



The role of hunova in rehabilitative treatment of functional balance in a patient with complete spinal cord injury (SCI)

A. Leo, L. Bertazzoni, M. Zarbo, T. Bianconi, M. Spinelli

ASST Grande Ospedale Metropolitano Niguarda, Unità Spinale Unipolare, Milan



We would like to share our clinical experience with a chronic SCI patient. The improvements we observed over therapy progression encouraged us to share this experience to support other clinicians working with the same patient group. In response to the therapy program the patient's postural control improved in a significant way. Therefore, we would like to provide an overview about the therapy and the progression in this case study report.

Introduction

Postural control is a very important and basic requirement in daily human life. The robotic device hunova allows to evaluate and practice postural control, stability and control using different exercises in seated position.

This case study aims to share an experience of the use of hunova for assessment and training of a chronic SCI subject with a complete lesion.

Medical history

46 years old male patient with complete neurological loss: no motor or sensory function (ASIA A), dorsal lesion (D11), in chronic state (distance from the acute event: 20 years).

Clinical initial evaluation

Clinical evaluation was performed at recruitment (T0) and at the end of the treatment with hunova (T1). Before starting the therapy sessions, the patient condition was:

- Poor control of the trunk. Initial SBASCI score 29/52
- Good level of independence. Initial SCIM score 63/86

Robotic evaluation

Robotic evaluation was performed at recruitment (T0) and at the end of the training (T1). The test performed were:

- *Static balance* (Eyes Open - Eyes Closed): the seat is static.
- *Dynamic balance* (EO-EC): the seat is unstable and follows the subject's oscillations who must actively maintain the seat horizontal in the center.
- *Perturbing balance* (EO-EC): the seat moves autonomously following a circular trajectory. The subject must stabilize their trunk in response to a continuous perturbation.
- *Trunk limits of stability*: The subject is seated and must move his trunk as far as they can in the indicated directions (right, left or forwards).

Treatment intervention

Session number	Difficulty level	Seat workspace
1 to 4	1V/1R/1I	5°
4 to 7	1V/1R/1I	3.5°
8 to 11	2V/2R/1I	5°
12	2V/2R/2I	5°
13 to 15	3V/3R/1I	5°
16 to 18	3V/3R/2I	5°
19 to 20	3V/3R/2I	6°

Table 1: Training difficulty progression table
 V = Robotic Seat Velocity
 R = Robotic Seat Resistance
 I = Robotic Seat Instability

20 personalized hunova training sessions with variation of difficulty depending on the patient's performance (Table 1) were prescribed together with conventional physical therapy. Hunova training sessions were focused on:

- Balance
- Trunk control
- Dual-motor-task with movements of the upper limbs
- Strengthening
- Core stability

The treatment goal was to improve functional capability in all the categories listed above.

Robotic Results

After 20 personalized training sessions the subject improved trunk control both in balancing conditions (in dynamic (case 1) and perturbing conditions (case 2)) and in performing active movements with the trunk (case 3, Figure 2).

Clinical Results

The score of the sitting balance assessment for spinal cord injury (SBASCI) scale improves from 29 to 37.5.

Conclusions

The results obtained show the effectiveness of robotic therapy in combination with conventional therapy, with an individualized and interdisciplinary approach. A chronic SCI subject with a complete lesion, with well-defined and consolidated compensation strategies, has benefited in a very positive way from the treatment with hunova, in terms of both pelvis and trunk control. Balance, stability and trunk control can influence the patient's safe wheeled mobility. This resulted in improved functionality, independence and social integration of the patient, despite his chronic condition. Therefore, we believe that it is important to share our experience and support other clinicians which work with the same patient group.

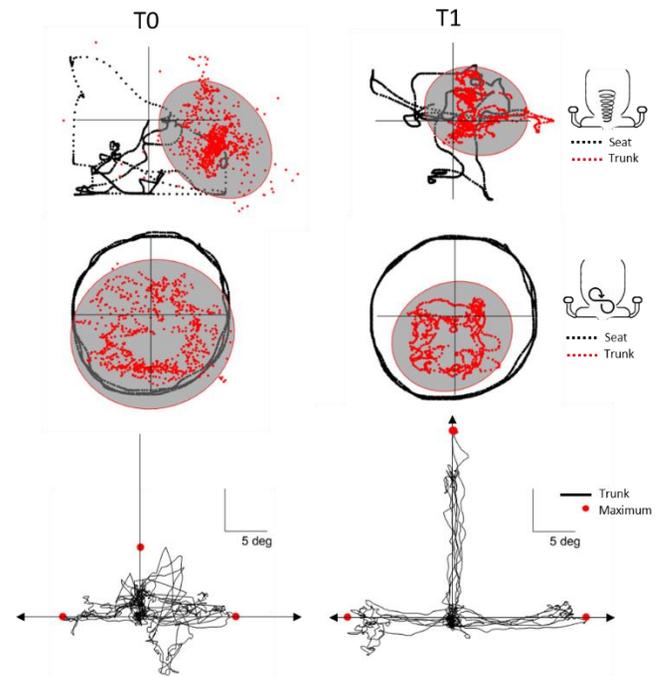


Figure 2: comparison of robotic evaluation tests at T0 and T1. In order: dynamic balance (1), perturbing balance (2) and trunk limits of stability (3). In tests number 1 and 2, the black line represents the seat angular displacement while the red colour shows trunk motion. The black trajectories in test 3 represent reaching movements performed with the trunk.

About us

The Spinal Unit (USU) at Niguarda Hospital in Milan, Italy, is a professional and multidisciplinary facility which aims at facing and satisfying the assistance, the therapeutic, rehabilitative and psychosocial needs of the people who suffered from a traumatic or non-traumatic spinal cord injury (SCI). It is located in the largest Hospital of Milan and Northern Italy. The activities that take place at USU deal with every aspect of this kind of disability, involving breathing, nutrition, neuro-motor activities, bowel and bladder management, and psychological and sexual issues.

