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An Adjustable Writing Device for Use with a Definitive Wrist Hand Orthosis

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INTRODUCTION

Writing independently is a valuable and intrinsically rewarding skill which may be necessary to improve a patient's potential for returning to school or employment. A patient with a spinal cord injury may display total or partial loss of function depending on the level of injury to the cord. He/she may lack the strength and fine manipulation skills required for doing tabletop activities such as writing, which is crucial in a vocational, avocational, or school setting.

To promote function for desk skills, a patient may use an orthotic device. Various definitive wrist hand orthoses are available to provide, augment, or substitute for grasp. Many have either a spring loop to hold a pen near the metacarpophalangel joint or a slot in which a writing device can be inserted and a pen attached with a thumb screw. There are also many commercially available writing devices or specially adapted devices that may be fabricated by an occupational therapist.

Many of the writing devices available have the disadvantage of having a permanent angle to the pen holder, and the need for assistance of another individual to change the writing tips for the user. For this purpose, an adjustable writing device has been designed to facilitate independence in changing a variety of tips (e.g. pen, pencil, eraser, crayon, etc.). In addition, the angle of the writing device can be adjusted with an allen wrench.

Some of the components needed for the adjustable writing device can be purchased commercially as a kit. This set-up is similar to the modular mouthstick system which was developed by the Northwestern University Rehabilitation Engineering Program and Rehabilitation Institute of Chicago Occupational Therapy department.[1] The commercially available kit includes: an arrowshaft with a distal round head screw; four appliance holders; an allen wrench; and an aluminum bracket attached to an adjustable camera clamp.

FABRICATION

The materials needed to fabricate the adjustable writing orthosis are as follows:

(1) control rod end
⅜"—24 male thread
⅜" inside diameter
(1) ⅜"—24 hex nut
(1) standard orthoses tab
(3) 8-32 × ⅛" set screws
(1) modular mouthstick kit
Loctite RC/609

Fabrication of the adjustable writing orthoses requires only tools normally found in an orthotics laboratory.

- In order to be able to lock the angle of the writing orthosis, two set screws need to be installed in the control rod end. Two holes, located 90° with respect to one another, are drilled and tapped for an 8-32 thread (Figure 1). The raceway of the control rod end needs to be repositioned during the drilling and threading procedure to allow access.
- The thread length of the control rod end is cut from 1¼" to ⅛" (Figure 2). This will lighten the device, yet still enable it to attach to the orthosis tab's hex nut. The remaining threaded shank is then bored longitudinally using a #1 drill to further decrease the weight.
- A ⅜"—24 hex nut is brazed at the end of a standard orthosis tab (Figure 3). This component forms the interface between the orthosis and the control rod end.
- The remaining portion of the control rod end's ⅜"—24 threaded shaft is inserted into the ⅜"—24 hex nut and fixed in position parallel to the orthosis tab by Loctite RC/609 fastener (Figure 3).
- An appliance tip and fiberglass arrowshaft from the modular mouthstick kit are now used to give the system its interchangeability. An appliance tip is cut along its central groove at the inside edge of the collar containing the set screw (Figure 4). The shortened appliance tip is pressed into the raceway of the control rod end with the collar positioned above.

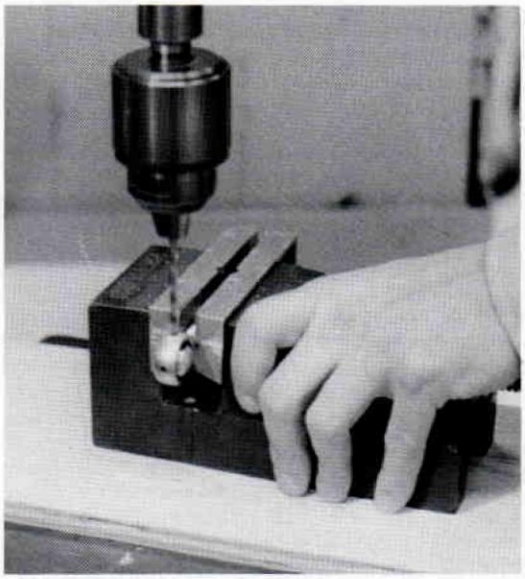

Figure 1. Drill and tap for 8-32 thread

Figure 2. Trim the control rod end.

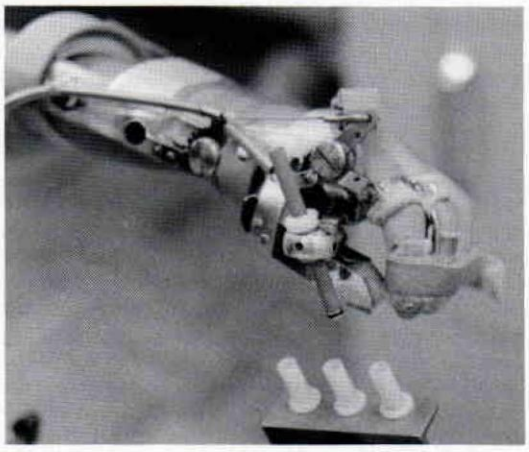

Figure 3. Control rod end, hex nut, and orthosis tab.

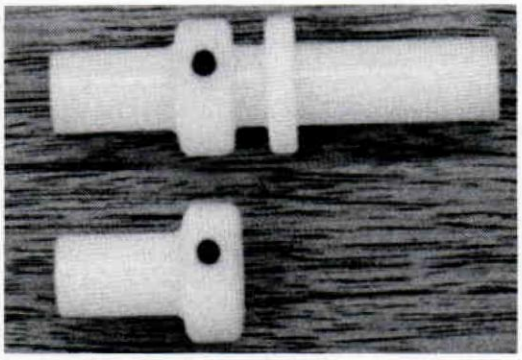

Figure 4. A trimmed appliance tip.

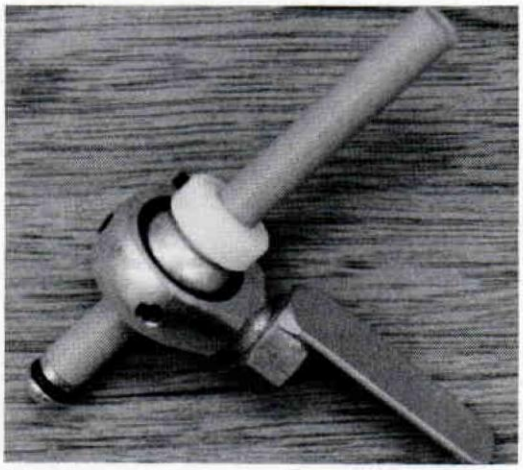

Figure 5. Adjustable writing device ready for insertion into slot of a definitive wrist hand orthosis.

A 3″ length of fiberglass arrowshaft is cut from the end containing the round head machine screw and locking O-ring. The arrowshaft is inserted into the shortened appliance tip's end. The position of the arrowshaft should be locked using the appliance tip's existing 4-40 × ¼″ set screw. The assembly is now ready to accept other tips from the modular mouthstick system (Figure 5). The weight of the device is approximately two ounces.

- The other appliance tips from the modular mouthstick kit should now be set with the desired instruments (e.g. pencil, pen, eraser end, paint brush, etc.). In all cases, the instrument's overall length needs to be cut down to approximately 2¼″. In some cases, the portion of the instrument's diameter which is to be inserted into the appliance tip will need to be reduced. The appliance tips are then ready to be positioned in the kit's stand. The stand can be mounted to the patient's wheelchair or work station and holds the tips when not in use (Figure 6).
- Once the system is set up, the optimum angle of use can be easily found and secured by using the 8-32 × ⅛″ set screws (Figure 7).

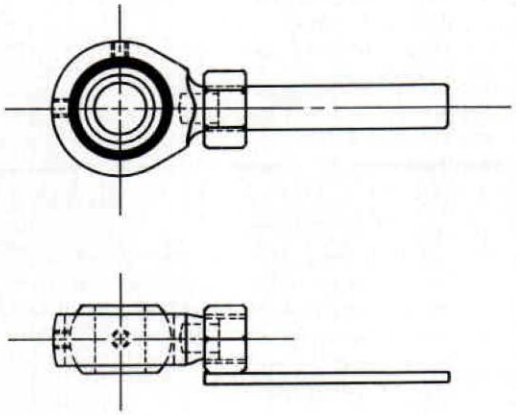

Figure 6. Completed kit stand mounted on work station.

SUMMARY

Through the use of this writing device and set-up, the therapist is able to evaluate and modify the angle of the writing device with the patient. This will eliminate the need for an involved initial angle determination or subsequent modifications by the orthotist. The patient may also prefer a different angle for different activities. In addition, the patient may choose, according to his needs, the various tips necessary to perform functional tasks. By providing

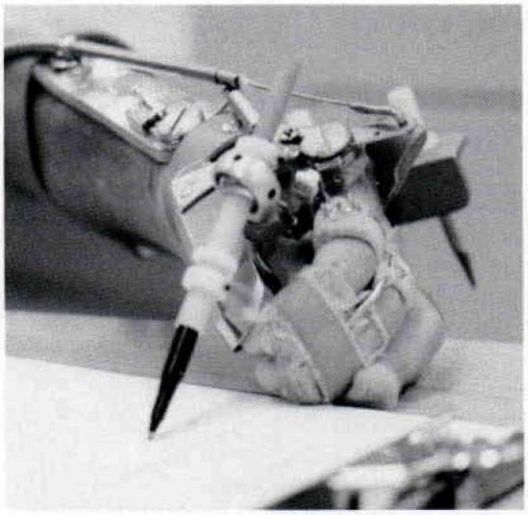

Figure 7. Completed components of adjustable writing device.

this device and set-up, the patient can independently change his tips for painting, writing, operating a typewriter, telephone, calculator, etc. For a school age child, the importance of coloring and changing different crayons is a vital and important developmental process.

With creative problem solving by both the therapist and patient, the set-up may have potential for use with other diagnoses, such as muscular dystrophy and arthrogryposis, or as a temporary device for patients awaiting a definitive prosthesis.

AUTHORS

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REFERENCES

[1]Kozole, K., Gordon, R., and Mycoff-Schultz, J., "A Modular Mouthstick System," *Proceedings of the Fifth Annual Conference on Rehabilitation Engineering*, 1982.

SUPPLIERS

Mouthstick Kit

Therafin Corporation
3800 S Union Ave.
Steger, Illinois 60475
(312) 755-1535
"Mouthstick Assembly Kit"

Don Johnston
Development Equipment
981 Winnetka Terrace
Lake Zurich, Illinois 60047
(312) 438-3476
Item #C42 Mouthstick Kit

Control Rod End

McMaster-Carr Supply Company
P.O. Box 4355
Chicago, Illinois 60680
(312) 833-0300
Item #6072K23