

# The Effect of Neurofeedback Therapy in Primary Enuretic Children

Mahmood Reza Khazaei<sup>1</sup>, Nasrin Aminifard<sup>2</sup>, Peyman Hashemian<sup>3\*</sup>

<sup>1</sup>Department of Pediatrics, Mashhad Branch, Islamic Azad University, Mashhad, Iran

<sup>2</sup>Department of Medicine, Mashhad Branch, Islamic Azad University, Mashhad, Iran

<sup>3</sup>Psychiatry, Psychiatry and Behavioral Sciences Research Center, Ibn-e-Sina Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

Email: \*[hashemianp@mums.ac.ir](mailto:hashemianp@mums.ac.ir)

Received 28 February 2015; accepted 13 April 2015; published 17 April 2015

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## Abstract

**Introduction:** Enuresis is one of the most common psychiatric disorders in children. Classical treatments for primary enuretic children are conditioning (Bell and Pad method, and drug therapy). Neurofeedback is a kind of conditioning by changing amplitudes of brain waves. **Method:** Three groups of 10 enuretic children were selected randomly. All three groups took imipramine. The first group also took neurofeedback sessions with protocol of enhancement of  $\beta/\theta$  wave ratio in occipital zone. The second group took non-real neurofeedback sessions beside the drug. The third group just took the drug. **Result:** All three groups showed significant remission ( $P < 0.0001$ ) after treatment and a three-month follow-up. **Conclusion:** Neurofeedback by this protocol was not any more efficient than imipramine therapy by itself.

## Keywords

Imipramine, Neurofeedback, Enuresis

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## 1. Introduction

Enuresis is one of the most common disorders in child psychiatry (6% - 15% in boys and 12.3% in girls). With an increasing age, its prevalence decreases and at age 14 the prevalence is between 0.5% and 1.5% [1]. Enuresis is defined as urinating in bed or clothes by children over 5 years old at least twice a week for over a consecutive 3-month period [2]. No obvious etiology has been found [3]-[5]. Various modalities of treatment exist, including Bell and Pad method and drug therapy [5] [6]. Neurofeedback is a type of biofeedback which deals with brain waves and it shows function of brain by giving feedback to the patient and treats the disorder by conditioning

\*Corresponding author.

effects [7]-[11].

Walker's study in 2012 found an increase in amplitude of brain waves with frequency of 0 - 3 Hertz in Occipital Zone (OZ region) in 11 patients compared with 100 healthy subjects in which there was no increase. Through ten neurofeedback therapy sessions, enhancement of beta waves (15 - 18 Hertz) and suppression of theta waves in occipital zone obtained good results after a one-year follow-up [12].

A systematic review conducted by Hammond and colleagues in 2007 showed one case of relapse a year later in a 7-year-old child who had been treated with 10 sessions of 20 minutes neurofeedback by suppressing amplitude of waves with 15 - 38 Hz in C3 and F3 region [13].

## 2. Method of Implementation

The objective of this study was to find out whether neurofeedback has an additive effect to that of imipramine in primary enuretic children. A clinical trial was performed on 30 enuretic children between 5 to 10 years old in one of the hospitals in Mashhad, Iran (22-Bahman). Child psychiatrist and child nephrologist confirmed enuresis without any organic or other psychiatric disorder by interview, physical examination and using Conner's test and Raven IQ test.

Patients were randomly divided into 3 groups. Patients in all the three groups took 25 - 75 mg imipramine tablet daily. The first group received Neurofeedback sessions, besides medication, in which  $\beta$  waves were enhanced and  $\theta$  wave were suppressed to evaluate the additive effect of neurofeedback. Each neurofeedback session last about 30 minutes twice a week. 10 sessions were performed. The second group was sham group (placebo or non-real group). In this group, patients undergo neurofeedback sessions by someone else's recorded film. The third group just took imipramine without any neurofeedback sessions.

Follow-up has been performed after 3 month from the last session in all the three groups for evaluation of ongoing additive effect of neurofeedback, if there is any.

The software used in this study was SPSS software (version 20). Mann-Whitney, Kruskal-Wallis, Kolmogorov-Smirnov, t-student and Analysis of Variance (ANOVA) tests were used to analyze data. Significance level of tests has been considered less than 5%.

## 3. Results

In this study 30 enuretic children were examined. No significant differences were observed between the three groups in terms of age (P-value = 0.354), gender (P-Value = 0.879) and family history of enuresis (P-Value = 0.430).

**Figure 1** compares the enuresis rate in the three groups before and after treatment and after a three-month follow-up. We can see a lower rate of enuresis.

The results above show that in all the three groups, the rate of enuresis was significantly decreased (P = 0.0001\*\*) (**Table 1**).

Butage, gender, and family history of enuresis had no significant effect on remission (P > 0.05).

Multivariate model using Scheffe's method shows that there is no significant difference between each two groups (P > 0.05).

## 4. Discussion

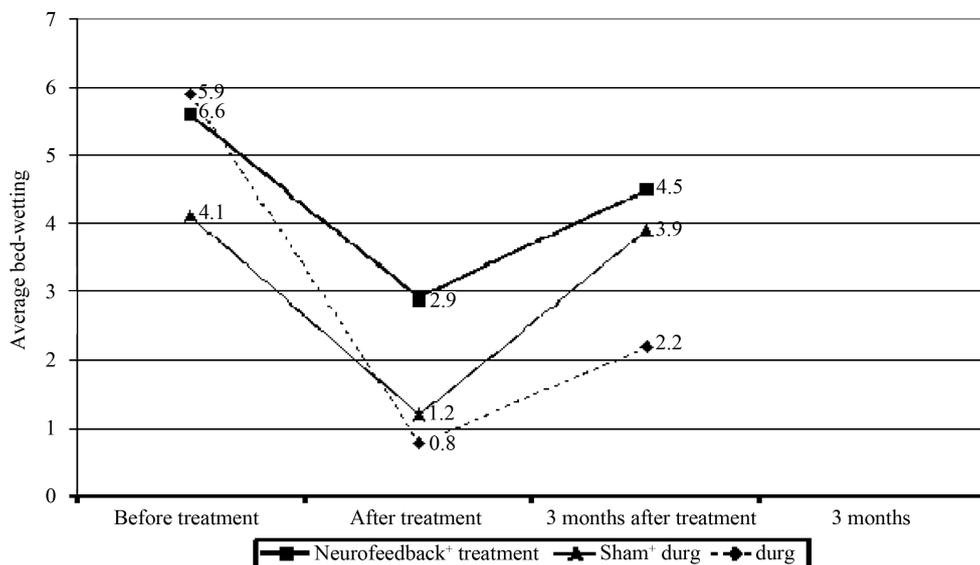
In this study, three groups of 10 children with primary nocturnal enuresis have been referred to specialized hospitals (22 Bahman) of Islamic Azad University in Mashhad. The results showed that in all three groups, bed-wetting was reduced, but no significant differences were seen between the three methods. It means that real neurofeedback and non-real neurofeedback does not further decrease the remission rate in enuretic children.

This study is not compatible with the study done by Jonathan E. Walker.

Unfortunately, no further study exists in literature for more comparison.

## 5. Conclusion

The study results show significant reduction in bed-wetting rate by using imipramine, with or without real or non-real neurofeedback training within the three-month follow-up. As the aim of this study was to evaluate every additive effect of neurofeedback on imipramine in treatment of primary enuretic children, we did not see any ad-



**Figure 1.** Comparison of enuresis in the three groups before and after treatment and after a three-month follow-up.

**Table 1.** Enuresis rate comparison among the three groups at different times.

| Probability     | Test Statistics                    | Times Compared                      | Group                      |
|-----------------|------------------------------------|-------------------------------------|----------------------------|
| 0.007**         | Wilcoxon Signed Ranks Test = -2.70 | Before-after                        | Imipramine + neurofeedback |
| 0.034*          | Wilcoxon Signed Ranks Test = -2.12 | Before-three months later           |                            |
| 0.048*          | Wilcoxon Signed Ranks Test = -1.98 | After-three months later            |                            |
| <b>0.003**</b>  | <b>Friedman Test = 11.81</b>       | Comparing the three groups combined |                            |
| 0.005**         | Wilcoxon Signed Ranks Test = -2.82 | Before-after                        | Sham + imipramine          |
| 0.157           | Wilcoxon Signed Ranks Test = -1.41 | Before-three months later           |                            |
| <b>0.0001**</b> | <b>t-Test = -5.45</b>              | After-three months later            |                            |
| 0.0001**        | Friedman Test = 17.87              | Comparing the three groups combined |                            |
| 0.005**         | Wilcoxon Signed Ranks Test = -2.83 | Before-after                        | Imipramine                 |
| 0.012*          | Wilcoxon Signed Ranks Test = -2.53 | Before-three months later           |                            |
| 0.068           | Wilcoxon Signed Ranks Test = -1.83 | After-three months later            |                            |
| <b>0.0001**</b> | <b>Friedman Test = 16.75</b>       | Comparing the three groups combined |                            |

ditive effect of neurofeedback with this protocol. This means that neurofeedback by this protocol is not efficient any more than the drug itself.

### Limitations

No similar study has been found in literature to compare with this research.

### Suggestion

Other protocols such as enhancement of Alfa to Theta ratio in this region or other regions of brain are suggested

to be evaluated.

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