United States Patent

[11] 3,625,220

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[21] Appl. No. **864,353**
[22] Filed **Oct. 7, 1969**
[45] Patented **Dec. 7, 1971**
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[54] **EXTENDIBLE SUTURE GUARD**
9 Claims, 7 Drawing Figs.

[52] **U.S. Cl.** **128/335,**
128/335.5, 285/303
[51] **Int. Cl.** **A61b 17/04**
[50] **Field of Search** 128/334,
335, 335.5, 336, 337, 339; 285/298, 302, 303;
24/129 D

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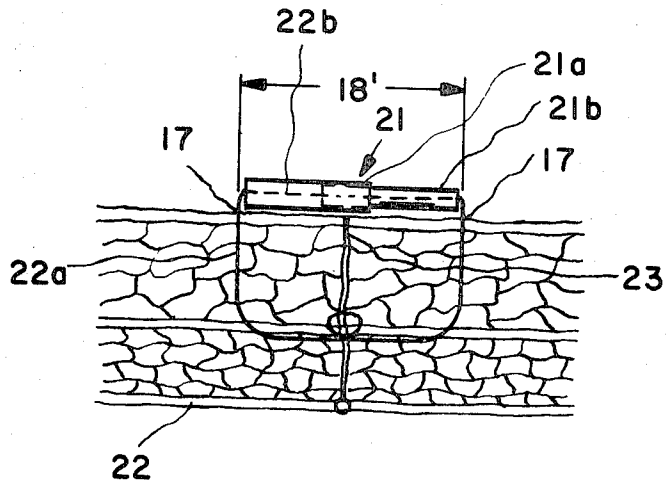
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Primary Examiner—Dalton L. Truluck
Attorney—Irving Seidman

ABSTRACT: A retention suture guard is formed of a pair of semirigid inner and outer tubes arranged in telescoping relationship. Locking means between the tubes permit their relative axial movement in one direction to lengthen the device incrementally as desired, while providing substantial resistance to relative axial movement in the opposite direction. In practice, the ends of a suture extend through exit points in the skin on opposite sides of a wound, with one end of the suture being threaded through the central bore of the suture guard. The tubes of the guard are then telescopically extended to have a total length equal to the distance between said exit points, and the suture ends are tied. The guard thus provides a generally flat support surface across the wound, and establishes fixed lateral points through which the suture's tension is applied.



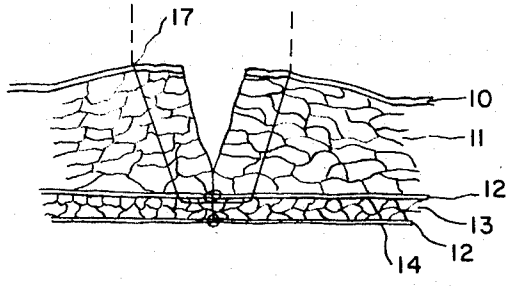


Fig. 1

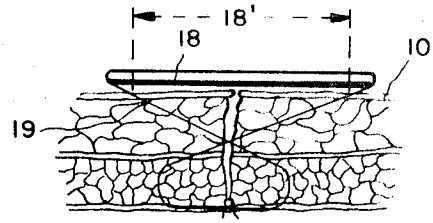


Fig. 3

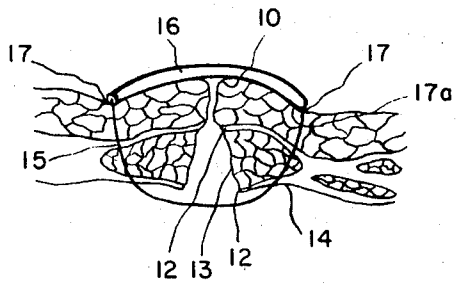


Fig. 2

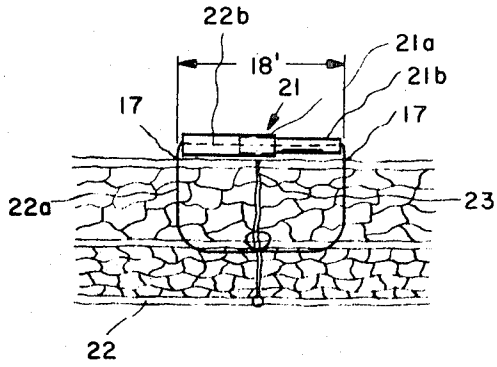


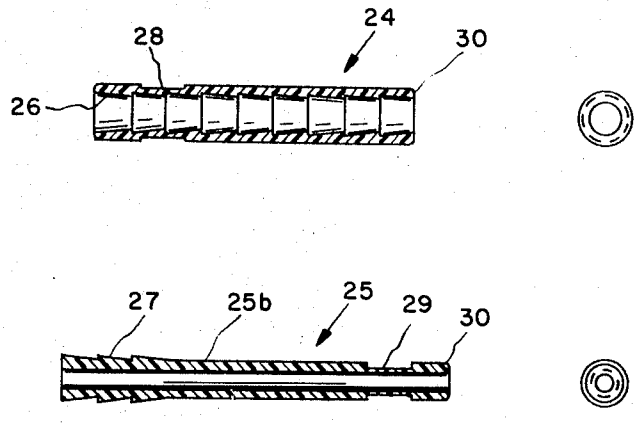
Fig. 4

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Fig. 5



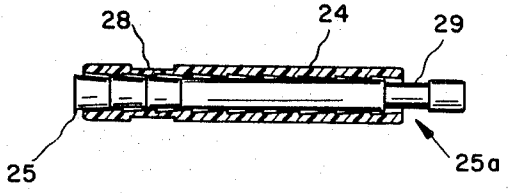


Fig. 6

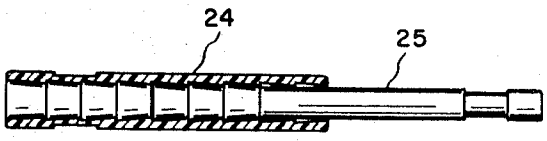


Fig. 7

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EXTENDIBLE SUTURE GUARD

BACKGROUND OF THE INVENTION AND DESCRIPTION OF THE PRIOR ART

This invention relates to a method and device for improving the surgical procedure using retention sutures to maintain the closure of incisions and wounds and to aid their healing. Retention sutures are used particularly to urge and hold together the adjacent sides of an opening, and further to align the corresponding layers of skin, fat, fascia, muscle and peritoneum of the two joined sides, and to maintain these layers in the immediate area of the closure in a generally relaxed state.

Unfortunately certain layers, particularly deeper layers, sometimes fail to join and heal properly, or they may become separated as in certain postoperative situations resulting in dihiscence, eventration, and hernia, or even total wound disruption or evisceration as occurs in some laparotomies and abdominal closures. In using retention sutures, other common and undesirable complications often occur particularly to the tissue adjacent the closure; these complications include ischemia, necrosis, infection, and postoperative scarring.

A variety of retention suture configurations and corresponding techniques for inserting sutures have been developed, each an attempt to provide better support for the closure to thus aid and hasten proper healing. Common examples of sutures are the through-and-through type, which circumscribes all the layers of the closure, and the figure-of-eight type, its lower loop encompassing only selected deeper layers such as the fascial, muscle and peritoneum layers, while its upper loop encompasses fat and skin layers. In each case there is an exposed upper loop portion of the suture extending out of exit points in the skin in the vicinity of the closure.

Employed with these common figure-of-eight and through-and-through suture configurations, are devices generally designated suture guards or bolsters used to reduce or distribute the suture's downward pressure that bears upon, irritates, and scars the skin adjacent to the closure at exit points. One of the commonly used guards is a single piece of flexible tubing which extends generally between exit points and across the closure, and through which the exposed loop portion of the suture is threaded. Because of their flexibility, such tubular guards will bend to fit the varying stitch lengths; however, such bending bows the guards to conform to upward rippling and inflammation of the skin about the closure. Consequently the immediate closure area is unsatisfactorily supported, while the skin near the exit points is subjected to excessive pressure from the ends of the suture guards.

Alternatively, rigid tubes or flat splints are used to guide the exposed portions of the sutures, with the expectation that the devices' flat surfaces traversing the closures would distribute the pressure and counteract any upward distention of the closure. Difficulties arise, however, because often the distance between exit points of a suture is either longer or shorter than the length of the standard suture guard selected by the surgeon. When a suture which extends through a guard of improper length is tightened, the ends of the suture will be forced to take an angular position at the exit points of the skin, rather than extending normally through the skin surface. Since it is an objective that the retention suture substitute for and approximate the wound marginal pressure existing prior to incision, any exit angle of the suture ends different from normal is undesirable, as there will result high-stress areas in tissue adjacent the exit points with subsequent irritation and scarring of the tissue. During each surgical closure, the many sutures often vary in size both by design and by necessity. If the rigid suture guards selected are of uniform size, many will not match the various long and short stitches; and if different size guards are selected, impractical trial and error sizing would be required to obtain proper fits.

A third type of suture guard subject to many of the drawbacks discussed above, is the spring bar which maintains appropriate tension in the suture during the postoperative period. This is especially useful in active children where the tissues and sutures often receive substantial stress and pressure; however, imperfect matching of the lengths of sutures and spring bars results in undesirable angles and excessive pressure of the suture at the exit points.

While it is generally accepted that suture guards should be used with retention sutures, the surgeons and writers on this subject tend to disagree on the theories by which the various guards operate or should operate. As discussed above, the techniques and devices employed have numerous inherent difficulties, this being continually evidenced by the undesirable effects still occurring in the use of all types of known suture guards.

SUMMARY OF THE INVENTION

The new retention suture guard of the present invention is formed of inner and outer tubular members disposed in telescoping relationship with a locking means between the two members. An overall axial length of the guard is established by these members, this length being extendible by their telescoping movement, and the locking means is formed of first and second locking parts on the outer and inner members respectively. These parts are releasably engaged to each other, thereby permitting incremental lengthening of the device during telescoping movement of the members in one direction, with the resulting length of the guard being greater than that of either tube alone. Relative axial movement of the members in the opposite direction is resisted by the locking engagement, so that the selected length of the guard may be maintained despite any compressive pressure tending to push the inner tube back into the outer tube. In one preferred embodiment the locking means comprises a plurality of axially spaced teeth or circular ridges on one tube and a corresponding tooth on the other tube, the tubes being axially movable only when sufficient force is applied to cause their respective engaging teeth to deflect enough to permit passage of one with respect to the others.

In practice two ends of a retention suture extend from exit points spaced from the incision, and one of these ends is threaded through the lumen of the guard; however, before typing these ends together, the new guard is telescopically extended to the desired and optional length. With this invention each suture guard is individually adjusted until its length is substantially equal to the distance between the exit points of the corresponding suture. The guard thus establishes fixed points through which the suture ends extend generally normal to the skin, with a resulting lateral force applied that approximates the wound margin's preincision lateral pressure for urging together the adjacent sides of a wound. This is a significant improvement over prior suture guards formed of flexible tubes which simply bend to conform to the spacing of the exit points with a concentration of pressure applied downward against the skin at these points, rather than generally parallel to the skin to close all layers of the incision as can now be accomplished. With respect to the rigid one-piece suture guards of the prior art, the new invention is also greatly superior. These new guards have the desirable characteristics provided by stiffness for distributing downward pressure, while being adjustable to fit every suture, in contrast to many one-piece guards of improper length, which were either used improperly or discarded as part of a trial and error procedure. Once the new suture guard is extended to the desired length, its locking means prevents any shortening of the device by telescopic movement of the tubular members in the opposite direction, but permits further lengthening at a later time if desired.

Actual use of these extendible guards of the present invention with retention sutures has demonstrated remarkable improvements in the speed and quality of healing and a reduction of complications. In specific comparative cases both known one-piece tubular rubber guards and the new extendible guards were used with different sutures on each closure. The results clearly established that in the tissue associated with the new suture guards, there was significantly less in-

cidence of erythema, necrosis and infection; and where erythema occurred at all in this tissue, it was evidenced only at a much later date. Thus, the new guard is highly beneficial for faster and more satisfactory healing of closures requiring retention sutures, and it substantially eliminates many of the common and deleterious postoperative effects.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary sectional view showing an incision or wound.

FIG. 2 is a similar view showing a flexible single-piece tubular suture guard.

FIG. 3 is a similar view showing a rigid single-piece splint suture guard.

FIG. 4 is a similar view showing the new extendible suture guard of this invention.

FIG. 5 is an exploded view of the new suture guard shown in section.

FIG. 6 is an elevation view in section of the new suture guard assembled an unextended.

FIG. 7 is a similar view, except that the new suture guard is extended.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 shows in cross section a typical incision or wound and a retention suture which might be used in combination with the extendible suture guard of the present invention. The layers of tissue exposed in this incision comprise skin **10** and **10***a*, fat **11** and **11***a*, fascia **12** and **12***a*, muscle **13** and **13***a*, fascia **12** and **12***a*, and peritoneum **14** and **14***a*. In closing such an incision the new suture guard is instrumental in making it possible for all the corresponding layers **10** and **10***a*, **11** and **11***a*, and so forth to be properly aligned and maintained together. How the preferred embodiment of this invention functions is best demonstrated by first considering the illustrations of two prior art suture guards having characteristics which are specifically improved upon by the new guard.

FIG. 2 shows a closure which is defective, because the lower layers of fascia **12**, muscle **13**, and peritoneum **14** have failed to join despite the close junction and healing of the upper layers of skin **10** and fat **11**, this being the type of situation with a dangerous possibility of hernia or even total wound disruption. In this figure a through-and-through suture **15** defining a single loop has been used along with a suture guard **16** formed of a single flexible tube, which has become bowed resulting in excessive downward pressure on exit points **17**, and insufficient lateral pressure for the deeper layers.

In FIG. 3 a rigid, one-piece suture guard **18** is longer than the space **18'** between the exit points **17**, such that the ends of the suture **19** are forced to take an angular rather than normal orientation upon leaving the skin **10**. While tension may be maintained in the suture, the layers within loop **20** will have inadequate lateral support for proper closure of the incision.

In FIG. 4 an extendible suture guard **21** of the present invention is shown with a sewn suture **22**. It should be noted that parts **21***a* and **21***b* have been telescopically extended until the guard's overall length is substantially equal to the space **18'** between the exit points **17**. At these points the end portions of suture **22***a* extend generally normal to the skin, the ends of the guard establishing fixed points of lateral support, and also preventing the suture parts **22***b* from bearing against, irritating and scarring the skin area in the vicinity of the exit points.

A slight bowing of the extendible guard may occur which raises the center part thereof from contacting the actual closure **23**, which then heals with further reduced direct pressure and scarring. Downward pressure applied by the guard is generally distributed along its length, such that excessive pressure near the exit points is avoided.

The construction of the new guard is disclosed in detail in FIGS. **5**, **6** and **7**, FIG. **5** showing the two component parts, FIG. **6** showing the parts assembled prior to use, and FIG. **7** showing the parts telescopically extended. Both the outer tube **24** and the inner tube **25** are made from a semirigid plastic, such as polyethylene. Of numerous practical sizes of this guard, the dimensions of one embodiment are given by way of example only: length variable between 2 and 3 inches with extension, outside diameter about five-sixteenths inch, and wall thickness of the tubes about three-sixtyfourths inch. Circular ribs **26** are disposed along the entire length of the inside wall of tube **24**, while there are only a few corresponding ribs **27** on inner tube **25**. As shown in the cross-sectional view of FIGS. **5–7**, the ribs of tubes **24** and **25** define teeth pointing in opposite directions. It should be obvious that in the assembled state shown in FIGS. **6** and **7**, the engagement of teeth **26** and **27** permits tube **25** to be moved only toward the right, and to be moved incrementally by spaces equal to the axial length of each tooth. During this relative movement of tube **25** toward the right, there must be at least some resilient deflection of the teeth however, the configuration of these engaged teeth will substantially preclude relative movement of the tube **25** toward the left, i.e., to telescopically shorten the guard, without very great and unlikely force.

In the embodiment shown in FIG. **6**, the inner tube is slightly longer than the outer tube, such that the exposed end **25***a* can be gripped and pulled for the telescopic extension. Where the teeth **26** and **27** are substantially identical, the tips of teeth **26** will provide a bearing surface to support the outer surface **25***b* during its telescopic movement. It is further desirable to have finger-gripping means **28**, **29** at one end of each tube; this is provided by a circular indentation, roughening, embossing or other convenient technique.

In variations of the embodiments shown, the outer tube could be the longer of the two tubes, or the inner tube could be the one to have teeth along its full length. Also many other forms of locking means would be feasible, including a hook element extending from the outside of the outer tube toward its bore, for engagement with teeth on the inner tube. The two tubes could even be engaged by mutual screw threads. Another optional feature is the rounded edges **30** on both tubes which might help avoid irritating the skin contacted. It should also be realized that the extendible suture guard of this invention does not necessarily require tubular members, and could comprise other forms of components or extendible material.

What is claimed is:

1. A suture guard device comprising:

a. an outer tubular member,

b. an inner tubular member movable disposed within the outer member in telescoping relationship, the device having an overall axial length defined by the two members, this length being extendible by said telescoping movement, and

c. locking means formed of first and second locking parts on said outer and inner members respectively, these parts being releasable engaged to each other to permit incremental lengthening of the device during telescoping movement of said members in one direction, said engagement resisting telescoping movement in the other direction for shortening the device.

2. A suture guard as defined in claim **1** wherein said inner member has length at least slightly greater than that of the outer member.

3. A suture guard as defined in claim **1** wherein one of said locking parts comprises a plurality of axially spaced elements defining incremental axial positions, and the other locking part comprises at least one cooperatively engaging element, at least one of said locking parts being sufficiently flexible to deflect for permitting said releasable engagement of said elements during said incremental lengthening of the device.

4. A suture guard device as defined in claim **3** wherein said first locking part comprises a plurality of circular ridges along the length of the inner surface of the outer member and extending inwardly, and the second locking part comprises at least one circular ridge on the outer surface of the inner member.

5. A suture guard device as defined in claim 4 wherein said ridges define teeth in axial cross section of the locking parts, the teeth in one of the parts pointing generally toward a first end of said part to facilitate movement of the other part toward said first end.

6. A suture guard device as defined in claim 1 further comprising gripping means on the end of the inner member which is extendible out of the outer member and on the opposite end of the outer member.

7. A suture guard device as defined in claim 1 wherein each tubular member and its corresponding locking part comprise an integral piece of molded plastic.

8. A suture guard device as defined in claim 7 wherein said integral pieces are polyethylene, the members having length of about 2 inches, outside diameter of about one-fourth inch and three-sixteenths respectively, and wall thickness of about one-thirtysecond inch each.

9. A suture guard device as defined in claim 1 and including a bore therethrough, in combination with a retention suture inserted about and urging together adjacent parts of a closure, the external portion of the suture extending from spaced exit points in said adjacent parts and through said bore of the device, the tubular members of the device being telescopically extended such that the overall length of the device is substantially equal to the space between said exit points.

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