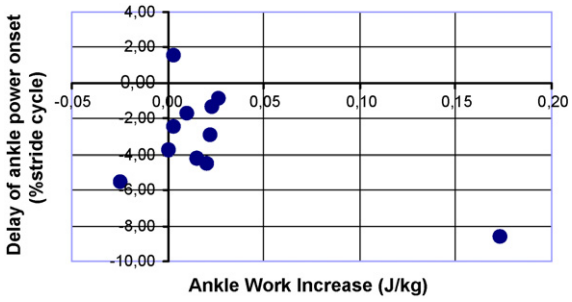


Fig. 1.

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## C5

## Quantitative analysis of the effect of a rehabilitation protocol using electromyographic biofeedback to improve gait in chronic stroke patients

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### 1. Summary and conclusions

An electromyographic biofeedback (EMG BFB) treatment administered in a rehabilitation protocol based on principles of motor learning was effective in improving various gait parameters in a population with chronic stroke. Effects of the treatment still persisted at follow up 6 weeks later.

### 2. Introduction

The gait of people with chronic stroke is often slow and insecure and thus may limit them in independence of daily activities. In consequence the retraining of walking is a major focus in rehabilitation. Efficacy of treatment is an essential issue and calls for methods of applying treatment aimed at maximizing effect and learning. BFB has given controversial results in rehabilitation of stroke patients [1]. The objective of this study was to evaluate the efficacy of EMG BFB applied in a rehabilitation protocol based on principles of motor learning [2] in improving gait speed and other gait parameters in a population with chronic stroke.

### 3. Patients/materials and methods

Twelve subjects with chronic stroke (mean age 62.3 (13.3), mean onset 5.4 (9.5)), either recovered or outpatients at the Don Gnocchi Foundation, Milan, Italy, participated in the study. All were referred to physical therapy with the objective of improving gait performance. After initial screening patients were randomly assigned to an experimental group or a control group and subjected to initial quantitative gait analysis (BTS emg, optoelectronical system and Kistler platform). All patients were capable of increasing their gait speed when asked to do so. The experimental group participated in a rehabilitation protocol with EMG BFB [3] applied to the triceps surae during functional gait. Treatment was administered with a fading frequency of BFB application and an increasing variability in gait activities according to principles of motor learning theories (from session 1 to 20). Subjects in the control group were randomly allocated to available physical therapists and were treated with a traditional treatment approach. After completing 20 treatment sessions both groups were again subjected to quantitative gait analysis. Efficacy of the treatment was evaluated at 6 weeks follow up. Repeated measures ANOVA with three time factors (pre, post and follow up) was used to analyze the data (Statistica 7). When significant main or interactions were present post-hoc comparisons were made using Neuman-Keuls tests.

### 4. Results

The experimental group had increased its gait speed significantly ($p > 0.05$) at post evaluation and at 6 weeks FU the increase was still significantly increased. There was no change in gait speed in the control group. The BFB treatment also increased significantly the healthy side step length, stride length, peak hip extension and peak knee flexion during swing. There were no significant changes in the control group neither following treatment nor at follow up. There was a slight increase in ankle flexor power peak at push off that was not significant in the experimental group.

### 5. Discussion

In the present study BFB was applied with a decreasing frequency and increased exercise variability during functional gait activities according to principles of motor learning theories. Patients in experimental group changed significantly in various gait parameters, including gait speed while there were no significant changes in control group.

The changes were still present at FU indicating that the motor learning approach had induced learning and retention. The increase in gait speed was not directly due to changes in ankle flexor push off power. There was an increase in symmetry, apparent by changes in the non affected side step length, indicating that the increase in gait speed was not due only to increases in the non-affected side.

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## C6

## Static postural analysis in eating disorder patients

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### 1. Introduction

In Italy – as reported by ISTAT in 2002 – three million people are affected by eating disorders (ED) and most of them are affected by main syndromes: binge eating disorder, anorexia nervosa and bulimia. Musco-skeletal adaptations to weight loss or to excessive increase are intimately related with these pathologies, and can cause postural and motor alterations [1]. The main aim of this study is to analyze postural strategies of subjects with anorexia nervosa and bulimia in order to quantify the postural control in these kind of pathologies.

### 2. Methods

Fifteen women affected by anorexia nervosa (age: $32 \pm 11$ years, body mass index, BMI: $15.8 \pm 1.8$ kg/m$^2$), 15 women affected by bulimia (age: $26 \pm 8$ years, BMI: $20.1 \pm 2.9$ kg/m$^2$), and 11 healthy women (age: $31 \pm 5$ years, BMI: $20.1 \pm 1.0$ kg/m$^2$) were analyzed. Two quiet standing conditions (eyes open (EO) and eyes closed (EC)) were analyzed (acquisition time 50 s) with the feet approximately at shoulder width [2]. An optoelectronic system (Vicon 460, Viconpeak, Oxford) with passive markers was used to analyze postural strategies. 3D marker positions and a biomechanical model were used to estimate center of mass (CoM) position [3]. Parameters about the CoM sway in coronal plane (path length, area, medio/lateral (M/L) and antero/posterior (A/P) escursions) were computed to quantify posture of each subject and normalized according to body heights. Statistical analysis was conducted using parametric and non parametric tests ($P < 0.05$).

### 3. Results

Subjects affected by bulimia nervosa resulted more unstable than normal subjects as shown by A/P CoM excursion (normal subjects: $13.6 \pm 6.3$ mm; bulimics: $21.4 \pm 10.7$ mm) and path length (normal subjects: $104 \pm 31$ mm; bulimics: $165 \pm 83$ mm), which resulted greater in subjects affected by bulimia than in normal subjects. The same behavior was shown in women affected by anorexia nervosa, but differences with normal subjects were not statistically significant. Visual input influenced only normal subjects (area CoM EO: $43$ mm$^2 \pm 22$ mm$^2$; area CoM EC: $68$ mm$^2 \pm 31$ mm$^2$) while there were not statistically significant differences in pathological groups between trial conditions (EO-EC).

### 4. Discussion

Subjects affected by bulimia nervosa had a BMI similar to normal subjects but, under the same trial conditions, showed higher CoM path length, thus highlighting that this pathology is characterized by poor stability. Subjects with anorexia nervosa were characterized by the smallest BMI, nevertheless they did not show differences in computed CoM parameters. Results let us to suppose that postural changes were related to weight fluctuation – characteristic of subjects with bulimia – rather than to BMI absolute value. The non-influence of visual input on posture strategies was a distinctive characteristic of all pathological subjects – women affected by both anorexia nervosa and bulimia – and could be associated to pathologies involving cerebral and musco-skeletal apparatus [2].

## References

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