Title of the Invention: **Splint**

Abstract Title: **A splint comprising adjustable collar means and a pad**

A splint for the stabilisation of limb fractures comprising a spine 12, location means (Figure 1, 13) adapted to locate the spine 12 in alignment with a limb, and an adjustable collar 14, 24, 34. The collar 14, 24, 34 is located on the spine 12 and is adapted to exert pressure on the limb, capable of being applied and adjusted by a clinician. A skin/splint interface pad 14e is also provided that allows liquid and vapour phase water to escape from the skin. Preferably the pad 14e comprises a small mesh textile outer component and a larger mesh substrate. The textile may be on a moulded support that has vents for escaping water. Preferably the pad has an edge region that is curved in profile. The device may be used with a base unit.

**FIG. 1**

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.
Splint

This invention relates to splints for the stabilisation of limb fractures.

US6197800 discloses a splint, particularly for holding a Colles fracture of the wrist in reduction, comprising first and second collars pivotally supported on a body member and adjustable so as to adjust the internal dimensions of the splint. Spaced resilient pads are provided internally so as to exert pressure on the limb held in the splint while allowing vascular flow. Pressure sensors, such as electronic sensors, diaphragms and liquid reservoirs expressing liquid into a visible chamber can warn of undesired pressure build-up so that the splint may be adjusted.

The present invention provides further improved splint arrangements.

The invention comprises, in one aspect, a splint for the stabilisation of limb fractures, comprising a spine, location means adapted to locate the spine in alignment with a limb, and collar means on and adjustable along the spine adapted to surround and exert adjustable pressure on the limb at the fracture site, comprising a skin/splint interface pad for direct contact with the skin that allows liquid and vapour phase water to escape from the skin.

Pressure may be applied through a pad comprising the skin-splint interface at the fracture site. The pad may contact a spring arrangement that moves a pointer to indicate the pressure. The spring arrangement may comprise a bowed leaf spring that flattens under pressure and has a fixed end and a free end that determines the position of a pointer depending on the degree of flattening.

The pointer may indicate a pressure in a range centred on a pressure equivalent to 28mm Hg, which corresponds to a pressure at which blood flow will not be undesirably restricted.

The pressure indicator may be used to adjust the collar during application of the splint and to indicate the need for tightening or relaxing as healing progresses. Swelling may reduce, for example, so that the fracture will not be stabilised properly. Swelling, on the other hand, may increase, restricting blood flow.

Desirably, the collar may be locked so as to preclude tampering, releasable by means of a key available to the clinician. The pressure indication may, however, be visible to the patient alerting to the need to have the splint adjusted.

The pad may comprise a textile material, and the splint including the pad may be made of such material that it can be immersed in water and will dry off rapidly, permitting bathing or showering.
The splint may comprise a spine, location means adapted to locate the spine in alignment
with a limb, and a first adjustable collar on the spine adapted to immobilise and exert
pressure at the fracture site, in which said location means comprise a second adjustable
collar on the spine adapted to hold the spine to the limb.

At least one of the collars may be adjustable lengthways of the spine. The collar or
collars may be slidably along the spine, which may comprise a ratchet into which a pawl
of the collar sits releasably for locking. The pawl may be released by a key.

A third adjustable collar may be provided, which may serve to prevent the splint moving
distally along a limb. For a Colles fracture splint, the third collar may comprise a hand
support carriage, which may be located adjacent the first collar, remote from the second
collar, and which may be fixed to the spine. The spine may be curved between the fist
and third collars correspondingly to the shape of the arm. Right arm and left arm splints
will be different of course.

The collars may be in the form of straps. The straps may locate in slots and be lockable
therein by a ratchet mechanism, the straps having ratchet perforations that can be slid
over a sprung detent on the spine on tightening, but held thereby against retraction. The
sprung detent may be released for adjustment or removal of the straps.

The splint may be used in conjunction with a base unit, to which it may be clamped for
application and adjustment of the splint. The base unit may comprise a base plate with at
least one sliding carriage that may be attached to an adjustable collar. On such
attachment, the adjustable collar may be released to be movable along the spine, as by
use of a key as aforementioned, which may also serve to release the strap on the collar, as
by releasing the sprung detent, again as aforementioned.

Such an arrangement may be adapted for single-handed operation by a clinician, insertion
of a collar key both releasing the collar for sliding along the spine and releasing the collar
strap. This leaves the clinician's other hand free for traction of the limb. This, in turn,
means that clinical staff may be used more effectively and efficiently. Treatment of a
fracture is swifter and less traumatic for a patient.

The splint including the pad may be made of material that can be immersed in water and
will dry off rapidly, permitting bathing or showering.

The splint may be made substantially if not entirely out of recyclable or disposable
material. A splint of polypropylene may be incinerated after use, avoiding the risk of
passing on infection. The increased cost of the splint as compared to conventional plaster
casts is more than offset by the clinician time saved in application and the facility for
adjustment affords both clinical and financial benefits.

One embodiment of a splint for the stabilisation of limb fractures according to the
invention will now be described with reference to the accompanying drawings, in which:
Figure 1  is a perspective view of a splint for stabilisation of a Colles fracture;

Figure 2  is an exploded view of a pressure pad arrangement, with a pressure indicator, of the splint of Figure 1;

Figure 3  is an exploded view of another pressure pad arrangement, with a pressure indicator, of the splint of Figure 1;

Figure 4  is a perspective view of a base on which the splint of Figure 1 is located for application and adjustment of the splint, showing the splint prior to location; and

Figure 5  is a partial end view of the splint showing a locking arrangement.

The drawings illustrate a splint 11 for the stabilisation of limb fractures, more specifically for Colles fractures, that is to say, fractures of the radius close to the wrist, comprising a spine 12, and location means 13 adapted to locate the spine 12 in alignment with a limb, comprising three adjustable collars 14, 24, 34 mounted on the spine 12.

A Colles fracture is a fracture of the radius close to the wrist, and adjustable collar 14 is adapted to exert pressure at the fracture site, and comprises a pressure indicator 17 giving a visible indication that the pressure exerted in relation to a reference pressure. In a Colles fracture there is posterior displacement and angulation of the wrist and hand, which is reduced by traction on the hand and pressure at the fracture site, typically about 25mm from the radio-carpal joint. A typical Colles fracture is illustrated in US6197800 aforementioned.

The collar 14 comprises a strap 14a anchored at one end 14b in a base 14c slidable along the spine 12 and, at its other end 14d, inserted in a slot on the base 14c. The base 14c comprises a cushioned pad 14e beneath the fracture site.

Pressure is applied at that site through pads 14f, 14g on the strap 14a by tightening the strap 14a. The pad 14f, shown in inverted, exploded view in Figure 2, acts as the indicator 17 of the collar/skin pressure and comprises a spring arrangement 18 that moves a pivoted pointer 19 to indicate the pressure. The spring arrangement comprises a bowed leaf spring 18a that flattens under pressure and has an end 18b fixed in the pad 14f and a free end 18c with a slot 18d that engages a pin 19a on the pointer and determines the position of the pointer 19 depending on the degree of flattening. The leaf spring 18a is depressed by a spiral spring 22 formed in a cover plate 21, which is the collar/skin interface.

The pointer 19 is viewed through a small window, not indicated on the drawing, in the pad 14f and appears centrally thereof at a pressure of 28mm Hg, which corresponds to a pressure at which blood flow will not be undesirably restricted.
The pressure indicator is used to adjust the collar during application of the splint and to indicate the need for tightening or relaxing as healing progresses. Swelling may reduce, for example, so that the collar will become loose and the fracture will not be stabilised properly. Swelling, on the other hand, may increase, effectively tightening the collar and restricting blood flow.

The collar 14 is locked to the spine 12, and the strap 14a locked in the base 14c after application, and after any subsequent adjustment, so as to preclude tampering, especially by the wearer, and releasable, by means of a key available to the clinician, as will be further explained below. The pointer 18 is, however, visible to the patient, alerting to the need to have the splint adjusted.

The pad 16 comprises a textile material, and the splint 11 including the pad 16 is made of such material that all or any part of it can be immersed in water and will dry off rapidly, permitting bathing or showering.

A second adjustable collar 24 is provided on the spine 12, adapted to hold the spine 12 aligned to the limb and keep the first collar 14 in correct position. The second collar 24 is similar to the first collar 14, but larger, fitting the forearm closer to the elbow, and comprises a strap 24a anchored at one end 24b in a base 24c slidable along the spine 12 and, at its other end 24d, inserted in a slot on the carriage 24c. The base 24d comprises a cushioned pad 24f.

Pressure is applied at that site through an adjustable pad 24g on the strap 24a by tightening the strap 24a in similar fashion to that of the collar 14. The pad 24g, shown in greater detail in exploded view in Figure 3, incorporates a pressure indicator similar to that of collar 14, with a pointer 19 moved by a leaf spring 18a that reacts to pressure from a spring interface 21.

Collar 24 is locked to the spine 12 and the strap 24a locked in the base 24c in like manner to collar 14.

At the other end of the spine 12 is provided a third adjustable collar 34, a hand support carriage, adapted to constrain the patient's hand, the spine 12 being cranked appropriately - there will, of course, be right and left hand models. This third collar 34 need not be adjustable lengthwise of the splint, as the other two collars can be correctly positioned with respect to it. It serves, of course, to prevent movement of the entire splint along the patient's arm.

While the splint described with reference to Figures 1, 2 and 3 is clearly useful on a stand-alone basis, it is designed to be used in conjunction with a base unit 51, as illustrated in Figure 4, to which it may be clamped for application and adjustment of the splint. The base unit 51 comprises a base plate 52 with sliding (as indicated by the double arrows) carriages 53, 54 that are each attached to an adjustable collar, carriage 53 to collar 14, and carriage 54 to collar 24.
The carriages 53, 53 have locating posts 55 corresponding to recesses in the undersides of the collars 14, 24. Like posts 55 are on the base plate 52 to receive the collar 34. A lever 56 on the base plate 52 serves to lock the spine 12 to the base unit 51 for application and adjustment.

Keyguides 57 are provided on carriages 52, 53 to receive keys 58 that engage sprung detents or pawls 59 in the bases 14a, 24a. One such pawl 50 is seen in Figure 5 normally biased to engage the serrations in the strap 14a to allow it to be tightened but not relaxed. When the key 58 is inserted, the pawl is held out of engagement so that the strap 14a can be relaxed.

Insertion of the key 58 can also unlock the collar 14, 24 from the spine 12 so that it is capable of axial movement along the spine. However, simply placing the spine 12 on the base unit 51 may also unlock the collars 14, 24 for axial movement.

Using the base unit 51 facilitates single-handed operation by a clinician. With the collars 14, 24 free to move along the spine 12 and the straps 14a, 24a free, the clinician can place the collars appropriately and place the patient’s arm with the straps loose. The straps can now be tightened using just one hand, leaving the clinician’s other hand free for traction of the limb particularly while tightening strap 14a and observing the pressure. This, in turn, means that clinical staff may be used more effectively and efficiently. Treatment of a fracture is swifter and less traumatic for a patient.

As already mentioned, the skin/splint interface pad comprises a textile material, not shown, that allows liquid and vapour phase water to escape from the skin. The pad component comprises a small mesh textile outer component and a larger mesh substrate. The textile covers a moulded support that has vents for escaping water. The pad has an edge region 21a, Figure 3, that is curved in profile whereby to avoid pinch shear of the underlying tissues. The splint as a whole is made of material that can be immersed in water with no ill effect, so that patients may bathe.

While the splint has been described with particular reference to a Colles fracture splint, it is clear that splints may be designed on like principles for other fractures of human or animal limbs and even for spinal fractures.

Though fairly complex in design, the splint and base unit can be inexpensively fabricated in inexpensive disposable or recyclable materials such as polypropylene, avoiding the possibility of cross infection through reuse.
Claims:

1. A splint for the stabilisation of limb fractures comprising a spine, location means adapted to locate the spine in alignment with a limb, and collar means on and adjustable along the spine adapted to surround and exert adjustable pressure on the limb at the fracture site, comprising a skin/splint interface pad for direct contact with the skin that allows liquid and vapour phase water to escape from the skin.

2. A splint according to claim 1, in which the pad component comprises a small mesh textile outer component and a larger mesh substrate.

3. A splint according to claim 1 or claim 22, in which the textile is on a moulded support that has vents for escaping water.

4. A splint according to any one of claims 1 to 3, in which the pad has an edge region that is curved in profile whereby to avoid in use pinch shear of underlying tissues.

5. A splint according to any one of claim 1 to 4, in which the pad comprises a pad component for direct contact with the skin that allows liquid and vapour phase water to escape from the skin.

6. A splint according to claim 5, in which the pad component is made of textile material.

7. A splint according to claim 6, in which the pad component comprises a small mesh textile outer component and a larger mesh substrate.

8. A splint according to any one of claims 1 to 7, made substantially or completely of recyclable or disposable material.

9. A splint according to claim 8, made of polypropylene.
Patents Act 1977: Search Report under Section 17

Documents considered to be relevant:

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<th>Category</th>
<th>Relevant to claims</th>
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<tr>
<td>X</td>
<td>1-9</td>
<td>US 7513881 B1 (GRIM et al) See whole document</td>
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<tr>
<td>Y</td>
<td>1-9</td>
<td>US 3776225 A (LONARDO) Note slideable collars 30, strip 12 and side walls 22</td>
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<tr>
<td>Y</td>
<td>1-9</td>
<td>US 2007/032756 A1 (WIN) Note moveable brackets 2 and spine 12</td>
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<tr>
<td>Y</td>
<td>1-9</td>
<td>US 5316544 A (MCANINCH) Note absorbent pad 30</td>
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<tr>
<td>Y</td>
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<td>US 4693239 A (CLOVER JR) Note porous pad 18</td>
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Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC:

Worldwide search of patent documents classified in the following areas of the IPC

A61F

The following online and other databases have been used in the preparation of this search report

WPI, EPDOC, TXTE

International Classification:

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