METHOD OF APPLYING VERTEBRAL APPLIANCE

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ABSTRACT
A method of applying a vertebral appliance for use in bridging one or more diseased or damaged vertebrae that comprises a pair of elongate flexible multiapertured together with fasteners used to clamp same on opposite sides of the spinous processes thus spanned. Each strap is of a length adapted to span at least two spinous processes and project therebeyond on each end so that fasteners can be passed both behind and in front thereof as well as through the interspinous gap therebetween. The apertures are located considerably closer together than adjacent processes and they are fastened to the latter in position such that at least one opening registers with each one to receive a growth of soft or bony tissue that eventually extrudes therein.

1 Claims, 3 Drawing Figures
METHODOF APPLYING VERTEBRAL APPLIANCE

The invention described herein was made in the course of work under a grant or award from the Department of Health, Education, and Welfare.

Vertebrates, both man and animal, experience diseased and damaged spines that require surgical techniques to repair or, in some instances, to immobilize same. In the absence of surgery, the patient is usually rendered completely immobile.

Cast metal plates have been used in the past to bridge diseased and broken vertebrae, however, they have proven to possess many deficiencies. To begin with, the surgeon is seldom able to determine in advance just what the size and shape of the appliance he will need is going to be and, once the incision is made and he finally knows this answer, it is exceedingly difficult to cut and shape a rigid metal appliance during the course of the operation. These metallic plates cannot be contoured to conform with the spinal processes of the patient and they thus fail to grasp same firmly and securely. The rigidity of the plates obviously cannot accommodate any growth or relative movement between adjacent vertebra bridged thereby and there is even some indication that their lack of flexibility impedes the patient's recovery.

Other forms of vertebral appliances require that the adjacent spinal processes be drilled and fasteners inserted therethrough to hold the appliance in place thereon. While a secure connection is undoubtedly formed, the thus-weakened processes have a strong tendency to break off, crack or fracture. As such, the appliance has a propensity to weaken the very anatomical structure it is intended to strengthen and support.

It has now been found in accordance with the teaching of the instant invention that these and other shortcomings of the prior art vertebral appliances can, in large measure, be eliminated by bridging two or more spinal processes with a pair of flexible straps that are clamped tightly thereto by passing fasteners through the interospinous gaps left between them rather than by passing these same fasteners through the bony tissue itself. Preferably, the appliance is attached between two healthy vertebra located on opposite ends of one or more diseased or broken ones; however, it is frequently possible to bridge directly between two adjacent spinal processes and avoid having to span three or more. In either event, the processes located on opposite extremities of the appliance have fasteners extending through the interospinous gaps both behind and in front thereof and, for example, on both ends of the intermediate processes as well. The apertures are so spaced that at least one will be next to each of the spinal processes bridged by the appliance so that, eventually, the new soft bony tissue or both will extrude therein and define knobs locking the appliance even more securely thereto.

The straps themselves are formed of a flexible non-toxic material inert to body fluids such as, for example, vinylidene fluoride and the like. This substance, while strong, remains bendable and is flexible enough to permit limited relative movement between the vertebra spanned by the appliance. It can be bent to conform closely to the shape of the processes to which it is clamped thus insuring a tight and secure grasp thereupon. Moreover, it can deform slightly to accommodate growth of the tissue while remaining rigid enough to resist compression and tension loading without appreciable deformation.

It is, therefore, the principal object of the present invention to provide a new and improved vertebral appliance.

A second objective is to provide a device of the type aforementioned that can easily be cut to length and shaped during the surgical procedure for installing same.

Another object of the invention herein disclosed and claimed is to provide a vertebral appliance for damaged or broken vertebra that bridges and repairs same without causing further damage thereto.

Still another objective is to provide a vertebral appliance that contributes to the rapid recovery of the patient due to the limited movement permitted thereby.

An additional object is the provision of a method for mounting such an appliance so as to take advantage of the continued growth of the spinal tissue to progressively increase the strength and security of the connection therebetween.

Further objects of the invention are to provide a vertebræ stabilizing appliance that is simple to install, lightweight yet strong, nontoxic, resistant to body fluids, extremely versatile, compact, and susceptible for use in any vertebrate.

Other objects will be in part apparent and in part pointed out specifically hereinafter in connection with the description of the drawings that follows, and in which:

FIG. 1 is a top plan view of a vertebral section showing the appliance of the present invention clamped to the spinal processes thereof in bridging relation; FIG. 2 is a side elevation thereof; and, FIG. 3 is a section taken along line 3-3 of FIG. 2.

Referring now to the drawings for a detailed description of the present invention, reference numeral 10 has been selected to broadly designate the vertebral appliance forming the subject matter hereof which has been shown attached to a section of vertebræ similarly referred to in a general way by numeral 1. Each vertebra, of course, includes a body portion 14 connected to adjacent vertebrae on opposite ends thereof for limited articulation movement by means of elastic fibrous disks 16 (FIG. 2). Eminent from the body is the ring 18 (FIG. 3) having both oblique processes 20 and transverse processes 22 projecting laterally from both sides thereof while a single spinous process 24 emerges from a point between the oblique ones. Interspinous gaps 26 are found between adjacent pairs of spinous processes.

When circumstances demand that a portion of the spinal column in a higher vertebrate be immobilized due to diseased or damaged vertebra, a minimum of two adjacent spinous processes 24 are bridged by a pair of elongate flexible multi-apertured straps 28 that are fastened in clamped relation on opposite sides thereof by fasteners 30. The minimum length of the straps 28 is such as to extend to the interspinous gaps on both ends of the bridged processes. For example, as illustrated in FIGS. 1 and 2, a total of four spinous processes have been bridged by the appliance and the length of the straps is selected such that the ends thereof are interconnected in the interspinous gaps ahead of the first and beyond the last thus spanning five gaps in all. Should the minimum of two spinous processes be bridged, the straps would be of a length to span three gaps. Ordinarily, the surgeon charged with insertion of the appliance will bridge between a pair of healthy vertebra on opposite extremities of the damaged section.

Both of the straps 28 are fabricated from same non-toxic material resistant to body fluids such as, for example, vinylidene fluoride. This material has the added advantage of being somewhat flexible and, for this reason, is preferred over cast or machined metal straps. Limited articulation movement of the bridged spinal section is desirable as it appears to speed recovery. Also, the flexible nature of the straps accommodates some degree of expansion due to growth of the living bony tissue.

The vinylidene fluoride straps also offer the advantage of being easily cut to length and shaped during the actual surgical procedure wherein the surgeon for the first time is able to determine with some degree of certainty just what is needed. Furthermore, when the fasteners draw the straps up tightly into clamped relation alongside the spinous vertebral processes, they conform thereto due to their flexible nature and provide a secure non-slip connection. To further insure against slippage, the interior surfaces of both straps can be roughened, serrated, checked or otherwise treated to form a non-slip surface 32.

Each strap includes a series of apertures 34 spaced longitudinally thereof and positioned such that at least one transversely alignable pair will register with each interspinous gap 26 so as to accommodate a fastener extending therethrough. It thus becomes unnecessary to drill into or through the spinous process and thereby weaken same as is so often necessary in
order to attach the prior art vertebral appliances. Obviously, the straps need not be pre-drilled as shown in that the surgeon can locate and drill the fastener holes during the surgical procedure if he so desires.

Certainly one of the most significant and unique aspects of the instant invention is the provision of pocket-forming apertures 34a in the straps 28 positioned to overlie the spinous processes bridged thereby and define means adapted to receive extrusions of bony tissue, or soft tissue, or both, that expand therein as the vertebral continue to grow. In the particular form of the invention illustrated herein, these pockets 34a are identical to the apertures 34 that accept the fasteners 30 because this is one of the simplest ways to form same and in a pre-drilled strap, these openings may be called upon to function as either fastener holes or tissue-receiving pockets depending upon their relative positions. It becomes obvious, therefore, that a "tailor-made" appliance could be fabricated to suit a particular vertebral application in which sockets on the interior surfaces of the straps could be used as the tissue-receiving pockets in place of the apertures 34a.

As for the method of mounting the appliance, the straps must be located relative to one another and to the spinous processes bridged thereby such that at least one pair of transversely-aligned fastener-receiving apertures 34 is located within each of the bridged interspinous gaps 26 as well as those at the opposite extremities while other tissue-receiving pockets overlie each of said bridged processes.

What is claimed is:

1. The method of stabilizing a section of vertebrae which comprises: bridging at least two spinous processes with elongate flexible straps placed along opposite sides thereof, clamping the processes thus bridged between the straps by drawing the latter together with fasteners located within each interspinous gap lying between the bridged processes as well as those gaps at opposite ends thereof, and providing pockets on the inside surface of each strap positioned to mate in face-to-face relation with a corresponding exterior surface of one of the spinous processes so as to promote continued growth of the latter in the form of a knob of bony tissue extruding therein.

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