DEVICE FOR CORRECTING
SCOLIOTIC CURVES

Inventors: Robert Roaf, 219 Speke Road, Liverpool; John Thomas Matthew Wright, 23 Grosvenor Road, Southport, both of England

Filed: June 23, 1971
Appl. No.: 155,796

Foreign Application Priority Data
June 26, 1970 Great Britain...31,141/70

U.S. Cl...........128/69, 128/92 R
Int. Cl............A61F 5/00
Field of Search...128/69, 92 R, 92 B, 92 D, 92 G

References Cited
UNITED STATES PATENTS
3,693,616 9/1972 Cleveland, Jr........128/92 R
2,774,350 12/1956 Thomas.............128/92 R
3,242,922 3/1966

Primary Examiner—Richard A. Gaudet
Assistant Examiner—J. Yasko
Attorney—Cushman, Darby & Cushman

ABSTRACT
An implantable spinal stabilizing device, developed initially for correcting and maintaining the correction of scoliotic curves, but also useful for fixing spinal fractures and dislocations, involves a pair of spaced parallel rigid bars, each bar having a succession of apertures. The bars are located on opposite sides of the spinous processes, between the spinous and respective transverse processes, and held in this location by tape laced through the bar apertures and around the spinous laminae or transverse processes. The tape is tensioned and secured by plugs in the relevant apertures, and the overall assembly serves to stabilize the spine in a required configuration.

8 Claims, 4 Drawing Figures
DEVICE FOR CORRECTING SCOLIOTIC CURVES

This invention relates to spinal stabilizing devices and more particularly, but not exclusively, such devices for correcting scoliotic curves and maintaining the correction.

Devices are known for correcting and maintaining the correction of scoliotic curves which comprise a rod and a pair of oppositely directed hooks at the ends of the rod. In application of the device, the hooks are engaged with vertebrae at the ends of the curve and a distractive force is applied to the portion of the spine between the hooks by increasing the length of the rod, whereby the laterally displaced and rotated vertebrae are drawn into their required positions. Such devices operate by distracting a portion of the spine and large forces have to be applied by the hooks on the vertebrae engaged therewith in order to correctly re-dispose the displaced vertebrae. The amount of force applied has to be carefully controlled by the surgeon to avoid fracture of the bone.

It is an object of the present invention to provide an improved device relative to those just mentioned.

According to the present invention there is provided an implantable spinal stabilizing device comprising two rigid bars to be located one at each side of the spinous processes between the spinous and respective transverse processes, each of said bars having a plurality of apertures therein and disposed in a sequence along the bar for receipt of tape in laced engagement therewith while embracing adjacent transverse processes or laminae, means for securing said tape to said bars, and rigid spacer means for holding said bars in substantially parallel spaced apart relationship at opposite sides of the spinous processes.

The apertures in the bars may be tapered therethrough and the means for securing the tapes to the bars may then conveniently be tapered plugs having their tapered surfaces serrated. Cover plates may be provided for attachment to each bar to retain such tape securement plugs in situ in their apertures.

For convenience, slots may be provided between respective apertures and one side of each bar so that tapes can be slid through the slots into the apertures, thereby avoiding the necessity to thread the tapes through apertures.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawing, in which:

FIG. 1 illustrates an exploded perspective view of a device in accordance with the present invention;

FIG. 2 is a posterior view of a portion of a spine with the device illustrated in FIG. 1 attached thereto;

FIG. 3 is a superior section view on the line III-III in FIG. 2, and

FIG. 4 is a sagittal sectional view on the line IV-IV of FIG. 3.

The device illustrated in the drawing comprises two like rigid bars 1 and 3 formed of stainless steel or other material suitable for implantation in the human body. Each of these bars is formed with a plurality of apertures 5 therethrough, which apertures are distributed along the bar, are tapered in the same sense through the bar, and have substantially parallel longitudinal axes.

Each bar also includes two threaded bores 7 for threaded engagement with screws 9 to secure transverse spacer members 11 to the bars. These bores 7 are located towards respectively opposite ends of each bar. The members 11 are each in the form of a cross-bar having stepped formation at each end to provide a shoulder which engages the nearer side of a bar connected thereto.

Each bar further includes two further threaded bores 13, respectively adjacent the bores 7, for threaded engagement with screws 15 to secure cover plates 17 of strip form to the bars 1 and 3. These plates are omitted from FIG. 2 for the sake of clarity.

Each aperture 5 has associated with it a slot 19 which extends from the aperture to a common side surface of the relevant bar so that each aperture is open to the exterior of the bar not only at its ends but also through the respective slot 19.

A plurality of tapered plugs 21 are provided for location in the tapered apertures 5, and these plugs have serrated side surfaces to enhance their securement of location in the apertures.

Two tapes 23 are provided for respective use with the bars. The tapes 23 are formed of terylene or other strong flexible material suitable for implantation in the human body.

Appropriate parts and surfaces of the illustrated components are rounded and smoothed to avoid damage to adjacent tissue and the like when the device is implanted.

The first step in implantation, after exposure of the site, is to pass the tapes in and out of the laminae. For example, as seen in FIG. 4, one of the tapes is looped behind four laminae, namely a first, a third, and a fifth and sixth, with loops of tape upstanding over the second and fourth laminae. The tape at the other side of the spinous processes may follow a similar, but not necessarily identical, path. To facilitate this insertion of the tapes behind the laminae, laminectomy may be necessary. The bars 1 and 3 are then brought up to the spine at opposite sides of the spinous processes 25, between the spinous processes 25 and the respective transverse processes 27, and are joined together by the spacer members 11.

The upstanding end portions of the tapes and the upstanding loop portions are introduced into appropriate apertures 5 of the bars by slipping them through the slots 19. One end portion of each tape is secured to its respective bar by inserting a plug 21 in the aperture 5 through which the end portion extends so as to grip the tape between the plug and the bounding surface of the aperture. The slack in the tapes is worked towards their free, unsecured ends to progressively tighten the tapes from their secured ends. By this action, the vertebrae in the curve are displaced and rotated into contact with the bars and the curve is thereby corrected, and this correction is held by insertion of plugs into the successive apertures through which the tapes extend.

The free ends of the tapes above the bars are cut off short and the cover plates 17 are secured to the bars. The cover plates 17 are disposed somewhat closer to the bars than is illustrated in FIGS. 3 and 4 of the drawings and serve to retain a plug should one tend to loosen.
If the gaps between adjacent laminae are too small to allow a tape to be disposed therein, the natural gaps may be enlarged by removal of bone.

In some cases a loop may embrace not one but two laminae, this being a matter of convenience. For example, it will be observed that the distance between the aperture 5 at the end of each bar and the next adjacent aperture 5 in the bar is considerably greater than the distance between other adjacent apertures 5 since the former distance spans a region of the bar accommodating the spacer member and cover plate securement screws. If then an aperture at the end of a bar is used, it will normally be convenient to employ a tape loop embracing two laminae in this region.

It will be appreciated from these last comments that the bars will normally be provided with more apertures than required for any one particular implant application, whereby a common form of bar is useful in different applications. Even so, provision of a small number of different, standard bar lengths may be appropriate to give a surgeon a fuller choice. In the same way a range of spacer members 11 of differing effective lengths may be provided so that a surgeon can choose particular spacer members to attain the desired spacing of the bars.

While reference has been made principally to passage of tape around laminae, the tape can equally well be passed around the transverse processes.

It will be realized that because, in use of the present invention, the forces being applied to correct the curve are forces acting approximately on radii of the curve, they may be less than those which have to be applied in the case of prior known devices which operate by distraction. Also, only a very small amount of bone removal, if any, is required. Furthermore, the transverse processes and laminae represent substantial bodies of bone for reaction with the tapes as compared to the anchorage available to the prior known distraction rods.

A further advantage believed to be present in use of a device according to the present invention is that the correction is maintained even when growth occurs because the mechanical arrangement of the device is such that growth, and hence movement, of the vertebrae relative to the device does not result in reduction of the correcting force applied by the device.

It is to be understood that the terms scoliosis and scoliotic are used herein in their broader meanings as including kyphosis and kyphotic, and lordosis and lordotic. Devices in accordance with the invention are suitable for correcting and maintaining the correction of curves which are strictly termed kyphotic and lordotic.

Details of one embodiment of the present invention as described above and illustrated are as follows:

The tapes were made of terylene, being one-half inch wide, and having a breaking strain of about 200 lbs. (Messrs. Beresford, Birchenhall & Co. Ltd., Type C 772).

The length of the bars was 8 inches but a range of bars between 5 inches and 8 inches long will be usual. The bars were of rectangular cross-section of sides 0.45 and 0.312 inch with the smaller side being parallel to the axes of the apertures.

The plug apertures were 0.817 inches at their narrower ends and tapered with an included angle of 10°. The center-to-center spacing of the main groups of apertures was 0.375 inch.

Spacers with lengths in the range 1.15 to 1.775 inches, and so formed as to provide distances between the center lines of the bars in the range 0.82 to 1.445 inches, were provided.

In conclusion, it is noted that, while the present invention has been conceived and developed primarily for use in correcting spondylitic curves, devices according to the invention can also be used for fixing spinal fractures and dislocations. It will be appreciated that no special adaption of the devices is required since they already serve to stabilize the spinal column in an appropriate manner.

We claim:

1. An implantable spinal stabilizing device comprising two rigid bars to be located one at each side of the spinous processes between the spinous and respective transverse processes and including a length of tape, each of said bars having a plurality of apertures therein and disposed in a sequence along the bar for receipt of said tape in laced engagement therewith while embracing adjacent transverse processes or laminae, means for securing said tape to said bars, and rigid spacer means for holding said bars in substantially parallel spaced apart relationship at opposite sides of the spinous processes.

2. A device according to claim 1 wherein said apertures are tapered in a common direction through said bars, and said securing means comprise a plurality of tapered plugs for individual engagement in said apertures having tape laced therethrough.

3. A device according to claim 2 wherein said plugs have serrated side surfaces.

4. A device according to claim 2 wherein said securing means further comprises two cover plates for respective connection along said bars over the larger ends of said apertures.

5. A device according to claim 1 wherein slots are provided between one side of each of said bars and the respective apertures therein to facilitate lacing of tape without threading.

6. A device according to claim 1 wherein said spacer means comprise two rigid bars of shorter length than the first-mentioned bars, said first bars and spacer bars being adapted for interconnection at their ends to form a rigid generally rectangular assembly.

7. A device according to claim 6 wherein each of said first bars extend beyond its connection points with said spacer bars, has a plurality of said apertures extending between said points, and has at least one aperture therein beyond each of said points.

8. A device according to claim 1 wherein: said apertures provided with slots between one side of each of said bars and the respective apertures, and said apertures are tapered in a common direction through said bars; said securing means comprise a plurality of tapered serrated plugs for individual engagement in said apertures having tape laced therethrough; and said spacer means comprise two rigid bars of shorter length than the first mentioned bars, said first bars and spacer bars being adapted for interconnection at their ends to form a rigid generally rectangular assembly.

* * * * *