INNOWALK

Experience from two counties in Norway

Experience so far has shown that Innowalk can improve or maintain endurance, stomach functioning and posture control. In addition, several users improved joint movement and for one user, Botox treatment was no longer indicated after the trial period ended.

Innowalk is a new aid designed for children with physical limitations who can benefit from increased movement. On request by government department responsible for special aids for people with disabilities in Norway, the rehabilitation services in the two counties in Norway together with EO Funktion, carried out a trial project with Innowalk.

The objective of the project was to defensibly show that it is possible to give assisted movement to children who have little or no ability to move on their own. At the same time, there was also a desire to record changes in the child related to increased movement and activity. The trial project is designed in collaboration with rehabilitation services in the two counties.

Method

The trial period was set at 4 weeks. The 5 children were chosen by rehabilitation services. During the trial, the children had to use Innowalk a minimum of 5 times per week, for a minimum of 30 minutes per day. The date, heart rate and length of time in movement was recorded. In addition, comments were written about each session. It was desirable to record the heart rate, measured by a heart rate monitor, in order to evaluate the effect on endurance, seen in relation to Innowalk's speed and the child's own level of activity.

Stomach functioning, sleep pattern and presence of pain were systematically recorded before and during the trial period with a view to assess possible changes related to an increase in activity level. Specific functions, in accordance with individual goals, were videoed before and after the trial period in order to document possible changes.

The thigh and calf circumferences were measured before and after the trial period, along with recording of the joint movement and spasticity.

Both carer and therapists gave an overall evaluation of the child after the trial period. This overall evaluation included a description of how movement in Innowalk, in combination with the treatments already in place for the child, effected the child's functioning and participation in relation to what was desirable to achieve with Innowalk during the trial period.

All the measurements, tests and analyses were undertaken by a rehabilitation physiotherapist (local hospital) and physiotherapist from the local government agency.

Participants:

User id	Gender	Age	Diagnose	GMFCS level
Id. 1	Girl	4 years	CP - Spastic diplegic	III
Id. 2	Boy	4 years	CP - Spastic quadraplegic	V
Id. 3	Boy	10 years	Acquired braindamage	
Id. 4	Girl	12 years	CP - Dyskinetic quadrapligic	V
Id. 5	Boy	3 years	CP - Spastic bilateral	IV-V

Results

Case - id. 1:

The records show 18 training sessions in 4 weeks. The average training time was 38.6 minutes. The heart rate records show that the child maintained a level of 58% - 65% of her maximum heart rate, which means that Innowalk has a positive effect in relation to improving conditioning.

Before and after joint measurements show improved movement deflection in the right and left ankle, 10 degrees and 5 degrees respectively. Before the trial period, Botox injection in the right calf were planed. After the trial period, the ankle movement had improved and there was no requirement for Botox as at the time of publishing. Based on observations of the child in Innowalk, it was obvious that she was able to bring the heel of each foot right down. One can think therefore that her calf muscles have been lengthened during training. This in combination with active use of ankle-foot orthotics.

The angle of the Popliteal before and after training was -15 and -25 degrees respectively, indicating that the hamstring muscles are a little tighter. Based on experience, one knows that that muscle has a tendency to become a little tighter in accordance with increased strength and practice standing. It is difficult to get an active stretch in that muscle group over a long time in the same way that one achieves using splints for the ankle joint. There are continued good levels of joint deflection.

Broadly speaking, the spasticity is unchanged. The child has increased muscle tone in her legs in particular and this is the same, 2 before and after. The hamstring muscles were slightly changed, from 1+ to 1, indicating slightly less spasticity here.

Muscle density/mass increased by 0.5cm around the left thigh.

Evaluation of functioning and video analysis of the child before and after the trial period shows improved posture control in the torso. The child sits up straighter with her back against a standard child's chair. This is also visible when she walks with her rollator. At the same time as the Innowalk trial, she began to practice with a forward-facing rollator. She has made progress using this. Regarding her ability to stand, before the trial it was difficult to get the child to try to stand on her own without help in the kindergarten. She was not confident and supported herself using a table or an adult. It was only at home that they could get her to try and then she managed to stand

only for a few seconds. After the trial, although she must continue to secure herself with an adult behind her, the child can now stand alone in the kindergarten for approximately 10 seconds.

The recommendation is for further use of Innowalk for the child.

Results

Case - id. 2:

The records show 30 training sessions in 4 weeks. The average training time was 37.7 minutes. The heart rate records show that the child maintained a level of 52% - 60% of his maximum heart rate. This indicates that Innowalk has had a positive effect on conditioning.
In relation to stomach/bowel functioning and sleep, there has been little change in the trial period compared with earlier patterns.
After the training sessions, the child has usually had warmer feet.

Joint measurements show a slight reduction in joint deflection. The spasticity has generally reduced or not changed except for in the plantar flexion, that have become more toned.

The child has increased thigh circumference, 1cm in the right thigh and 0.5cm in the left. This is also confirmed subjectively by the parents and the kindergarten assistant .
The videos that were taken after the trial period show improved functioning in relation to all the goals that were set before the start. Level of uprightness and control when sitting and in a forward lying position are improved. This has led to freer arm movements in such a way that he supports himself better and handles toys, etc more easily. One can also see that he lifts his legs higher and with greater ease when he walks both in and out of the NF-Walker.

Most importantly, the child is now more flexible and looser in the body in such a way that it can relax more easily and participate more in different activities. All in all, one can see that the child has got a better quality of everyday life.

The child has been motivated to use Innowalk. The recommendation is for further daily use of Innowalk.

Results

Case - id.3:

The records show 18 training sessions in 4 weeks. The average training time was 38.6 minutes. The child maintained a heart rate level of 52% of his maximum heart rate. This indicates that Innowalk has had a positive effect on conditioning.

Joint measurements and muscle mass indicates marginal changes except for abduction in the hips. The measurements changed from 30 to 50 degrees. This is positive. The videos that were taken after the trial period indicate some improved functioning in relation to the measurements that were taken before the start.

He sits somewhat sturdier on the mat and has freer hand functioning. This has led to his ability to play with toys without needing to support himself in order to avoid falling. There has been some improvement in stability and balance whilst kneeling beside a latter leaning against the wall. He is now able to take weight on his knees without his legs sliding out from under him.

Despite some improved functioning, the aid is currently considered to be time-consuming and difficult to organise for the staff at the school. The child's motivation to use Innowalk has been low. Altogether, this has brought about a great deal of strain on the child and the professionals who work with him.

The recommendation is to discontinue the use of Innowalk.

Results

Case - id. 4:

The records show 29 training sessions in 4 weeks. The average training time was 36.6 minutes. The child maintained a heart rate level of 52% - 66% of her maximum heart rate. This indicates that Innowalk has had a positive effect on conditioning.

It has been difficult to evaluate movement deflection and spasticity due to pronounced dystonia. It looks like the angle of the hamstring on the left side is better. Significantly, with an extended knee the left ankle now comes to 90 degrees.

A discreet increase in muscle mass is registered (0.4cm in the thighs and 0.3cm in the calves).

It does not look like the number of bowel movements has changed, but they have become easier to expel. The child usually has difficulty with stomach wind and therefore some pain. In the trial period, the guardians noted and the child experienced a significant change in this area. The pain reduced in weeks 2 and 3 and by week 4, it had completely disappeared.

The child began training in Innowalk in high sitting position because the spasticity was triggered when the knees were stretched. By the end of the trial period, the child was able to achieve a full stretch in parts of the training sessions without being dominated by the spasticity. The child also got a better active stretch in the knees whilst walking with help.

The child has improved torso stability and head control. Whilst walking in NF-Walker, there is no swerving towards the right and the head is more upright. Immediately after the training session,

whilst sitting cross legged on the floor, the child's body is a lot more settled and consequently, she has better head control.

Whilst walking in NF-Walker, one can see significant, positive changes. The speed is considerably faster, the length of step is even, there is good flow in the movements and the standing leg lands with the whole foot on the floor (not tiptoed like before).

The recommendation is for further use of Innowalk for the child.

Results

Case - id. 5:

The records show 27 training sessions in 4 weeks. The average training time was 31.6 minutes. The child maintained a heart rate level of 72% - 79% of his maximum heart rate. This indicates that Innowalk has had a positive effect on conditioning.

4 weeks is a short time period, but we believe it can be said that daily training with Innowalk has given the child increased strength in the extensor muscles in the legs. He stands better and has improved control. Torso stability has also improved.

The circumferences of the child's right thigh and calf have increased by 0.5cm and his left calf by 0.8cm. There has been a measureable decrease in the spasticity of adductors, flexors and extensors of the knee. Reduced toning in the hip adductors is important for preventing the wrong position and possibly hip dislocation. It is also important for improving walking ability in and out of NF-Walker.

After the trial period, the child walks in the NF-Walker for longer distances and with multiple steps after one another. Directly after training in Innowalk, when he walks with the support of an adult, we also see that he does not cross legs even though he does not have the S.W.A.S.H ortosis (Hip ortosis) on.

He has normal and good joint deflection before and after the trial period. Sleep patterns have not changed.

For long periods, the child has had problems with stomach/bowel functioning. He takes, among other things, Movicol, a laxative to make the stools softer. During the trial period, the consistency of the stools has become normal and he strains a lot less to pass them. In addition, the child has got a better appetite.

The recommendation is for further use of Innowalk.

Results and discussion:

The objective of the trial period was to show that it is possible, in a defensible way, to give assisted movement to children who have little or no possibility of moving on their own. At the same time, it was desirable to record changes in the child related to increased movement/activity.

The children have trained at a heart rate that can have a positive effect on conditioning. The average training heart rate was between 52% and 79% of the maximum heart rate.

4 of 5 children have increased muscle mass in the course of 4 weeks. The increase has been between 0.3cm and 1cm. The measurements are conducted with a measuring strap by the same therapist before and after the trial period. The measurements' margins of error are available.

One child improved joint deflection in the ankle joint by 10 degrees, which resulted in no longer requiring a Botox treatment that was planned before the trial period. Two other children also improved their joint deflection, one in the hips and the other in the ankle.

Several of the children look like they have achieved some reduction in spasticity due to increased movement. It is uncertain whether it is a transitory improvement or not. The measurements of spasticity are conducted manually using the Ashworth scale and therefore contains margins of error.

Before the trial period, 3 of the children had problems with stomach functioning. For 2 of these children, the problems were associated with expelling the bowel movement. This improved significantly during the trial, and for one child, the consistency of the stools became normal. For one child, the problems with stomach functioning was associated with considerable wind in the stomach, which resulted in constant stomach pains. These were diminishing during the first weeks and had totally disappeared by week 4.

All 5 children improved their posture control during the 4 weeks. Posture control is not measured, but subjectively evaluated from videos and observations before and after the trial period. The children attained better posture control sitting, standing and walking.

Those children who had NF-Walker from before the Innowalk trial period, all improved their walking in NF-Walker afterwards.
4 of the 5 children were motivated to use Innowalk.

For 4 out of 5, the recommendation was for further use of Innowalk. In spite of positive results for user id. 3, Innowalk was not recommended because the user became difficult and time-consuming for the people around him.

The trial project lasted 4 weeks. We have seen that it is defensible to give assisted movement with the help of Innowalk. In addition, it was recorded that all 5 children had positive results from increased movement.

Nevertheless, it is necessary to try out Innowalk on more users over a longer period in order to know more about the effects of this aid on children with movement limitations. Among other things, it could be interesting to make use of objective methods to measure the changes in the strength of the children's muscles.

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