

재활보조기구

게시일시 및 장소 : 10 월 19 일(토) 08:30-12:30 Room G(3F)

질의응답 일시 및 장소 : 10 월 19 일(토) 11:00-11:30 Room G(3F)

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The Functional Effect of 3D Printing Orthosis for the Patients with Peripheral Nerve injury

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Aim

this study is to investigate the functional effect of a patient-specific manufactured orthosis for a patient with peripheral nerve injury using 3D printing technique.

Methods

the thin slice CT images (1mm) were used to create external contour of each part of body applied orthotics. After acquisition of the scan, a 3D reconstruction software that produces 3D data from the CT scan. After acquiring 3D surface images from the scanning technique, the 3D-printed orthosis was designed. Based on the prepared design, the orthosis was printed using 3D printer (Fig. 1). In the case 1 and case 2, the Jepsen-Taylor Hand Function Test (JHFT) and Visual Analogue Scale (VAS) were assessed. In the case 3, 6 minute walking test and modified Emory Functional Ambulation Profile (mEFAP) were performed. Stability score was measured during standing posture using the Gaitview[®] AFA-50 system for balance function.

Subjects

Case 1, Wrist orthosis for carpal tunnel syndrome (CTS): a 55-year-old male patient complained of 1st-3rd fingers tingling sensation of the left hand. Electrodiagnostic findings showed left median neuropathy at wrist level. After 2 weeks of the use of wrist carpal tunnel orthotics, the VAS score was decreased from 7 to 3. The mean score of JHFT was improved from 12.85±1.77 to 14.12±0.89 (Table 1). Case 2, Ulnar wrist orthosis: patient is a right-handed 59-year-old male having suffered from left wrist pain and 4th-5th finger abnormal sensation. He underwent the ulnar nerve neurolysis and abscess removal at left wrist lateral aspect. After surgery, he was diagnosed as ulnar neuropathy. After 8 weeks of the use of ulnar wrist orthotics, the VAS score was improved from 6 to 4. The mean score of JHFT was decreased from 9.85±2.91 to 9.00±4.24 (Table 1). Case 3, Ankle foot orthosis

(AFO): a 72-year-old female patient complained of right foot drop. Her right ankle dorsiflexor muscle strength had grade 2 on the MRC scale. Electrodiagnostic findings revealed right lower lumbar radiculopathy. She could walk and received gait training with 3D printing manufactured AFO for 4 weeks. The distance of 6 min walking test was increased from 62.5m to 100m. Total mEFAP score was improved (Table 2). The stability score with eye closed was improved from 43 to 63.

Results

the hand function and pain severity were improved after application 3D manufactured CTS orthosis. However, only the severity of pain decreased after ulnar wrist orthosis application. The ambulatory and balance function improved after AFO application.

Conclusion

we designed and manufactured a patient-specific assistive device optimized for patient function after estimating the disability status of a patient with peripheral nerve injury through 3D printing techniques. We hope to provide effective personalized orthosis to disabled patients using 3D printing techniques. In the future, the comparative study with conventional made orthosis and larger sample study would be necessary.

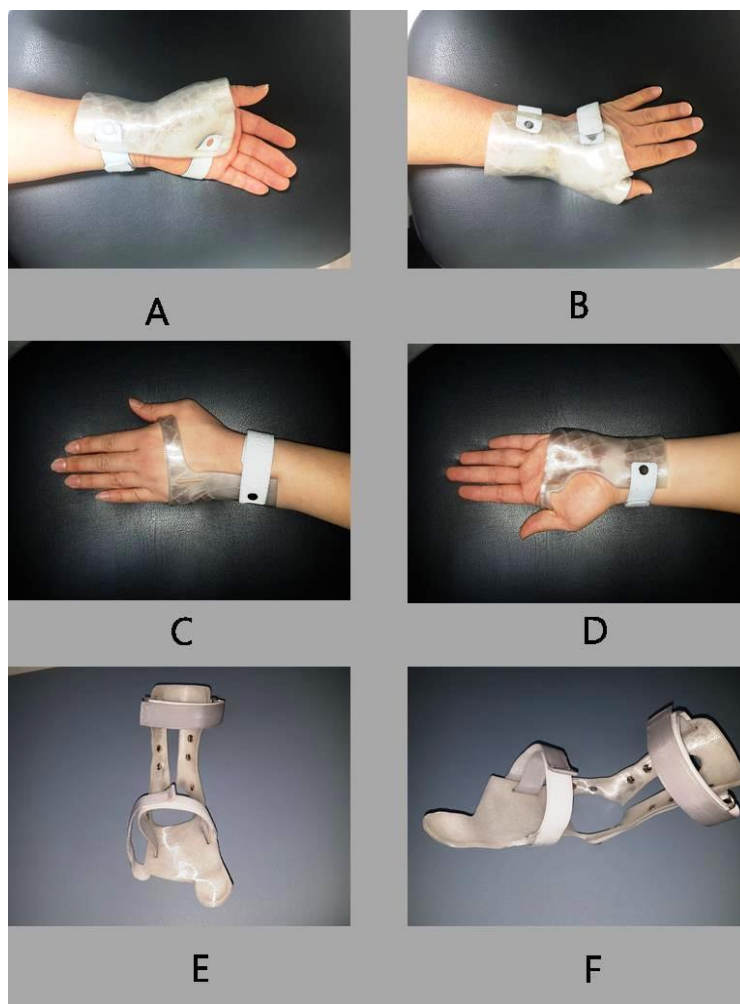


Figure 1. Wrist orthosis for carpal tunnel syndrome, palmar view (A), dorsal view (B); Ulnar wrist orthosis, palmar view (C), dorsal view (D); Ankle-foot orthosis, anterior view (E), lateral oblique view (F).

Table 1. Jabsen-Taylor hand function test (Case 1, 2)

Item ^o	Orthosis for CTS (case 1) ^o		Ulnar wrist orthosis (case 2) ^o	
	Pre ^o	Post ^o	Pre ^o	Post ^o
Writing ^o	34.06 (15) ^o	26.38 (15) ^o	31.35 (15) ^o	26.50 (15) ^o
Stimulated page turning ^o	5.07 (11) ^o	4.09 (13) ^o	6.53(8) ^o	9.34 (3) ^o
Lifting small object ^o	7.78 (14) ^o	7.15 (14) ^o	15.07 (6) ^o	10.75 (10) ^o
Simulated feeding ^o	9.41 (14) ^o	7.84 (15) ^o	13.13 (11) ^o	12.19 (13) ^o
Stacking ^o	4.91 (11) ^o	3.97 (13) ^o	6.44 (8) ^o	7.43 (6) ^o
Lifting large, light object ^o	3.22 (14) ^o	2.72 (15) ^o	5.44 (11) ^o	6.00 (10) ^o
Lifting large, heavy object ^o	4.88 (11) ^o	3.47 (14) ^o	5.59 (10) ^o	7.22 (6) ^o

Values are second (point). ^o

CTS: carpal tunnel syndrome. ^o

Table 2. Modified Emory Functional Ambulation Profile (Case 3)

Item ^o	Pre (sec) ^o	Post (sec) ^o	^o
Floor ^o	27.38 ^o	10.98 ^o	^o
Carpet ^o	29.58 ^o	14.85 ^o	^o
Up & go ^o	25.38 ^o	15.56 ^o	^o
Obstacle ^o	40.63 ^o	15.63 ^o	^o
Stairs ^o	60.00 ^o	47.05 ^o	^o
Total mEFAP ^o	182.97 ^o	104.07 ^o	^o