

## BIOFEEDBACK AND NEUROFEEDBACK APPLICATION IN THE TREATMENT OF MIGRAINE

Sanja Martic-Biocina<sup>1</sup>, Ivana Zivoder<sup>2</sup> & Goran Kozina<sup>2</sup>

<sup>1</sup>Psychiatric Clinic Vrapce, Zagreb, Croatia

<sup>2</sup>University North, Varazdin, Croatia

### SUMMARY

**Introduction:** Biofeedback is a non-invasive method of measurement of physiological functions. Precise instruments measure the slightest changes of different body functions-which are then in a clear and understandable manner shown in the form of feedback. Person gets an insight into what is going on inside the body and thus learns to change the patterns of behavior to improve health and performance. Any changes that are wanted are rewarded, which leads to learning of the new patterns of behavior.

Neurofeedback is a type of biofeedback which uses electrical activity in the brain. Certain disorders are associated with specific patterns of brain activity, and through neurofeedback it is possible to reduce or even remove symptoms of some disorders. In the treatment of migraine different biofeedback methods- such as breathing, training of vasoconstriction/vasodilatation and neurofeedback, may be applied.

**Methods:** This paper will describe the successful treatment of 25 years old girl who suffered for many years from painful migraine. She had in total 25 treatments during which listed biofeedback methods were used. The first part of the treatment was neurofeedback training on the central sensorimotor area, followed by respiration training and at the end by biofeedback training of vasoconstriction/vasodilatation.

**Results and Conclusion:** The final result of the treatment was significant reduce in the frequency of migraine attacks and the pain reduction. Further study, have to be done with more patients and with placebo group to scientifically prove the effectiveness of the method.

**Key words:** biofeedback – neurofeedback - migraine treatment

\* \* \* \* \*

### Introduction

Biofeedback is a non-invasive method of measurement of physiological functions. Precise instruments measure the slightest changes of different body functions-which are then in a clear and understandable manner shown in the form of feedback. Person gets an insight into what is going on inside the body and thus learns to change patterns of behavior to improve health and performance. Any changes that are wanted are rewarded, which leads to learning of the new patterns of behavior (Schwartz & Andrasik 2003). Biofeedback is a common intervention in pain management. For migraine treatment, the most frequently used biofeedback methods have been peripheral skin temperature biofeedback, blood volume pulse and electromyography feedback (Schwartz & Andrasik 2003).

Some studies have shown that using biofeedback can reduce the occurrence of migraine or reduce the strength of the pain. A German meta - analysis of efficacy of biofeedback for migraine /took into account 55 studies/ showed medium effect size for all BFB interventions and proved stable over an average follow-up phase of 17 months. Frequency of migraine attacks and perceived self-efficacy demonstrated the strongest improvements.

Blood-volume-pulse feedback yielded higher effect sizes than peripheral skin temperature feedback and electromyography feedback (Nestoriuc & Martin 2007).

In the migraine study 62% of participants using neurofeedback reported major or total improvement in

their migraines (Stokes & Lappin 2010). Per the study, most patients had long histories of migraines and had tried multiple pharmaceutical treatments prior to trying neurofeedback. Most were on medications during the study. Participants took part in an average of 40 sessions over six months. Seventy percent of the 37 participants showed a 50% or greater reduction in the frequency of their migraines, and only 16% failed to improve at all. Of those who improved, 62% reported major or total improvement in their migraines. The goal of neurofeedback, however, is to reduce, on an ongoing basis, the number and intensity of migraines. Based on these results – and on clinical experience from clinicians around the country – neurofeedback offers the potential for significant relief for anyone still struggling with migraines.

For individuals with migraines, biofeedback relates back to the vascular theory of the causes of migraines. The rationale behind biofeedback as a treatment for migraines is embedded in the vascular theory. Migraines are the result of the processes of vasoconstriction and vasodilation. This theory further suggests that the blood flow during migraines has been increased to certain areas in the head and decreased to the extremities (Johnson 1999; Diener & May 1996)

According to Webster (2001), a migraine sufferer who practices in this form of biofeedback for 20-30 minutes 2 to 3 times a week, will learn the skills necessary to decrease the severity of a migraine attack and even prevent an attack (if the technique is employed during the “aura” phase).

Another study examined the efficacy of biofeedback in three case studies, two of which involved migraine sufferers (Earles et al. 2001). Results indicated that drastic improvements occurred in all three cases treated with biofeedback. Specifically, the two migraine sufferers both reported at least a 50% reduction in the severity and number of migraines experienced after treatment (Earles et al. 2001).

Sharff, Marcus, and Masek (2002) conducted a study to examine the effects of handwarming biofeedback, as compared to handcooling biofeedback and no treatment at all. Sharff et al. found that the children who were in the handwarming biofeedback group improved more than the comparison groups, and sustained this improvement for up to 6 months later.

Results from a study conducted by Grazi, Andrasik, D'Amico, Leone, Usai, et al. (2002) suggest that the use of biofeedback in combination with medication is more successful than medication alone in treating migraines. In their study, they examined 61 participants who were classified as having "transformed migraines," meaning a previous history of migraines which led to chronic daily headaches. Results showed a relapse rate of 42.1% (16 of 38) for participants in the medication only group vs. a relapse rate of only 12.5% (2 of 16) for the medication plus biofeedback group at year 3 of follow-up. This study therefore suggests that a combination of medication and biofeedback rather than either by itself may perhaps be the best means of treating migraines, specifically transformed migraines.

Vasudeva, Claggett, Tietjen, and McGrady (2002) conducted a study to examine whether migraine sufferers who experienced aura reacted differently to biofeedback/relaxation than those without, and if this was accounted for by blood flow velocity. In this study, forty participants were randomly assigned to either the biofeedback treatment group or the control group. The results shown that post-treatment, the biofeedback group experienced a decline in the severity of their migraine pain and also reported using less migraine medication to treat/control the pain. Additionally, migraine sufferers with aura reacted similarly to migraine sufferers without aura; no significant differences were found in how the two groups responded to biofeedback. Furthermore, no association between biofeedback-assisted relaxation and blood flow velocity was found. Therefore, this study provides corroborating evidence for the notion that biofeedback is an effective treatment for migraines.

### **Application of neurofeedback and biofeedback in treatment of migraine – our case study**

According to relevant research, we started a combined biofeedback treatment with a girl aged 25 years who had been suffering from migraine from teenage age. At the beginning frequency of migraine attacks was one per month, but it increased to 3 times per week when she became university student. On the scale from

0 to 10, the average pain was between 7 and 9. The girl has been under control of a neurologist for the several years. In the family there was a positive history of migraine. The treatment consisted of a combination of three forms of biofeedback treatment: neurofeedback, breathing and vascular biofeedback. Treatments started in the beginning of September 2015 and completed at the end of December 2015. During the treatment, a headache diary was conducted.

### **Treatment goals**

Improvement of the quality of life and increase in everyday functioning by reducing the symptoms related to the primary diagnose.

### **Initial assessment**

- Analyses of medical documentation (conducted diagnostic and therapeutic procedures)
- Structured interview
- Measuring of baseline EEG (one channel, Cz)

### **Implementation of neurofeedback**

Protocols were determined individually according to the initial assessment:

- Electrode position (according to the International 10-20 system)
  - Frequency bands that will be inhibited or rewarded
- Mean duration of each session was 30 minutes.

### **Administered protocols**

- CZ** – inhibition of theta waves (4-9 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 10 sessions
- C4** - inhibition of theta waves (4-9 Hz), strengthening of SMR and beta waves (12-15 Hz), inhibition of high beta (22-30 Hz) – 7 sessions
- C3** - inhibition of theta waves (4-9 Hz), strengthening of SMR and beta waves (14-18 Hz), inhibition of high beta (22-30 Hz) – 8 sessions

### **Implementation of biofeedback**

#### ***Vascular training***

25 sessions of vascular training on a temporalis, learning of modality of vasoconstriction and vasodilatation. Each training session was 30 minutes. We used device that had a vascular training.

#### ***Breathing training***

Using of diaphragmatic breathing in duration of 15 min. The girl had instructions to use diaphragm breathing at home at least once a day. Breathing technique is a recommended method for relaxation and to reduce stress which is important for people with migraine.

## Results and Discussion

The girl had in total 25 treatments. All three modalities were used at each treatment. Duration of one treatment was 1 hour and 15 min. The training sessions were done 2-3 times per week.

The results were a reduction in the frequency of migraine attacks, as well as a reduction in pain severity during the attacks. The reduction in the frequency of migraine attacks and in the strength of pain were gradual. In September, she had 9 migraines, with pain ranges between 8 and 9. In October, she had 6 migraine attacks (3 less), pain strengths from 5 to 8. In November there was 5 migraine attacks, with a pain score from 2 to 7. In December the number of migraine attacks was 4, which is a reduction in frequency by more than 50% since the beginning of the training in September. The pain strength was from 3 to 5, which is also a reduction of more than 40% from September. The girl learned to apply the vasoconstriction method when she was experiencing migraine, which reduced the strength of the pain. The efficacy of biofeedback is evident in the application of the aforementioned method, for the reduction of migraine as well as pain relief. Within four months of treatment, the girl had fewer migraine attacks and the pain was reduced at such extent that it did not require the use of analgetics.

## Conclusion

This case shows good curative potential of biofeedback treatments in migraine. Combination of treatments (neurofeedback, breathing and vascular training) in 25 sessions helped the female patient with a long history of severe migraine. Further research of patients suffering from migraine with different treatment protocols is needed to establish the method.

### Contribution of individual authors:

Sanja Martić -Biocina: design of the study, literature searches and analyses, interpretation of data, writing of the report;

Ivana Zivoder: design of the study, recruitment and collection of data, interpretation of data, writing of the report;

Goran Kozina: literature searches and analyses, writing of the report

**Acknowledgements:** None.

**Conflict of interest:** None to declare.

## References

1. Diener HC & May A: *New aspects of migraine pathophysiology: Lessons learned from positron emission tomography*. *Current Opinion in Neurology* 1996; 9:199-201.
2. Grazzi, L., Andrasik, F., D'Amico, D., Leone, M., Usai, S., Kass, S.J., & Bussone, G. *Behavioral and pharmacologic treatment of transformed migraine with analgesic overuse: Outcome at 3 years*. *Headache*, 2002. 42, 483-490.
3. Earles, J., Folen, R.A., & James, L.C. *Biofeedback using telemedicine: Clinical applications and case illustrations*. *Behavioral Medicine*, 2001. 27, 77-82.
4. Johnson, C. J. *Headaches and facial pain*. In L. R. Barker, J. R. Burton & P. D. Zieve (Eds.) *Principles of Ambulatory Medicine* (pp. 1214-1230). Baltimore, MD: Williams & Wilkins. 1999.
5. Lipton, R.B., Diamond, S., Reed, M., Diamond, M.L., & Stewart, W.F. *Migraine diagnosis and treatment: Results from the American Migraine Study II*. *Headache*, 2001. 41, 638-645.
6. Nestoriuc Y., Martin, A. *Efficacy of biofeedback for migraine: a meta-analysis*. *Pain*. 2007 Mar; 128 (1-2):111-27.
7. Sharff, L., Marcus, D.A., & Masek, B.J. *A controlled study of minimal-contact thermal biofeedback treatment in children with migraine*. *Journal of Pediatric Psychology*, 2002. 27, 109-119.
8. Schwartz, M.S. Andrasik, F. *Biofeedback: A Practitioner's Guide*, Guilford Press, 2003. Chapt 14: 275-334.
9. Stokes DA and Lappin MS: *Neurofeedback and biofeedback with 37 migraineurs: a clinical outcome study*. *Behavioral and Brain Functions* 2010. 6:9 <http://www.behavioralandbrainfunctions.com/content/6/1/9>
10. Vasudeva, S., Claggett, A.L., Tietjen, G.E., & McGrady, A.V. *Biofeedback-assisted relaxation in migraine headache: Relationship to cerebral blood flow velocity in the middle cerebral artery*. *Headache*, 2003; 43:245-250.
11. [http://www.headaches.org/\(dostupno 24.06.2017\)](http://www.headaches.org/(dostupno 24.06.2017))
12. [http://www.holistic-online.com/Remedies/migraine/mig\\_biofeedback.htm.\(dostupno 24.06.2017\)](http://www.holistic-online.com/Remedies/migraine/mig_biofeedback.htm.(dostupno 24.06.2017))

Correspondence:

Sanja Martić-Biocina, MD, PhD  
Psychiatric Clinic Vrapce  
Bolnicka 32, Zagreb, Croatia  
E-mail: smarticbiocina@gmail.com