The invention relates to a wound treatment device (100) with at least one elastically deformable vacuum-generating element which can be actuated directly by hand and which is arranged on and connected directly to a film-like wound-covering element (2) that covers the wound chamber (1). The vacuum-generating element is a hollow body (4.1) whose cavity (7), in the state with the device applied to the patient’s body, communicates directly with the wound chamber (1) via an opening (3) formed on the wound-covering element (2). At least one absorption body (5) that absorbs the wound secretions is positioned in the wound chamber (1) and is surrounded by a finely porous sleeve (6) that is permeable to liquid. The hollow body (4.1) is provided with at least one valve (12).
FIG. 14

FIG. 15
WOUND TREATMENT DEVICE WITH ELASTICALLY DEFORMABLE VACUUM-GENERATING ELEMENT

[0001] The invention concerns a wound treatment device with at least one elastically deformable vacuum producing element, which can be operated directly by hand, being arranged on a film-like wound cover element, covering the particular wound cavity, and being connected to the latter tubelessly. A wound treatment device of the above mentioned kind is found in DE 198 44 355 A1. The vacuum producing element shown in FIG. 2 is glued directly to the wound cover film. The vacuum producing element is a bell-shaped hollow body, filled with a precompressed sponge, which swells up during the suction process only when a water-soluble plate located between the sponge and the wound surface dissolves. The precompressed sponge also presses against the entire inner surface of the hollow body. The compression and subsequent expanding of the sponge in the direction of the wound can also occur without a water-soluble plate if the sponge is compressed only when the bandage is put in place and the sponge is accommodated in the hollow body. The drawback in both instances is that the compressed sponge upon expanding presses against the sensitive wound surface.

[0002] The problem of the invention is to design an improved wound treatment device with vacuum producing element, integrated with the wound cover film, wherein the precompressed filling can be done away with.

[0003] This problem is solved by a wound treatment device of this kind, wherein

- the vacuum producing element is a hollow body, whose cavity in the condition placed on the patient’s body is in direct contact with the wound cavity via an opening worked into the wound cover element,
- at least one absorption body to absorb the wound secretions is placed in the wound cavity, being surrounded by a fine-pore, liquid-permeable envelope.
- The aim is to achieve a new kind of wound treatment device, in which the wound exudate is taken up by the absorption body, while at the same time the suction function is supported by a simplified vacuum system which can be activated by hand. The absorption body can be a sheetlike shape, whose final volume increases greatly in the course of the absorption process, without exerting a noteworthy pressure on the wound surface. However, if a pressure is to be exerted on the wound, one can at least resort to an additional absorption body, encased or not, which can be placed directly on the wound surface, i.e., underneath the mentioned flat absorption body. The additional absorption body can also take on the function of a trapping layer for the coarse, chalklike secretions. The absorption body can be placed dry or slightly premoistened on the wound surface.
- The additional absorption body can be a perforated pouch containing absorbent particles, a shaped piece of foam plastic or fleece, possible with superabsorbent particles. Superabsorbing foam plastic beads can be poured into the pouch.
- The encased absorption body can be one which is interspersed with superabsorbents. The envelope can have pores whose size does not greatly exceed that of the superabsorbing particles. In this way, the wound secretions sucked up remain inside the envelope until the absorption body is removed from the wound and help improve the climate of the wound space, i.e., maintain the moist surroundings. The wound exudate does not necessarily have to be taken away through an additional conduit, unless there is an excess of wound exudate.
- The absorption body can be made from various medically safe materials, such as open-cell foam plastic, gel or textile. Preferably, it consists of at least one layer of a fleecelike textile material containing cellulose and having superabsorbent particles, which is easy to work and make ready. The absorption body can consist of or contain alginate fibers. It is expressly pointed out that the absorption body (or bodies) placed in the wound cavity or in the cavity of the hollow body is (are) not precompressed.
- Finally, the shaped absorbing piece or the pouch with absorber particles contained therein can be placed directly on the wound, without having to use the mentioned encased sheetlike absorption body.
- In order to kill germs, the encased absorption body and/or the additional absorption body of fleece or foam plastic or an antiadhesive film element which can be placed directly on the wound can be provided with substances containing silver or copper, for example, in nanocrystalline form. As the antiadhesive film element, one can use a perforated so-called wound spacer grid, which is arranged between the wound surface and the absorption body. Substances containing zinc are also possible, and can support the wound healing process.
- Furthermore, the absorption body can contain carboxymethylcellulose, natural or synthetic hyaluronic acid, honey and/or its derivatives, propolis and/or pharmaceutically active plant extracts, such as Aloe vera.
- The compressible hollow body can have any desired external shape, provided that it is connected tubelessly to the wound cover element and sits stable thereupon. The hollow body can have the shape of a prism, such as a cuboid. Preferably, the hollow body is configured as an elastically deformable solid of revolution, such as one made of elastomer. The hollow solid of revolution can be spherical, cylindrical or conical, but it can also have the shape of a pear or oval cylinder. An especially advantageous configuration of the hollow body is a cuboidal or somewhat cylindrical bellows, which can be deformed essentially only in one direction, say, perpendicular to the cylindrical axis.
- Preferably, the hollow body is joined to a circumferential flat collar, which can be joined to the wound cover element directly or via a cushion ring. The cushion ring can have a flat to round or toroidal cross section. The task of the cushion ring is to gently transfer the pressure on the hollow body when pressed by hand against the patient’s skin and to distribute it evenly. The cushion ring can be made from any desired deformable and especially elastomeric material, such as rubber or plastic.
- The hollow body can also be designed as a single piece with the wound cover element. This can be the case, in particular, for the smaller sizes of wound cover element. A single-piece configuration can furthermore pertain to a product which is assembled from the hollow body, the wound cover element, and the encased absorption body. Here, “single-piece” refers to a one-part design, e.g., a molded piece.
- The wound treatment device can be provided with at least one window arranged on the wound cover element and able to be removed or swiveled, on which the mentioned
A vacuum indicator can be connected or connectible to the valve, by which the patient himself or the doctor can read off the vacuum level and change it if necessary by activating the hollow body or the valve. The vacuum indicator can be part of an external pump. The vacuum producing element itself, i.e., the hollow body, can take on the supplemental function of a vacuum indicator if it is appropriately scaled. For example, the vacuum indicator can be a scaled glass tube with piston, connected directly to the valve.

With the wound treatment device according to the invention, the following kinds of wounds can be treated:

- Mechanical wounds such as cuts and puncture injuries, bite wounds, gunshot wounds, abrasions;
- Iatrogenic wounds;
- Thermal wounds, such as burns;
- Chemical wounds, such as acid or alkali burns;
- Open wounds;
- Perforating wounds and others.

Some additional selected usage possibilities are listed below:

- As a dressing to treat an edematous or inflammatory altered wound region;
- As a dressing to treat a microbiologically laden wound surface, by using the suction force to take germs or cell fragments with enclosed, dehydrated or [missing words?] into anaerobic regions of the swollen absorption body;
- As a dressing to remove inflammatory cytokines, matrix metalloproteinases, TIMPs, degraded fibronectin (holds the tissue together) or other substances causing chronicity;
- As a dressing to regulate the air humidity, since the absorption body releases the aqueous components back into the air through their vapor pressure;
- As a dressing on top of a primary applied wound spacer grid or a gauze as a secondary dressing having no immediate sheetlike contact with the wound;
- As a dressing beneath a film permeable to water vapor to achieve a breathable dressing;
- As a dressing during a compression therapy;
- As a dressing during a maggot therapy promoting epithelial cell migration and granulation, in which the larvae of _Lucilia sericata_ are used; this involves, in particular, acute and chronic wound infections. Instead of larvae, a substance secreted by the maggots can be used, namely, their saliva.

The benefits of the invention consist, in particular, in that:

- Thanks to the use of the encased absorption body, the moist environment within the wound cavity can be maintained,
- The absorption process can be supported by the air evacuation,
- The air evacuation can be done by the patient; it is enough to exert a pressure by hand or finger on the bellows or the bell of the hollow body;
- The absorption body can serve as a storeroom for the wound exudate; the liquids need not be carried away from the wound region; instead, they can be gathered close to the wound;
- The time and the costs of the wound treatment can be reduced.

Sample embodiments of the invention are explained more closely hereafter by means of the drawing. The figures show:

- FIG. 1, a wound treatment device with a bell-shaped hollow body, glued onto the skin of the patient, in a schematic representation;
- FIG. 2, the wound treatment device per FIG. 1 in a perspective view;
- FIG. 3, the wound treatment device per FIG. 1 with a thickening arranged in its apex region, in a schematic representation;
- FIG. 4, the wound treatment device per FIG. 1 in use;
- FIG. 5, the wound treatment device per FIG. 1 in a top view of the wound cover element;
- FIG. 6, the wound treatment device per FIG. 1, with a cushion ring, in a schematic representation;
- FIG. 7, the cushion ring in top view of its flat side;
- FIG. 8, a cross section A-A per FIG. 7;
- FIG. 9a, a second embodiment of the bell-shaped hollow body, with inward pointing projections, in a schematic view;
- FIG. 9b, the hollow body per FIG. 9a with swollen absorption body;
- FIG. 10a to 10c, a further, single-piece embodiment of the wound treatment device, likewise in a schematic representation;
- FIG. 11a to 12, a fourth, bellows-like embodiment of the wound treatment device, in a schematic representation;
- FIG. 13, a wound treatment device with a cuboidal, bellows-like hollow body, in a perspective view;
- FIG. 14, the wound treatment device per FIG. 11, with a cushion ring, in a schematic representation; in a schematic representation;
- FIG. 15, a wound treatment device with a ball-shaped hollow body, in a schematic representation; and
- FIG. 16, a hollow body with bottom plate element, likewise in a schematic representation.

FIGS. 1 and 2 show a first embodiment (reference number 100) of the wound treatment device, consisting of a film-like wound cover element 2, a bell-shaped hollow body 4.1 and an absorption body 5. The hollow body 4.1 is made as a molded piece of polyethylene in the deep drawing process. The wall thickness of the translucent hollow body is 0.8 mm. The spherical molded piece passes into a peripheral flat collar 14, which is glued onto the wound cover element 2 by means of a medically safe adhesive. The wall of the hollow body bounds a cavity 7, which is in direct contact with a wound cavity 1 via an opening 3 made in the wound cover element 2. The wound cavity 1 is defined by a wound surface, designated as 24, and the wound cover element 2.

The hollow body 4.1 is provided with a oneway valve 12, which allows the flow through of air and—if necessary—excess wound secretions, if the hollow body is connected via an additionally provided conduit 19 to a corresponding mechanical or electrical suction device (not shown), in one direction (arrow R). Thus, a return flow from the outside is prevented. Even so, another oneway valve 13 (see FIG. 2) can be provided, with which the pressure inside the hollow body and thus in the wound cavity 1 can be regulated. Medications can be dispersed via a conduit 23, indicated by broken line.

FIGS. 1, 3 and 4 shows the wound treatment device 100 in use. First, the opening 3 on the filmlike wound cover
element 2 is cut out according to the wound size and the wound cover element 2 is glued onto the skin of the patient. The absorption body 5 is laid flat in the wound cavity 1 underneath the wound cover element 2 and only then is the hollow body 4.1 installed with its flat collar 14. FIGS. 1 and 3 show this condition. The absorption body 5 is surrounded by a perforated envelope 6, whose dimensions (width and length, or diameter) are much larger than those of the absorption body. In the present case, the absorption body 5 is around 5.5 cm x 5.5 cm in plan view on its flat side and the envelope is around 7.0 cm x 7.0 cm in size.

[0061] According to FIG. 3, the hollow body 4.1 has a thickening 17 in the region of its apex 18, which can facilitate the deformation of the hollow body when pressing on it by hand, as shown in FIG. 4.

[0062] The embodiment per FIG. 5 calls for arranging the hollow body 4.1 on a round window 15, which can swivel via a film hinge 20. The window 15 is coated peripherally on its underside with a release glue 21, so that it can be opened and glued back again as needed, for example, in order to take out the swollen absorption body. A pull flap 11 facilitates the handling of the window.

[0063] The hollow body 4.1, as shown in FIG. 6, can be braced against a cushion ring 8 by its flat collar 14. The cushion ring 8 (see FIGS. 7 and 8) is made from an elastomeric material, which allows the pressing forces exerted by hand to be distributed over its entire surface. It is beneficial that the cushion ring 8 can increase the effective volume of the cavity 7 of the hollow body 4.1.

[0064] FIGS. 9a and 9b show a similar embodiment (designated 200) of the wound treatment device, in which several spacers 22 are provided on the inside of the hollow body 4.2. A perforated pouch 10 with a somewhat lens-shaped absorption body 9 contained therein is laid in the wound cavity 1. When the absorption body 9 swells to its maximum volume (see FIG. 9b), the spacers 22 prevent the absorption body 9 from taking up the entire cavity 7, since some free spaces 16 remain between the envelope 6 and the inner surface of the hollow body 4.2, making it possible to disperse liquid medications via the conduit 23 (see FIG. 2) even before removal of the absorption body 9.

[0065] Optionally, the absorption bodies 5, 9 can contain a quantity of nanoparticles of silver, copper or zinc, which are useful as antibacterial agents.

[0066] FIG. 16 shows a hollow body whose ball-shaped, compressible part 29 passes into a plate-like bottom element 28, on which is arranged an opening 27, situated in the middle, and making contact with the wound cavity 1 (not shown). The bottom element 28 makes possible a uniform distribution of pressure when exerting pressing force by hand.

[0067] FIGS. 10a, 10b and 10c: show a one-piece wound treatment device 300, consisting of a hollow body 4.1 or 4.2 with a film segment of the wound cover element, an absorption body 5 glued to this, and a removable, peripherally arranged, ring shaped protective film 25. The collar 14 of the hollow body 4.1 is firmly glued or welded to the wound cover element. Before putting the wound cover element in place, the protective film 25 is pulled off, so that a glue layer 26 located on the underside of the wound cover element is exposed (see FIG. 10b) and the device can be glued onto the patient’s skin all around the wound (see FIG. 10c). The wound treatment device 300 is designed as a prefabricated disposable product, which can be made in various sizes.

[0068] FIGS. 11a, 11b and 12 show a wound treatment device 400, which is basically similar to that shown in FIG. 5, with the difference that its hollow body 4.3 has the shape of a cylindrical bellows, which can be deformed basically only in one direction, corresponding to a pressing force designated as P (see FIG. 11b). The bellows can be compressed very easily by hand or by finger. FIG. 12 shows, in turn, the bellows-like hollow body 4.3 in two positions. The hollow body 4.3 can be swiveled through a very wide angle a by the film hinge 20.

[0069] The embodiment of FIG. 13 is a wound treatment device 500 having a film-like rectangular window 15, on which a cuboidal hollow body 4.4 is arranged. The design principle of the wound treatment device 500 is identical to that of the wound treatment device 400.

[0070] As FIG. 14 shows, the two hollow bodies 4.3, 4.4 can likewise be braced against the cushion ring 8 by their flat collar 14. Preferably, the bellows of the hollow body is configured such that its portion extending from the flat collar 14 has smaller dimensions (diameter or width) than those of the compressible part. This configuration makes it possible to shove the finger of the hand underneath the upper, compressible part and press the bellows with the thumb, without having to exert pressure on the wound cover element 2.

[0071] Finally, FIG. 15 shows a wound treatment device 600 whose hollow body 4.5, provided with the flat collar 14, is roughly pear shaped. The one-way valve 12 can be seen in the apex region.

[0072] All wound treatment devices 100 to 600 described, and their parts, come in sterile packaging.

LIST OF REFERENCE SYMBOLS

[0073] 1 wound cavity
[0074] 2 wound cover element
[0075] 3 opening
[0076] 4.1 to 4.5 hollow body
[0077] 5 absorption body
[0078] 6 envelope
[0079] 7 cavity
[0080] 8 cushion ring
[0081] 9 absorption body
[0082] 10 pouch
[0083] 11 pull flap
[0084] 12, 13 one-way valve
[0085] 14 flat collar
[0086] 15 window
[0087] 16 space
[0088] 17 thickening
[0089] 18 apex
[0090] 19 conduit (additional)
[0091] 20 hinge
[0092] 21 release glue
[0093] 22 spacer
[0094] 23 one-way valve
[0095] 24 wound surface
[0096] 25 protective film
[0097] 26 glue layer
[0098] 27 bottom element
[0099] 28 opening
[0100] 29 part
[0101] angle α
[0102] 2 P pressing force
[0103] 3 direction R
[0104] 100; 200; 300 wound treatment device
[0105] 400; 500; 600
1. A wound treatment device having at least one elastically deformable vacuum producing element, which can be operated directly by hand, arranged on a film-like wound cover element, which is adapted to cover a wound cavity in a patient’s body, and which is adapted to be connected to the patient’s body tubelessly, wherein the vacuum producing element is a hollow body having a cavity that is adapted to communicate with the wound cavity via an opening worked into the wound cover element when the wound cover element is placed on the patient’s body, and wherein the wound treatment device further comprises at least one absorption body that is adapted to be placed in the wound cavity to absorb wound secretions, the absorption body being surrounded by a fine-pore, liquid-permeable envelope.

2. The wound treatment device according to claim 1, wherein the hollow body is in the shape of a bell or tray.

3. The wound treatment device according to claim 1, wherein the hollow body is in the shape of a bellows.

4. The wound treatment device according to claim 1, wherein the hollow body has the shape of a ball or a pear.

5. The wound treatment device according to claim 1, wherein the hollow body has a collar, which is joined to the wound cover element.

6. The wound treatment device according to claim 1, wherein the hollow body is designed as a single piece with the wound cover element.

7. The wound treatment device according to claim 1, wherein the hollow body is supported by a cushion ring.

8. The wound treatment device according to claim 1, wherein the cushion ring is elastic.

9. The wound treatment device according to claim 1, wherein the wound treatment device is provided with at least one valve.

10. The wound treatment device according to claim 9, wherein the valve is arranged on the hollow body.

11. The wound treatment device according to claim 9, wherein the valve is a one-way valve.

12. The wound treatment device according to claim 1, wherein the absorption body is sheetlike in a nonswollen condition.

13. The wound treatment device according to claim 1, wherein the absorption body has a shape other than sheetlike in a nonswollen condition.

14. The wound treatment device according to claim 1, wherein the absorption body is interspersed with superabsorbing particles.

15. The wound treatment device according to claim 14, wherein the envelope has pores whose size does not greatly exceed that of the superabsorbing particles.

16. The wound treatment device according to claim 1, wherein the absorption body is a textile.

17. The wound treatment device according to claim 1, wherein the absorption body consists of or contains alginate fibers.

18. The wound treatment device according to claim 1, wherein the absorption body is spongelike.

19. The wound treatment device according to claim 1, wherein the absorption body is gel-like.

20. The wound treatment device according to claim 1, wherein the absorption body and/or the envelope is enriched with metallic nanoparticles.

21. The wound treatment device according to claim 1, wherein the opening of the wound cover element is covered by a window, wherein the hollow body is arranged on the window, and wherein the window can be removed or swiveled away from the wound cover element.

22. The wound treatment device according to claim 1, wherein the hollow body is provided with a bottom element, and wherein an opening is provided in the bottom element.

23. The wound treatment device according to claim 1, wherein the absorption body contains carboxymethylcellulose.

24. The wound treatment device according to claim 1, wherein the absorption body is enriched with natural hyaluronic acid.

25. The wound treatment device according to claim 1, wherein the absorption body contains an addition of synthetic high-molecular hyaluronic acid substrate(s).

26. The wound treatment device according to claim 1, wherein the absorption body contains honey and/or its derivatives and/or propolis.

27. The wound treatment device according to claim 1, wherein the absorption body contains pharmaceutically active plant additives.

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