

[54] **SUTURE BRIDGES**

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[58] Field of Search **128/334 R, 335**

[56]

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Primary Examiner—Dalton L. Truluck

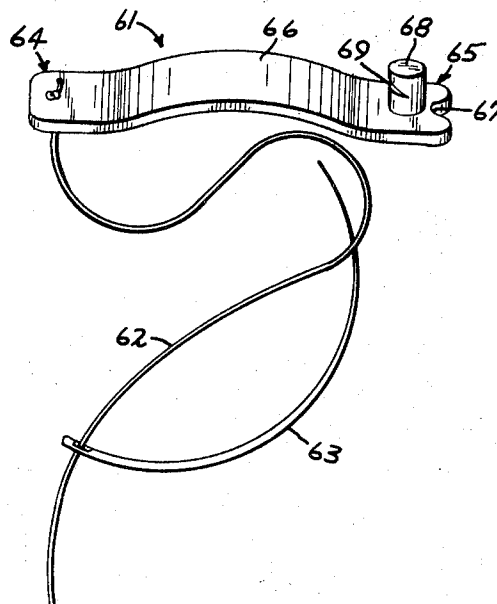
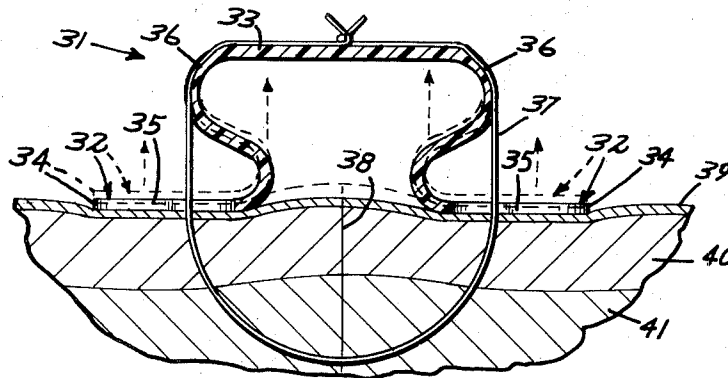
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[57]

ABSTRACT

The disclosure is directed to a surgical bridge for supporting incision sutures under continuous tension. One form of the surgical bridge comprises an elongated member constructed to bridge the incision, and which is resiliently flexible under the influence of suture tension to compensate for swelling of the incision as it heals. In another form, the bridge includes slotted end guides which are respectively disposed under elevated suture support points, which structure precludes cutting or slicing of the patient's skin by the suture itself upon pressured lateral movement of the bridge over the skin surface.

18 Claims, 11 Drawing Figures



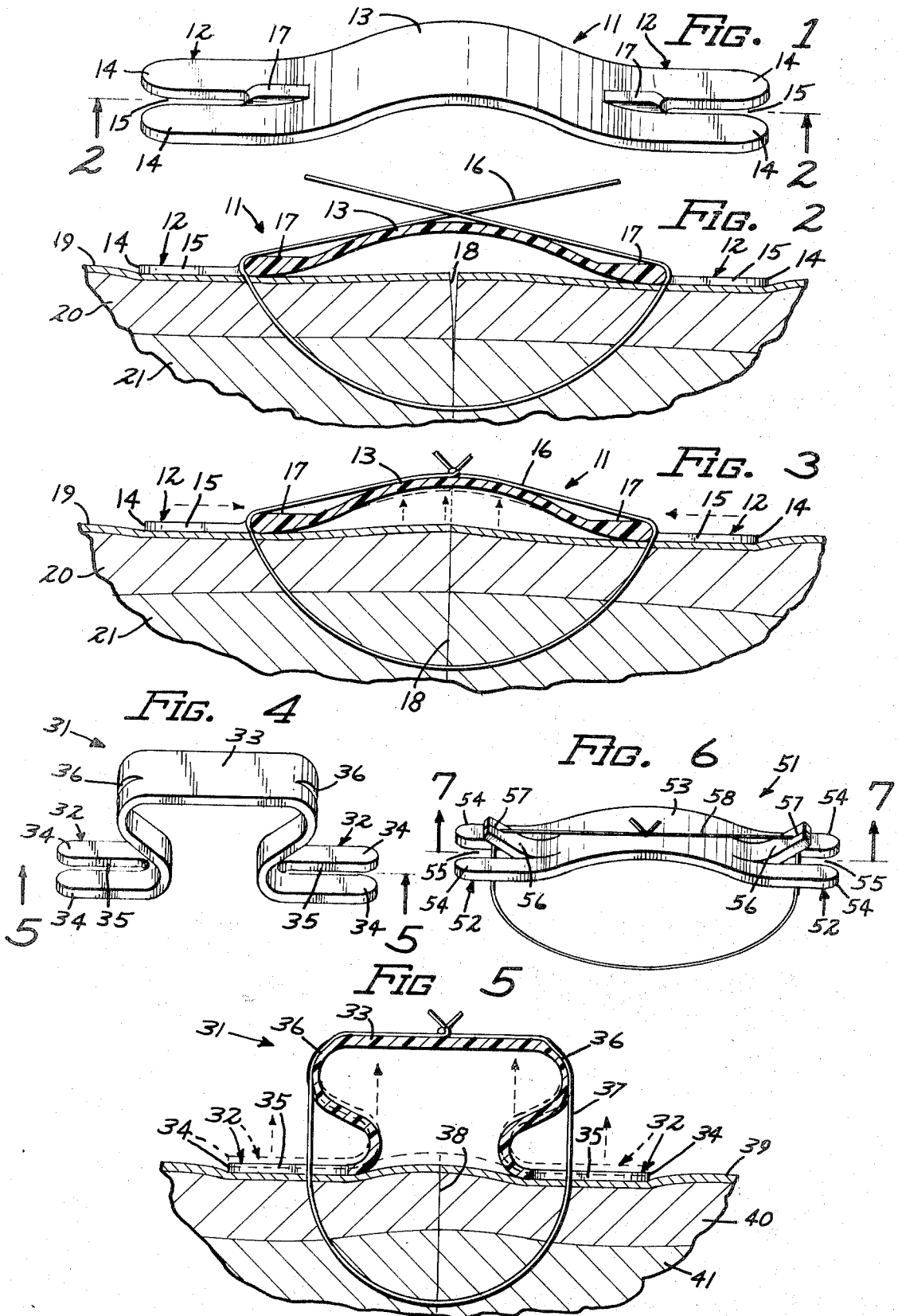


FIG. 7

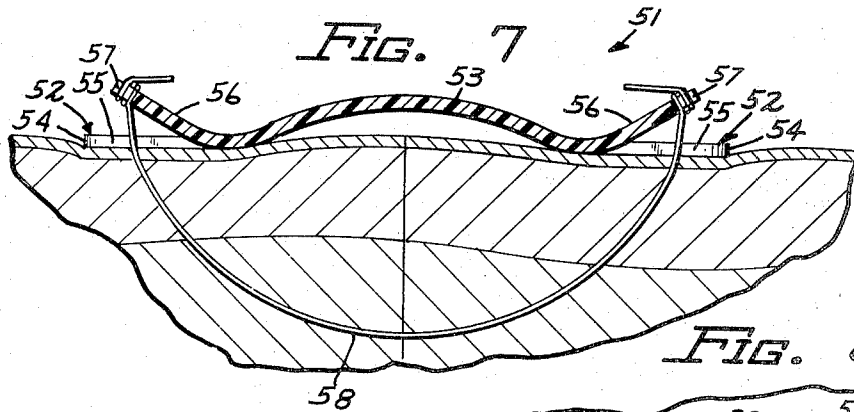


FIG. 8

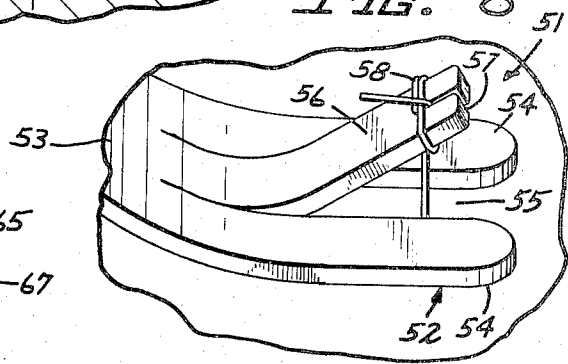


FIG. 9

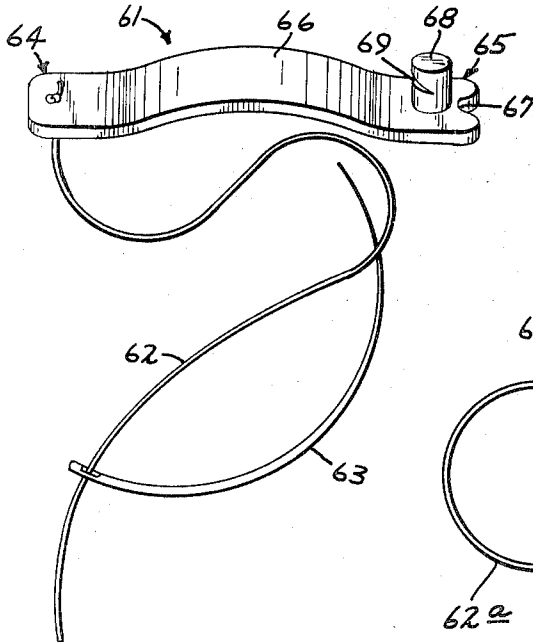


FIG. 10

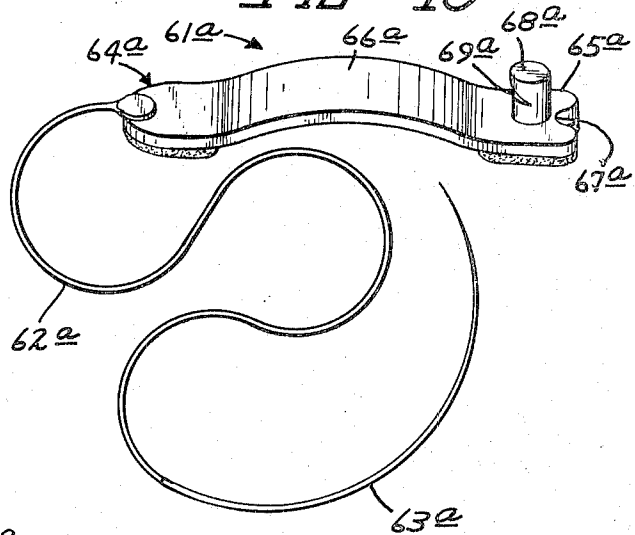
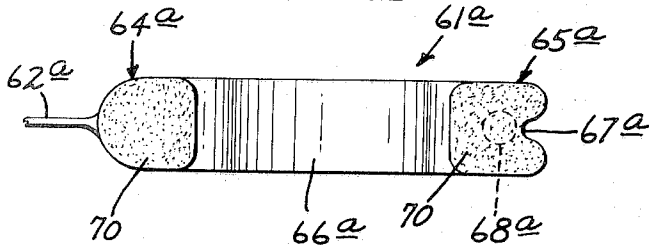


FIG. 11



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SUTURE BRIDGES

The invention relates to surgical bridges for supporting incision sutures under continuous tension.

Surgical devices of this general type have existed for some time in a number of different forms. For example, see the devices disclosed in U.S. Pat. No. 815,264 issued to Joseph E. Chambers on Mar. 13, 1906; U.S. Pat. No. 1,852,098 issued to Alfred W. Anderson on Apr. 5, 1932; and U.S. Pat. No. 3,014,483, which issued on Dec. 26, 1961 to Horace F. McCarthy. With such devices, an incision closing surgical stitch is formed by inserting the suture through the incision under the skin with a surgical needle in the known manner, placing the bridge over the incision relative to the suture, bringing the suture ends around the respective bridge ends and tying them at the middle under the requisite tension.

One problem that has accompanied the formation of surgical stitches with existing devices is cutting or slicing of the patient's skin by the suture itself as swelling of the incision occurs during the healing process. Such swelling tends to force the bridge outwardly, which increases suture tension until the adjacent skin gives way and is cut or slit. The same end effect is also caused by pressured movement of the bridge (as by swelling, for example) which carries the suture laterally with it until the skin gives way. No matter how they occur, skin cuts or slits are a source of major irritation to the patient, and they increase the possibility of infection before the wound has healed completely which can result in the formation of scars.

Our inventive surgical bridge alleviates the problems of excessive suture tension and resulting skin cuts through the regulation of suture tension and suspension of the suture relative to its point of entry into the skin. More specifically, one form of our suture bridge comprises an elongated member having skin contacting end portions joined by a connecting portion constructed to bridge the incision. The suture pierces the skin adjacent the incision in a conventional manner, and is then brought around each end of the bridge and is tied or otherwise secured under proper tension. Of primary significance is making the bridge flexible so that it will resiliently and elastically bend under the influence of increasing suture tension due to swelling of the wound. In so doing, the bridge compensates and thereby maintains proper tension of the suture. Also, when the swelling decreases as the wound heals, the bridge returns to its initial shape and takes up any loosening to maintain such proper tension.

In another form, our suture bridge comprises a connecting or bridge portion which elevates the suture support point over a guiding slot which completely surrounds the point at which the suture enters the skin. Thus, even though the bridge is moved due to swelling or the like, the slot precludes engagement of the suture by the bridge itself, thus precluding the suture from being laterally forced against the adjacent skin.

Our invention further contemplates the provision of an individual pre-cut suture and needle for each surgical bridge which may be integrally formed therewith, to eliminate needless repetition in taking surgical stitches and to insure maximum convenience and simplicity to the physician in carrying out his surgical duties.

Other structural features and advantages of our inventive surgical bridges will become apparent from the

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description below in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a surgical bridge for supporting incision sutures under proper tension;

FIG. 2 is a sectional view of the suture bridge and suture in place over an incision, taken along the line 2—2 of FIG. 1;

FIG. 3 is the sectional view of FIG. 2 with swollen body tissue surrounding the incision;

FIG. 4 is a perspective view of an alternative form of the inventive suture bridge;

FIG. 5 is a sectional view of the suture bridge of FIG. 4 over an incision with a suture in place, taken along the line 5—5 of FIG. 4;

FIG. 6 is another alternative embodiment of the inventive suture bridge;

FIG. 7 is an enlarged sectional view of the suture bridge of FIG. 6 over an incision with a suture in place, taken along the line 7—7 of FIG. 6;

FIG. 8 is an enlarged perspective view of one end of the suture bridge of FIG. 6;

FIG. 9 is a perspective view of another alternative embodiment of the inventive suture bridge;

FIG. 10 is a perspective view of another alternative embodiment of the inventive suture bridge; and

FIG. 11 is a fragmentary view of the suture bridge of FIG. 10 in bottom plan.

DESCRIPTION OF THE PREFERRED EMBODIMENT

With initial reference to FIGS. 1 and 2, a suture bridge embodying the inventive principle is represented generally by the numeral 11. Bridge 11 is elongated in shape, having end portions 12 joined by a connecting portion 13 constructed to bridge an incision. Each end portion 12 includes a pair of projections 14 which define a slot 15 that serves to guide and retain a suture 16. At the inner most point of the slot 15, bridge 11 includes a thickened region 17 which is rounded to prevent damage to the suture 16.

Connection portion 13 is formed with a gentle curvature in this embodiment which permits it to arch an incision 18 extending through a patient's skin 19 and layers 20 and 21 of deeper tissue. As used herein "incision" is intended to encompass wounds, lacerations and the like which disrupt normal tissue integrity, as well as openings made for surgical purposes. Bridge 11 may be made from any number of materials suitable for surgical accessories of this type, examples of which are stainless steel, nylon and teflon. Of primary importance to the construction of bridge 11, whatever material from which it is made, is its ability to flex under varying degrees of suture tension, as discussed more fully below.

FIG. 2 represents formation of a surgical stitch with the use of a suture bridge 11. With the aid of a surgical needle, suture 16 is passed through the skin 19 and layers 20 and 21 of tissue as shown, and the suture ends are brought through the respective slots 15, over the thickened regions 17 and tied or otherwise secured on top of the connecting portion 13 under proper tension as shown in FIG. 3.

Under normal circumstances, the tissue surrounding incision 18 undergoes swelling during the healing process. As shown by the broken line and upward arrows

in FIG. 3, this swelling may entirely fill the bridge space and engage the underside of connecting portion 13.

With prior art devices, the result of swelling is increased suture tension, often to the extent that the suture exerts sufficient pressure on the adjacent skin to cause it to give way and be cut or torn. The flexibility of suture bridge 11, however, permits it to resiliently bend in a compensating manner, thereby precluding suture tension from becoming excessive to the point of damaging the skin. This significant feature of the suture bridge 11 also works conversely; i.e., as the swelling of skin surrounding incision 18 decreases, any loosening within the suture is automatically tightened by resilient flexibility of the bridge 11 so that proper suture tension is maintained and the surgical stitch continues to carry out its intended purpose.

With reference to FIGS. 4 and 5, an alternative suture bridge embodying the inventive principle is represented generally by the numeral 31. Bridge 31 comprises similar end portions 32 joined by a connecting portion 33. Each of the end portions 32 is similarly formed with projections 34 defining a slot 35 which is somewhat longer relative to the slot 15 of bridge 11. The connecting portion 33 is quite different than that of bridge 11, having sides which diverge upwardly from the respective end portions 32 and are interconnected by an essentially flat top section. Each of the sides of connecting portion 33 is also formed with a notch 36 to prevent a suture 37 from slipping off.

As described, it will be appreciated that the suture 37 is supported by the connecting portion 33 at points elevated or spaced above the skin surface, and that each of the slots 35 extends inwardly beyond these elevated support points to preclude engagement of suture 37 by the projections 34. Broadly speaking, it is the provision of elevated support points coupled with reasonably constructed end portions which gives rise to the improved structure and use.

Formation of a surgical stitch to close an incision 38 is essentially the same; i.e., the suture 37 is introduced through skin and tissue layers 40 and 41, and its ends are respectively brought through the slots 35 and tied at the top of connecting portion 33. Due to the specific construction of connecting portion 33, the suture is suspended between the aforementioned elevated support point and the skin 39, and is disposed essentially normal to the skin to reduce the likelihood of skin tears or cuts. Further, even if swelling of the tissue surrounding incision 38 is appreciable, suture 37 will not be engaged due to the recessed construction of end portions 32, and tearing of the skin by reason of such engagement is precluded.

This improved function occurs whether or not bridge 31 is flexibly constructed. Preferably, however, bridge 31 is constructed to resiliently flex under the influence of increased suture tension due to swelling, and such flexure is represented by the broken lines and arrows in FIG. 5.

FIGS. 6 and 7 disclose an alternative suture bridge 51 which preferably is resiliently and flexibly constructed, and also defines elevated suture support points. More specifically, bridge 51 comprises modified end portions 52 and a connecting portion 53 essentially the same as connection portion 13 of bridge 11. End portions 52 are similar insofar that they include projections 54 defining elongated slots 55. In the preferred case, each of the slots 55 is formed by punching out a supporting tab

56 which bends upwardly and away from the connecting portion 13 in cantilevered fashion. The extreme end of each tab 56 has a slit 57 formed therein which is sized to receive and frictionally retain any portion of a suture 58. It will be appreciated that the tabs 56 and slits 57 define elevated support points for the suture 58, and that the slots 55 extend inwardly beyond these support points to preclude engagement of the suture 58 at its point of entry into the skin.

Formation of a surgical stitch with the bridge 51 may be in the manner shown in FIG. 6; i.e., by tying the suture 58 at the top of connecting portion 53 after bringing the suture ends around and through slits 57 of tabs 56. Preferably, tabs 56 are constructed to resiliently flex and bend downwardly with increasing suture tension as swelling occurs, in the manner described above. Alternatively, and with reference to FIGS. 7 and 8, suture 58 may simply be wrapped around the tab 56 and ultimately through slit 57 so that the surgical stitch is held in place without tying. It will be apparent that the surgeon may simply release the surgical stitch for removal or adjustment purposes simply by grasping the free end of suture 58 and removing it from the tab 56.

FIG. 9 depicts form, the bridge 61 of the inventive type in conjunction with an individual pre-cut suture 62 and needle 63.

Surgical bridge 61 comprises end portions 64, 65, which are not the same as in the previous embodiment, and a connecting portion 66 which is essentially the same as that of surgical bridge 11 and 51. A small aperture is formed through end portion 64 to receive suture 62, which is knotted at one end to prevent its release. End portion 65 conforms with a short recess 67 for guiding and retaining the opposite end of suture 62 in formation of a surgical stitch, and further includes a post or stud 68 projecting upwardly from its top surface. Post 68 has a notch 69 which permits suture 62 to be frictionally secured simply by winding it around the post 68 and through notch 69.

In the preferred form the free end of suture 62 is threaded through the eye of surgical needle 63, and all components are packaged as a unit for maximum convenience and efficiency to the surgeon.

FIGS. 10 and 11 set forth a surgical bridge similar to the bridge 61 of FIG. 9, and in which like parts are represented by like numerals with the letter *a* added. Bridge 61a differs in that one end of the suture 62a is fused or bonded to the end 64a rather than the knot-aperture method of securement. It will be appreciated that suture 62a could be integrally formed with bridge 61a whether made from the same material, an example of which is nylon, or from a different material.

The opposite end of suture 62a is fused or integrally secured to the head of surgical needle 63a so that all components define an integral unit. This manner of securement of suture 62a to needle 63a is advantageous because it forms a smaller skin opening in the formation of a stitch, as compared to the opening formed when the doubled suture 62 at the eye of needle 63 passes through the skin.

As shown particularly in FIG. 11, bridge 61a is different in one further respect through its inclusion of a resilient pad 70 on the under surface of each of the end portions 64a, 65a. In the preferred embodiment, pads 70 are formed from a layer of sponge, which offers a better frictional engagement with the skin surface and

also absorbs any secretion from the incision during the healing process.

It will be apparent that the sutures 62 and 62a may be formed from absorbable material capable of being assimilated by the body, such as catgut, or from non-absorbable material, examples of which are silk and nylon. Similarly, and as suggested above, the several suture bridges disclosed herein can also be formed from either type material, whichever is suitable for a specific application and capable of being constructed in accordance with the inventive principles set forth above. The suture bridges can also be constructed from porous or microporous material to themselves serve as absorbers of body fluids secreted during the healing process, and to better admit air to the incision and thereby hasten the healing process.

Although our inventive suture bridges are disclosed and described for use in supporting surgical stitches which secure an incision or break in a patient's outer layer of tissue or skin, it will be appreciated that the devices are equally capable of use in securing deeper layers of tissue and/or structures together.

We claim:

1. A surgical bridge for supporting incision sutures under tension, comprising:

- a. a bridge member having first and second end portions joined by a connecting portion, the end portions being adapted to engage the surface of a patient's skin on opposite sides of an incision, and the connecting portion being constructed to arch and be spaced from the incision;
- b. a pre-cut suture one end of which is secured to the first end portion of the bridge member;
- c. a stud member projecting upwardly from the second end portion and having a friction notch formed therein for securely receiving the opposite end of the pre-cut suture;
- d. said bridge member being constructed to resiliently flex under the influence of changing tension within the suture.

2. The device defined in claim 1, wherein the bridge member is elongated in shape, and each end portion comprises a pair of longitudinally extending projections defining a slot therebetween to guidably receive a suture.

3. The device defined in claim 2, wherein the end and connecting portions are of essentially uniform thickness, and further comprising a region of increased thickness at the inner suture supporting end of the slot, said thickened region being rounded to preclude damage to the suture.

4. The device defined by claim 1, and further comprising a surgical needle for the pre-cut suture.

5. The device defined by claim 4, wherein said opposite end of the pre-cut suture is integrally secured to the head of the surgical needle.

6. The device defined by claim 1, wherein said one end of the pre-cut suture is integrally formed with said first end portion.

7. The device defined by claim 1, and further comprising a resilient pad disposed on the under surface of each end portion in a skin engaging position.

8. The device defined by claim 1, wherein the bridge member is formed from absorbable material capable of being assimilated by the human body.

9. The device defined by claim 1, wherein the bridge member is formed from non-absorbable material.

10. The device defined by claim 1, wherein the bridge member is formed from porous material capable of absorbing body fluids and admitting air to the incision.

11. A surgical bridge for supporting incision sutures under tension, comprising:

- a. a bridge member having end portions joined by a connecting portion;
- b. the end portions being generally flat and adapted to engage the surface of a patient's skin on opposite sides of an incision;
- c. the connecting portion being constructed to bridge the incision and adapted to receive and support a suture over the incision, and comprising sides which diverge longitudinally of the bridge and upwardly from the plane of the respective end portions and a top section which interconnects the sides, the juncture of the top section and each of the sides defining an elevated suture support point which overlies and is spaced from the associated end portion;
- d. each end portion having an opening formed therein below the associated suture support point and sized to preclude engagement of said end portion with the suture.

12. The device defined by claim 11, wherein the bridge member is constructed to resiliently flex under the influence of changing tension of a suture supported thereby.

13. The device defined by claim 11, wherein the bridge member is elongated in shape, and each end portion comprises a pair of longitudinally extending projections, and said opening comprises a slot defined between said projections.

14. The device defined by claim 11, wherein the connecting portion is notched at each of said junctures to guidably retain the suture.

15. A surgical bridge for supporting incision sutures under tension, comprising:

- a. an elongated bridge member having end portions joined by a connecting portion;
- b. the end portions being in part adapted to engage the surface of a patient's skin on opposite sides of an incision and said connecting portion being constructed to bridge the incision and adapted to receive and support a suture over the incision;
- c. each end portion comprising a plurality of longitudinally extending projections at least one of which is adapted to engage the patient's skin surface, and one of which bends upwardly and away from the connecting portion in cantilever fashion to form a suture support member and elongated opening therebelow through which the suture can pass, the extreme end of each support member defining an elevated suture support point which overlies and is spaced from said elongated opening.

16. The device defined by claim 15, wherein each cantilevered support member is constructed to resiliently flex under the influence of changing tension within the suture.

17. The device defined by claim 15, wherein each cantilevered support member has a frictional slot formed therein to receive and retain the suture.

18. The device defined by claim 15, wherein the bridge member is resiliently flexible.

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