

# The Use of a Respirator in the Treatment of Cerebral Palsied Children

by INA OOSTHUIZEN (National Diploma in Physiotherapy)

Physiotherapist at West Rand School for Cerebral Palsied Children, Krugersdorp

## I Physiotherapy Report

"In the spastic, breathing often exists at a purely vegetative level, close to the limits of life, lacking cortical control and inhibition required to adapt to any higher function such as speech. There is no economy of outgoing air and voicing, which may be initially strong, rapidly fades away to a breathy whisper. Shallow clavicular breathing is often associated with postural defects and reversed breathing makes controlled expiration almost impossible."

"Breathing is not separated from voicing. The two are practised simultaneously, although no attention should be placed on breathing."

As all previous attempts to teach our cerebral palsied children effective breathing were not satisfactory, this experiment by making use of a respirator to assist us in teaching these children correct way of breathing, was undertaken. It was a combined effort with the speech-therapist, in that speech followed immediately after the physiotherapy treatment.

### NORMAL BREATHING PATTERN.

#### 1. *Rhythmic breathing.*

Mechanical respiration is dependent on movement of tidal air in and out of the lungs; it is related to rhythm of the chest and abdomen.

#### *Breathing in:*

1. diaphragm and chest elevator muscles contract
2. vertical, transverse and antero-posterior diameter of thorax increase
3. intra-thoracic pressure decreases
4. expansion of the lungs.

#### *Breathing out:*

1. relaxation of inspiratory muscles and during forced expiration, contraction of the abdominal muscles
2. decrease in size of thorax
3. intra-thoracic pressure increases
4. decrease in size of the lungs.

### ABNORMAL ASPECTS IN THE CEREBRAL PALSIED BREATHING PATTERN.

1. *Arrhythmic, spasmodic breathing*, related to the pre-respiratory behaviour of a foetus, prior to the development of the pneumotoxic centre. In spastics the cause is the lack of inhibition and in athetoids diaphragmatic spasm plays a large role in some of the speech problems of the cerebral child.

2. *Pressure changes* takes place both to get air into and out of the lungs, e.g., to blow up a balloon or to speak, one must use air under pressure.
3. *Reciprocal movement* of respiratory muscles during breathing establishes a greater efficiency of inspiration and expiration.
4. *Vital capacity* i.e. approximate volume of the lungs as determined by measuring the largest possible expiration after the largest possible inspiration.
 

*Vital capacity depends on:*

  1. size of thoracic cavity
  2. posture
  3. state of lung tissue
  4. fitness of patient.
2. *The exaggerated stretch reflexes and lack of reciprocal inhibition* causes both prime movers and antagonistic muscles to go into spasm while the child is breathing. When the child wants to force air out of the lungs, both abdominal and chest elevator muscles may contract, resulting in an expanding ribcage and at the same time, contracting abdominals pushes up onto the diaphragm, and the child is unable to force air out.
3. *Reversed breathing* is present where, when during inspiration, abdominal muscles contract and chest elevators relax. Therefore there is no reciprocal movement and the child is unable to breath efficiently.
4. *Vital capacity* when less than normal, might be due to:
  1. weakness of respiratory musculature
  2. bad posture e.g. scoliosis
  3. reduced size of the thorax
  4. diminished use of lung tissue.

**Discussion.**

Reasons for using a respirator are as follows:

- (a) Air forced into the lungs with the respirator, brings about a stretch movement from inside the lungs to the ribcage and if done repetitively, should cause an inhibitory effect, resulting in a more normalised tone.
- (b) In addition, when air is forced into the lungs, the ribcage will move sufficiently to stretch the abdominal muscles during inspiration, and as a result get a more normalised forceful contraction of the abdominal muscles during forced expiration. This leads to more efficient expiration. This is of vital importance in order to:
  - (i) get enough pressure from forceful contracting abdominal muscles
  - (ii) have as a result a forceful pressure of outgoing air
  - (iii) throw the vocal folds into vibration.
- (c) Cortical control and inhibition should follow after the child has felt, experienced and practised the normal pattern of breathing, that is after spasm has been reduced.
- (d) When cortical control and inhibition is obtained, speech should improve.

**Aims of Treatment with Respirator.**

1. To reduce spasm of intercostal and diaphragmatic muscles.
2. To enable the child to experience rhythmic breathing.
3. To facilitate a normalised breathing pattern.
4. To teach cortical control and inhibition.
5. Overall aim to improve speech.
6. To reduce occurrence of bronchitis, asthma or respiratory disorders.

**SUBJECTS:****TABLE 1**

Case	Age	Sex	Diagnosis
1	15 yrs	Male	Athetoid
2	16 yrs	Male	Athetoid
3	14 yrs	Female	Athetoid
4	14 yrs	Female	Athetoid
5	8 yrs	Male	Tension Athetoid
6	9 yrs	Female	Spastic
7	15 yrs	Male	Spastic
8	10 yrs	Female	Spastic

On initial assessment of these children, it was observed that their breathing pattern consisted of apical breathing only. They could not do controlled lateral costal or diaphragmatic breathing.

Their breathing patterns were assessed by:

- (i) observation without them being aware of it
- (ii) manual assessment of their ability for localised breathing.

Patterns observed were:

- (i) shallow apical breathing
- (ii) reversed breathing
- (iii) arrhythmic spasmodic breathing.

Their vital capacities were, as listed below in

**TABLE 2**

Case	Diagnosis	Vital capacity at beginning	Vital capacity at end
1	Athetoid	3.3	4.4
2	Athetoid	2.3	2.8
3	Athetoid	1.5	2.1
4	Athetoid	0.4	0.8
5	Tension Athetoid	0.3	0.6
6	Spastic	1.0	1.6
7	Spastic	0.9	2.0
8	Spastic	0.9	1.3

For these measurements a dry spirometer was used. Because the children could not close their lips sufficiently and for long enough periods, these measurements only gave an idea of improvement and are by no means 100 per cent statistically correct.

Their communication through speech was poor and difficult to understand.

**Apparatus.**

We used the Bennett Therapeutic Cylinder Mounted Unit to assist us in this observation. The machine assists breathing by inflating the lungs during inspiration under safe controlled pressure. The child can stop the inflow voluntarily by a forceful expiration. Breathing can be regulated to suit each child's breathing pattern and capacity. This is possible because the machine does not cycle automatically.

Medical air was used as the respiratory gas and distilled H<sub>2</sub>O at 135°F as the humidifier to maintain adequate humidification by adding H<sub>2</sub>O vapour to the stream.

**PLATE 1:**

Note the mouth piece strapped across the child's mouth and the use of a nose clip.

A mouth piece strapped across the child's mouth and the use of a nose clip, eliminated the possibility of nasal breathing. See plate 1. After a while it was found that the children could control their breathing through the mouth only, and the nose clip was no longer necessary.

The children over the age of ten years responded very well to the use of the machine, while those under the age of ten years needed encouragement to get them used to it. After about a month they all adjusted to the use, and actually enjoyed the treatment.

**Technique.**

The children were placed in reciprocal inhibitory postures for example an extensor pattern child was positioned with knees flexed, hips flexed, back upright with head in neutral position and arms folded.

The reason being that in the cerebral palsied children, inspiration is associated with extensor spasticity, thus the child is unable to breathe in efficiently. By using reflex inhibiting postures the respiratory musculature is freed from spasticity and so should work with more normalised tone.

In all the children we started with a systemic pressure of 10 cm/H<sub>2</sub>O or even less, 5 cm/H<sub>2</sub>O for two minutes and progressed up to 15 cm/H<sub>2</sub>O for five minutes. The normal pressure for children is 15 cm/H<sub>2</sub>O.

It took approximately one month to work the pressure up to 15 cm/H<sub>2</sub>O. Daily treatments were given for six months.

At the beginning of the treatment, for the first month, the physiotherapist gave pressure to assist lateral costal and diaphragmatic breathing at the same time as the child was on the respirator. As the children improved, assistance was slowly reduced and finally stopped when they were able to do lateral costal and diaphragmatic breathing without assistance of the therapist.

**Results.**

1. Increased vital capacity, see Table 2 for details.
2. Improved diaphragmatic and lateral costal breathing without assistance of machine or physiotherapist.
3. Improved breathing pattern.
4. Improved communication through improved speech. (See speech-therapist report.)
5. Reduction of attacks of asthma and bronchitis.
6. Two spastic children claim they can walk longer distances without getting tired.

**Conclusion.**

After a six weeks school holiday during which no treatment was given, there was no reduction in the vital capacities measured, or in the control of breathing achieved previously before the holidays.

The improvement in communication gained, was also maintained.

Along these lines it could be assumed that the carry-over after the school holidays indicates that voluntary control taught by this method should be of a lasting nature.

"Reflex control of breathing makes life possible; voluntary cortical modifications makes speech feasible."

**Summary.**

Eight cerebral palsied children, three spastics, four athetoids and one tension athetoid were treated with the aid of a Bennett Respirator to improve breathing patterns and speech.

This observation was carried out at the West Rand School for Cerebral Palsied Children over a period of six months in co-operation with a speech therapist.

**Opsomming.**

'n Proefneming is gedoen om die bruikbaarheid van respirators vas te stel in die behandeling van serebraal verlamde kinders. Agt kinders is daagliks vir ses maande behandel.

Die hoof doel was om hierdie kinders se asemhalingspatroon en spraak te verbeter. Die spraakterapeut en fisioterapeut het in noue kontak met mekaar gewerk.

**References:**

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HEDLLY BYRNE 16



**WAT OMTRENT  
MY FINANSIELE  
TOEKOMS?**

GROEPVERSEKERING bied u spesiale voordele teen verminderde tariewe, met inbegrip van waardevolle ongeskiktheidsvoordele.

U finansiële toekoms is meer verseker as u by U EIE VERENIGING se annuïteitsfonds aansluit. Dit kos minder as u deur middel van die „Groep“-wyse versekering uitneem. Vul die onderstaande koepoon in en pos dit vir volledige besonderhede oor hoe u uit u S.A. VERPLEEGSTERSVERENIGING SE GROEPVERSEKERINGSKEMA voordeel kan trek —alle korrespondensie sal streng vertroulik behandel word.

Aan die Kurators, S.A. Vereniging vir Fisioterapie, Groep-begiftigingsfonds, Posbus 1194, Johannesburg.

Naam .....

Adres .....

Ouderdom met volgende verjaardag. .... Beroep.....

Werkgewer .....

Hoeveel kan u bekostig om maandeliks by te dra? .....

**DIE KOLONIALE  
MUTUAL**

