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Triangulation assembly for rectifying vertebrae, and spinal osteosynthesis system comprising such assemblies

Abstract

An assembly for rectifying vertebrae, comprises: two bone anchoring means intended to be implanted on a same vertebra, a triangulation bar and a connection means for connecting the triangulation bar to each bone anchoring means and for holding the bone anchoring means in a given position in order to form, with the triangulation bar connected to the bone anchoring means by means of the connection means, a rigid triangular assembly, the triangulation bar comprising an attachment area for attaching a correction instrument arranged to ensure a rigid attachment in rotation and in translation of the correction instrument on the triangulation bar.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS (1) This application is a continuation of U.S. patent application Ser. No. 17/046,676, filed Mar. 1, 2021, which is a national phase entry under 35 U.S.C. § 371 of International Patent Application PCT/FR2019/050866, filed Apr. 12, 2019, designating the United States of America and published as International Patent Publication

WO 2019/197787 A1 on Oct. 17, 2019, which claims the benefit under Article 8 of the Patent Cooperation Treaty of French Patent Application Serial No. 1853204, filed Apr. 12, 2018.

TECHNICAL FIELD

(1) The present disclosure relates to an assembly enabling the rectification of vertebrae and, in particular, but not exclusively, of lumbar vertebrae via the posterior approach, and a system for spinal osteosynthesis comprising such assemblies.

BACKGROUND

(2) Lumbar vertebrae are conventionally rectified using systems for spinal osteosynthesis comprising bone anchoring means of the pedicle screw type, implanted in successive vertebrae involved in the rectification, and connected longitudinally to one another by connecting rods or plates via connection means.

(3) However, the rectification of vertebrae using existing lumbar spinal osteosynthesis systems encounters several problems associated, in particular, with the bending and placing of the connecting rods.

(4) Indeed, in the case of monoaxial pedicle screws, it is necessary to adapt the connecting rods with suitable curvatures. However, the bending of the connecting rods is not an easy or precise operation to perform, and becomes increasingly difficult, the more pronounced the deformation of the vertebral column is. In addition, the correction is effectively limited by the curvature given to the connecting rod in combination with the angle at which the screws are inserted into the pedicles. Moreover, in the event of a significant correction, the corrective forces directly applied to the pedicle screws may adversely affect the quality of the anchorage and, in particular, in the case of osteoporotic bones, may cause the pedicle screws to be torn out.

(5) In order to overcome these disadvantages of monoaxial pedicle screws, it is known to replace monoaxial screws with multiaxial pedicle screws. However, the use of multiaxial screws does not prove entirely satisfactory, since they require the vertebrae to be reduced either by the technique of patient positioning, or by techniques of bending the connecting rod, which techniques are however relatively heavy-handed, long and complicated and do not systematically ensure, like monoaxial pedicle screws, the proper rectification of the vertebrae. In addition, the use of multiaxial screws results in a loss of correction.

(6) Thus, whether the pedicle screws used are monoaxial or multiaxial screws, it proves particularly difficult to achieve a precise correction in 3 dimensions (sagittal, coronal and transverse). Additionally, it is not possible to systematically ensure proper rectification of the vertebrae.

(7) The present disclosure aims to solve these problems by proposing a rectification assembly, and also a system for spinal osteosynthesis comprising such assemblies, enabling precise sagittal, coronal and transverse corrections with a large capacity for these corrections, while ensuring a satisfactory quality of attachment to the vertebrae.

BRIEF SUMMARY

(8) To this end, and according to a first aspect, the present disclosure relates to an assembly for rectifying vertebrae, comprising two bone anchoring means intended to be implanted on a same vertebra, a structure for bridging the bone anchoring means to one another, the bridging structure, which is implantable, comprising a triangulation bar and connection means for connecting the triangulation bar to each bone anchoring means, a correction instrument mounted on the triangulation bar, means for locking the triangulation bar on the bone anchoring means via the connection means, the triangulation bar thus forming, with the bone anchoring means, a rigid triangular assembly, and means for adjusting the angular position of the correction instrument relative to the vertebra at a determined angle.

(9) The implanted triangulation bar, associated with the convergent position of the bone anchoring means inherent to the very constitution of the vertebra, makes it possible to obtain a rigid triangular attachment assembly, which is reinforced and inseparable from the vertebrae. This thus makes it

possible to perform corrective maneuvers in 3 dimensions, directly applied to the vertebra on which the assembly is mounted, and without a risk of damaging the bone anchorages. Moreover, the possibility of adjusting the angular position of the correction instrument relative to the vertebra on which it is mounted will enable the surgeon to establish a reference point, making it possible to simply and easily achieve the desired rectification of the vertebra.
(10) According to a first configuration of an embodiment of the present disclosure, the connection means comprise means for adjusting the angular position of the correction instrument.
(11) Advantageously, the triangulation bar comprises an attachment area for the correction instrument, arranged to provide secure attachment, in rotation and in translation, of the correction instrument on the triangulation bar.
(12) Advantageously, the triangulation bar comprises a flattened portion forming the attachment area.
(13) According to another configuration of an embodiment the present disclosure, the means for adjusting the angular position of the correction instrument are fitted on the triangulation bar.
(14) Advantageously, the triangulation bar comprises an attachment area for the correction instrument, arranged to permit at least one displacement of the correction instrument on the triangulation bar in the sagittal plane, the attachment area forming the means for adjusting the angular position of the correction instrument. According to a particular embodiment, the triangulation bar comprises a notched part forming the attachment area.
(15) Advantageously, the attachment area is central.
(16) Advantageously, the connection means comprise two connectors each comprising a first passage area defining a longitudinal passage axis for the triangulation bar and a second passage area arranged to receive one of the bone anchoring means, said second passage area having an oblong form oriented parallel to the longitudinal passage axis of the first passage area, the connectors forming the means for adjusting the angular position of the correction instrument.
(17) Advantageously, the second passage area is offset relative to the longitudinal passage axis.
(18) Advantageously, the first passage area is shaped to enable the sliding and the rotation of the triangulation bar within itself before it is locked on the bone anchoring means. After the triangulation bar is locked on the two bone anchoring means, the latter form, with the triangulation bar, a rigid triangular attachment assembly with no degrees of freedom.
(19) According to a particular configuration, each connector is in the form of a clip comprising a part having a C-shaped section extended by two arms comprising, respectively, an orifice, the orifices of each arm being arranged facing one another so as to define the second passage area, while the C-shaped section delimits the first passage area. It may advantageously be provided that the arm orifices are arranged to have an axial offset relative to one another. This arrangement makes it possible to obtain greater clamping on the rod, due to the shearing effect.
(20) Advantageously, each bone anchoring means comprises a fixed screw head extended on either side by a lower threaded part for implantation in the vertebra and an upper threaded part onto which a retaining nut, forming the locking means, is intended to be screwed.
(21) Advantageously, the triangulation bar is straight or curved.
(22) The present disclosure also relates to a connector intended to be implemented with a rectification assembly such as, for example, as described above, the connector being arranged to enable the adjustment of the angular position of a correction instrument. The connector has all the characteristics described above. In particular, it comprises a first passage area defining a longitudinal passage axis for a triangulation bar and a second passage area arranged to receive a bone anchoring means, which second passage area has an oblong form oriented parallel to the longitudinal passage axis of the first passage area. According to a particular configuration, the connector is in the form of a clip comprising a part having a C-shaped section extended by two arms comprising, respectively, an orifice, the orifices of each arm being arranged facing one another so as to define the second passage area, while the C-shaped section delimits the first

passage area. It may advantageously be provided that the arm orifices are arranged to have an axial offset relative to one another. This arrangement makes it possible to obtain greater clamping on the rod, due to the shearing effect.
(23) The present disclosure also relates to a system for spinal osteosynthesis comprising at least two assemblies for rectifying vertebrae as described above, the assemblies being intended to be implanted on two discrete vertebrae and to be connected to one another.
(24) Advantageously, the system comprises at least one maneuvering instrument connecting the correction instruments of each of the triangulation assemblies to one another.
(25) The present disclosure also relates to a method for rectifying vertebrae using two assemblies for rectifying vertebrae as described above and comprising the following steps: implanting first bone anchoring means in a first vertebra, implanting second bone anchoring means in a second vertebra connecting the first bone anchoring means to one another by means of a first triangulation bar comprising first means for attaching a first correction instrument, the first triangulation bar forming a first implanted bridging structure, connecting the second bone anchoring means to one another by means of a second triangulation bar comprising second means for attaching a second correction instrument, the second triangulation bar forming a second implanted bridging structure, positioning the first and second correction instruments relative to one another at an angle corresponding to the desired sagittal angular correction and locking the first and second correction instruments in position, and, after locking the first and second correction instruments in position, displacing the first and/or the second correction instrument in order to position them parallel to one another.
(26) According to a first embodiment, the positioning of the first and second correction instruments at an angle corresponding to the desired sagittal angular correction is carried out by pivoting the first and second triangulation bars on the first and second bone anchoring means. The adjustment of the angular position of the correction instruments is made possible by implementing means for connecting the triangulation bars to the bone anchoring means, which connection means are arranged to permit, before locking, a multiaxial movement of the triangulation bars on the bone anchoring means. The locking of the first and second correction instruments in position is then carried out by locking the triangulation bars on the first and second bone anchoring means.
(27) According to another embodiment, the positioning of the first and second correction instruments at an angle corresponding to the desired sagittal angular correction is carried out by pivoting the correction instruments on their respective triangulation bars via the attachment means of the bars, arranged to enable such a pivoting movement.
(28) The placing of the triangulation bars and the positioning of the correction instruments at a defined angle before locking enables optimal and precise control of the sagittal, coronal and transverse corrections.
(29) Advantageously, the first and second correction instruments are attached, respectively, to the first and second triangulation bar, at the first and second attachment means, prior to the triangulation bars being placed on the associated bone anchoring means.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) Other subjects and advantages of the present disclosure will become apparent from the following description, made with reference to the appended drawings, in which:
(2) FIG. **1** shows a schematic view of an assembly for rectifying vertebrae according to one embodiment;
(3) FIG. **2** shows a partial exploded view of the assembly for rectifying vertebrae of FIG. **1**;
(4) FIG. **3** shows a plan view of the triangulation bar implemented in the assembly for rectifying

vertebrae of FIG. **1**;
(5) FIG. **4** shows another embodiment of the triangulation bar;
(6) FIGS. **5** to **7** show, respectively, perspective, plan and side views of the connector implemented in the assembly for rectifying vertebrae of FIG. **1**;
(7) FIGS. **8** and **9** show a perspective detail view of the rectification assembly, before and after, respectively, placing the retaining nut;
(8) FIGS. **10** and **11** show a lateral view of the rectification assembly illustrated in FIGS. **8** and **10**;
(9) FIGS. **12** to **18***b* show the steps of placing two rectification assemblies with a view to rectifying vertebrae;
(10) FIGS. **19***a* to **19***c* show, respectively, perspective, transverse and posterior views of vertebrae requiring rectification in 3 dimensions, the vertebrae being fitted with rectification assemblies according to the present disclosure;
(11) FIGS. **20***a* and **20***b* show the vertebrae illustrated in FIGS. **19***a* to **19***c* after a transverse rotation correction;
(12) FIGS. **21***a* to **21***c* show the vertebrae illustrated in FIGS. **20***a* and **20***b* after a coronal shift correction;
(13) FIG. **22** shows a schematic view of an assembly for rectifying vertebrae according to another embodiment;
(14) FIG. **23** shows a partial exploded view of the assembly for rectifying vertebrae of FIG. **22**.

DETAILED DESCRIPTION

(15) In relation to FIGS. **1** to **11**, an embodiment of an assembly **1** for rectifying vertebrae according to the present disclosure is described.
(16) The rectification assembly **1** comprises two bone anchoring means **2** intended to be implanted on a same vertebra **100**, a triangulation bar **3** and connection means **4** for connecting the triangulation bar to each bone anchoring means.
(17) In the embodiment illustrated, the triangulation bar **3** (of circular section in the example) is advantageously omega-shaped in order to follow the form of the vertebra **100** on which it is mounted. More particularly, it comprises a central part **30** and two end parts **31**, **32**, which are, respectively, linear, the end parts each being connected to the central part by a curved portion.
(18) In order to rectify the vertebrae according to the technique described below, the triangulation bar **3** comprises an attachment area **33** enabling the attachment of a correction instrument **10**. In the embodiment illustrated, the attachment area **33** is provided at the central part **30**. It is formed of two flattened portions arranged on either side of the bar. They are arranged centrally in the curved part.
(19) The connection means **4** associated with each anchoring means **2** comprise a connector **5** and a retaining nut **6**.
(20) Each connector **5** comprises a first and a second passage area **51**, **52**, the first area being arranged to receive the end parts **31**, **32** of the triangulation bar **3**, the second area being arranged to receive one of the bone anchoring means **2**. Advantageously, the second passage area **52** is offset relative to the first passage area **51** and defines a longitudinal passage axis perpendicular to the longitudinal passage axis of the first passage area **51**.
(21) According to an advantageous configuration, the second passage area **52** is advantageously of oblong form in order to enable the attachment of the rectification assembly in a configuration in which the triangulation bar **3** and the anchoring means **2** are not perpendicular. In the embodiment described, the angular displacement is +/−15°. Advantageously, the second passage area **52** is arranged in order to enable a rotation of the connector **5** on the anchoring means **2** and thus to enable the adaptability of the triangulation bar when the latter is not perpendicular to the anchoring means **2**.
(22) In the embodiment illustrated, each connector **5** is in the form of a clip, generally U-shaped, comprising two arms **53**, **54** extending facing one another at a distance from one another and, at the

starting point of the arms **53**, **54**, a tubular portion **50** having a C-shaped section defining the first passage area **51** for receiving the triangulation bar **3**. Each arm **53**, **54** of the connector comprises a through-orifice **523**, **524** defining the second passage area **52**. Advantageously, the through-orifices **523**, **524**, respectively, have an oblong form oriented parallel to the longitudinal passage axis of the first passage area **51**, the through-orifice **523** having a length greater than that of the through-orifice **524**. This arrangement of the orifices **523**, **524** of oblong form has the advantage of enabling the free rotation of the connector **5** on the bone anchoring means before locking thereof. As illustrated in the figures, the second passage area **52** is offset from the longitudinal passage axis.

(23) In the embodiment illustrated, the through-orifices **523**, **524** are arranged coaxially, facing one another. According to a variant embodiment, the through-orifices **523**, **524** may be arranged to have a slight offset relative to one another in order to ensure a greater clamping pressure on the rod due to the shearing effect.

(24) Advantageously, the through-orifice **523** of the upper arm (arm **53**) is delimited by an inner bearing surface **523**A having a curved form shaped to receive one of the retaining nuts **6**, the retaining nuts **6** each having a base of convex form able to cooperate with the inner bearing surface of the through-orifice **523** of the arm **53**.

(25) Advantageously, the first passage area **51** is shaped to enable the sliding and the rotation of the triangulation bar **3** within itself before it is locked on the connectors **5** via the retaining nuts **6**.

(26) The connectors, which have just been described are thus arranged to form adjustment means, which will make it possible to adjust the angular position of a correction instrument mounted on the triangulation bar **3**, as will be described below. It may also be provided that the adjustment means are borne not by the connectors but by the triangulation bar **3**. FIG. **4** gives an example of a triangulation bar **3** in which the attachment area **33** comprises a notch. It is thus possible to adjust the angular position of the correction instrument.

(27) In the embodiment illustrated, the bone anchoring means **2** are in the form of a pan-head anchoring screw. Hereinafter, no distinction will be made between "bone anchoring means" and "anchoring screws."

(28) Each anchoring screw **2** comprises a screw head **20** extended on either side by threaded parts **21**, **22**, the lower threaded part **21** being shaped for implantation in the vertebra, the upper threaded part **22** being shaped to receive one of the retaining nuts **6**. Moreover, the screw head **20** comprises a convex spherical upper face **20**A and, in the lower part, a lateral face **20**B having a 6-sided imprint. As will be seen below, the connector **5** is positioned on the associated anchoring screw **2**, the lower face of the lower arm **54**, advantageously of complementary form, bearing against the spherical upper face **20**A of spherical form of the screw head **20**, the latter serving as pivot during the rectification of the vertebrae. The retaining nut **6**, under the application of a tightening torque, causes the arms **53**, **54** to come closer to one another, until the triangulation bar **3** is locked in the connection means **4** (FIGS. **8** to **11**).

(29) FIGS. **12** to **19***b* illustrate the placing of two rectification assemblies **1** as described above and the implementation thereof for rectifying vertebrae.

(30) Firstly, the anchoring screws **2** of each of the rectification assemblies are placed on the two vertebrae **100**, **110** located on either side of the area of the spinal column to be treated (FIG. **12**). Each anchoring screw **2** is implanted at one of the pedicles of the associated vertebra (the figures show simplified vertebrae). The anchoring screws **2** of each vertebra **100**, **110** are implanted so as to each converge in the direction of the other.

(31) The anchoring screws **2** of the same vertebra are then connected to one another with a triangulation bar **3** by threading, through the second passage **52** of each connector **5** fitted to the ends of the bar, the upper threaded part **22** of the anchoring screw **2** in question until the lower arm **54** of the connector **5** comes to bear against the spherical upper face **20**A of the screw head **20**. This step is carried out using a handling instrument **10** attached beforehand to the attachment area of the triangulation bar **3** (FIGS. **13***a* and **13***b*). In the embodiment illustrated, the handling instrument **10**

is intended to also ensure the correction of the vertebrae. Hereinafter, it will be referred to as correction instrument **10**. In the embodiment illustrated, the correction instrument **10** is formed of a shaft **16** provided with a plurality of attachment means **11** intended to enable the attachment of additional instruments, and, in particular, “maneuvering” instruments. Advantageously, the attachment means **11** form a ball joint in order to enable multi-directional connection to the additional instruments, the ball joint being lockable at any time. The correction instrument **10** comprises, at the end opposite to the end for attachment to the triangulation bar **3**, a handle **17**. Advantageously, the handle **17** is arranged to have extensions **18** extending on either side of the shaft, and advantageously perpendicular thereto, in the transverse plane of the vertebrae when the correction instrument **10** is mounted thereon.
(32) The retaining nuts **6** are then placed on the upper threaded part **22** of the screw head **20** emerging from the connector **5** without however being completely screwed on, so as not to block either the displacement of the triangulation bar **3** through the connector **5** or the movement of the connectors **5** on the anchoring screws **2** (FIG. **13***c*).
(33) The correction instruments **10** are then positioned at an angle α relative to one another, which angle corresponds to the sagittal angular correction determined beforehand by the surgeon, which is generally chosen to obtain optimum sagittal balance of the patient using an angle-measuring instrument **15**. In the case of an osteotomy, the angular position of the correction instruments **10** is chosen to correspond to the ultimately desired lordosis angle.
(34) Once the angle between the correction instruments **10** has been reached, the nuts **6** are finally tightened to hold the triangular attachment assemblies in a fixed and rigid position on each of the vertebrae.
(35) Maneuvering instruments **12**, **13**, connecting the correction instruments **10** of each of the triangulation assemblies, are then put in place on the attachment means **11** of the correction instruments **10**. The maneuvering instruments comprise a rack and pinion system enabling the correction instruments **10** to be gradually moved away from, or closer to, one another via the triangulation assemblies, and therefore enabling gradual compression or distraction of the vertebrae relative to one another. The fixed and rigid position of the attachment assembly obtained using the maneuvering instruments makes it possible to stabilize the vertebrae in any position, and thereby to perform a number of surgical gestures on a stable spinal column. In the case of an osteotomy, this fixed and rigid position provides essential stability to the surgical gesture, since the partial ablation of a vertebra results in significant instability of the spinal column.
(36) A first maneuvering instrument **12**, connecting the correction instruments **10** of each of the rectification assemblies, is thus put in place (FIGS. **14***a* and **14***b*). This first instrument enables, aside from the compression/distraction of the vertebra **100**, **110** carried out subsequently, an angular correction of the vertebrae. The anteroposterior displacement of this maneuvering instrument also enables direct anteroposterior positional correction of the vertebrae, advantageously in the case of spondylolisthesis. This displacement/correction is possible by the combination of the correction instruments **10**, maneuvering instrument positioned in the form of a frame and the attachment means between these instruments, of ball joint type. A handle, not shown here, could also be positioned at the end of the maneuvering instrument in order to facilitate this displacement. Another advantage of this first instrument is that of avoiding any instability of the spine when the ball joints are locked.
(37) When an osteotomy is necessary, the vertebral bone is cut in a V shape (FIGS. **15***a* and **15***b*) with an angle corresponding to the ultimately desired lordosis angle and thus corresponding to the angular distance of the correction instruments **10** relative to one another (spacing at angle α). To this end, the angular positioning of the correction instruments **10** in the predefined position forms a guide for the osteotomy bone-cutting instruments, with the vertebral bone cuts in a V shape being made parallel to the correction instruments **10**.
(38) In order to control the compression/distraction correction of the vertebrae with instruments

between them, a second maneuvering instrument **13** can be placed between the two correction instruments **10** (FIG. **16**).

(39) Once the maneuvering instruments are in place, the correction of the vertebrae is performed. For this purpose, the correction instruments **10** are acted upon until they are placed parallel to one another (FIGS. **17***a* and **17***b*), the final parallel positioning of the correction instruments **10** corresponding to the optimal correction of the sagittal angle, the two faces of the V shape, created by the osteotomy, which may have been carried out, then being parallel or even colinear.

(40) Once the correction has been carried out, it only remains to connect the triangular attachment assemblies together in order to fix the position thereof, before the correction instruments **10** are disassembled. This connecting can be carried out, for example, by means of a longitudinal attachment system **14** composed of hooks **14**A and plates **14**B (FIGS. **18***a* and **18***b*).

(41) The preceding figures show vertebrae requiring rectification only in the sagittal plane. Of course, it is clear that the rectification system according to the present disclosure is not limited to this type of correction, the system being suitable for enabling corrections in 3 dimensions. FIGS. **19***a* to **19***c* show an example of vertebrae requiring such a correction. In order to facilitate understanding of the movement of the vertebrae performed during the rectification thereof using the rectification system according to the present disclosure, the maneuvering instruments are not shown.

(42) Thus, after having positioned the correction instruments **10** of each rectification assembly relative to one another at the sagittal angle α corresponding to the targeted posterolateral angular correction, a transverse rotation correction is carried out so as to bring the shafts **16** of the correction instruments **10** into the same plane, as illustrated in FIGS. **20***a* and **20***b*. A coronal shift correction is then carried out by positioning the handles **17** of the correction instruments **10** parallel with one another, as illustrated in FIGS. **21** to **21***c*. The sagittal correction of the vertebrae is then carried out, by bringing, as in the previous example of vertebral rectification, the shafts **16** of the correction instruments **10** parallel with one another (FIG. **17***a*).

(43) The movements (transverse rotation, coronal shift and sagittal shift) applied to the vertebrae have been described sequentially. Of course, it is clear that all of these movements can be carried out in a single gesture. The measuring instrument **15** described in the initial phase of angular positioning of the correction instruments can also be used during all the surgical steps described, in order to monitor and measure the progression of the correction.

(44) FIGS. **22** and **23** show a variant embodiment of an assembly for rectifying **1**A vertebrae. The implementation of the assembly is similar to that described previously. However, the rectification assembly of this variant differs from that described previously in terms of the arrangement of the connectors **500** and also the bone anchoring means **200**.

(45) In this variant, the connector **500** is formed of two separate parts **500**A, **500**B.

(46) One of the parts **500**A forms a sleeve intended to receive the triangulation bar **3**. The sleeve is provided at both of its ends with a notch **501**A, **503**A. It is provided on its outer face with a threaded shaft **502**A. The notches are arranged facing one another on either side of the threaded shaft.

(47) The other part **500**B comprises a groove **501**B arranged to receive the upper part **220** of the bone anchoring means. It comprises a hole **502**B for the passage of the threaded shaft **502**A. The groove **501**B is arranged to be placed facing one of the notches **501**A. Thus, when the two parts are assembled by tightening the retaining nut **6** on the threaded shaft **502**A, which extends through the passage hole **502**B, the upper part **220** of the bone anchoring means and the triangulation bar **3** are clamped by being pressed against one another, with the two parts acting as a vise.

(48) As will be understood, the arrangement of sleeve/threaded rod/upper part of the bone anchoring means is such that it enables multiaxial movement of the triangulation bar before complete tightening of the nut, thereby enabling the adjustment of the angular position of the correction instrument mounted on the triangulation bar (instrument not shown).

(49) Embodiments of the present disclosure are described above by way of example. Of course, a person skilled in the art is able to carry out different variant embodiments of the present disclosure without departing from the scope of the invention as defined by the claims.

Claims

1. An assembly for rectifying vertebrae comprising: a first screw and a second screw each configured to be implanted in a vertebra; a triangulation bar having an attachment area and configured to be implantable between the first screw and the second screw; a first connector having a first passage along a longitudinal axis configured to be connected to the triangulation bar by the first screw, a second connector having a second passage arranged to receive one of the two screws and configured to be connected to the triangulation bar by the second screw wherein each second passage includes an oblong form oriented parallel to the longitudinal axis of the first passage; a first retaining nut configured to lock the triangulation bar to the first screw; and a second retaining nut configured to lock the triangulation bar to the second screw, wherein the triangulation bar forms, when engaged with the first screw and the second screw, a rigid triangular assembly.
2. The assembly of claim 1, wherein the first passage of each of the first and the second connectors is shaped to enable a sliding and a rotation of the triangulation bar prior to being locked to the two connectors.
3. The assembly of claim 1, wherein each second passage is configured to enable a rotation of the first and the second connectors to allow for an adjustment of an angular position of a correction instrument relative to the vertebra.
4. The assembly of claim 3, wherein each connector is included as a clip having a C-shaped section that is extended by two arms, each arm defining an orifice so as to define the second passage for each of the first and the second connectors, while the C-shaped section delimits the first passage of each of the two connectors.
5. The assembly of claim 4, wherein the orifices defined by each arm are axially offset from one another.
6. The assembly of claim 5, wherein each screw includes a screw head and a first threaded portion suitable for implantation in the vertebra and a second threaded portion suitable for receiving one of the first and the second retaining nuts.
7. The assembly of claim 1, wherein the attachment area is suitable for receiving a correction instrument and arranged so as to provide secure attachment, in rotation and in translation, of the correction instrument on the triangulation bar.
8. The assembly of claim 1, wherein the attachment area is suitable for receiving a correction instrument and arranged so as to permit at least one displacement of the correction instrument on the triangulation bar in a sagittal plane.
9. The assembly of claim 8, wherein the attachment area is centrally positioned on the triangulation bar.
10. The assembly of claim 8, wherein the triangulation bar includes a flattened portion forming the attachment area.
11. The assembly of claim 8, wherein the triangulation bar includes a notch forming the attachment area.
12. The assembly of claim 1, wherein each connector is fitted on the triangulation bar.
13. The assembly of claim 1, wherein each screw includes a screw head and a lower threaded portion that is suitable for implantation in the vertebra and an upper threaded portion onto which one of the first and the second retaining nuts may be screwed.
14. The assembly of claim 1, wherein the triangulation bar is at least one of straight and curved.
15. A system for spinal osteosynthesis comprising at least two assemblies for rectifying vertebrae according to claim 1, the at least two assemblies being suitable for implantation on two discrete

vertebrae and to be connected to one another.
16. The system of claim 15, further comprising at least one maneuvering instrument connecting a correction instrument of each of the at least two assemblies for rectifying vertebrae to one another.
17. The system of claim 16, wherein the at least one maneuvering instrument comprises a rack and pinion system.
18. The system of claim 16, further comprising an angle measuring instrument.
19. An assembly for rectifying vertebrae comprising: a first screw and a second screw each configured to be implanted in a vertebra; a triangulation bar configured to be implantable between the first screw and the second screw; a first connector having a first passage along a longitudinal axis configured to be connected to the triangulation bar by the first screw, a second connector having a second passage arranged to receive one of the two screws and configured to be connected to the triangulation bar by the second screw wherein each second passage includes an oblong form oriented parallel to the longitudinal passage axis of the first passage; a correction instrument mountable to the triangulation bar; a first retaining nut configured to lock the triangulation bar to the first screw; and a second retaining nut configured to lock the triangulation bar to the second screw, wherein the triangulation bar forms, when engaged with the first screw and the second screw, a rigid triangular assembly.
20. A method comprising: implanting a first screw and a second screw into a first vertebrae; connecting the first screw and the second screw with a first triangulation bar through at least one passageway that includes an oblong form oriented parallel to a longitudinal passage axis; attaching the first screw and the second screw to the first triangulation bar; and attaching a first correction instrument to an attachment area on the first triangulation bar.
21. The method of claim 20, further comprising implanting a third screw and a fourth screw into a second vertebrae; connecting the third screw and the fourth screw with a second triangulation bar; attaching the third screw and the fourth screw to the second triangulation bar; and attaching a second correction instrument to an attachment area on the second triangulation bar.
22. The method of claim 21, further comprising positioning the first correction instrument and the second correction instrument at an angle relative to each other.
23. The method of claim 22, wherein the angle corresponds to a sagittal angular correction.
24. The method of claim 22, wherein the angle corresponds to a desired lordosis angle.
25. The method of claim 22, further comprising tightening the first screw and the second screw to the first triangulation bar and tightening the third screw and the fourth screw to the second triangulation bar.
26. The method of claim 25, further comprising connecting the first correction instrument and the second correction instrument with a first maneuvering instrument.
27. The method of claim 26, further comprising moving the first correction instrument and the second correction instrument relative to each other with the first maneuvering instrument.
28. The method of claim 26, further comprising connecting the first correction instrument and the second correction instrument with a second maneuvering instrument.