European Symposium on Fluency Disorders 2014

THE EFFECT OF DIFFERENT BREATHING TECHNIQUES ON STUTTERING THERAPY OUTCOME

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Various modifications of breathing pattern have been used in the treatment of stuttering:

(Andrews&Tanner, 1982; Azrin&Nunn, 1973; Azrin&Nunn, 1974; Azrin et al, 1979; Falkowski et al, 1982; Hasbrouck, 1992; Lee, 1976; Schwartz, 1976; Perkins, 1973; Wagaman et al, 1993)

- regulated breathing technique
- control of breathing
- breath stream management
- airflow therapy
- graded airflow
- deep breathing, etc

Purpose

To discover the optimal speech-related respiratory behavior for stuttering therapy, we undertook the investigation where stuttering children used different respiration models during the therapy course.

Method

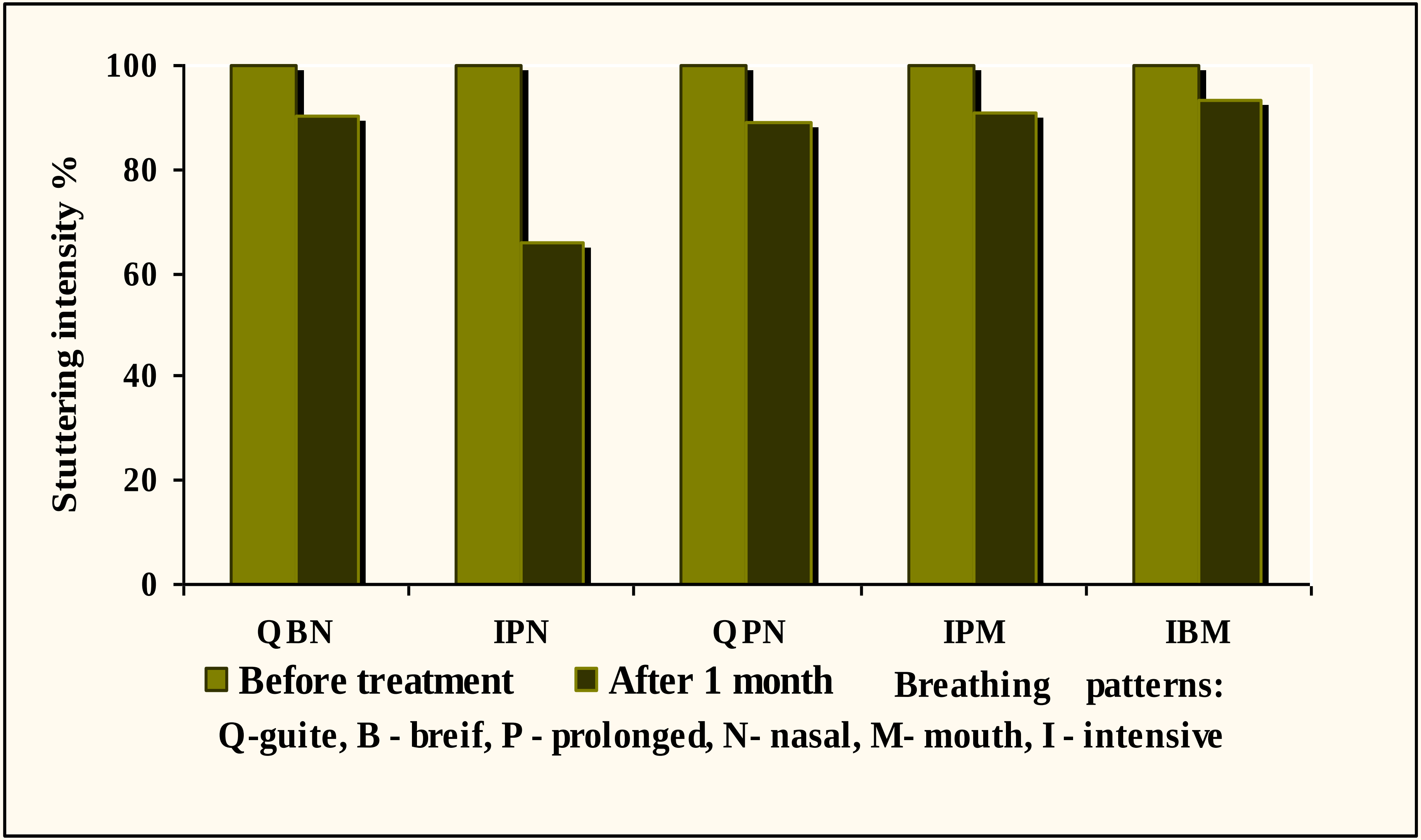
- 35 stuttering children (3;4-13;2 yo)
- 5 groups
- 1 month stuttering therapy course
- 1/week sessions with speech therapist
- Daily 1 hour treatment sessions with parents
- Speech control

Method

Participants were divided into groups according to speech-related inhalation mode:

- Quiet brief nasal inhale
- Intensive prolonged nasal inhale
- Quiet prolonged nasal inhale
- Intensive prolonged mouth inhale
- Intensive brief mouth inhale

The best results were achieved in the group with intensive prolonged nasal inhalation



Treatment

It was offered to parents to continue the treatment using intensive prolonged nasal inhalations.

- 1/week therapeutic sessions
- Daily 1 hour treatment sessions with parents
- Speech control

Results

6 children interrupt the treatment, 29 subjects completed the course, achieving fluent speech. Participants used nasal inhalation during all therapy period. They allowed returning to habitual breathing pattern after the terminating of treatment course. Treatment time was individual (2-6 months) and depended of stuttering experience, age, gender and stuttering severity. In 4 children single stuttering episodes were observed during first month after graduating the course, but was successfully eliminated. After 3 months of terminating the treatment all 29 subjects maintained fluent speech.

Why nasal inhalation is more effective in stuttering therapy?

Adrian, 1950; Arduini Moruzzi, 1953; Gault&Coustan, 1965; Servit & Strejckova, 1978; Servit&Strejckova, 1979; Servít et al, 1981; Tsubone, 1989; Ueki & Domino, 1961.

Intensive air passing (insufflation) through nasal cavity of lower vertebrates elicit synchronous theta-activity in

- bulbus olfactorius
- hippocampus
- pyryform cortex
- amygdale
- thalamus
- general cortex

Studies on animals revealed the existence of flow receptors in nasal mucosa. Their afferent fibers connected to mechano-sensitive nasal endings, extend to trigeminal nerve.

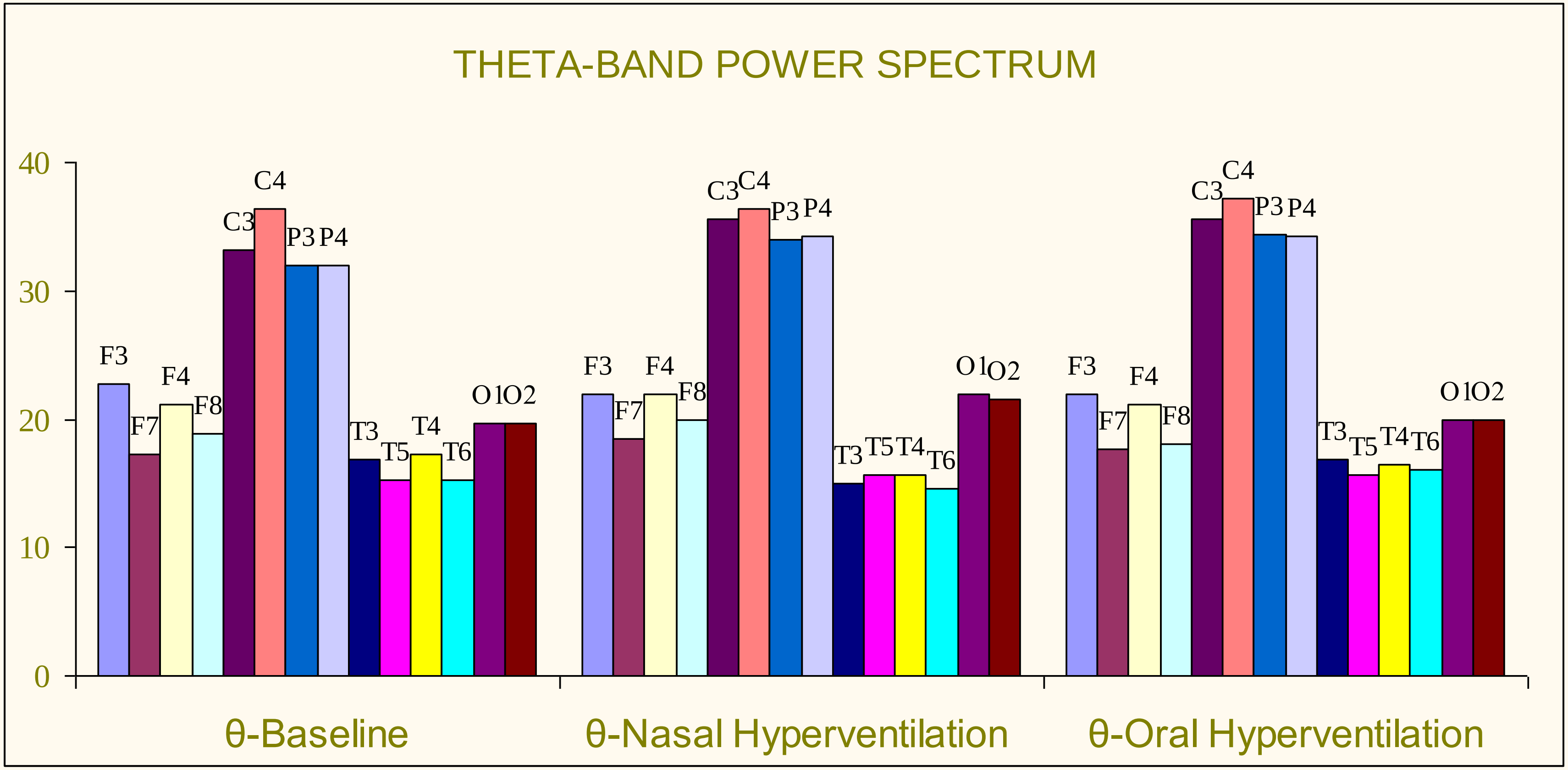
Purpose

For the purpose of determine the effect of intensive nasal respiration on central nervous system we registered brain bioelectric activity during nasal and oral hyperventilation.

Method

- 8 healthy adult volunteers
- EEG recording (14 bipolar leads)
- 3 experimental conditions:
    - 3 minutes of quiet respiration (baseline)
    - 3 minutes of mouth hyperventilation (15 breathing movements/minute)
    - 3 minutes of nasal hyperventilation (15 breathing movements/minute)

Baseline theta-activity did not change in response to neither nasal nor oral hyperventilation



0-40 - averaged meanings of theta-band power spectrum. F, C, T, P, O - leadings

Changes in brain bioelectric activity are conditioned by the volume of ventilated air, but not the breathing pathway (nasal or mouth).

Following the instructions, our participants breathed with equal intensity and frequency during nasal and oral hyperventilation. Maximal attainable frequency of nasal hyperventilation was limited by about 15 breathing movements per minute. The more frequent deep nasal respiration was impracticable, because translaryngeal inspiratory and expiratory resistance during nasal breathing is higher than during mouth breathing. Such hyperventilation couldn’t lead to the degree of hypocapnia that evokes changes in brain bioelectric activity, while standard hyperventilation with approximate frequency 30 breathing movements per minute usually elicits those changes.

We suppose that presence and degree of alterations in brain bioelectric activity in response to the hyperventilation are conditioned by the volume of ventilated air, but not the breathing pathway (nasal or mouth). Therefore better results of stuttering treatment with intensive nasal inhalations couldn’t be explained by specific effect of nasal respiration on central nervous system.

What is the difference between nasal and mouth inhalations?

Vennard, 1967; Hirano et al, 1969; Rubin et al, 1967; Basner et al, 1989; Tangel et al, 1995

Mouth inhalation:

- relax the larynx and the pharynx
- dilate the larynx and the pharynx
- relax and abduct vocal chords
- lowers the larynx

What is the difference between nasal and mouth inhalations?

Jounieaux et al, 1995; Moreau-Bussière et al, 2007; Mukai, 1989; Song&Pae, 2001; Tangel et al, 1995; Yong-Xin Shi et al, 1998

Nasal inhalation:

- induce glottal constrictors activity
- strain, contract and narrow the pharynx and the larynx
- adduct vocal chords
- increase muscle tension of the diaphragm and the neck
- increase respiratory resistance

We suppose, that extensive muscle load during nasal inhalations acts in the capacity of strength training

Adkins, 2002; Andersen et al, 2006; Comery et al, 1995; Enoka, 1996; Häkkinen & Komi, 1983; Greenough et al, 1985; Jones et al, 1999; McDonagh & Davies, 1984; Pucci et al, 2006; Kleim et al, 1996; Kleim et al, 2002; Swain et al, 2003; Withers & Greenough, 1989

Strength training:

- produces increases in muscular growth and strength
- induces neuromuscular activation, cortical angiogenesis and synaptogenesis; alterations in neuromuscular transmission
- changes the sensitivity of the muscle spindles

Conclusions

- It is possible that regular vigorous muscle work during intensive inhalations strengthen speech related muscles. It could lead to changes in sensitivity of muscle spindles and therefore raise thresholds of neuromuscular excitation.

- In this case some portion of compulsive efferent stimuli turn into subthreshold exciters and didn’t have an influence on speech related muscles.

- It could induce positive alterations in central and peripheral mechanisms of neuromuscular transmission, resulting in the reduction of pathological involuntary activity, thereby decreasing stuttering severity.

Acknowledgement

Special thanks to:

- All participants of the study
- Dr Derevyagin VI, biostatistic; Dr Baziyan BKh, Dr Damyanovich EV
- Director - Natalie Kaminsky, and stuff of English Nurcery School “Magic Castle”
- Cristal Williams and Robert Hartley

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