International Journal of Health Sciences and Research
Volume 14; Issue: 10; October 2024
Website: www.ijhsr.org
ISSN: 2249-9571

Case Study

An Indigenous Design of Splinting for Radial Nerve Palsy Patient - A Case Study

Rashmita Dash

Department of Prosthetics and Orthotics Swami Vivekananda National Institute of Rehabilitation Training and Research, Cuttack, Odisha, India.

Corresponding Author: Rashmita Dash

DOI: https://doi.org/10.52403/ijhsr.20241038

ABSTRACT

Introduction: The radial nerve is the most frequently injured major nerve of the upper extremity leading to a clinical condition of wrist drop. Individuals affected experiences major hand impairments that include spasticity, limited range of motion, poor muscle strength which in turn results in restriction of the upper extremity in performing activities of daily living. Splinting to maintain joint motion and functional use of the hand is usually required until nerve recovery occurs or tendon transfer procedures are performed. Application of various types of splints in this population is widely used in clinical practice as an integral part of rehabilitation.
Method: the patient suffering from radial nerve palsy with significant wrist drop was provided a new design assistive glove aimed to provide an appropriate splinting management for prehension activity. This further allows them to improve motor recovery and regain functional independence by active assistance of the newly designed gloves. The outcome measure of upper extremity functional recovery evaluated clinically by Modified Ashworth Scale for spasticity and available active range of motion before and after a period of 3 weeks was assessed.
Result and Conclusion: After the splint is worn for a period of 3 weeks a positive result is observed on patient with increased hand function along with active range of motion and decrease in spasticity. The patient is able to perform the grasping and gripping activity individually and independently. This study concludes the application of splinting on radial nerve palsy individuals enhances the upper limb functional recovery and reduces the motor impairment of the hand.

Keywords: Radial nerve palsy, Spasticity, Assistive glove, Activities of daily living

INTRODUCTION

The deformity in radial nerve palsy is classic: inability to extend the wrist, loss of finger extension at the meta-carpophalangeal joints, and inability to extend and abduct the thumb. This is commonly referred to as the wrist-drop deformity. With the inability to extend and stabilize the wrist causes the patient to be unable to use his long flexors adequately in making fist. The sensibility of the palmer surface of the hand is uninvolved; therefore, the loss of active extension robs the otherwise normal palmer surface of its usefulness. For this reason, appropriate splinting during period of recovery has the potential of establishing almost normal functional use of the hand. The loss of power in the wrist and finger extensors destroys the reciprocal tenodesis action that is essential to the grasp-release pattern of normal hand function. The ideal splint would recreate this harmony of tenodesis action: finger extension with wrist flexion and wrist extension with finger flexion. Although stabilization of the wrist does allow transmission of forces to the flexors for power grip, immobilization of the wrist only accentuates the inability of the fingers and the thumb to open out of the palm.

Static wrist splinting does not replace the fine manipulative ability of the hand, a function needed more frequently in our daily tasks than that of the power grip. Barton and Goldner caution against the contractures frequently seen following prolonged periods of static splinting (1, 2). A volar wrist splint covers the valuable sensory palmer surface of the hand, limiting normal function. In effort to allow motion while also providing support, various splinting combinations have been proposed. Pearson and Wynn Parry recommend dynamic splinting of the wrist (3, 4). Peacock, and Thompson and Littler have demonstrated splints that add outriggers for concurrent dynamic finger and thumb extension. Although these splints are very effective in assisting extension when the hand is relaxed, they are in-effective in maintaining wrist extension during finger flexion, since the wrist and finger flexors pull against the outriggers, overpowering the dynamic portion of the splint. The presence of a dynamic force substituting for absent musculature provides a stimulus against which to pull, strengthening even more the intact musculature. Although this assists in maintaining excellent joint motion, it does not effectively re-establish the pattern of grasp/release that is missing with wrist drop (5, 6).

MATERIALS & METHODS

The patient (male, 40 years) reported to the institute SVNIRTAR after suffering from traumatic radial nerve injury (right upper extremity). The patient present with Manual muscle testing grade 3, and Spasticity (MAS) grading of 3+. The patient was continuing physiotherapy session and was reported to department of prosthetics and orthotics for fabrication of hand splint. After proper assessment and medical history, the patient is advised for wrist hand splint. As the patient is undergoing continuous therapeutically exercises, we decided to go for fabrication of a dynamic hand splint with some modified design. The patient gave a written informed consent form to participate in the study, and appropriate approval was also obtained from the Institutional Ethical committee.

Fabrication procedure- As the patient had wrist movement, and had mild spasticity, he can flex his finger with little assist, so we decided to use that body motion to allow him to do prehension activity, therefore, we fabricated, “Assistive glove” for prehension and exercise of hand. This splint is designed to provide a functional “Three jaw chuck” type prehension for the patient who has wrist drop and lacking finger extension. While it has limitation it cannot provide to patient exhibiting increased tone/spasticity. Components like Forearm strap, Wrist splint, Thumb hook, Splint liner, Hand attachment site, Tensioners, Finger hook, and non-slip surface was used to design the hand splint. The fabrication procedure includes casting of the affected side U/E with wrist held in achievable functional position. Pop bandage was applied over the hand covering 2/3rd circumference of the hand till proximal inter-phalangeal joint. And pressure is applied over the bony surfaces and in-between the knuckles. After casting the negative cast is set for pouring with POP slurry and modification was done including the bony prominence area and groove for the attachment of different components. Once the positive mould is achieved, it is set for vacuum moulding using a 3mm polypropylene sheet. After moulding the wrist splint was shaped and smoothened.

The hand attachment site was cut with sharp knife to provide the hook for holding the tensioner. The wrist splint was ready for further attachment. Velcro forearm was attached to the polypropylene wrist splint proximally, with respect to the fitment strap. The Tensioners acts as a connecting medium between DIP, PIP, MCP joints and thumb's IP, MCP joint with digit extension. The extension system was made of different sized tensioners for maximum adjustability. The glove keeps the fingers in extension position and holds the Finger hook. On the palmar side it has non slippery surface for better gripping. Finger hooks were made up of steel; these hooks are attached on the glove above the proximal, middle and distal phalange.

RESULT

From this present study we observed that the patient was satisfied with the device as it helps him to enhance his recovery process by incorporating functional task training at home. It helps to restore his hand function and regaining control. The device makes him independent to perform his day to day activity by facilitating everyday purposeful movements. Overall it maintains the hand and wrist in functional position which further aids in maintaining post therapeutic effects. It helps to enhance the recovery process by rewiring after the injury. It is made up of easily available material with ease in donning and doffing. And require low maintenance.

Fig 1- Negative Cast

Fig 2- Components Of Assistive Glove

Fig 3- Patient With Assitive Glove

DISCUSSION

The study evaluated that the effectiveness of the assistive gloves in patient with radial nerve palsy. The result shows that the grip force and grasping strength increases effectively with the gloves on. The patient regains the confidence of grasping the object independently. The gloves combine comfort and functionality to help in performing hand exercise that promotes optimal hand rehabilitation. The flexible design further supports to personalize the level of resistance to promote targeted and effective hand recovery. Strategically placed elastic bands helps the patient in assisting finger extension and flexion (grasping and releasing), actively promoting range of motion and strengthening hand muscles. The proprietary tension system extends the fingers and thumb after grasping so that affected limb can be engaged for task specific training and rehabilitation.

CONCLUSION

Overall data from this study may potentially be used to better understand the biomechanics and design principle of the assistive gloves with regard to fabrication, prescription and fitting. And the simple design may further help to enhance the prehension capabilities in the rehabilitation of persons with wrist drop while in recovery process. It should be emphasized that because of the uni sample size nature of this study, the validity of this intervention should be reconfirmed by a large sample size and randomized clinical trial.

Declaration by Author

Acknowledgement: None
Source of Funding: None
Conflict of Interest: The author declares no conflict of interest.

REFERENCES

1. Barton NJ: radial nerve lesions. Hand 5(3), 1973.
2. Goldner JL: function of the hand following peripheral nerve injuries. In American academy of orthopedic surgeons: instructional course lectures, vol X St Louis, C V Mosby Co., 1953
3. Pearson S: Splinting the nerve injured hand. In Hunter JW, Schneider LH, Mackin EJ, Callahan A: rehabilitation of the hand, St Louis, CV Mosby Co., 1984,p 455.
4. Wynn Perry, CB: Rehabilitation of the hand. London, Butterworths, 1978, pp 91-92.
5. Peacock EE Jr: dynamic splinting for the prevention and correction of the hand deformities. J bone joint surg 43A (4), 1952.
6. Thomson JS, Littler JW: Dressings and splints. In converse JM (ed): Reconstructive plastic surgery, vol 6. Philadelphia, W.B Saunders, 1977, pp. 2991-2999.

How to cite this article: Rashmita Dash. An indigenous design of splinting for radial nerve palsy patient - a case study. *Int J Health Sci Res.* 2024; 14(10):363-366. DOI: *https://doi.org/10.52403/ijhsr.20241038*

******