

The Effect of Botulinum Toxin on The Postural Sway of Spastic Patients

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Summary

This study evaluates the effect of botulinum toxin (BoNT) on postural sways of spastic patients during quiet standing. Our results showed that: (1) postural sways did not change one month after BoNT injection; and (2) standing with eyes closed resulted in greater postural sways.

Introduction

Lower limb spasticity, as a consequence of stroke or multiple sclerosis, affects balance control and therefore severely impairs activities of daily living [1]. BoNT has been used as a treatment alternative to conventional therapy and there is strong evidence showing its efficacy in reducing spasticity of lower limb muscles [2]. However, few studies with objective methods for evaluating the BoNT effect on posture control have been conducted [3,4]. The present study aims to evaluate the effect of BoNT on balance of individuals with lower limb spasticity by means of stabilometric tests.

Methods

Eleven spastic patients (5♂ and 6♀; 5 ischemic stroke, 3 hemorrhagic stroke, 3 multiple sclerosis; 52±11 years, 69±18 kg, 173±0.1 cm) participated in the study. Evaluations took place before (T0) and one month after (T1) BoNT injection. Postural sways during quiet standing were evaluated using a force platform (Kistler model 9286B), in two conditions: with eyes open (EO) and with eyes closed (EC). Each test consisted in two trials of 60 s duration each, with a one-minute interval between trials [3,4]. From center of pressure (CoP) coordinates the parameters analyzed were: (1) the area of the ellipse adjusted to the data by diagonalizing the x-y covariance matrix (CoP, mm²); (2) CoP velocity in mediolateral and anterior-posterior axes (mm/s); and (3) the total distance traveled by the CoP (cm). The trial presenting the lower CoP area were selected from each condition for statistical analysis. The Generalized Estimative Equations test was performed using conditions (EO and EC) and time of evaluation (T0 and T1) as factors. A Bonferroni *Post Hoc* was used for paired comparisons and a significance level of 5% was adopted (SPSS v.26.0).

Results and Discussion

Both the elliptic area and the CoP mediolateral velocity were not different between T0 and T1 for both EO and EC conditions. Similarly, no pre-post differences were observed for CoP anterior-posterior velocity and CoP trace length for both EO and EC conditions, however, they were ~40% greater for EC in both T0 and T1 (Table 1). This preliminary study is in agreement with Trappier et al. (2006), who observed that both CoP area and CoP trace length were not modified after BoNT injection in both EO and EC conditions. However, our study agrees partially with Kerzoncuf et al. (2020), which observed no difference on CoP area for EO, while it was greater after BoNT infiltration for EC condition.

Conclusions

Spastic patients balance was not altered one month after BoNT injection. In addition, body sway was greater on anterior-posterior direction when the patients were evaluated with their eyes closed. Whether there is no BoNT effect on postural control or the metrics used are not sensitive to BoNT effect is an issue we are currently assessing.

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References

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Table 1: CoP area, CoP velocity in mediolateral and anterior-posterior axes and Cop trace length before and one month after BoNT injection.

Moment	T0		T1	
Condition	Eyes open	Eyes closed	Eyes open	Eyes closed
CoP area (mm ²)	256.4±265.1	593.5±1163.4	187.3±151.6	409.8±701.1
CoP velocity in x (mm/s)	5.0±1.9	6.3±2.4	5.5±2.8	13.0±19.3
CoP velocity in y (mm/s)	9.0±5.1	13.9±9.4 ^a	8.7±4.6	15.2±7.6 ^b
CoP trace length (cm)	69.9±32.3	112.9±57.9 ^a	70.2±34.5	112.4±57.1 ^b

^aDifference between conditions (p<0.05); ^bdifference between conditions (p<0.0001).