CROSS-DIAGONAL CLOSURE OF PELVIC AND SPINAL APPLIANCES

By Louis Ekus, C.O.*

The pelvic region with its numerous bony prominences, subcutaneous structures, and varied contours, has long been a useful site for the stabilization of many different orthoses and prostheses. The Milwaukee orthosis, body jackets, prostheses for hemipelvectomy and hip disarticulation amputees, to name a few, often maintain high internal forces as components of complex three-point pressure systems. Due to the nature of these devices, the internal forces are often quite different on the patient's opposing sides. Most practitioners are already aware that when the differences in the forces from right to left sides becomes large enough, relative motion of the two sides of the appliance becomes a difficult problem. This motion, in the superior or inferior direction in the frontal plane, causes skin breakdown, irritations, torsional stress on the devices and, thus, provides less than optimal function. In hip disarticulation and hemipelvectomy prostheses, "pumping" can be attributed to a great extent to the lack of the closures to maintain effective apposition of the two sides of the socket. The cross-diagonal closure is one way of dealing with this undesirable movement effectively.

Figure 1

When the attachment points of closure straps are placed horizontally across from one another, as in conventional practice, the long axis of the straps is perpendicular to the direction of the relative movement between the two sides. A large amount of this motion can then occur with little increase in the distance between these points. This fact, in addition to the high degree of compression and migration of the tissue in the pelvic region, contributes greatly to the problem. In this case, the unwanted action can take place due to a lack of increased tension on the closure straps at the onset of the motion. However, if the points are placed so that the long axis of the straps will *not* be perpendicular to the direction of movement, the distance change between these points per unit of motion is much greater.[1] This will cause a rapidly increasing tension on the straps, hence restricting additional movement.

Each strap in the cross will restrict translation in one direction; motion in the other direction will bring the attachment points closer together, and the strap will loosen. Application of the cross introduces a strap for the limitation of motion in both directions (fig. 1).

When applied to prostheses, a visible difference in the amount of relative motion possible could be noted between the conventional closure and the cross-diagonal closure (fig. 2). The appliances with the crossed type were no more difficult to don and doff than the corresponding conventional types. This closure is presented here because of the similarities in the pelvic sections of both prostheses and orthoses along with the similarities in the problems that accompany each. The cross-diagonal closure may be utilized as an important new method of optimizing increased effectiveness and patient comfort.

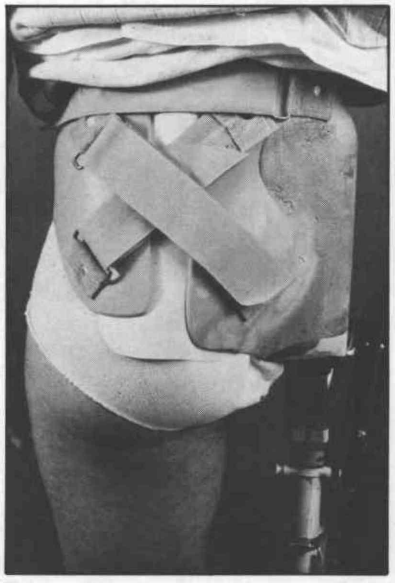

Figure 2

[1] This physical phenomenon is explained trigonometrically by the fact that the difference in the sine functions of a one degree (1°) change (0° to 1°) near the horizontal is much larger than the difference in the sine function of a one degree (1°) change near the vertical (89° to 90°).

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