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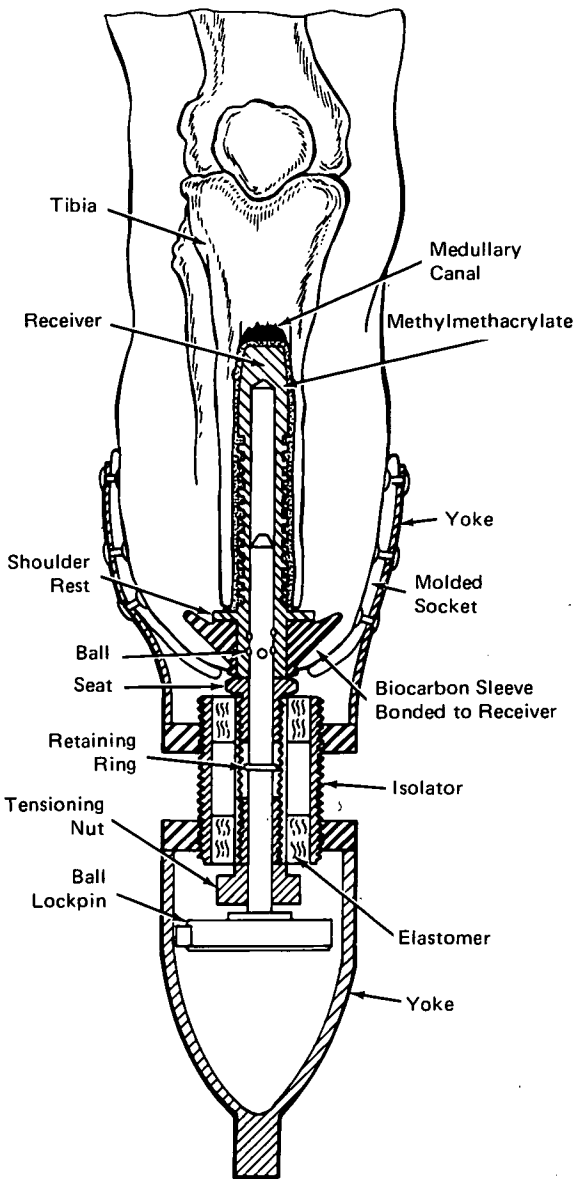
NASA TECH BRIEF

John F. Kennedy Space Center

Artificial Limb Connection



Artificial Limb Connection

The problem:

Artificial limbs, or prostheses, have been used by amputees for many centuries. At first the prostheses were crude, shaped as sticks attached to legs or as hooks attached to arms. Recently they have become much more sophisticated, incorporating electronic equipment and servomotors to produce more natural limb movement. With all this development, however, problems still remain in means of attaching prostheses. When prostheses are worn for a long time, the harnesses and clamps create discomforting pressures. This is particularly true of the legs supporting the weight of the entire body. In addition, the present harnesses are difficult and bothersome to connect and disconnect from the stumps of amputated limbs.

The solution:

A more effective connection has been developed for attaching a prosthesis to the remaining stump of an amputated limb. The connection simplifies and eases donning and removing the artificial limb; eliminates harnesses and clamps; and reduces skin pressures by allowing the bone to carry all tensile and part of the compressive loads between the prosthesis and the stump.

How it's done:

The receiver of the connection as shown in the illustration is implanted by a surgical procedure. One part of it is inserted into the bone cavity (medullary canal) of the stump. The other part is built into the prosthesis. Both ends match and are locked into place, forming a very effective union. Then most of the loads are transmitted to the bone, as nature intended.

Specifically, the bone within the stump is exposed, and its internal cavity is cleaned to accept the stainless steel female receiver. The end of the bone is trimmed to fit flush against a shoulder on the receiver. The other side of the shoulder supports a vitreous carbon sleeve.

(continued overleaf)

This material is biocompatible with the body and the skin, allowing the skin to form a hygenic seal around it. The receiver is bonded to the inner bone surface with methylmethacrylate. To minimize the stress between the receiver and the bone and for ease of insertion into the methylmethacrylate, the upper end of the receiver is tapered and grooved. The receiver is hollow and has an annular groove to accept the balls carried on the ball lockpin.

Rancho Los Amigos Hospital, Downey, California has designed a molded-plastic socket to custom fit the individual's stump. This proven design has been incorporated in the connection as shown.

Because each bone is protected from sharp impacts by a softer tissue, the connector includes a coaxial shock absorber. The absorber consists of two concentric tubes separated with an elastomer to protect the stump against shock and vibration. The threaded exterior tube can be adjusted to vary the weight distribution between the socket (skin pressure) and the connector (the bone). Some weight should be supported by the skin to give the wearer a more sensitive feeling of his prosthesis. Isolators with different properties (i.e., varying the elastomer amount and hardness) can be readily interchanged as the wearer changes weight or habits.

Custom designs, including cosmetic treatment and dimensioning, are determined by a physician who considers the amputee's age, sex, build, weight, and degree of activity. Because the connection is modular, it is easily modified to suit individual needs.

Note:

Requests for further information may be directed to:

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Reference: TSP74-10183

Patent status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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