LIGHT THERAPY BANDAGE SYSTEM

[0001] This application claims the priority benefit of U.S. application Serial No. 61/791,738, filed March 15, 2013, the disclosure of which is incorporated herein by reference.

INCORPORATION BY REFERENCE

[0002] "Light Therapy Platform System", U.S. Patent Publication No. US 2013-0066404 A1, published on March 14, 2013, by Tapper et al., the disclosure of which is incorporated herein by reference in its entirety.

FIELD

[0003] The present embodiments relate to devices and methods for delivering light-based skin therapy treatments for improving skin health, and/or relieving subdermal tissue using light-emitting diode (LED) light therapy, although other types of light radiating sources can be used.

BACKGROUND

[0004] Certain light spectrums emitted by LEDs (blue or red) are known to be therapeutic for skin treatment by being beneficial to better factor wound healing or relieving muscular or other subdermal tissue pain. However, there is a need to provide users/patients with a convenient at-home light therapy delivery device such as a wearable bandage that is adjustable or flexible to conform to different sizes and shapes, and that is simple to use without user discomfort. The alternative is visiting a doctor's office to receive treatments.

[0005] Prior known light therapy devices have suffered from problems relating to the exposure of the LEDs and the associated circuitry to power the LEDs to contact by users. More particularly, in an effort to maximize light communication to a patient, the LEDs have been disposed in a manner which allow them to be physically engaged (e.g., touched) by a patient, or even contact a treatment surface, which processes are debilitating to the LEDs as a result of the accumulation of dirt and oil. In addition, any

such engagement can be dangerous to patients who are exposed to the sharp or hot edges of the LEDs and the associated circuitry. The exposure of detailed circuitry presents an intimidating and unpleasant experience.

[0006] Another problem with prior known devices is that the LED arrangement is fixed and not adjustable to better correspond to would location, size or shape, or to be better placed relative to pain areas. The LEDs of such devices are not selectively arrangeable in a variety of patterns to better go near particular pain areas of a wound.

[0007] It is desired to provide alternative means of using the benefits of the light therapy in a manner to maximize therapeutic efficiencies in exposure while maintaining ease and convenience of use. For this reason, a variety of light weight, flexible and adjustable embodiments are disclosed within this disclosure incorporating a variety of energy varying applications responsive to user conditions or needs.

SUMMARY

[0008] The present embodiments comprise phototherapy systems and devices comprising a therapeutic lamp platform for radiant lamps such as LEDs which are disposed in an assembly comprising a multi-layer structure wherein the LEDs are guarded from patient contact.

[0009] The present embodiments comprise an adjustable/flexible platform for providing a light-based therapy that is adaptable to the user's receptive surfaces, whether based on size or condition, wherein the light therapy can be applied without limitation of the kind of light and without limitation of the ultimate purpose of the therapy, i.e., beauty, health, pain relief and/or wound healing. Such sources can vary in the form of the radiant energy delivery. Pulsed light (IPL), focused light (lasers) and other methods of manipulating light energy are encompassed within the present embodiments. Other methods of light emission may comprise continuous, pulsed, focused, diffuse, multi wavelength, single wavelength, visible and/or non-visible light wavelengths.

[0010] A present embodiment describes forms such as a shaped/fitted bandage with LED light emitted from LED bulbs or LED strips that are capable of being adjusted to accommodate the variances in the desired treatment area.

[0011] The present disclosure thus describes a fully flexible and adjustable LED device which provides improved usability and light dispersion. Such device comprises light therapy bandage system including a spacing and insulating layer to effectively elevate the lamp radiation from the treatment area (e.g. skin) of the patient's last user. The lamps are recessed relative to the insulating layer and further covered by a sheer mesh layer to protect the user from being able to contact the lamps.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIGURE 1A is a plan view of one embodiment of a therapeutic lamp platform comprising a lumbar brace;

[0013] FIGURE 1B is an opposite plan view of the device of Figure 1A;

[0014] FIGURE 2 is an exploded view of the device of Fig. 1A and 1B;

[0015] FIGURE 3 is a perspective view of the device of Fig. 1A and 1B on a patient;

[0016] FIGURE 4A is a perspective view of another embodiment comprising a knee brace;

[0017] FIGURE 4B is an alternative view of the device of 4A;

[0018] FIGURE 4C is an alternative view of the device of 4A;

[0019] FIGURE 4D is an alternative view of the device of 4A;

[0020] FIGURE 5 is an exploded perspective view of the device of Fig. 4A;

[0021] FIGURE 6 is an alternative embodiment of a knee brace;

[0022] FIGURE 7 is an exploded view of the device of Fig. 6;

[0023] FIGURE 8 is another embodiment of a knee brace;

[0024] FIGURE 9 is another embodiment of a knee brace ;

[0025] FIGURE 10 is a top perspective view of one embodiment of the subject bandage system;

[0026] FIGURE 11 is a bottom view of the device of Fig. 10; and

[0027] FIGURE 12 is an exploded view of the device of Fig. 10.

DETAILED DESCRIPTION

[0028] The subject embodiments relate to a phototherapy system including methods and devices, preferably comprising a wearable device with a removable, portable battery pack for powering therapeutic lamps in the device. The subject devices display numerous benefits including a light platform wherein the platform and the lamps therein are properly positionable relative to a user during use with no human touch. That is, structural componentry of the device not only supports the lamp platform on the user, but functions as a guide for the appropriate disposition of the lamps relative to the treatment areas of the user. The structural assembly of the device precludes sharp or hot surfaces from being engageable by a user as the lamps are recessed relative to an inner reflective surface nearer to and facing the patient treatment surface. Circuit componentry to communicate power to the lamps is also encased within the flexible wall structure. Therapeutic light, shining through wall apertures or mesh, is communicated to the user while the lamps and the circuitry are effectively covered within the layered wall structure. A surface is thus presented to the user that is properly spaced for the desired therapeutic treatments, yet provides improved ventilation so that an aesthetic and appealing device surface is presented to the user that minimizes user discomfort. Other benefits relate to the adjustability of the device in the form of a bandage which forms upon user receipt to match a treatment surface, e.g., back or knee, of the user. The overall assembly is purposefully constructed of relatively light weight and minimized componentry for ease of user use and comfort.

[0029] More particularly, and with reference to Figs. 1A, 1B and 2, the subject embodiments preferably comprise a lumbar brace **10** that can be worn by a patient/user such as shown in Fig. 3. The brace **10** can be supported and affixed on the user by a hook-and-loop locking fabric at the terminal ends of the brace. Such a brace will typically include heat wraps for lower back and hips **14** on the exterior of the brace **10** opposite of the patient facing surface. The LED platform of the bandage comprises an elastic member **12** on which LED strips **14** are mounted on a support layer **16** that is

heat insular and/or reflective. It is important that the layer **16** be flexible and stretchable with the elastic bandage **12**. Note that the wires connecting the LEDs to the battery pouch **18** are of extra length to allow stretching of the dimension between the LED strips. Power is supplied by a battery pack **20** received in battery pack **22**. The LED lights **14** are spaced from direct engagement of the patient by an insular layer **24** which can range from a mesh cloth to a flexible sheet of formable material in which the strips are integrally molded.

[0030] In one embodiment the mesh cloth allows communication of the lamp radiation through to the patient without reflection.

[0031] In another embodiment the flexible formable material **24** can have apertures (not shown) functioning as a window to allow the light to pass through and the remainder can be of a light reflective surface. In this embodiment the LEDs are effectively hidden from the patient, where layer **24** is a mesh cloth that the patient can, of course, see the LEDs tips and the associated circuitry.

[0032] The subject system may also include control systems to vary light intensity, frequency or direction. A portable battery pack is included.

[0033] The subject adjustability may be implemented through "smart" processing and sensor systems for enhanced flexibility/adjustability in the form of adjustable energy output, adjustable wavelengths, priority zones, timers, and the like. The sensors of the sensor systems will enable the subject embodiments to have the ability to evaluate the treatment area and plan a smart treatment, utilizing more or less energy on the priority zones. The subject embodiments can be smart from the standpoint of body treatment area such as knee or back, and of skin type, age, overall severity of problems and have the ability to customize the treatment accordingly.

[0034] In yet another embodiment, the lamps are embedded in a flexible sheet of formable material and are integrally molded as strips within a material sheet.

[0035] With reference to Figs. 4A, 4B, 4C, 4D and 5, the LED bandage is shown where the LED strips are arranged in a diamond pattern and the elastic bandage is formed as a unitary sleeve which is pulled over the leg to the knee area. The multi-structural layer of the brace is shown in Fig. 5 to comprise an elastic bandage platform **50**, a first layer reference material that may be constructed of emergency blanket

material **52**, LED light strips **54**, and a surface layer **56** to cover the strips **54**.

[0036] With reference to Figs. 6 and 7, another alternative embodiment of a knee brace is shown where the elastic bandage is a wraparound of the knee as it is shown in Fig. 6 again in a diamond pattern about the patient's kneecap including the multi-layer structures such as is shown in Fig. 7.

[0037] Figs. 8 and 9 show yet other embodiments which can also function as a wraparound knee brace including the same multi-layer structures such as is shown in Fig. 9.

[0038] In other embodiments the strip pattern can be arranged in different placements as shown in the Figures to better match treatment to the desired patient area. For example, rather than being equally spaced, the strips can be bunched together in a group, or several groups. In which case the bandage material would be constructed of a material that would allow the strips to be selectively moved and then affixed to the material at different locations. Hook-and-loop fastening fabric could accomplish this structural objective.

[0039] Figures 10 and 11 show another embodiment wherein the battery energy sources **70** are encased in battery shrouds **72** and received with controller **74** on a primary fabric layer **76**. Fig. 10 shows the top layer of the device away from a user treatment area (not shown). Fig. 11 shows the bottom surface of the device of Fig. 10 wherein the therapeutical lamps of radiation communicate to the treatment area through a plurality of spacer window openings **80**.

[0040] Fig. 12 shows more clearly the component elements of the device. The battery pack **72** and controller **74** are either mechanically attached or heat bonded to the primary fabric layer **82** which can be secured to a patient treatment area through a strap (not shown) received in a buckle **84** and buckle receiver **86** assembly. The therapeutic lamps preferably comprise a plurality of LED strips **90** mounted on a foam and reflective layer **92** in a manner so that the LEDs are aligned with the windows **80**. Power to the LED strips **90** is communicated from the battery **72** via wires (not shown). The foam and reflective layer **92** comprises a heat insulator and spacer so that the LEDs on the strips **90** are recessed relative to the opposite surface of the layer **92** than that on which they are mounted. The strips **90** and layer **92** form a subassembly that in

one embodiment is selectively removable and replaceable from and to the device. Layer **92** is highly flexible as are the strips **90** so that the strip **90** and layer **92** subassembly is preferably flexible along a plurality of directions aligned with the areas intermediate the strips for the overall purpose of providing a device which is conformable to properly and comfortably cover a non-flat treatment area. The layer **92** is dimensioned so that the lamps on the LED strips **90** don't break the surface plane of layer **92** on which a reflective layer **94** is attached. Reflective layer **94** preferably comprises some type of flexible foil suitable for reflecting the radiant energy of the lamps. A secondary fabric layer **96** covers the foam and reflective layer **92** with a sheer mesh **98** which allows lamp radiation to be communicated to the treatment area with minimal obstruction. The effect is that of a plurality of expanding cones of radiant energy from the lamps of the LED strips **90** that is communicated through the foam layer **92** for therapeutic treatment of the treatment area.

[0041] The controller **74** is intended to communicate operational aspects of the device to the user in several ways. When the user actuates an on switch an indicator such as a light or beep sounder will let the user know that the device is operating. The controller will time the operation to a predetermined limit such as 10 or 15 minutes. In addition, the controller will count usage or cycle sessions to indicate to the user via a controller display of how many sessions have been run and additionally, to disable the device after the sessions have occurred so many times that the LED efficiency in generating therapeutic radiation has been so diminished that the device should no longer be used. The controller will also deactivate the indicator light after the session has been timed out or may alternatively send another sound beep to the user. Alternatively, the indicator can also provide for indicating battery life or lamp failure.

[0042] It will be appreciated that variants of the above-disclosed and other features and functions, or alternatives thereof, may be combined into many other different systems or applications. Various presently unforeseen or unanticipated alternatives, modifications, variations or improvements therein may be subsequently made by those skilled in the art which are also intended to be encompassed by the following claims.

WHAT IS CLAIMED IS:

1. A phototherapy system comprising:
a plurality of therapeutic lamps;
an elastic bandage supporting the lamps;
an insular material disposed between the lamps and the bandage; and,
a cover material covering the lamps.

2. The system of claim 1 wherein the cover material is light reflective.

3. The system of claim 1 wherein the insular material is light reflective.

4. The system of claim 1 wherein the lamps are selectively arrangeable on the bandage.

5. The system of claim 1 wherein the insular material compresses a foam and reflective layer spacing the lamps from the cover material.

6. The system of claim 5 wherein the foam and reflective layer includes a plurality of lamp windows aligned with the lamps for communicating lamp radiant energy therethrough.

7. The system of claim 6 further including a battery supply and controller.

8. The system of claim 7 wherein the elastic band includes a fabric layer, flexible and compliant for conforming to a user treatment area.

9. The system of claim 8 wherein the LEDs, battery and controller are disposed on the fabric layer for system flexibility in a plurality of directions for enhanced conformance of the bandage to the user treatment area.

10. The system of claim 1 wherein the cover material comprises a sheer mesh layer.

11. A radiant energy bandage system comprising:

a plurality of therapeutic lamps;

a controller for operating the lamps;

a source of energy to power the lamps and the controller;

a flexible fabric layer to support the lamps, energy source and controller;

a foam and reflective layer including a spacer foam and radiant reflector and having a plurality of spacer windows aligned with the lamps for communicating lamp radiation therethrough; and

a sheer mesh fabric layer disposed to cover the foam and reflective layer.

12. The bandage system of claim 11 wherein the lamps comprise a plurality of LED strips attached to the foam and reflective layer to form a lamp and spacer subassembly.

13. The bandage system of claim 12 wherein the lamp and spacer subassembly is selectively removable and replaceable.

14. The bandage system of claim 11 wherein the lamps are recessed relative to the radiant reflector.

15. The bandage system of claim 14 wherein the spacer foam is heat insular.

16. The bandage system of claim 11 wherein the controller includes a timer for limiting lamp on-time and use cycles.

17. The bandage system of claim 11 wherein the lamps, controller and energy source are disposed on the flexible fabric layer for system flexibility fabric layer for system flexibility in a plurality of directions for enhanced conformance of the bandage system to a user treatment area.