is no attachment inserted into the laser emitting device, the ejector plate 42 and shutter 41 are in their resting position. In this position, the end of the laser emitting device 30 which acts as the attachment key hole is closed off. This advantageously prevents access to the interior of the laser emitting device and excess dust contamination. A transparent membrane may also be provided inside the attachment itself to ensure that the
25 interior of the laser emitting device is not contaminated when the attachment is in position on the device.

In certain embodiments, the laser emitting device may include an LED which may indicate, for example, laser charge status, engagement of the attachment with the device and power status of the laser emitting device.

30 The material of construction of the attachment is of no particular importance, but it is preferred that the attachment be manufactured from material which is biocompatible and

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which maximizes ease of use while minimizing and risk of adverse reactions, such as allergic reactions.

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
5 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
10 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.

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CLAIMS:

1. An attachment for a laser emitting device, including:
a body having a first end configured to detachably engage the laser emitting device
5 and further having a second end; and
a cap associated with the second end of the body,
wherein said body includes engagement means adapted to facilitate preliminary
engagement with the laser emitting device which enables energising of the device and
secondary engagement with the laser emitting device which enables firing of the device.
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2. An attachment according to claim 1, wherein a first tab is located on the first end of
the body of the attachment, said first tab being adapted to engage a lever of the laser
emitting device on said preliminary engagement.
3. An attachment according to claim 2, wherein the first tab has a bevelled face.
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4. An attachment according to claim 2, wherein a second tab located on an opposing
side of the body relative to the first tab is adapted to engage a switch of the laser emitting
device on said secondary engagement.
- 20 5. An attachment according to claim 4, wherein the second tab includes electronic
identification means which is readable by the laser emitting device on secondary
engagement with the device.
6. An attachment according to claim 1, wherein the engagement means includes an
25 annular retaining lip on the first end of the body.
7. An attachment according to claim 6, wherein the retaining lip has a bevelled face.
8. An attachment according to claim 1, wherein the second end of the body engages or
30 is integral with the cap.

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9. An attachment according to claim 1, wherein the body includes a passage extending between the first end and the second end and the cap includes a substantially central aperture, the passage and aperture being commensurate so as to enable passage of the laser beam of the device through the attachment.
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10. An attachment according to claim 9, wherein a transparent membrane is positioned between the passage of the body and the aperture of the cap.
11. An attachment according to claim 10, wherein said membrane allows the passage of at least 92% of the laser burst energy.
- 10 12. An attachment according to claim 10, wherein said membrane is formed from teflon .
13. An attachment according to claim 9, wherein the aperture of the cap is such that the laser of the laser emitting device is clipped on firing of the laser through the aperture.
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14. An attachment according to claim 1, wherein the body includes a flange which is received by and engages the cap.
15. An attachment according to claim 1, wherein the body includes a control device
- 20 configured to control the operation of the laser emitting device when the first end of the body is engaged with the laser emitting device.
16. An attachment according to claim 15, wherein the control device includes an electric circuit.
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17. An attachment according to claim 16, wherein the electric circuit is configured to allow a laser element located in the laser emitting device to draw an electric charge from a power source associated with the laser emitting device when the first end of the body is engaged with the laser emitting device.
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18. An attachment according to claim 16, wherein the electric circuit comprises a fuse

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element configured to cease operating after a predetermined amount of electric charge has passed through the electric circuit to prevent the laser element from drawing electric charge from the power source.

5 19. An attachment according to claim 16, wherein the electric circuit comprises a memory containing a predetermined code sequence.

20. An attachment according to claim 19, wherein the electric circuit is configured to communicate the predetermined code sequence to the laser emitting device.

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21. An attachment according to claim 19, wherein the electric circuit is configured to delete the predetermined code sequence from the memory upon operation of the laser emitting device.

15 22. An attachment according to claim 1, wherein the body is configured to detachably engage the laser emitting device for movement when at least a minimum amount of pressure is applied to the cap by contact with the skin to actuate a mechanism in the laser emitting device for firing of the laser emitting device.

20 23. An attachment according to claim 22, wherein the cap is positionable substantially in a focal plane of the laser emitting device when at least the minimum amount of pressure is applied to the cap by contact with the skin.

24. An attachment according to claim 1, wherein on firing of the laser emitting device or on removal of the attachment from the device, the attachment is altered so that it cannot
25 be reused.

25. An attachment for a laser emitting device, comprising:
engagement means configured to detachably engage the laser emitting device;
a contact surface attached to the engagement means and configured to contact the skin of a patient; and

30 control means configured to control the operation of the laser emitting device when the attachment is engaged with the laser emitting device, wherein said engagement means

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is adapted to facilitate preliminary engagement with the laser emitting device which enables energizing of the device, and secondary engagement with the laser emitting device which enables firing of the device.