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(54) Title: APPARATUS FOR RADIOLUCENT PATIENT POSITIONING AND METHOD OF USING THE APPARATUS

(57) Abstract: A positioning system is provided that effectively engage the patient's neck/shoulder area so as to enable the caudally migration of the patient's neck/shoulder(s). An instance of the system includes a puller member for engaging a patient's neck/shoulder area and applying a pulling force thereupon. A support member is provided that is joined to the pulling member at a location away from where the engagement portion of the pulling member contacts the patient during normal use. The support member and the joining thereto are operational to enable the pulling member to adjustably maintain a substantially fixed vertical elevation that aligns the engagement portion of the pulling member to effectively engage the patient's neck/shoulder area; and, the support member also has a variable shuttle member that is adjustably joined to a guide member for adjusting the removable joining position of the support member along a length of a guide member. This guide member is configured to have a substantially parallel orientation relative to a longitudinal axis of the engagement portion of the pulling member such that the pulling member is operable for being positioned relative to the patient and effectively engage the patient's neck/shoulder area so as to enable the caudally migration of the patient's neck/shoulder(s). A method for using the apparatus is also included.

# Apparatus for Radiolucent Patient Positioning and Method of Using the Apparatus

by Michael Campagna

## CROSS- REFERENCE TO RELATED APPLICATIONS

[0001] The present PCT patent application claims priority benefit of the U.S. provisional application for patent serial number 61329253 and entitled "Method and Apparatus for Variable Medical/Surgical/Diagnostic Rigid Radiolucent Patient Positioning", filed on April 29, 2010 under 35 U.S.C. 119(e), and U.S. Utility patent applications number 12464456 and entitled "AN APPARATUS FOR MOUNTING AN ANATOMICAL POSITIONER ON A PATIENT CARE PLATFORM", filed on 12-MAY-2009 , and number 13098293 and entitled "Apparatus for Radiolucent Patient Positioning and Method of Using the Apparatus", filed on 29-APR-2011 under 35 USC 111(a). The contents of these related provisional and patent applications are incorporated herein by reference for all purposes.

FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

[0002] Not applicable.

REFERENCE TO SEQUENCE LISTING, A TABLE, OR A COMPUTER LISTING APPENDIX

[0003] Not applicable.

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## FIELD OF THE INVENTION

[0005] One or more embodiments of the invention generally relate to medical equipment. More particularly, the invention relates to a rigid anatomical positioning device.

## BACKGROUND OF THE INVENTION

[0006] For accurate diagnosis, the visualization of the vertebrae during radiography procedures such as, but not limited to, X-Ray, fluoroscopy, computed tomography (CT), etc. must be correct. Often, a subject's shoulders obscure the lateral imaging of the cervical vertebrae. This radiographic visualization is optimized via the temporary caudal (towards the feet) migration of the shoulders of the immobilized patient, preferably without interference with the stabilization of the head and neck. Traditional means currently employed by clinicians to achieve correct positioning for cervical visualization typically involve overt positioning and manipulation of the patient's head and neck during live radiography or the positioning and manipulation of the patient's arms and shoulders. There are concomitant risks to the immobilized structures of the head and neck when positioning these structures. Generally, practitioners are concerned about the risk of aggravating any existing injuries.

[0007] Cervical spine injuries are the most commonly missed severe injuries and can have serious implications for the patient and the physician. Approximately 5-10% of unconscious patients who present to the Emergency Room as the result of a motor vehicle accident or fall have a major injury to the cervical spine. Well more than half of catastrophic injuries in sports are cervical spine injuries. Cervical spine injuries can be disastrous and cause an estimated 6000 deaths and 5000 new cases of quadriplegia in the U.S. annually.

[0008] The normal anatomy of the cervical spine consists of seven cervical vertebrae separated by intervertebral disks and joined by a complex network of ligaments. These ligaments keep individual bony elements behaving as a single unit. Cervical spine injuries are best classified according to several mechanisms of injury. These include flexion, flexion-rotation, extension, extension-rotation, vertical compression, lateral flexion, and imprecisely understood mechanisms that may result in odontoid fractures and atlanto-occipital dislocation.

[0009] The following is an example of a specific aspect in the prior art that, while expected to be helpful to further educate the reader as to additional aspects of the prior art, is not to be construed as limiting the present invention, or any embodiments thereof, to anything stated or implied therein

or inferred thereupon. By way of educational background, another aspect of the prior art generally useful to be aware of is that due to the Omnipresent danger of further complication, the commonplace and accepted transport protocols for patients with suspected cervical spine injuries dictate the supine immobilization of the patient upon a backboard or longboard with a semi-rigid cervical collar and with the head and neck cradled and supported by a variety of straps across the forehead and simultaneous lateral immobilization of the head and neck via the positioning of sand bags or various foam or otherwise fashioned blocks, triangles, pads, collars, etc. Strapping is preferably applied to the shoulders and pelvis in addition to the head to prevent the neck becoming the center of rotation of the body. The cervical spine is often stabilized until an injury in this area is ruled out. The patient's neck is typically kept immobilized until a full cervical spine series can be obtained in the radiographic department. Also, if the patient has suffered a head injury, cervical spine precautions are typically maintained until spinal column injuries have been ruled out roentgenographically.

[0010] Cervical spine radiographs are almost routine in many emergency departments, yet cervical spine radiographs have limitations. It is believed that, approximately 85-90 percent of cervical spine injuries are evident in the radiographic lateral view, making it the most useful view from a clinical standpoint. A technically acceptable lateral view typically shows all seven vertebral bodies and the cervicothoracic junction, the C7-TI interspace, allowing visualization of the alignment of C7 and TI. However, up to 20 percent of fractures are believed to be missed on plain radiographs. It is believed to that the most common reason for a missed or overlooked cervical spine fracture, subluxation or dislocation injury is a cervical spine radiographic series that is technically inadequate. One metric of success is often the ability to obtain all of these views and visualize all of the vertebrae. One can expect that the failure to fully visualize these areas may result in higher rates of patient morbidity and successful malpractice litigation against emergency physicians.

[0011] The following is an example of a specific aspect in the prior art that, while expected to be helpful to further educate the reader as to additional aspects of the prior art, is not to be construed as limiting the present invention, or any embodiments thereof, to anything stated or implied therein or inferred thereupon. By way of educational background, another aspect of the prior art generally useful to be aware of is that it is believed that during radiography, all seven vertebrae and the C7-TI junction are not visible, and no arm injury is present, traction on the arms may facilitate visualization of all seven cervical vertebrae on the lateral film. This traction on the arms has the

effect of migrating the shoulder and thus alleviating the radiographic artifact caused by the shoulder, which obscures optimum visualization. However, this traction is typically provided by staff members pulling directly on the arms or using straps or bandages to pull on the arms, which means that these staff members must be present during the imaging and are subject to radiation exposure. In the absence of any arm injury, a radiographic lateral scan is often taken with one arm extended over the head in the so-called "Swimmer's View". This technique may provide adequate visualization of the cervical spine. Practitioners pay close attention to the traumatic circumstances of the initial injury to try and avoid insult and fractures that currently often occur to the arms. Furthermore, due to the necessity of complete immobilization of the patient's head and neck with foam or sand bags during radiographic diagnosis, no means of pushing or pressing upon the shoulders for purposes of radiographic diagnosis are favorable, as these means interfere with the necessary immobilization with the possibility of further detriment to the patient.

[0012] The following is an example of a specific aspect in the prior art that, while expected to be helpful to further educate the reader as to additional aspects of the prior art, is not to be construed as limiting the present invention, or any embodiments thereof, to anything stated or implied therein or inferred thereupon. By way of educational background, another aspect of the prior art generally useful to be aware of is that while some studies have used magnetic resonance imaging (MRI) as an adjunct to plain films and CT scanning, the lack of wide availability and the relatively prolonged time required for MRI scanning limits its usefulness in the acute setting. Another aspect often useful to consider is that resuscitation equipment with metal parts may not be able to function properly within the magnetic field generated by the MRI. MRI scanning of ventilated patients is typically a difficult undertaking often requiring special non-ferromagnetic equipment. Often, MRI imaging for purposes of diagnosis of suspected subluxation in the cervical vertebrae is largely impractical in many circumstances.

[0013] The following is an example of a specific aspect in the prior art that, while expected to be helpful to further educate the reader as to additional aspects of the prior art, is not to be construed as limiting the present invention, or any embodiments thereof, to anything stated or implied therein or inferred thereupon. By way of educational background, another aspect of the prior art generally useful to be aware of is that other current means of radiographic diagnosis of suspected subluxation of the cervical vertebral column include fluoroscopic passive dynamic flexion/extension stressing of the cervical spine, performed by an experienced clinician. It is believed that several centers have

reported their results, and some guidelines give primary support to the use of dynamic fluoroscopy in clearance of the spine in unconscious patients. It is believed that, there are significant difficulties in performing flexion/extension imaging routinely on the intensive care unit, and many spinal surgeons are unwilling to perform this flexion/extension due to safety implications. It is believed that cases of neurological deterioration have been reported, including quadriplegia.

[0014] In view of the foregoing, it is clear that these traditional means are not perfect and leave room for more optimal approaches.

## BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

[0016] Figures 1A and 1B are side perspective views of exemplary patient positioning devices for improved lateral imaging of the cervical vertebral structure of a patient with suspected head or neck injuries in use on a patient transport backboard, in accordance with an embodiment of the present invention. Figure 1A shows the positioning devices in an engaged position, and Figure 1B shows the positioning devices in a released position; and

[0017] Figure 2 is an exploded view of the internal components of an exemplary rail guided shuttle, in accordance with an embodiment of the present invention.

[0018] Unless otherwise indicated illustrations in the figures are not necessarily drawn to scale.

## SUMMARY OF THE INVENTION

[0019] To achieve the forgoing and other objects and in accordance with the purpose of the invention, an apparatus for radiolucent patient positioning and method of using the apparatus is presented.

[0020] In one embodiment an apparatus includes a first patient positioning device including a rigid puller comprising a first end being operable for engaging a patient's shoulder area. A support member is joined proximate a second end of the rigid puller where a longitudinal axis of the support member is approximately perpendicular to a plane containing the rigid puller. The first patient

positioning device includes a first rail and a variable positioning assembly that is movably joined to the support member to clamp the rigid puller at an adjusted distance from the variable positioning assembly. The variable positioning assembly is movably joined to the first rail to clamp the variable positioning assembly at an adjusted distance along a length of the first rail. The first patient positioning device further includes a second rail and a rail guided shuttle that is movably joined to the second rail and operable to be secured at a position along the second rail. The guided shuttle is joined to the first rail where the first rail is approximately perpendicular to the second rail. The first patient positioning device also includes a clamping mechanism joined to the second rail and being operable to secure the second rail parallel to a flat structure positioned below the patient where the rigid puller is operable for being positioned to engage the patient's shoulder area, proximal to the first patient positioning device, and to be pulled to and secured at a position where the patient's shoulder area has been caudally migrated. In another embodiment the rigid puller is further operable for engaging the patient's acromioclavicular joint and caudally migrating the acromioclavicular joint. In yet another embodiment the first end of the rigid puller comprises an arch. In still another embodiment the rigid puller further comprises a thickened edge along an inner curve of the arch. In another embodiment the rigid puller further comprises a radiolucent material. In yet another embodiment the variable positioning assembly is further operable to clamp the rigid puller at an adjusted angle about the longitudinal axis. In still another embodiment the rail guided shuttle further comprises a braking mechanism being operable to secure the rail guided shuttle at a position along the second rail. In another embodiment the braking mechanism further comprises a trigger to release the rail guided shuttle from a secured position. In yet another embodiment the rigid puller is further operable to caudally migrate the patient's shoulder area to facilitate lateral radiographic visualization of the patient's cervical vertebral structures without moving the patient. Still another embodiment further comprises a second patient positioning device comprising a mirror image of the first patient positioning device. The second patient positioning device is joined to the flat structure where the second patient positioning device is operable for engaging the patient's other shoulder area distal to the first patient positioning device.

[0021] In another embodiment an apparatus includes a first patient positioning device including a rigid puller comprising a generally straight portion joined to an end of an arm of an arch on a first end of the straight portion, the arch being operable for engaging a patient's shoulder area within the arch. The rigid puller further includes a radiolucent material. A support member is joined proximate a second end of the rigid puller where a longitudinal axis of the support member is

approximately perpendicular to a plane containing the rigid puller. The first patient positioning device further includes a first rail and a variable positioning assembly comprising a first clamping mechanism and a second clamping mechanism. The first clamping mechanism is movably joined to the support member to clamp the rigid puller at an adjusted distance from the variable positioning assembly and at an adjusted angle about the longitudinal axis. The second clamp is movably joined to the first rail to clamp the variable positioning assembly at an adjusted distance along a length of the first rail. The first patient positioning device further includes a second rail and a rail guided shuttle comprising a braking mechanism. The rail guided shuttle is movably joined to the second rail where the breaking mechanism is operable to enable the guided shuttle to be moved along a length of the second rail and to be secured at a position along the second rail. The guided shuttle is join to the first rail where the first rail is approximately perpendicular to the second rail. The first patient positioning device also includes a clamping mechanism joined to the second rail and being operable to secure the second rail parallel to a flat structure positioned below and parallel to a coronal plane of the patient where the rigid puller is operable for being positioned to engage the patient's shoulder area, proximal to the first patient positioning device, and to be clamped in position, and the rail guided shuttle is operable to be moved to pull the rigid puller and to be secured at a position where the patient's shoulder area has been caudally migrated. In another embodiment the rigid puller is further operable for engaging the patient's acromioclavicular joint and caudally migrating the acromioclavicular joint. In yet another embodiment the rigid puller further comprises a thickened edge along an inner curve of the arch. In still another embodiment the braking mechanism further comprises a trigger to release the rail guided shuttle from a secured position. In another embodiment the clamping mechanism is further operable for securing to a patient transport structure. In yet another embodiment the rigid puller is further operable to caudally migrate the patient's shoulder area to facilitate lateral radiographic visualization of the patient's cervical vertebral structures without moving the patient. Still another embodiment further includes a second patient positioning device comprising a mirror image of the first patient positioning device. The second patient positioning device is joined to the flat structure where the second patient positioning device is operable for engaging the patient's other shoulder area distal to the first patient positioning device.

[0022] In another embodiment a method for using the apparatus includes the steps of joining the clamping mechanism of the first patient positioning device to a flat structure positioned below a patient where the clamping mechanism is near a midsection of the patient. A height and width

positions of the rigid puller is adjusted to engage a shoulder area of the patient proximal to the first patient positioning device. The height is adjusted by vertical movement of the variable positioning device on the first rail. The width is adjusted by lateral movement of the support member in the variable positioning device. The rigid puller is clamped at the adjusted height and width. The patient's shoulder area is migrated caudally by moving the rail guided shuttle caudally along the second rail. The rail guided shuttle is secured at a position along the second rail where the caudal migration by the rigid puller facilitates lateral radiographic visualization of the patient's cervical vertebral structures. In another embodiment the step of adjusting further comprises engaging the patient's acromioclavicular joint in the shoulder area to migrate the acromioclavicular joint. Yet another embodiment further includes the step of joining a clamping mechanism of a second patient positioning device to the flat structure where the second patient positioning device comprises a mirror image of the first patient positioning device, and the second patient positioning device is operable for engaging the patient's shoulder area distal to the first patient positioning device.

[0023] In yet another embodiment of the present invention, an apparatus is provided which includes a puller member, the puller member including an engagement portion being configured for engaging a patient's neck/shoulder area and applying a pulling force thereupon. A support member is provided in this embodiment that has a first portion at a first end of the support member and a second portion at a second end of the support member. The first support member portion is joined to the pulling member at a location away from where the engagement portion of the pulling member contacts the patient during normal use. Also, in this configuration a longitudinal axis of the first support member portion forms an off-axis relationship to a longitudinal axis of the pulling member. The first support member portion and the joining thereto being configured to be at least operational to enable the pulling member to adjustably maintain a substantially fixed vertical elevation that aligns the engagement portion of the pulling member to effectively engage the patient's neck/shoulder area; and, the second support member portion being configured with a variable shuttle member that is adjustably joined to the guide member for adjusting the removable joining position of the support member along a length of a guide member. This guide member being configured to have a substantially parallel orientation relative to a longitudinal axis of the engagement portion of the pulling member. Also provided in this embodiment is a joining mechanism configured to removably fix the guide member to a structure positioned below the patient such that the pulling member is operable for being positioned relative to the structure and effectively engage the patient's neck/shoulder area so as to enable the caudally migration of the patient's neck/shoulder(s).

[0024] In yet another embodiment of the present invention, which includes a puller member that has an engagement portion being configured for engaging a patient's neck/shoulder area and applying a pulling force thereupon. A support member is provided in this embodiment that has a first portion at a first end of the support member and a second portion at a second end of the support member. The first support member portion is joined to the pulling member at a location away from where the engagement portion of the pulling member contacts the patient during normal use. Also, in this configuration a longitudinal axis of the first support member portion forms an off-axis relationship to a longitudinal axis of the pulling member. The first support member portion and the joining thereto being configured to be at least operational to enable the pulling member to adjustably maintain a substantially fixed vertical elevation that aligns the engagement portion of the pulling member to effectively engage the patient's neck/shoulder area; and, the second support member portion being configured with a variable shuttle member that is adjustably joined to the guide member for adjusting the removable joining position of the support member along a length of a guide member. This guide member being configured to have a substantially parallel orientation relative to a longitudinal axis of the engagement portion of the pulling member. Also provided in this embodiment is a joining mechanism configured to removably fix the guide member to a structure positioned below the patient such that the pulling member is operable for being positioned relative to the structure and effectively engage the patient's neck/shoulder area so as to enable the caudally migration of the patient's neck/shoulder(s).

[0025] Other features, advantages, and objects of the present invention will become more apparent and be more readily understood from the following detailed description, which should be read in conjunction with the accompanying drawings.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0026] The present invention is best understood by reference to the detailed figures and description set forth herein.

[0027] Embodiments of the invention are discussed below with reference to the Figures. However, those skilled in the art will readily appreciate that the detailed description given herein with respect to these figures is for explanatory purposes as the invention extends beyond these limited embodiments. For example, it should be appreciated that those skilled in the art will, in light of the teachings of the present invention, recognize a multiplicity of alternate and suitable approaches, depending upon the needs of the particular application, to implement the functionality of any given detail described herein, beyond the particular implementation choices in the following embodiments described and shown. That is, there are numerous modifications and variations of the invention that are too numerous to be listed but that all fit within the scope of the invention. Also, singular words should be read as plural and vice versa and masculine as feminine and vice versa, where appropriate, and alternative embodiments do not necessarily imply that the two are mutually exclusive.

[0028] It is to be further understood that the present invention is not limited to the particular methodology, compounds, materials, manufacturing techniques, uses, and applications, described herein, as these may vary. It is also to be understood that the terminology used herein is used for the purpose of describing particular embodiments only, and is not intended to limit the scope of the present invention. It must be noted that as used herein and in the appended claims, the singular forms "a," "an," and "the" include the plural reference unless the context clearly dictates otherwise. Thus, for example, a reference to "an element" is a reference to one or more elements and includes equivalents thereof known to those skilled in the art. Similarly, for another example, a reference to "a step" or "a means" is a reference to one or more steps or means and may include sub-steps and subservient means. All conjunctions used are to be understood in the most inclusive sense possible. Thus, the word "or" should be understood as having the definition of a logical "or" rather than that of a logical "exclusive or" unless the context clearly necessitates otherwise. Structures described herein are to be understood also to refer to functional equivalents of such structures. Language that may be construed to express approximation should be so understood unless the context clearly dictates otherwise.

[0029] Unless defined otherwise, all technical and scientific terms used herein have the same meanings as commonly understood by one of ordinary skill in the art to which this invention belongs. Preferred methods, techniques, devices, and materials are described, although any methods, techniques, devices, or materials similar or equivalent to those described herein may be used in the practice or testing of the present invention. Structures described herein are to be understood also to refer to functional equivalents of such structures. The present invention will now be described in detail with reference to embodiments thereof as illustrated in the accompanying drawings.

[0030] From reading the present disclosure, other variations and modifications will be apparent to persons skilled in the art. Such variations and modifications may involve equivalent and other features which are already known in the art, and which may be used instead of or in addition to features already described herein.

[0031] Although Claims have been formulated in this Application to particular combinations of features, it should be understood that the scope of the disclosure of the present invention also includes any novel feature or any novel combination of features disclosed herein either explicitly or implicitly or any generalization thereof, whether or not it relates to the same invention as presently claimed in any Claim and whether or not it mitigates any or all of the same technical problems as does the present invention.

[0032] Features which are described in the context of separate embodiments may also be provided in combination in a single embodiment. Conversely, various features which are, for brevity, described in the context of a single embodiment, may also be provided separately or in any suitable subcombination. The Applicants hereby give notice that new Claims may be formulated to such features and/or combinations of such features during the prosecution of the present Application or of any further Application derived therefrom.

[0033] References to "one embodiment," "an embodiment," "example embodiment," "various embodiments," etc., may indicate that the embodiment(s) of the invention so described may include a particular feature, structure, or characteristic, but not every embodiment necessarily includes the particular feature, structure, or characteristic. Further, repeated use of the phrase "in one embodiment," or "in an exemplary embodiment," do not necessarily refer to the same embodiment, although they may.

[0034] As is well known to those skilled in the art many careful considerations and compromises typically must be made when designing for the optimal manufacture of a commercial implementation any system, and in particular, the embodiments of the present invention. A commercial implementation in accordance with the spirit and teachings of the present invention may configured according to the needs of the particular application, whereby any aspect(s), feature(s), function(s), result(s), component(s), approach(es), or step(s) of the teachings related to any described embodiment of the present invention may be suitably omitted, included, adapted, mixed and matched, or improved and/or optimized by those skilled in the art, using their average skills and known techniques, to achieve the desired implementation that addresses the needs of the particular application.

[0035] It is to be understood that any exact measurements/dimensions or particular construction materials indicated herein are solely provided as examples of suitable configurations and are not intended to be limiting in any way. Depending on the needs of the particular application, those skilled in the art will readily recognize, in light of the following teachings, a multiplicity of suitable alternative implementation details.

[0036] Applicant's prior inventions include, without limitation, rigid radiographic shoulder presses that include embodiments that can provide means for the distal migration of the shoulder. Those embodiment may work with or without specificity to an optimal point of migration. Applicant believes that in many practical applications of at least some embodiments of the present invention the acromioclavicular joint is an optimal point of migration. Some of those prior means may appear to be suitable for the migration of the shoulders in the emergency setting; however, with respect to practical application in the emergency situation, none of these means are compatible for usage without removal of or appreciable disturbance to either immobilization or the means of immobilization of the head and neck. For example, usage would require the removal of the neck immobilization or overt interference in the fitting of a harness to the patient. Since this interference to immobilization or the means of immobilization carries significant risk of patient morbidity, paralysis, and at the very least, complication of injuries, the actual usage of said devices in the emergency diagnostic setting is not suitable.

[0037] Applicant believes that many conventional techniques may not be effective in migrating the acromioclavicular joint, which Applicant believes is the actual structure that typically causes the dense artifact that obscures the lateral imaging of the cervical vertebrae. Applicant

believes that much of the prior art does not lock into place during use, thereby often necessitating that staff members are exposed to cumulative radiographic tissue load with each usage as they hold the means in place. At least some embodiments of the present invention are useful to provide safe and effective means for correct radiographic imaging for diagnosis of suspected injury of the cervical vertebrae.

[0038] One aspect of the preferred embodiment of the present invention to provide means for positioning the subject's shoulders during radiography that migrate the shoulders caudally out of the line of sight of the lateral image of the cervical vertebrae.

[0039] An embodiment of the present invention and at least one variation thereof provide a patient positioning device comprising a set of rigid radiolucent pullers designed to adjust and to fit ergonomically at a cervical trauma patient's acromioclavicular joint and adjacent anatomic structures when positioned with the head and neck of the patient immobilized in lateral restraints upon a patient transport backboard. Many embodiments of the present invention are arranged to facilitate lateral migration of the patient's anatomic structures for purposes of optimized lateral radiography without interference with the immobilization of the patient's head and neck and without interference with the means of immobilization of the patient's head and neck. Many embodiments of the present invention of the present invention may be used in various medical fields such as, but not limited to, the fields of radiology, surgery and emergency medical diagnosis and in various different settings including, but not be limited to, the hospital setting, the medical transport setting, the battlefield triage setting, the sports arena and pool setting, the maritime setting, the aviation setting, and any other setting where the immobilization and transport of patients with suspected injuries to the head and neck call for the swift radiographic diagnosis of said injuries.

[0040] Figures 1A and 1B are side perspective views of exemplary patient positioning devices 100 for improved lateral imaging of the cervical vertebral structure of a patient 102 with suspected head or neck injuries in use on a patient transport backboard 101, in accordance with an embodiment of the present invention. Figure 1A shows positioning devices 100 in an engaged position, and Figure 1B shows positioning devices 100 in a released position. In the present embodiment, positioning devices 100 comprise rigid pullers 103 affixed to variable positioning assemblies 104 mounted to a set of rail guided shuttles 105 equipped with trigger actuated braking systems. Each positioning device 100 comprises a universal locking clamp 106 in order to attach to patient transport backboard 101 near the area of the midsection of patient 102. In typical use of the present

embodiment, positioning devices 100 are variably positionable and automatically lockable without interference with immobilization means 125 fitted around the head and neck of patient 102, which are typical in emergency situations, and without interference with the immobilized anatomy of patient 102. Positioning devices 100 preferably provide caudal migration of the acromioclavicular joints and adjacent structures in order to provide optimized lateral radiographic visualization of the cervical vertebral structures.

[0041] Rigid pullers 103 comprise flat arms 107 each terminating in variable thickness arches 109 that are preferably constructed of radiographically invisible, or radiolucent, material in order to deliver a platform for migration of the acromioclavicular joint of patient 102 that does not appear on radiographic imaging. In the present embodiment, pullers 103 are preferably constructed of radiolucent carbon fiber; however, in alternative embodiments, the pullers may be constructed of various different durable radiolucent and non radiolucent materials including, but not limited to, PEEK, carbon, thermoplastic resins, polypropylene, polyethylene, polyamides, polyphenylene sulfides, high performance polymers, polyaryletherketones, carbon fiber reinforced thermoplastics, polycarbonates, beryllium, glass fiber reinforced acrylic, etc. In some alternate embodiments, the pullers may be made of non-radiolucent materials such as, but not limited to, various plastics, foam, metal, etc. Furthermore, pullers in alternative embodiments may be made of non ferromagnetic materials as well as ferromagnetic materials, although the use of ferromagnetic materials will preclude all usage within the MRI Environment due to the inherent dangers and risks attendant with the extremely high magnetic fields generated within the MRI array. Those skilled in the art, in light of the present teachings, will readily recognize that a multiplicity of suitable construction methods may be used to form pullers in different embodiments including, but not limited to, extrusion, compression molding, injection molding, or whatever means suit the particular radiolucent or non-radiolucent materials chosen. In the present embodiment, pullers 103 each have a uniform, thin cross section with a thickened edge 111 along the inner curve of arch 109. This enables pullers 103 to be thick enough where needed to comfortably migrate the shoulders of patient 102 without the excessive pressure that would be caused by a uniformly thin arch. It is contemplated that the thickness of the pullers may be different in alternate embodiments. For example, without limitation, one alternate embodiment may have a uniform thicker cross section, and other alternate embodiments may be thinner at the main portion of the arch and thicker throughout the edge of the arch and the rest of the structure to provide strength and to generally eliminate any artifact from the arch in the image. Some embodiments may include padding along the edge of the arch for the

comfort of the patient. Alternate embodiments of the present invention may have arches of various different shapes and sizes to accommodate a variety of subjects

[0042] In the present embodiment, each puller 103 is connected to an automatic brake assembly that comprises shuttle 105 mounted on a guide rail 113. Shuttle 105 houses a rack brake assembly actuated via the release of a trigger 115, as illustrated by way of example in Figure 2. Trigger 115 enables shuttle 105 to be locked into place on guide rail 113 or to be released from guide rail 113. When trigger 115 is held down by a user, shuttle 105 is able to slide caudally along guide rail 113, and when trigger 115 is released, the brake is engaged and shuttle 105 is held securely in place on guide rail 113. The braking systems allow for the hands free usage of positioning devices 100 during radiography, with quick release of all migratory pressure to the shoulders of patient 102 via the simple tapping of triggers 115. In alternative embodiments the braking mechanism may not be equipped with an automatic brake, and instead may be equipped with a brake requiring a separate step to actuate the braking via usage of a mechanism such as, but not limited to, a lever, a knob, a set screw, a pin, a dial, a trigger, a switch, a clutch, etc.

[0043] In the present embodiment, pullers 103 are attached to shuttles 105 with variable positioning assemblies 104. To adjust the height of pullers 103, variable positioning assemblies 104 slide up and down on vertical rails 117. Once pullers 103 are at the correct height, variable position assemblies 104 are secured into place with clamps 119. Those skilled in the art, in light of the present teachings, will readily recognize that a multiplicity of suitable means may be used to adjust the height of the pullers in alternate embodiments, such as, but not limited to, a perforated rail and sliding mechanism that is held in place with a pin, a notched rail and sliding mechanism with a spring loaded pin, pneumatic or hydraulic mechanisms, etc. In the present embodiment, the distances of pullers 103 from vertical rails 117 are adjusted by sliding rods 121 attached to pullers 103 through clamps 123 on variable positioning assemblies 104. Again, it will be readily recognized by those skilled in the art, in light of the present teachings, that various different adjustment means may be used in alternate embodiments such as, but not limited to, a pin that may be inserted into one of a multiplicity of holes on the rod, a threaded rod that may be screwed into or out of a threaded piece on the adjustment mechanism or on the vertical rail, a telescoping rod, set screws, etc. In the present embodiment, the angle of pullers 103 may also be adjusted by rotating rods 121. Some alternate embodiments may be implemented in which the pullers are not adjustable or adjustable in fewer directions. For

example, without limitation, in one non-adjustable embodiment, the pullers are directly attached to the braking shuttle by a fixed connection rod. In another alternate embodiment, only the heights of the pullers are adjustable.

[0044] In the present embodiment, guide rails 113 are attached to patient transport backboard 101 with clamps 106. Clamps 106 are simple adjustable clamps employing hand actuated adjustable screws as the means of variable opening, closing and securement onto transport backboard 101. In alternative embodiments, a multiplicity of suitable securing means may be used to secure the guide rails to various patient transport and immobilization platforms such as, but not limited to, different types of clamps, bolts, screws, hooks, etc. Some alternate embodiments may be permanently attached to the patient platform.

[0045] In typical use of the present embodiment, patient 102, who has suspected head or neck injuries, is placed on patient transport backboard 101, and immobilization means 125 are placed near the head of patient 102 in order to immobilize the head and neck of patient 102. To prepare patient 102 for optimized lateral radiographic visualization, positioning devices 100 are then affixed to backboard 101 near the level of the midsection of patient 102 with one device 100 on each side of patient 102. Then, the height and width of pullers 103 are adjusted with variable positioning assemblies 104 so that arches 109 are placed at the acromioclavicular joints of patient 102. Clamps 119 and 123 hold puller 103 in their adjusted positions. A user may then actuate triggers 115 and pull shuttles 105 and thus puller 103 away from the head of patient 102 in order to effect temporary caudal migration of the shoulders of patient 102 for purposes of full radiographic visualization of the cervical vertebral column without disturbance to the structures of the vertebral column or to immobilization means 125. Furthermore, since positioning devices 100 attach directly to patient transport backboard 101, imaging can be performed without removing patient 102 from backboard 101. Once the shoulders are properly migrated, the user releases triggers 115 to engage the braking system of shuttles 105 to lock pullers 103 into place. Upon successful radiography, triggers 115 are actuated, and pullers 103 are pushed away from the shoulders of patient 102 so that the temporary caudal migration of the anatomy of patient 102 is relaxed and the shoulders return to their natural positions.

[0046] Those skilled in the art, in light of the present teachings will readily recognize that the present embodiment may be used in various different ways. For example, without limitation, in typical use of the present embodiment two positioning devices 100 are used in tandem as a mirror

imaged set for purposes of simultaneous positioning of the shoulders to optimize the radiographic visualization of the cervical vertebral structures. Alternatively, positioning devices 100 may be used independently from each other to migrate the shoulders independently to different degrees. In another alternative use, one shoulder positioning device may be used alone to migrate a single shoulder. Furthermore, alternate embodiments may comprise various different features that may alter the method of use of these devices. For example, without limitation, some embodiments may comprise a quick release mechanism for the braking mechanism so that the device may be immediately removed from the subject in case of an emergency. One alternative embodiment may be equipped with handholds to be operated without the usage of any assembly. Furthermore, the variation of some features of the positioning devices in alternate embodiments such as, but not limited to, variable positioning assemblies or securing means may alter the particular way users employ the device.

[0047] In the present embodiment, positioning devices 100 generally eliminate the common radiographic artifact presented by the inherent bone density of the shoulders of patient 102 without interference with the immobilization of the head and neck or immobilization means 125 via the safe, temporary and variable caudal migration of the acromioclavicular joint and adjacent structures of the shoulder, such that said structures no longer directly overlay the cervical vertebral column in a typical line of sight for a diagnostic lateral radiography. Those skilled in the art have failed to recognize that the acromioclavicular joint is an optimal force application point to migrate the shoulders caudally. With proper usage of positioning devices 100, arches 109 make direct contact with these joints and transfer all motive energy directly to these joints via rigid positioning. Positioning devices 100 may be mountable to trauma backboards, longboards and the full spectrum of emergency patient transport platforms utilized with a cervical trauma patient. In other embodiments, positioning devices 100 may be configured to attach to a thin radiolucent sheet positioned under a patient, or immediately positioned under a patient care platform with a minimum of difficulty. In these embodiments positioning devices 100 may be utilized with any and all patient care platforms. The correct use of the present embodiment generally eliminates the risk of further patient injuries that are implicit in the usage of the controversial dynamic flexion/extension method and the swimmers view, and in concomitant disruption to the immobilization of the patients head and neck and the associated risk which these and other current positioning options entail. Concurrently, the present embodiment generally eliminates the cumulative radiation exposure to

staff in the diagnosis of suspected injury to the cervical vertebral column and the cervico-thoracic junction.

[0048] Figure 2 is an exploded view of the internal components of an exemplary rail guided shuttle 205, in accordance with an embodiment of the present invention. In the present embodiment, rail guided shuttle 205 houses an exemplary braking mechanism mounted upon a toothed rack 210 fitted within a rail guide assembly 213, such that bidirectional free travel of shuttle 205 is permitted while a user grips a spring loaded trigger 215. When the user grips and holds trigger 215, a release mechanism 220 connected to trigger 215 pushes down on a locking pin 225 and lifts a tooth 227 of locking pin 225 above toothed rack 210. The brake actuation is affected via the release of trigger 215 by the user, thereby allowing a spring 230 to return trigger 215 to the locked position, which lifts release mechanism 220 and lowers a locking mechanism 235 connected to trigger 215 to force tooth 227 of locking pin 225 into immediate rigid interface with toothed rack 210. This restricts all motion of shuttle 205 until such time as trigger 215 is actuated by the user to release said rigid interface thru the of lifting tooth 227 of locking pin 225 from toothed rack 210, thereby restoring free motion of shuttle 205. Those skilled in the art, in light of the present teachings, will readily recognize that a multiplicity of alternate and suitable types of locking means may be used in alternative embodiments to hold the device in place on the guide rail such as, but not limited to, various friction and caliper braking mechanisms along the lines of bicycle or motorcycle disc, drum or caliper brakes arranged so as to replicate the above braking function with equivalent trigger actuation, a ratcheting rack and pinion mechanism with a crank, various types of clamps, etc. Other alternate embodiments may comprise braking mechanisms which operate upon various different mechanical means well known to one skilled in the art including, but not limited to, mechanical cone brakes, hydraulic braking systems, hydraulic clutches, mechanical clutches, pneumatic brakes, pneumatic clutches, friction/disc clutches, spring clutches, sprag clutches, roller ramps, electromagnetic clutches, gear drives, chain drives, etc. The mechanical means of these braking mechanisms may involve, yet not be limited to, friction, wrap springs, oil shear, toothed surfaces, as well as non contact methods. Furthermore, actuation means other than triggers may be used to control the braking mechanism in alternate embodiments such as, but not limited to, remotely operated solenoids, buttons, spring loaded knobs, dials, etc.

[0049] In one alternative embodiment of the present invention, the rigid pullers may be affixed to a handheld framework as opposed to being affixed to a variably positionable and lockable patient

platform mounted assembly. Although this embodiment would sacrifice the ability to safeguard the user from cumulative radiation load, one skilled in the art would readily recognize the advantages to the portability offered by such a modality.

[0050] In another alternative embodiment, the rigid radiolucent pullers may be affixed to a set of handheld or mechanically positionable straps, as opposed to a mountable and variably positionable and lockable sliding assembly. Said straps may be constructed of durable materials to including, without limitation, heavy duty fabric, Kevlar, polypropelene, braided nylon cord, cotton canvas, cotton duck, plastics, vinyl fabric, vinyl composites, vinyl coated mesh, Luma-Fab GT, engineered polymers, stainless steel electromagnetic shielding textile, composite ripstop, denier nylon, Lycra, Lycra blends, polyurethane laminate, Textiline, mylar, Canvak waxed canvas, ballistic and non-ballistic Cordura, Sorbtex poly mesh, neoprene, Hypalon, Toughtek leather, braided rope, etc.

[0051] It is contemplated that some alternate embodiments may be implemented in which various components of the shoulder positioning device are ergonomically designed. For example, without limitation, the trigger and brake mechanism in one alternate embodiment may be encased in a rubberized grip with ergonomic features such as, but not limited to, finger grooves and curved edges. In another alternate embodiment, the variable positioning assemblies and securing clamps may have large ergonomic dials that allow for easy operation. In other embodiments mechanical force gauges may be employed to provide feedback to the medical personal as to the force being applied to the patient's acromioclavicular joints. In yet other embodiments electronic sensors and displays may be incorporated to monitor the forces applied. In still other embodiments automatic safety releases may active to release the brake mechanisms if an amount of force exceeds a preset limit.

[0052] In yet other alternate embodiments, some or all of the mechanical movements of the positioning device may be achieved through the use of motors. For example, without limitation, in one alternate embodiment, motors on the braking mechanisms move the shuttles along the guide rails to exert beneficial migratory pressure to the acromioclavicular joints or to relieve this pressure. In yet other embodiments the motors may be operated under computer control to simultaneously provide an equal amount of force on each of the patient's acromioclavicular joints. In still other embodiments the computer control of the motors may also activate the radiographic visualization when a determined amount of pressure has been applied. In yet other embodiments the computer

control may release the force applied as soon as the radiographic visualization is complete. In another alternate embodiment the adjustment of the positioning of the shoulder pusher may be accomplished by motors controlling the variable positioning assemblies. In still further embodiments the control of motors for positioning and applying force and control of the radiographic visualization may be all remotely controlled medical personal or computer controlled.

[0053] In yet another embodiment of the present invention (not shown), a radiolucent patient positioning system includes a puller member that has an engagement portion being configured for engaging a patient's neck/shoulder area and applying a pulling force thereupon. This embodiment further includes a support member that has a first portion at a first end of the support member and a second portion at a second end of the support member. The first support member portion is joined to the pulling member at a location away from where the engagement portion of the pulling member contacts the patient during normal use. Also, in this configuration a longitudinal axis of the first support member portion forms an off-axis relationship to a longitudinal axis of the pulling member. The first support member portion and the joining thereto being configured to be at least operational to enable the pulling member to adjustably maintain a substantially fixed vertical elevation that aligns the engagement portion of the pulling member to effectively engage the patient's neck/shoulder area; and, the second support member portion being configured with a variable shuttle member that is adjustably joined to the guide member for adjusting the removable joining position of the support member along a length of a guide member. This guide member being configured to have a substantially parallel orientation relative to a longitudinal axis of the engagement portion of the pulling member. Also provided in this embodiment is a joining mechanism configured to removably fix the guide member to a structure positioned below the patient such that the pulling member is operable for being positioned relative to the structure and effectively engage the patient's neck/shoulder area so as to enable the caudally migration of the patient's neck/shoulder(s). In some alternate embodiments the puller member is a rigid structure as described in at least some of the foregoing embodiments. In some alternate embodiments (not shown) the puller member further includes a support portion, which is what the support member portion is joined to. In such puller member embodiments having more than one puller member portions, the support portion may be made of a non-rigid or semi-rigid construction. By way of example, and not limitation, the support portion could be a firm but flexible structural support material, or even extremely flexible materials like straps.

[0054] Those skilled in the art will readily recognize, in light of the teachings of the present invention, that a multiplicity of alternative configurations are possible instead of a rod/clamp based offset adjustment approach, and will depend on the particular needs of the application. By way of example, and not limitation, the joining between the pulling member and the first support member portion includes a variable offset member, where the variable offset member is configured to enable the engagement portion of the pulling member to be horizontally adjusted to be able to contact the patient's neck/shoulder area at various locations there along within a certain range determined by an adjustment range of the variable offset member. In some alternate embodiments (not shown) of the present invention the variable offset member is not a rod, but generally an elongated rigid member and the variable positioning device is a removable position locking mechanism where the pulling member is joined towards one end of the elongated rigid member and the top support member portion is joined to the variable positioning device. The variable positioning locking mechanism is configured using known removable position fixing techniques to movably fixating the pulling member along a length of the elongated rigid member thereby enabling an adjustable range of offset distances between the pulling member and the top support member portion.

[0055] In yet another alternate embodiment of the present invention (not shown), instead of using orthogonal degrees of freedom to achieve 3-D positioning of the shoulder pullers, a radial or spherical based 3-D positioning system is implemented using at least some angular adjustable joints instead of only linearly adjustable joints (e.g., without limitation, slide rail/clamping at 90 degree angles to each other). By way of example, and not limitation, angular adjustable joints may be implemented with pivoting joints having screw down clamps to fix their angle, and the pivoting joints may each be restricted to one or two degrees of freedom, Those skilled in the art will readily recognize, in light of the teachings of the present invention, that there are a multiplicity of suitable alternative approaches to implementing angular adjustable joints depending upon the needs of the particular application. In some alternate embodiments of the present invention, the degrees of freedom to achieve 3-D positioning of the shoulder pullers are a desired mix and match of linear joints and pivoting joints.

[0056] It should be appreciated that some applications may not require the horizontal offset capability of the present embodiment, and, as such, alternate embodiments may not include this capability and/or its enabling components. Similarly, there may be applications that do not require

the vertical adjustment capability of the present embodiment, and, as such, alternate embodiments may not include this capability and/or its enabling components.

[0057] All the features disclosed in this specification, including any accompanying abstract and drawings, may be replaced by alternative features serving the same, equivalent or similar purpose, unless expressly stated otherwise. Thus, unless expressly stated otherwise, each feature disclosed is one example only of a generic series of equivalent or similar features.

[0058] Having fully described at least one embodiment of the present invention, other equivalent or alternative methods of providing proper anatomic positioning for optimized radiographic imaging of the cervical vertebrae in emergency circumstances according to the present invention will be apparent to those skilled in the art. The invention has been described above by way of illustration, and the specific embodiments disclosed are not intended to limit the invention to the particular forms disclosed. For example, the particular implementation of the trigger may vary depending upon the particular type of braking mechanism used. The triggers described in the foregoing were directed to squeezable implementations; however, similar techniques are to provide braking mechanisms that are actuated by various different means such as, but not limited to, pulled triggers, push buttons, twistable knobs, electrically operated solenoids, etc. Implementations of the present invention without squeezable triggers are contemplated as within the scope of the present invention. By way of further example, all the adjustment degrees of freedom in at least some of the foregoing embodiments were shown as all being 90 degrees to each other; however, those skilled in the are will readily recognize, in light of the foregoing teachings, that depending on the needs of the particular application, alternate embodiments have any suitable angles between each component and/or with any mounting table to achieve the desired positioning capability, which may or may not achieve the full 3-D positioning range of at least some of the foregoing embodiments. The invention is thus to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the following claims.

[0059] Claim elements and steps herein may have been numbered and/or lettered solely as an aid in readability and understanding. Any such numbering and lettering in itself is not intended to and should not be taken to indicate the ordering of elements and/or steps in the claims.

What is claimed is:

## CLAIMS

1. An apparatus comprising:

a first patient positioning device comprising:
a puller comprising a first end being operable for engaging a patient's shoulder area;

a rod joined proximate a second end of said puller where a longitudinal axis of said rod is approximately perpendicular to a plane containing said puller;

a first rail;

a variable positioning assembly being movably joined to said rod to clamp said puller at an adjusted distance from said variable positioning assembly, said variable positioning assembly being movably joined to said first rail to clamp said variable positioning assembly at an adjusted distance along a length of said first rail;

a second rail;

a rail guided shuttle being movably joined to said second rail and operable to be secured at a position along said second rail, said guided shuttle being joined to said first rail where said first rail is approximately perpendicular to said second rail; and

a clamping mechanism joined to said second rail and being operable to secure said second rail parallel to a flat structure positioned below the patient where said puller is operable for being positioned to engage the patient's shoulder area, proximal to said first patient positioning device, and to be pulled to and secured at a position where the patient's shoulder area has been caudally migrated.

2. The apparatus as recited in claim 1, in which said puller is further operable for engaging the patient's acromioclavicular joint and caudally migrating the acromioclavicular joint.

3. The apparatus as recited in claim 1, in which said first end of said puller is rigid and comprises an arch.

4. The apparatus as recited in claim 3, in which said rigid puller further comprises a thickened edge along an inner curve of said arch.

5. The apparatus as recited in claim 1, in which said puller further comprises a radiolucent material.

6. The apparatus as recited in claim 1, in which said variable positioning assembly is further operable to clamp said puller at an adjusted angle about said longitudinal axis.

7. The apparatus as recited in claim 1, in which said rail guided shuttle further comprises a braking mechanism being operable to secure said rail guided shuttle at a position along said second rail.

8. The apparatus as recited in claim 7, in which said braking mechanism further comprises a trigger to release said rail guided shuttle from a secured position.

9. The apparatus as recited in claim 1, in which said puller is further operable to caudally migrate the patient's shoulder area to facilitate lateral radiographic visualization of the patient's cervical vertebral structures without moving the patient.

10. The apparatus as recited in claim 1, further comprising a second patient positioning device comprising a mirror image of said first patient positioning device, said second patient positioning device being joined to the flat structure where said second patient positioning device is operable for engaging the patient's other shoulder area distal to said first patient positioning device.

11. An apparatus comprising:

a first patient positioning device comprising:
a puller comprising a generally straight portion joined to an end of an arm of an arch on a first end of said straight portion, said arch being operable for engaging a patient's shoulder area within said arch, said puller further comprising a radiolucent material;

a rod joined proximate a second end of said puller where a longitudinal axis of said rod is approximately perpendicular to a plane containing said puller;

a first rail;

a variable positioning assembly comprising a first clamping mechanism and a second clamping mechanism, said first clamping mechanism being movably joined to said rod to clamp said puller at an adjusted distance from said variable positioning assembly and at an adjusted angle about said longitudinal axis, said second clamp being movably joined to said first rail to clamp said variable positioning assembly at an adjusted distance along a length of said first rail;

a second rail;

a rail guided shuttle comprising a braking mechanism, said rail guided shuttle being movably joined to said second rail where said breaking mechanism is operable to enable said guided

shuttle to be moved along a length of said second rail and to be secured at a position along said second rail, said guided shuttle being join to said first rail where said first rail is approximately perpendicular to said second rail; and

a clamping mechanism joined to said second rail and being operable to secure said second rail parallel to a flat structure positioned below and parallel to a coronal plane of the patient where said puller is operable for being positioned to engage the patient's shoulder area, proximal to said first patient positioning device, and to be clamped in position, and said rail guided shuttle is operable to be moved to pull said puller and to be secured at a position where the patient's shoulder area has been caudally migrated.

12. The apparatus as recited in claim 11, in which said puller is further operable for engaging the patient's acromioclavicular joint and caudally migrating the acromioclavicular joint.

13. The apparatus as recited in claim 11, in which the puller is rigid and further comprises a thickened edge along an inner curve of said arch.

14. The apparatus as recited in claim 11, in which said braking mechanism further comprises a trigger to release said rail guided shuttle from a secured position.

15. The apparatus as recited in claim 11, in which said clamping mechanism is further operable for securing to a patient transport structure.

16. The apparatus as recited in claim 11, in which said puller is further operable to caudally migrate the patient's shoulder area to facilitate lateral radiographic visualization of the patient's cervical vertebral structures without moving the patient.

17. The apparatus as recited in claim 11, further comprising a second patient positioning device comprising a mirror image of said first patient positioning device, said second patient positioning device being joined to the flat structure where said second patient positioning device is operable for engaging the patient's other shoulder area distal to said first patient positioning device.

18. A method for using the apparatus of claim 1, the method comprising the steps of:

joining said clamping mechanism of said first patient positioning device to a flat structure positioned below a patient where said clamping mechanism is near a midsection of the patient;

adjusting a height and width positions of said puller to engage a shoulder area of the patient proximal to said first patient positioning device, said height being adjusted by vertical movement of said variable positioning device on said first rail, said width being adjusted by lateral movement of said rod in said variable positioning device;

clamping said puller at said adjusted height and width;

migrating the patient's shoulder area caudally by moving said rail guided shuttle caudally along said second rail; and

securing said rail guided shuttle at a position along said second rail where the caudal migration by said puller facilitates lateral radiographic visualization of the patient's cervical vertebral structures.

19. The method as recited in claim 18, in which said step of adjusting further comprises engaging the patient's acromioclavicular joint in the shoulder area to migrate the

acromioclavicular joint.

20. The method as recited in claim 18, further comprising the step of joining a clamping mechanism of a second patient positioning device to the flat structure where said second patient positioning device comprises a mirror image of said first patient positioning device, and said second patient positioning device is operable for engaging the patient's shoulder area distal to said first patient positioning device.
21. An apparatus comprising:

a puller member, said puller member including an engagement portion being configured to be operable for engaging a patient's neck/shoulder area and applying a pulling force thereupon;

an guide member having a longitudinal axis;

a support member having a first portion at a first end of said support member and a second portion at a second end of said support member, said first support member portion being joined to said pulling member at a location away from where said engagement portion of said pulling member contacts the patient during normal use, and in which a longitudinal axis of said first support member portion forms an off-axis relationship to a longitudinal axis of said pulling member, said first support member portion and said joining thereto being configured to be at least operational to enable said pulling member to adjustably maintain a substantially fixed vertical elevation that aligns said engagement portion of said pulling member to effectively engage the patient's neck/shoulder area; and, said second support member portion being configured with a variable shuttle member that is adjustably joined to said guide member to be operable for adjusting the removable joining position of said support member along a length of said guide member, said guide member being configured to have a substantially parallel orientation relative to a longitudinal axis of said engagement portion of said pulling member; and

a joining mechanism configured to be operable to removably fix said guide member to a

structure positioned below the patient such that said pulling member is operable for being positioned relative to said structure and effectively engage the patient's neck/shoulder area so as to enable the caudally migration of the patient's neck/shoulder(s).

22. The apparatus as recited in claim 21, in which said engagement portion of said pulling member is a generally rigid structure and comprises an arch.
23. The apparatus as recited in claim 21, in which said puller member further comprises a support portion, said puller member support portion being what said support member portion is joined to, and in which said puller member support portion is made of a non-rigid or semi-rigid construction.
24. The apparatus as recited in claim 21, in which said joining between said pulling member and said first support member portion comprises a variable offset member, said variable offset member being configured to enable said engagement portion of said pulling member to be horizontally adjusted to be able to contact the patient's neck/shoulder area at various locations there along within a certain range determined by an adjustment range of said variable offset member.
25. The apparatus as recited in claim 24, in which said variable offset member is an elongated rigid member and a variable positioning device combination wherein said pulling member is joined towards one end of said elongated rigid member and said first support member portion is joined to said variable positioning device, said variable positioning device being configured to be operable for movably fixating said pulling member along a length of said elongated rigid member thereby enabling an adjustable range of offset distances between said pulling member and said first support member portion.
26. The apparatus as recited in claim 21, in which said vertical adjustability of said joining between said pulling member and said first support member portion is at least partially achieved by a removable lock or clamping mechanism that removably joins, directly or indirectly, said pulling member to a joining location along a vertical axis of said first support member portion.
27. The apparatus as recited in claim 21, in which said puller further comprises a substantially radiolucent material.

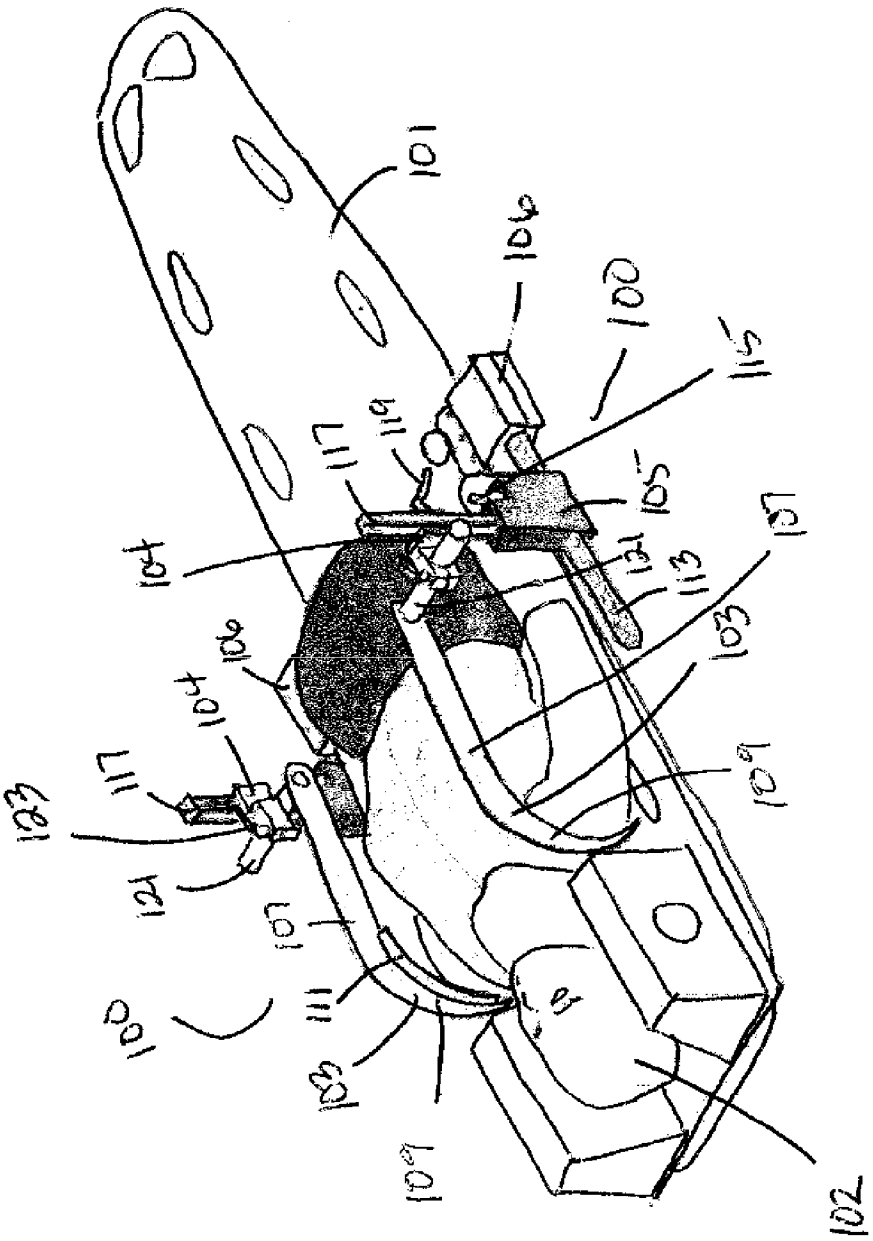


Figure 1A

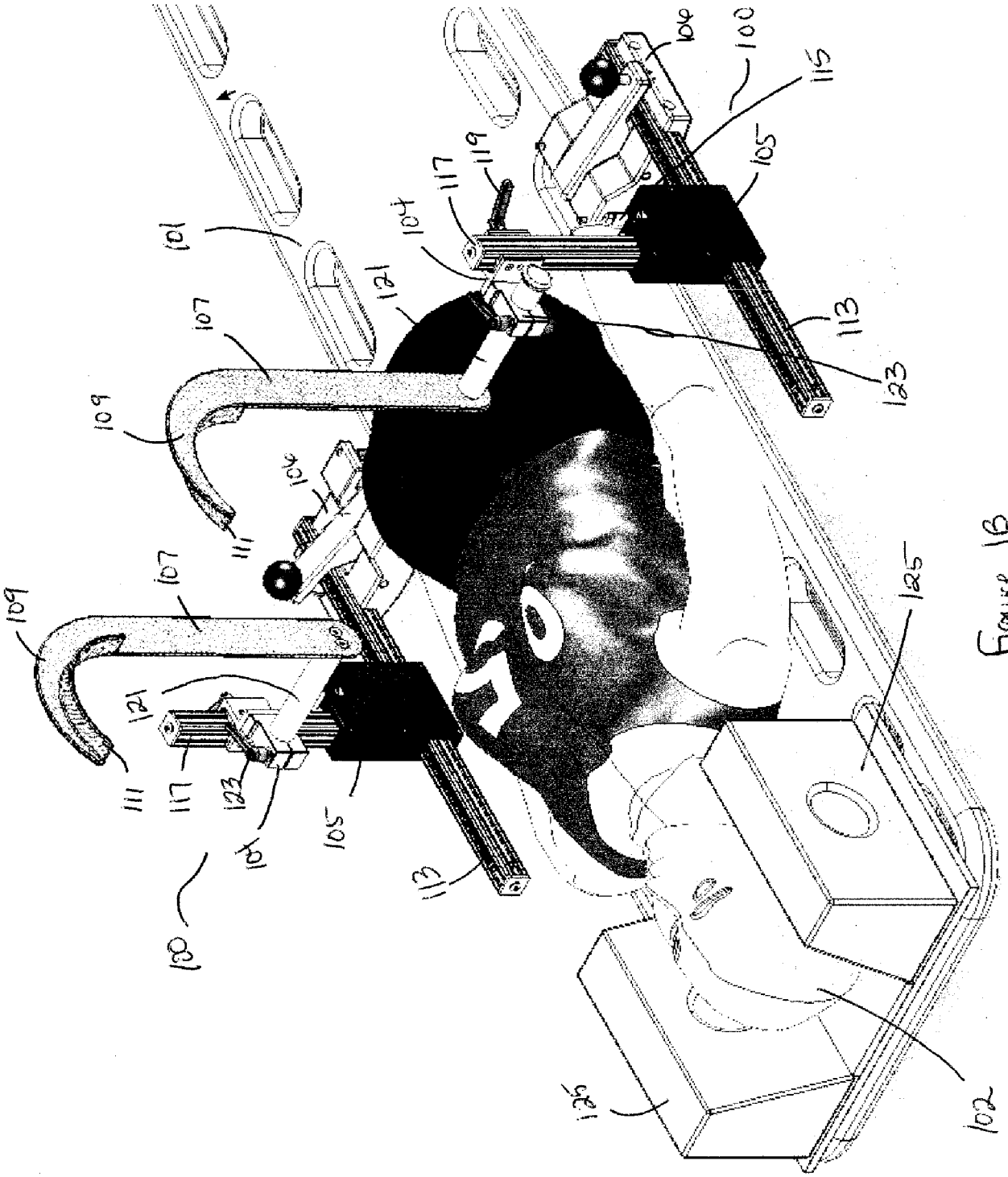
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Figure 1B

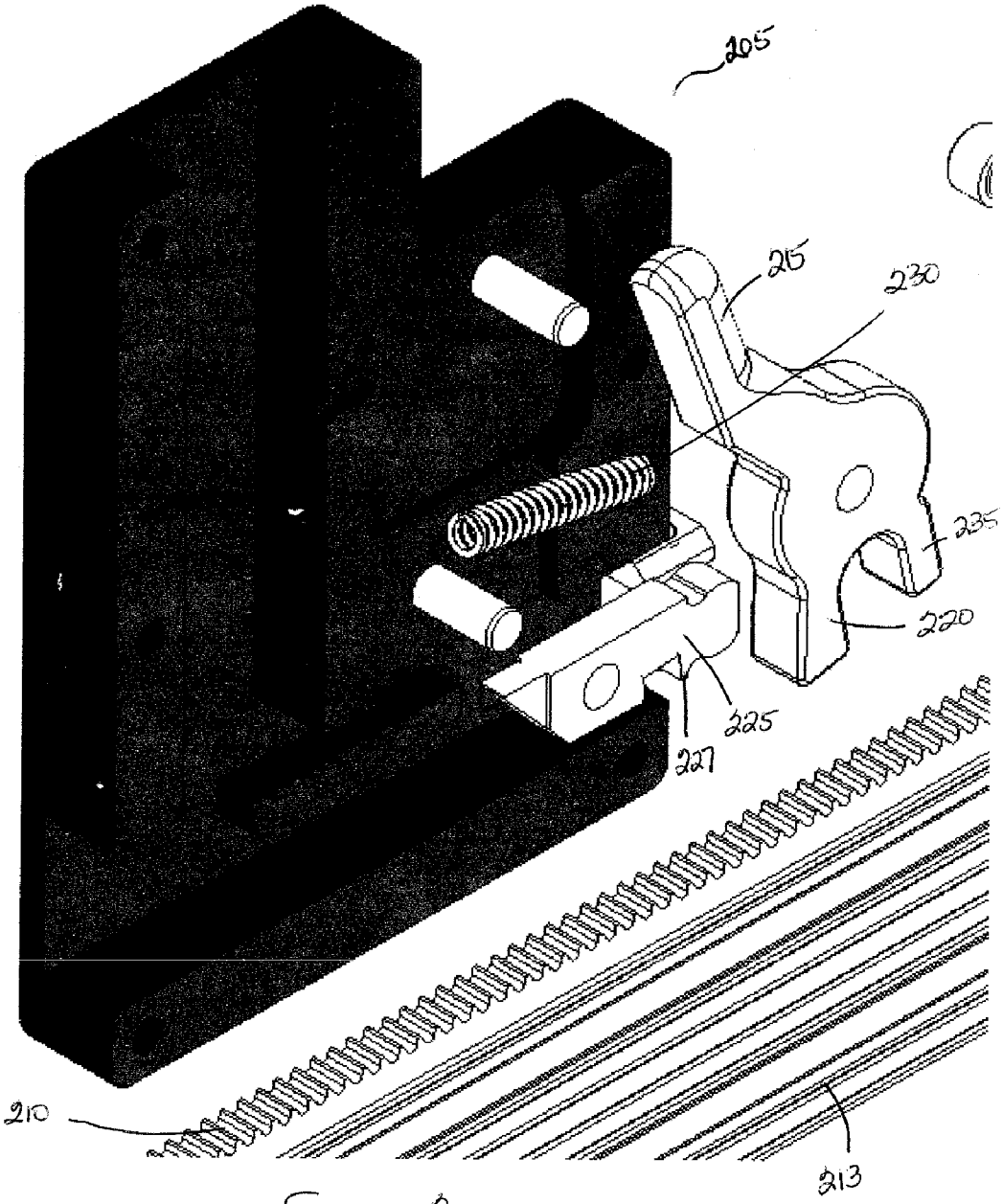


Figure 2