Effects on Gait Pattern of Intrathecal Baclofen in Subjects Affected by Cerebral Palsy

M.Romei[a], M.Galli[a], F.Motta[b], M.Crivellini[a]
[a] Dept. Of Bioengineering, Politecnico di Milano, Milano, IT
[b]Paediatric Orthop. Dept., "V.Buzzi" Children Hospital, Milano, IT

Introduction

Intrathecal Baclofen Therapy (ITBT) is one of the treatments for individuals with cerebral palsy (CP). In particular ITBT reduces spasticity in the upper and lower extremities and is often associated with improved gait and upper extremity function [1].The previous studies focused on quality of life [2], clinical assessments [3] and qualitative evaluation of ambulatory status [4], but a quantitative evaluation of ITBT effects using Gait Analysis (GA) on gait pattern has not previously been addressed.

Statement of Clinical Significance

This study focuses on one of the treatments for spasticity reduction. In particular the aim of this work is a quantitative evaluation using GA of changes in gait pattern of diplegic subjects after ITBT. In order to analyse the effects of intrathecal Baclofen the analysed patients underwent GA in two post ITBT sessions: the first was performed 5 months after ITBT (short follow-up) and the second was performed 24 months after ITBT (long follow-up).

Methodology

16 subjects affected by CP (mean age 17, range: 6 - 26 years) were recruited from the Department of Paediatric Orthopaedics of the "V. Buzzi" Children's Hospital in Milan. They were all diplegic and were analysed using GA before ITBT (PRE) and after ITBT. One GA session was carried out for all the subjects 5 months after ITBT (POST1) and a second post ITBT session (POST2) was performed for 6 subjects on average 24 months after ITBT. 11/16 subjects had surgery before ITBT and 14/16 walked with aids. The same clinical equipe recruited all the subjects and performed clinical, functional and neurological evaluation (Ashworth scale, clonus scale, spasm scale).

22 healthy subjects (mean age: 17 years, range: 6-26 years) underwent GA and their data were considered as reference.

An 8-camera optoelectronic system with passive markers (ELITE, Bts, Milan, Italy) working at a sampling rate of 100 HZ for measuring the kinematics of movement was used. From kinematic data shoulders, pelvis, hip, knee and ankle joint movement were considered. In this study we were particularly interested in the effects on lower joint and for this reason range of motion (ROM) of pelvis, hip, knee and ankle on sagittal plane were calculated for all the GA sessions. From the comparison between ROM values before and after ITBT the improvements in articular mobility on each joint were calculated. Since 68.75% of subjects had previous surgery, the data of these subjects were separately considered from the data of subjects that had no previous surgery and the ROM values of all the lower limb joints PRE and POST1 for both groups (ITBT+surgery and only ITBT) were compared. We evaluated as improved a subject that after ITBT showed higher ROM for all the joints than before ITBT.

Results

In Tab.1 the results of clinical evaluation were shown.

Ashworth scale			Clonus scale			Spasm scale		
PRE	POST1	POST2	PRE	POST1	POST2	PRE	POST1	POST2
3±1.1	2.15±0.7	2.3±0.5	1.2±1.1	0.7±0.7	0.3±0.5	0.8±0.8	0.3±0.5	0.2±0.4

From clinical evaluation it's possible to observe that after ITBT we obtained lower values both after 5 months and after 24 months. In Figures 1 and 2 the percentage of improved ROM on pelvis, hip, knee and ankle on sagittal plane after 5 months (Fig.1) and after 24 months (Fig.2) were shown.

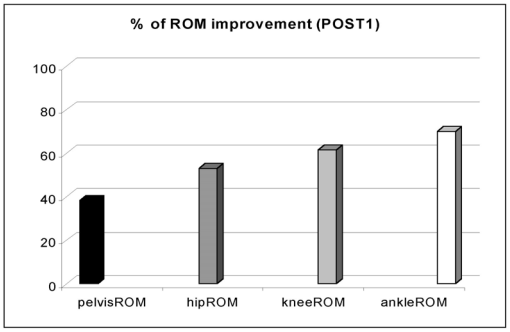

Fig.1: % of ROM improvement in POST1

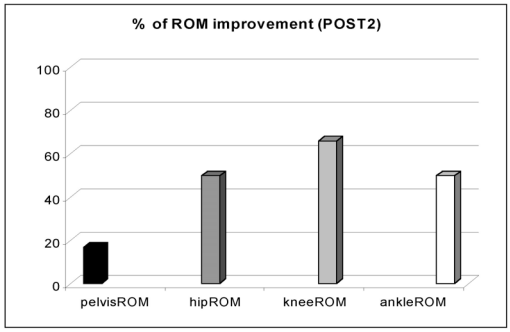

Fig.2: % of ROM improvement in POST2

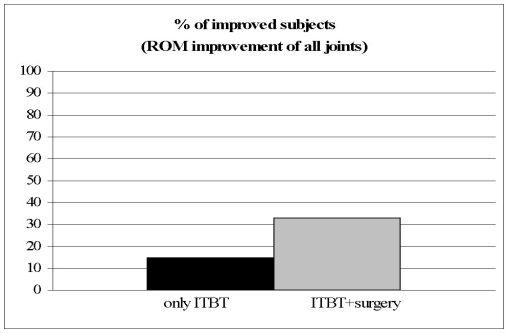

Fig3: % of improved subjects for ITBT

After 5 months we noticed that the subjects improved more in ankle and knee joints than in hip and pelvis joints. After 24 months we didn't observe a similar effect: the knee was the joint that showed the biggest improvement of the lower limb joints. If we compare the POST1 and POST2 results we can see that hip and knee showed a similar trend and pelvis and ankle seemed to have a reduced effect of ITBT 24 months after the treatment.In Figure 3 the results for the subjects that had surgery before ITBT and those that had no surgery are shown. It's possible to notice that the percentage of improved subjects is higher for the group ITBT+surgery than for the subjects that had only ITBT.

Discussion

Based on the different results found 5 months after ITBT and 24 months after ITBT, it seems that few months after ITBT the pharmacological effects act more on distal joints than on proximal joints. Two years late this trend is disappeared and it could be due to a new gait strategy that the subjects were able to perform. From this results we suggest to analyse the gait pattern of subjects treated with ITBT more times after the implant in order to study the development of the new gait strategy.From the comparison of the results for subjects that had previous surgery and those that had no previous surgery, we observed that the improvements after ITBT are greater in the subjects that had previous surgery. This result is according to Gage [5]: he affirmed that to obtain the best improvement in subjects affected by CP first it's necessary to correct bone deformities and muscle contractures with orthopaedic surgery and then to reduce spasticity with ITBT or rhizotomy.

References

1. Albright AL. J of Child Neurol 1996; 11(suppl 1): 29-35
2. Gianino JM, York MM, Paice JA, Shott S. J Neurosi Nurs 1998; 30(1): 47-54
3. Albright AL, Barry MJ, Fasick MP, Janosky J. Pediatr Neurosurg 1995; 23:82-85
4. Gerszten PC, Albright AL, Barry MJ. Pediatr Neurosurg 1997; 27(1): 40-4
5. Gage J , Notes on pre conference Course ESMAC 2002, 16-18 september 2002