

# **Walking Training with Functional Electrical Stimulation : 3 Years Experience in Korean National Rehabilitation Hospital**

Bum S Lee\*, Hyung I Shin, Sung M Kim, Byung S Kim

National Rehabilitation Hospital, Seoul, Korea

## **Introduction**

The Spinal Cord Injury (SCI) unit of our hospital has 50 beds, and most of patients are subacute patients from acute care hospital.

The objective of this study was to evaluate the outcome and usefulness of 8 weeks standing and walking training with FES to the hospitalized patients with spinal cord injury.

## **Methods**

From January 2000 to December 2002, 714 patients were admitted to SCI unit of our hospital. Patients with C7 to L1 level lesions (ASIA impairment scale A, B or C) were referred to FES for evaluation (n=273). After the first FES evaluation, 93 patients were not entered into the FES training program due to painful sensations (19 patients) or no muscle contraction response to FES (74 patients). So 180 patients were entered into the 8 weeks FES walking training program (6 sessions per week and 20 minutes per session).

The median age of the 180 patients was 32 years old (16 – 77), and the median time since injury was 9 months (2 – 295). 111 patients were ASIA-A, 33 were ASIA-B and 36 were ASIA-C. The FES training was done with a 6-channel system (Parastep®) and the 6-channel stimulation sites were bilateral Gluteus maximus, Quadriceps and Tibialis anterior muscles. The 8-week training program consisted of 6 sessions per week at 20 minutes per session. Muscle strengthening session were 3 times per week, and walking session were 3 times per week. The FES walking program started with quadriceps muscle strengthening exercise in the sitting position, and then progressed to standing and walking training.

## **Results**

During the training program, 23 patients (12.8%) dropped out. The reasons for drop out were increased spasticity, pain and poor general condition. 77 patients (42.8%) could stand with FES after 8 weeks training. The average standing time was  $10.6 \pm 9.3$  minutes, and maximal standing time was 50 minutes.

32 patients (17.8%) could walk after 8 weeks of FES training. The average walking distance was  $25.8 \pm 28.6$ m and the maximal walking distance was 100m. The only significant factor to predicting standing and walking was age.

The 32 walking patients were 4.5% of all admitted patients (714) in SCI unit of our hospital for 3 years.

None of the 180 patients bought the FES system at discharge, mainly because of the cost (too expensive) and the fact that it could only be used for short distances.

## Discussion

In comparison to previous studies, the result of our study shows a lower walking rate and shorter walking distances. This result may be explained with two reasons. First, we did not select the patients with good condition only. Almost all of the C7 to L1 patients were referred to the training program, unless they refused the FES therapy. Second, due to staffing issues at our hospital, patients had only 3 walking sessions per week, and the other 3 sessions were replaced with the muscle strengthening training.

But the walking rate of 4.5% of all admitted SCI patients was similar with the result of Kralj's study. Kralj's study, in his 9 years experience, showed that 5% of the 500 admitted patients could walk with FES. The result of our study may thus represent the SCI population more closely than other studies.

At discharge, none of the 180 patients bought the FES device. The reasons they did not purchase Parastep® were the cost (too expensive) and the walking distances were too short.

In conclusion, 42.8% of the patients with spinal cord injury could stand and 17.8% could walk after 8 weeks FES training. The only significant factor to predicting standing and walking was age. Unfortunately, practical use of FES for walking after discharge was limited by the cost of the device and short walking distance.

## References

- [1] Brissot R, Gallien J. Clinical experience with functional electrical stimulation-assisted gait with parastep in spinal cord-injured patients. *Spine* 2000; 25: 501-508
- [2] Gallien P, Brissot R, Eyssette M, Tell L, Barat M, Wiart L, Petit H. Restoration of gait by functional electrical stimulation for spinal cord injured patients. *Paraplegia* 1995; 33: 660-664
- [3] Klose KJ, Jacobs PL, Broton JG, Guest RS, Needham BM, Lebwohl N, Nash MS, Green BA. Evaluation of a training program for persons with SCI paraplegia using the Parastep® 1 ambulation system: part 1. Ambulation performance and anthropometric measures. *Arch Phys Med Rehabil* 1997; 78: 789-793
- [4] Kralj A, Bajd T. (eds.) *Functional electrical stimulation: standing and walking after spinal cord injury*. Boca Raton: CRC Press Inc. 1989.