Combining physiotherapy with Botulinum toxin type A injections improve the Range of Motion of children with spastic cerebral palsy

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Introduction – Spasticity is a common feature of cerebral palsy (CP). It often interferes with motor function, causes painful muscle spasms and predisposes to the development of fixed contractures. The successful treatment of spasticity usually improves the selective motor control and motor function and delays or prevents the occurrence of contractures [1]. BTX-A has been shown to be a very safe and effective treatment of spasticity in children with CP. It reduces muscle tone, relieves muscle pain and improves motor function [2-8]. The combination of treatment modalities has been shown to be more effective than the use of one treatment in the management of muscle spasticity. Physiotherapy is considered the corner stone in the management of spastic CP and BTX-A was recommended an adjuvant to physiotherapy in the management of dynamic contractures [9]. Furthermore, empirical clinical observations suggest that physical activity enhances the beneficial effect of BTX-A. For example, Koman et al [3] observed that children with CP who were more physically active had a better improvement in tone of injected muscle and a longer duration of effect after BTX-A injections than those who were less active. However, the superiority of BTX-A and physiotherapy over BTX-A alone has not been conclusively demonstrated. Some authors have found the combined use of BTX-A and physiotherapy to be more effective than BTX-A alone [10], but this observation was not confirmed by other investigators [11]. The Purpose to examine whether the combination of botulinum toxin type A (BTX-A) with physiotherapy is better than BTX-A alone in reducing improving range of motion in children with spastic diplegia.

Methods – 46 ambulatory CP children with significant lower limb spasticity in their lower limbs were invited to join a prospective longitudinal study. They all had spastic diplegia and dynamic equinus foot deformity. They were assigned to two groups. Group one 18 children received BTX-A injections into the lower limb muscles on study entry and six month later. The number of muscles injected depended on the clinical indications. The ankles were placed in plaster casts for 2 weeks after the first injection and the children were fitted with medical shoes after removal of the casts. Group two 28 children received the same treatment with the addition of intensive physical therapy for 2 weeks after the removal of the casts. The BTX-A injections were made by an experienced clinician, but using anatomical surface landmarks [12]. Change in the muscle tone was assessed by measuring the joint range of motion with an electric goniometer. ROM of the children in Group 1 and Group 2 were compared on entry and 4 and 6 weeks later.

Outcome measures - The measurement of the ankle joint range of movement (ROM) with a goniometer. Spasticity decreases the range of motion at joints. In more recent studies electrogoniometers make continuous measurements of the angle of a joint. The output of an electrogoniometer is usually plotted as a chart of joint angle against time [15]. The measurement of the ROM at the ankle joint in the dorsiflexion-planter flexion plane was made with a twin axis electrogoniometer. A calibration was performed on the electrogoniometer immediately before each session. The goniometer was fixed on the lateral side of the patient's ankle joint. At proximal end-block was placed parallel to a line between the lateral malleolus and the fibula head. The distal ankle end-block was aligned with the plantar surface.

Results –18 and 28 children were enrolled into Group 1 and Group 2 respectively. The demographic and clinical characteristics of the two groups were comparable at baseline. Children in both groups showed improvements in the joint ROM. But the improvement in-group two was bigger. There were no statistically significant differences between the two groups in their demographic or baseline ankle ROM.

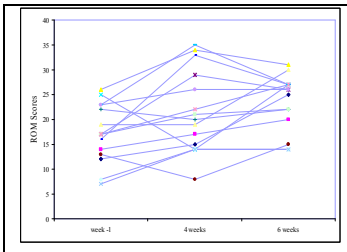

Figure 1. Shows the range of motion at the ankle the children in Group 1 week before, 4 weeks and 6 weeks after BTX-A injection.

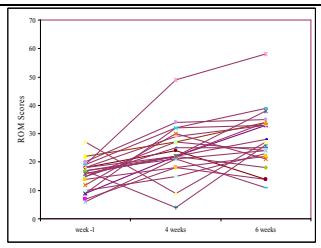

Figure 2. Shows the ROM scores for all the children in Group 2. The improvement form baseline is significant at 4 and 6 weeks.

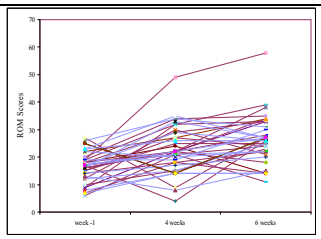

Figure 3. This shows the mean ROM scores for Group 1 and group 2 one week before, 4weeks and 6weeks after

		BTX-A injection

	Group 1	-1 week vs 4 weeks	-1 week vs 6 weeks	Group2	-1 week vs 4 weeks	-1 week vs 6 weeks
Mean	17.4°	21.2°	23.9°	15.5°	25.6°	27.9°
St.Dev	5.7°	8.0°	5.6°	5.1°	7.1°	10.4°
P Value		0.127	0.003		<0.001	<0.001

Table 1.

A summary of the results of ANOVA tests comparing the mean ROM pre and post BTX-A injection in group1. The results show that the mean ROM was statistically significant in group1 after BTX-A injection 6 weeks.

Table 2.

A summary of the results of ANOVA test comparing the magnitude of the ROM pre and post BTX-A injection in group 2. The results show that the mean ROM was statistically significant in group 2 4 and 6 weeks after the BTX-A injection.

Comparison of ROM in Group 1 and Group 2._There was an improvement from baseline in the ROM at the ankle in both groups at all assessment points (see tables 1 & 2), (see figures 1 & 2), but the magnitude of improvement was greater in group 2.

		Group 1	**Group 2**
A	**Mean**	**17.4°**	**15.5°**
	St.Dev	5.7°	5.1°
	P Value	0.290	
B	Mean	21.2°	25.6°
	St.Dev	8.0°	7.2°
	P Value	0.085	
C	Mean	23.9°	27.9°
	St.Dev	5.6°	10.4°
	P Value	0.173	

Table 3.A summary of the result of ANOVA tests comparing the magnitude of the ROM pre and post BTX-A injections in group 1 and group 2. A One week before BTX-A injection. B Four weeks after BTX-A injection. C Six weeks after BTX-A injection.

Group	Baseline	Week 4	Week 6
Group one (n = 18)	17.4 (5.7)	21.2 (8.0)	23.9 (5.6)
Group two (n = 28)	15.5 (5.0)	25.6 (7.2)	27.9 (10.4)

Discussion – BTX-A has been used in the management of spasticity to reduce muscle tone [13, 3, 4] and to improve motor function [1, 5, 16]. In addition, in children with cerebral palsy it has been shown to increase muscle length, to facilitate the use of orthoses and it may also delay the need for corrective orthopaedic surgery [1, 5]. The effectiveness of BTX-A appears to be enhanced when it is combined with other treatment modalities. The present study confirmed the superiority of BTX-A when combined with physiotherapy over the use of BTX-A alone in the management of lower limb spasticity in diplegic CP. The additional benefit of physiotherapy was clear at the level of impairment as well as at the level of functional activity. These findings contrast with those of Reddihough et al. [13].

The present study examined the effect of the interventions on functional activities rather than the changes in muscle tone, as improvement in function is what important to the patient. In this study children were provided with foot orthoses after the BTX-A injections. This has the advantage of distributing weight-bearing forces evenly during standing and walking and reducing the stress on proximal lower limb joints.

Our study has shown that the duration of benefit of BTX-A was improved by the addition of physiotherapy. A major limitation of this study is the use of convenience sampling which prevented the random allocation of the patient to a study or control group. This was unavoidable because of the patients' social circumstances.

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