Neurofeedback Treatment of College Students’ Test on Anxiety, Depression, Personality, and Mood

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Abstract—Biofeedback is used to treat the mental diseases of college students, such as test anxiety, depression, personality, and mood. Anxiety of the colleague students was first tested by test anxiety scale (TAS) and then treated by biofeedback. After getting the biofeedback treatment, the students’ TAS scores, blood volume pulse, and skin conductance were decreased, especially, their TAS scores dropped markedly. Meanwhile, the level of EEG (β1 rhythm/α rhythm) and peripheral temperature increased observably. Then, neurofeedback (β1 rhythm/α rhythm) was applied to treat students’ depression, personality, and mood. As a result, these three kinds of symptoms got alleviated. And their therapeutic effects based on neurofeedback were more stable, durable and less recrudescent.

Index Terms—Biofeedback, depression, mood, neurofeedback, personality, test anxiety.

1. Introduction

Many mental diseases, such as obsessive-compulsive disorder, anxiety disorder, and panic disorder, are partly resulted from physiological reasons[1]. Participants can adjust their own biological signals so as to change their physical and psychological situation through biofeedback, especially neurofeedback. In the previous studies, the neurofeedback has been widely applied to the treatment of psychosomatic disorder, psychiatry, psychological consultation, re-habilitation medicine, and other clinical areas. At the end of 1960s, biofeedback had been initially applied to clinic in the United States, which was introduced into China in 1979. Fenglin Huang firstly reported a successful cured case on using EMG biofeedback to treat limbs paralysis caused by brain death[2]. Thereafter, biofeedback has been applied to the treatment of many kinds of illness, such as epilepsy, autism, attention deficit hyperactivity disorder (ADHD), and so on[3][5]. In addition, Garrett and Sliver arranged a neurofeedback training for the patients with anxiety disorder[3]. They found the patients’ alpha brain waves increased by 33% after training, and reported that the posttest anxiety score of the patients decreased remarkably, which revealed that neurofeedback was an effective way to heal the patients’ anxiety[1]. Baechr found that the neurofeedback therapeutic effect of depression could be well maintained for a long time, and the obvious changes of the frontal alpha brain waves emerged, the asymmetry gradually disappeared in the following process[3]. The study of Peniston and Kulkosky showed that after neurofeedback treatment, people would become more warm-hearted, intelligent, emotionally stable, social, relaxed, and satisfied[6]. Egner and Gruzelier reported that biofeedback could be widely applied to various realms, for instance, it can be used to improve the artistic quality in music performances[6]. Therefore, based on the evidences in the empirical studies above, in this program we apply neurofeedback at the psychological angle to treat a series of mental diseases, including anxiety, depression, personality disorders, emotional disorders, etc.

2. Neurofeedback Treatment of Test Anxiety

The survey in this program shows that the students’ anxiety comes mostly from test. Psychological counseling and drug treatment are two conventional ways to treat test anxiety. However, counseling usually needs a long time, and its effect is not very remarkable. The drug treatment also has some side effects, such as drug dependence. But there are not these disadvantages in biofeedback treatment.

We firstly selected 529 college freshmen in Sichuan, according to the outcome of test anxiety scale (TAS), 80 (male 40, female 40) among them had test anxiety. Then we divided them into two groups (n=40 individuals). One is the experimental group and the other is regarded as the control group. The experimental group got the biofeedback treatment (totally 4 times, 40 min per time). The four indexes are adopted to evaluate, peripheral temperature (PT), skin conductance (SC), blood volume pulse (BVP), and electroencephalogram (EEG). Nothing was done for the control group. As for the physiological indicators, higher BVP and SC and lower PT and EEG (β1 rhythm/α rhythm) mean his (her) higher level of anxiety.
Table 1: The change of two groups on TAS score and physical levels after biofeedback treatment

<table>
<thead>
<tr>
<th>Channels</th>
<th>Experimental group</th>
<th>Control group</th>
<th>χ²</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAS</td>
<td>−3.33</td>
<td>−1.17</td>
<td>6.373</td>
<td>0.041*</td>
</tr>
<tr>
<td>BVP</td>
<td>−3.59</td>
<td>10.07</td>
<td>4.885</td>
<td>0.087</td>
</tr>
<tr>
<td>SC</td>
<td>4.08</td>
<td>3.80</td>
<td>8.013</td>
<td>0.081*</td>
</tr>
<tr>
<td>PT</td>
<td>−1.60</td>
<td>−0.76</td>
<td>4.840</td>
<td>0.061</td>
</tr>
<tr>
<td>EEG</td>
<td>0.56</td>
<td>0.12</td>
<td>6.457</td>
<td>0.051*</td>
</tr>
</tbody>
</table>

According to this program, we could find that the anxiety level of the experimental group after the biofeedback treatment dropped down more remarkably than before, which proved that the biofeedback therapeutics could help reduce the test anxiety of the participants.

3. Neurofeedback Treatment of Depression

Davidson documented that depression was associated with the activities of right and left prefrontal cortex; the left frontal area was related to positive emotions and memories, and the right hemisphere was involved in negative emotions. Thus, when the left hemisphere was basically “stuck” in an alpha idling rhythm, there were more withdrawal behaviors and more obstacles in positive emotions and behaviors. This happened not only to adults, but also to the depressed infants[1].

In this program, we randomly selected 1246 college students in Sichuan to take Minnesota Multiphasic Personality Inventory (MMPI). Baehr, E. Rosenfeld found that MMPI depression scale percentage scores greatly more than 60 indicated that there was not a predisposition to depression, while scores of 58 or less indicated the presence of a predisposition[1]. In this program, the results of MMPI showed that 1 of 4 patients was judged to be severely depressed, one was moderately depressed, and the other two were mildly depressed. Three of them experienced the treatment fully and carefully. Only one dropped out of the treatment at the second time because of some affairs about his family. After the treatment, we took MMPI one time again. As shown in Fig. 1, compared with the pretest outcome, the posttest scores of MMPI decreased greatly.

Among the three participants who experienced the whole treatments, depression level of the first participant changed from the moderate to the mild, and the second one became normal. The third one who was severely depressed reported that he felt better after taking the treatment. But the treatment effect on the third one was not very obvious,
which we presumed that it is related to his especial situations. He had lost his parents in an unexpected traffic accident in the last year, and he had been involved in a dispute about property distribution with his relatives. In addition, it was the last year that he failed in the college entrance examination for these reasons. So his depression was very serious. Our short treatments can not have him cured. After this test, we took the following surveys of these participants, especially, for the seriously depressed one, which nearly lasted for one year. Meanwhile, we added counseling and drug treatment to him. Then he gradually felt better. And other participants were followed for 8 months, we found that the therapeutic effect seemed stable, and we did not find any recrudescence. The results of this test is a strong evidence that neurofeedback is a helpful treatment method for depression with non-invasion, good stability and no recrudescence.

4. Neurofeedback Treatment of Personality

Peniston and Kulkosky’s findings also showed that people after having accepted the biofeedback treatment would become more warm-hearted, intelligent, emotionally stable, socially bold, relaxed, and satisfied. Although Egner and Gruzelier did not employ measures of personality in their study, participants who had alpha/theta neurofeedback reported that they felt better in themselves after neurofeedback training. To sum up, biofeedback is probably an important mediating factor to change in personality.

According to previous research, study group selected 561 college sophomores in Sichuan Province. 8 of 561 students had personality disorder on withdrawal scale of the PSQ-80. This result was different from the findings of Peniston and Kulkosky or Bodenhamer-Davis and Callaway’s. The results are not consistent, there may be two reasons for the different results, one is the methodological, and the other is theoretical deviation.

First of all, methodological deviation was that there was less number of neurofeedback sessions in our study: an average of 9 times used in our study rather than the 20 times used in previous studies. And personality was relatively stable. It was not easy to change. So, 9 times in 6 weeks was too short and hard to change the participants’ personality.

Secondly, the theoretical deviation for the discrepancy was that both Peniston & Kulkosky’s and Bodenhamer-Davis & Callaway’s results were obtained from drug-addicted subjects who had both highly deviant personalities and great motivations were needed to reform. By contrast, the subjects in our study were health students who were in the top 30% of their year group for withdrawal as measured by the PSQ-80. So we could not say they are highly deviant.

5. Neurofeedback Treatment of Mood

The neurofeedback has continued in the mood research front regarding the personality research. Only add a profile of mood states (POMS) finally in the personality research. Those testers’ POMS scores are shown in Fig. 2. Scores of the real group were significantly higher than the mock group, and the real neurofeedback group showed they felt more energetic ($P < 0.01$), sedation ($P < 0.01$), pleasant ($P < 0.01$), exciting ($P < 0.05$), and self-confidence ($P < 0.01$) significantly than before. In return, sessions of mock feedback made participants feel more tired ($P < 0.01$), yet composed ($P < 0.05$). But it should be noted that composure scores of both group were significantly improved.

Such result prompted us: the real group got more mood enhancements compared with the mock group. It was most remarkable in the energy dimension, and the exciting dimension also changed a lot. These results may prove powerfully that to a large extent, the neurofeedback strengthened mood.

In addition, such experimental result has conformed to the researcher’s first hypothesis of the neurofeedback treatment of personality that the real group compared with the mock group after training will have a bigger response, and the real group will feel happier. To some extent, self-confident and rouses could be regarded as the opposite sides of flinch. If testers’ self-confident and happy were increased, we could consider that testers had gradually reduced flinches and approached to the personality normalization’s direction. All of these had supported that the neurofeedback as one of the efficient path in personality changed.
Fig. 2. Mean POMS scores pre- and post-training.

6. Discussions and Conclusion

The neurofeedback treatment has made great achievements in curing test anxiety, depression, personality, and mood of college students. But we also found some limitations of this program. Firstly, our treatment processes had not experienced enough time. For example, for the various reasons, the anxiety treatment had been made in only 160 minutes, however, as a clinical treatment, a biofeedback treatment should last at least for 7 to 12 hours[1]. Our program was far below this required time standards. In future works, we will appropriately increase treatment time in order to consolidate the therapeutic effect. Secondly, as mentioned above, the treatment effect of personality is not as good as expected, mainly because the test sample size was too small. So we should also enlarge the sample size in order to avoid the distortion of the test outcome because of the participants’ robustness. Thirdly, there may be placebo effect in the neurofeedback treatment, which should be considered in the future research too.

In addition, from this program, we found that the effects of neurofeedback therapy are not just only confined to diseases, but also can be extended to other specific situations in daily life. As mentioned previously, a patient’s personality would get improved after he experienced a neurofeedback treatment. All these can reveal that neurofeedback treatment is helpful to the improvement of whole psychological quality of the patients. Therefore, in the future work, we may not only provide treatment to the students with some psychological diseases, but also make the healthy ones have access to neurofeedback in order to further enhance their mental health and make them adapt themselves to the society better.

References