

## **EXPERIENCE WITH SILICONE SUCTION SOCKETS USING MYOELECTRIC CONTROL**

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The use of silicone or similar material with distal attachment as a suspension system has gained great acceptance and usage for lower limb amputees. Since its introduction in the mid 1980's by Kristinsson, the silicone suction socket (3S) has undergone extensive development and the options available have proliferated due to its popularity.

Benefits for the lower limb include: reduced shear forces on the skin, better pressure distribution especially when a gel type liner is employed, and excellent suspension. Shortly after its introduction, 3S technology was applied to upper limb fittings. [2] Some early success was achieved and results were promising. Problems existed related to inappropriate sizing of liners and locking system for utilization in upper limb applications and difficulty interfacing myoelectric control in combination with 3S suspension.

One method for conducting the myoelectric signal through the roll-on-socket, which has gained success, employs the use of steel electrodes threaded to snaps with the silicone sandwiched between [1]. This method has proven very useful for fitting a variety of amputees who have experienced difficulty with conventional socket designs and myoelectric control. As recommended by Daly, the author has used the Ohio Willow Wood Alpha liner exclusively when using the snap electrodes as provided by Motion Control. Types of amputees that have most benefited include: transradial amputees with short residuums, especially those with scar tissue, and transhumeral amputees with short residuums. Electrode contact can be difficult to maintain in both groups when using electrodes fixed to a rigid or semi-rigid interface. In some of these cases, conversion to 3S interface with snap electrodes has meant the difference between marginal, intermittent control and the excellent control reliability attained with the new system.

The Alpha liner now is available with several variation that should be considered when choosing the most appropriate product for a particular application. These include sizing, color, textile backing material (standard or Spirit), and size of the distal umbrella or no distal attachment at all (locking vs cushion liners). When utilizing a distal locking mechanism there are two basic choices, either a clutch lock or a ratchet can be used. The clutch lock has been used when it is desirable to assist the limbs' entry into the socket by "pulling in" using the slotted lock release button. This lock mechanism is longer and larger than the other options and this may preclude its use. There are many ratchet locks commercially available. The ratchet mechanism now favored by the author is the Ossur Upper Extremity ratchet lock which is very low profile and light weight. The Ossur ratchet is also easily assembled, or disassembled, from the inside of the socket. Two other options are a lanyard and no distal attachment in select cases. The lanyard, (often just a Velcro strap), offers the lowest profile distal attachment, allows for "pulling in" and is therefore useful for longer residual limbs.

When donning the Alpha liner it is important to do so with the right orientation in order to best approximate the desired electrode sites. This is perhaps best done by aligning the seam of the liner with some feature of the limb such as a freckle or scar. Electrode orientation using this method has not been a problem. Another consideration is how to address the actual attachment of the snaps, they can be pushed in place either before donning the socket or after the limb is inserted. In most of cases, the snaps have been engaged prior to donning and the wires simply guided into the socket to find their own resting place. Photo 1 Initially there was concern that the wires, snaps, or the thickened junction points would cause discomfort but this has not been the case with any of the transhumeral cases and has only presented a problem with slender and bony transradials. Therefore, only in the cases where there is insufficient soft tissue padding has the socket been fabricated to align the snaps over the electrode site to be secured after donning. Photo 2



Photo 1



Photo 2

This experience favorably supports that of Daly and suggests that continued research and development of Roll-on-Suction-Sockets for use with myoelectric control should be pursued. The means of conducting the myoelectric signal from the limb to the pre-amps is one issue that deserves attention. Although all of the clients fitted found the new system to be superior to their previous prosthesis, the need to individually attach each electrode and the potential for failure when wires are continually manipulated is not ideal. As suggested by several parties interested in this technology, it should be possible to embed the connection in the liner and bring the signal out through the distal fixation mechanism or through one simple plug. Although the Alpha liner works very well with snap electrodes, it may be advantageous to use a liner that is thinner such as the Ossur UX liner. In any case, 3S systems with myoelectric control are a valuable tool in managing the upper limb deficient client and is a welcome addition to our fitting choices.

References:

1. Daly, W., "Clinical Application of Roll-on Sleeves for Myoelectrically Controlled Transradial and Transhumeral Prostheses", Journal of Prosthetics and Orthotics, Vol 12 No. 3 88-91, 2000.
2. Salam, Y., "The Use of Silicone Suspension Sleeves With Myoelectric Fittings", Journal of Prosthetics and Orthotics, Vol 6 No.4, 119-120, 1994.