Original Article

Evaluating the Effect of Botulinum Toxin on Visual Pathway Measured by Visual Evoked Potential Using Flash and Pattern Reversal Checkerboard Stimulation Techniques

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Abstract

Purpose: The aim of the present study was to investigate possible side effects of botulinum toxin on the visual pathway, measured by visual evoked potentials using two stimulation techniques: flash and pattern reversal checkerboard.
Patients and Methods: Twenty-six eyes from thirteen female subjects, aged between 40 and 52 years, who received botulinum toxin injections for cosmetic purposes in the upper face area, comprised the case group. Visual evoked potentials using two stimulation techniques (flash and pattern reversal checkerboard) were measured in this group. The obtained results were compared with those of 26 eyes from 13 healthy females with no history of botulinum toxin, who formed the control group.
Results: A significant difference was observed in the latency of the flash visual evoked potential P100 peak between the case and control groups ($P < 0.001$) when using the flash stimulation technique.
Conclusion: Botulinum toxin may affect the visual pathway of patients, which can be measured using flash visual evoked potentials.

Keywords: Botulinum Toxin; Visual Pathway; Visual Evoked Potential.

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Introduction

Botulinum toxin (BT), commonly called Botox, is a popular injectable that temporarily reduces or eliminates facial fine lines, frown lines, forehead creases, and Crow's feet near the eyes [1]. Despite its widespread uses, BT may have certain side effects. Some adverse effects of BT include dysphagia, respiratory compromise, and generalized muscle weakness [2]. Ophthalmic adverse effects following facial injection of BT have also been reported. Diplopia, ptosis, and decrease in visual acuity or vision loss in rare cases are among the visual adverse effects of BT injection [3,4].

Some previous studies have shown that the visual pathway might be affected by BT injection [5,6]. Visual evoked potential (VEP) is a suitable technique to monitor the visual pathway [7]. There are two stimulators usually used to record VEP in different physiological and pathological conditions [8]. These methods are flash and pattern reversal checkerboard methods.

Here we examine the probable changes in the visual pathway caused by BT injection for cosmetic purposes among patients using VEP, utilizing flash and pattern reversal checkerboard techniques.

Patients and Methods

In this case-control study, we evaluated 26 eyes from thirteen females with a history of BT injection for cosmetic purposes as the case group. To examine the visual pathway of the case group, visual evoked potential (VEP) using two types of stimulation techniques (pattern reversal checkerboard and flash) was performed, utilizing a Mangoni device. For comparison, 26 eyes from 13 healthy females with a similar age range to the case group were included as the control group. The control group also underwent similar VEP tests. The latency and amplitude of VEP, specifically the P100 peak, were measured in milliseconds (msec) and microvolts (μV) respectively, to examine the participants' visual pathways.

The VEP recordings were conducted using three electrodes connected to the Mangoni machine: the active electrode was placed on the occipital region, the reference electrode on the vertex, and the ground electrode on the forehead.

The study was approved by the institutional ethics committee, and all participants gave written consent before entering the study.

Results

The average age for the case and control groups was 44.62 ± 3.69 and 43.77 ± 3.03 years, respectively. There were no statistically significant differences between the two groups in terms of age ($P = 0.58$) and sex (all subjects were female).

The table shows the comparison of latency and amplitude of VEP, specifically P100 peak, between the case and control groups using two types of stimulation techniques (flash and pattern reversal checkerboard).

It was observed that the case group had a significantly higher latency ($P < 0.001$) when using the flash stimulator; however, the amplitude of VEP, P100 peak ($P = 0.29$), did not show a significant difference.

Discussion

In the present study, the effect of BT on the visual pathway was evaluated. Visual evoked potential (VEP) using two types of stimulation techniques (pattern reversal checkerboard and flash) were employed for this purpose.

Table 1: Comparison of latency and amplitude of VEP, P100 Peak using two types of stimulation techniques (flash and pattern reversal checkerboard) in the case and control groups

Variable	Mean ± Sd		P value *
	Control	Case	
Pattern Reversal Latency	100 ± 2.65	100.46 ± 3.01	0.53
Pattern Reversal Amplitude	6.62 ± 2.1	6.69 ± 2.04	0.88
Flash Latency	100.85 ± 3.26	108.31 ± 5.5	< 0.001
Flash Amplitude	5.23 ± 1.88	5.77 ± 1.9	0.29

* Based on Mann-Whitney Test

A significant delay in the latency of VEP, specifically the P100 peak, was observed in cases injected with BT during flash stimulation, indicating disturbance in the visual pathway within the case group.

Similar to our findings, Eski et al.,[6] who examined VEP changes following BT administration in patients with blepharospasm, observed VEP changes in P100 peak parameters. Contrary to our results, they found these changes when using the pattern reversal checkerboard stimulation technique, whereas we observed them during flash VEP recording [6].

Another study conducted by Khalili et al.,[5] examining the effect of BT injection into the medial rectus muscle for the treatment of traumatic sixth nerve palsy, showed decreased P100 amplitude and normal latency.

It appears that BT injection, whether used for therapeutic or cosmetic purposes, has the potential to adversely affect the visual pathway, as measurable by VEP. Further studies with a higher number of participants are warranted to better establish the changes in visual pathway performance among patients receiving BT for these purposes.

Conclusion

Botulinum toxin may affect the visual pathway of patients, which can be measured by flash visual evoked potential.

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Footnotes and Financial Disclosures

Conflict of interest:

The authors have no conflict of interest with the subject matter of the present manuscript.