On the Effect of Everyday Stress by Repeated Vocalization of "voo"

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Abstract *— Stress is a normal biological response, but long-term, severe stress will have a negative impact on people's health. Stress has become a problem that plagues modern people. So, it becomes necessary to reduce stress. This article proposes a new method of decompression, which is simple, convenient and cost-free, but very effective. In order to prove its effectiveness, this paper attempts to use HRV and SDNN analysis as indicators to detect pressure to detect its decompression effect. After comparing the normal SDNN with the SDNN after using this method, the test results not only illustrate the fact that most people are stressed, but also prove that the "Voo" Vocal Breathing Method is a very effective way to help modern people decompress.*

Keywords —*Stress, "Voo", Vocal Breathing Method, HRV, SDNN, Autonomic Nervous System.*

I. INTRODUCTION

People deal with all kinds of stress every day, which may come from life, work or study. In fact, humans have a complete coping system (autonomic nervous system) for these stressors from the outside world to maintain balance in the body. Therefore, human beings have the ability to adapt to changes in the external environment. However, stress is not completely harmful, but once this balance is broken, it will endanger our health. It is medically defined as the normal biological response to potentially dangerous situations. This will instantly fill the body with chemicals and hormones (such as adrenaline and cortisol), which speeds up breathing and heartbeat. The heart pumps oxygen-saturated blood throughout the body, making the body energetic and strengthening consciousness. But this kind of excitement will break the hormone balance in the body for a long time, mentally, people will feel tired, tired, and produce negative emotions, such as depression, anger, tension, anxiety, etc. This is what we often think of as great stress. status. Physiologically, hormonal imbalance in the body leads to decreased immunity and increases the risk of disease. It is said that stress is the root cause of all diseases. Therefore, it is necessary to reduce stress and maintain good health. There are many ways to reduce stress. For example, proper exercise, listening to English, reading aloud, adequate sleep, meditation, deep breathing, etc. [1] [2] voo~" Repeated vocal breathing is a simple and effective method of decompression. It is similar to deep breathing, which is a slow breathing rhythm. But it requires vocalization when exhaling. The normal breathing mode is to breathe through the nose, and the breathing rate It is 15~16 times per minute. “Voo" vocal breathing method Inhale through your nose and exhale through your mouth. The breathing rate is 6~8 times per minute. Deep inhale for 4 seconds, hold your breath for 2 seconds, and then pout, The exhaled air vibrates the vocal cords and makes a "Voo" sound for 7 seconds. A large number of studies have shown the decompression effect of deep breathing. And the sound vibration will enhance the body's feeling of decompression.[3]

This article studies the effect of "voo" vocal breathing method on reducing stress, and uses HRV as an indicator of pressure monitoring. In chapter 2, explains why Vo breathing method can reduce stress. In chapter 3, explains heart rate, HRV and stress It also introduces the role of SDNN analysis in pressure detection. In chapter 4, the heart rate of normal breathing and “Voo" vocal breathing is measured, and SDNN analysis is performed to obtain the results. In chapter 5, the conclusion.

II. REASONS WHY "VOO" VOCAL BREATHING CAN REDUCE STRESS

Stress is actually maintaining a stable resistance to stimuli that disrupt mental and physical balance and stability. And the stronger this resistance, the stronger the pressure resistance. The human body has two sets of completely opposite systems to deal with external stimuli. They are the sympathetic nerve and the parasympathetic nerve. The sympathetic nerve controls the secretion of adrenal hormones, which has a positive and promoting effect. The parasympathetic nerve controls cortisol, which has a soothing and inhibitory effect. Sympathetic nerves and parasympathetic nerves are collectively called

autonomic nerves, and these two oppositely acting autonomic nerves together maintain the balance in the body. The motor regulation ability of the autonomic nerve reflects people's ability to resist stress, that is to say, the more sensitive the activation of autonomic regulation, the stronger people's ability to cope with stress, and vice versa. [4]

"Voo" breathing method strengthens the ability of self-regulation. When inhaling, because the oxygen in the lungs increases, the sympathetic nerves are activated, speeding up the heartbeat, and transporting blood faster. When exhaling, the oxygen decreases and the parasympathetic nerve is activated, which slows the heart rate. The slower inhalation and exhalation processes strengthen the sympathetic and parasympathetic nerves. Therefore, the dynamic adjustment of the autonomic nerves is strengthened, and the resistance to the current stress state is strengthened. In reality, we often do this, such as taking deep breaths to overcome tension, sighing to relieve stress, and so on. [5]

In particular, the "Vo" breathing method is a deep breathing method of vocalization. Human vocalization is the sound signal generated by the air in the lungs vibrating through the squeezing of the vocal cords through the resonance of the mouth and nose cavity and other organs. In other words, vocalization activates the vibration of other organs, and the tense organ obtains a soothing and relaxing effect due to the vibration.[6]

III. HEART RATE AND HEART RATE VARIABILITY (HRV)

A. Definition of heart rate and heart rate variability

Heart rate refers to the number of heart beats per minute, in bpm. The instantaneous heart rate calculation formula is F = 1/T (times/s) = 60/T (times/min). Here T is the interval between two heart beats (NN interval), that is, the distance between the two peaks in the ECG chart. The speed of the heart rate reflects the speed at which the heart supplies blood. And HRV refers to the heart rate variability (HRV) refers to the degree of fluctuation in the length of the heartbeat interval. That is, the degree of change in the length of the NN interval. Figure 1 is the NN interval. [7] [8]

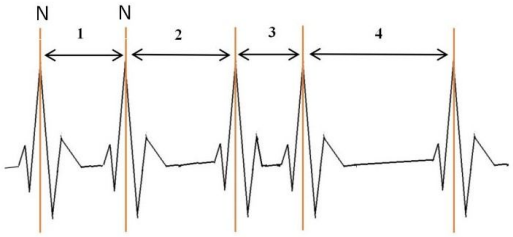

Figure 2. NN-interval

B. The relationship between HRV and stress

HRV is the degree of change in heart rate, and the rate of heart rate is closely related to the regulation of autonomic nerves. The role of sympathetic nerves speeds up the heartbeat, and the role of parasympathetic nerves slows down the heartbeat. Irregular changes in heart rate are the result of the joint action of sympathetic nerves and parasympathetic nerves. Therefore, HRV can reflect the dynamic regulation of autonomic nerves. And the dynamic regulation of autonomic nerves is related to stress. As a result, HRV can be used as an index for measuring pressure. A decrease in HRV mainly means that the heart rate is monotonous and regular. This means that the ANS's regulatory function and the ability to maintain homeostasis, cope with internal and external stressors, resist diseases or recover at an appropriate time. That is, the pressure is very high, and the increase in HRV means the pressure is reduced. Combine the deep breathing method to illustrate the effect of deep breathing on HRV, as shown in Figure 2. [9] [10]

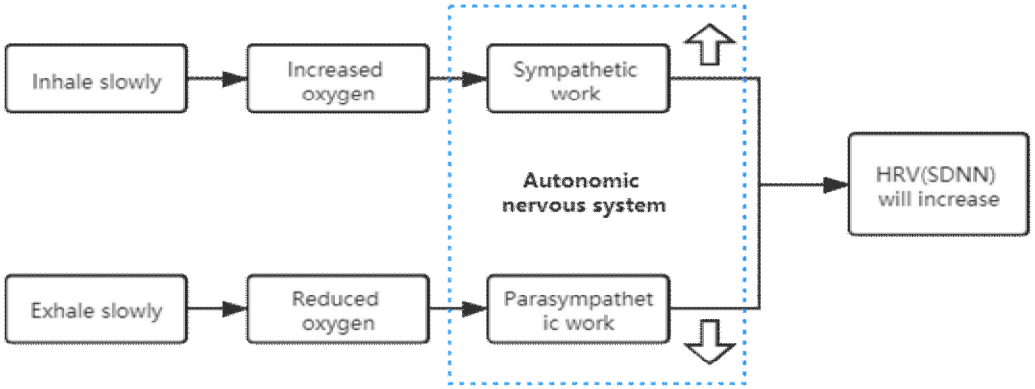

Figure 3. The effect of deep breathing on HRV

C. HRV analysis method

HRV analysis methods are divided into time domain analysis method, frequency domain analysis method and graph analysis method. SDNN is one of the simplest mainstream analysis methods. It is to calculate the average standard deviation of all NN intervals within 5 minutes. The unit is milliseconds. Standard deviation (Standard is the arithmetic square root of the arithmetic mean of the square of the deviation from the mean. It can reflect the degree of dispersion of a data set. So, using the standard deviation method can well indicate the degree of change in heart rate. The larger the SDNN, the greater the HRV. In some studies, HRV and DNN are equivalent. The SDNN analysis method is currently used in the application software of various smart phones and smart wearable devices as an important indicator for detecting physical health. Usually, the analysis of SDNN is not directly based on ECG chart is based on the instantaneous heart rate chart. Figure 3 is the instantaneous heart rate chart. The following is the function relationship between heart rate and NN interval.[11] [12]

$$X_{k\,NN-Interval}\ (\mathrm{ms}) = \frac{60 \times 1000(\mathrm{ms})}{F_{Heart\ Rate}\ (bpm)} \quad (1)$$

This function shows that the heart rate (F) and the NN interval (X_k) are inversely proportional. Then calculate the average of all NN intervals.

$$\mu = \frac{\sum_{k=1}^{N} X_k}{N} \quad (2)$$

Finally, calculate the standard deviation.

$$SDNN(\sigma) = \sqrt{\frac{\sum_{k=1}^{N}(X_k-\mu)^2}{N}} \quad (3)$$

Here 〖X〗_(k)represents the Kth NN interval, the total number of NN intervals is N, and μ is the average of all NN intervals.

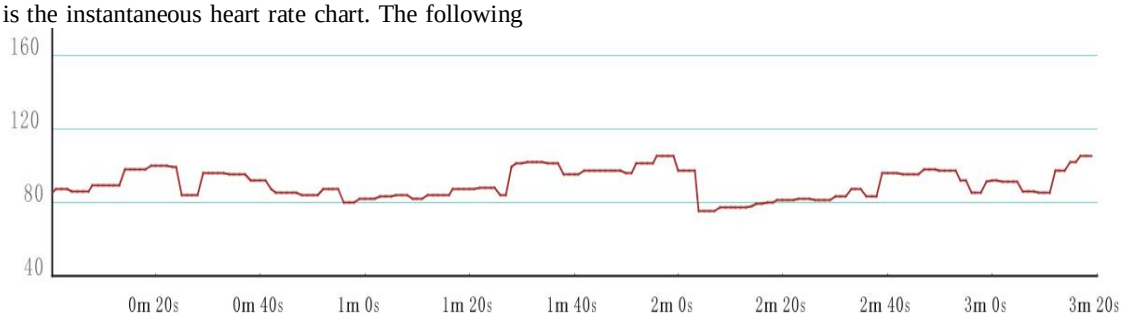

Figure 3. Instantaneous heart rate graph

IV. EXPERIMENT AND SIMULATION

A. EXPERIMENTAL PROCESS

The subjects of the experiment were 12 healthy men and women aged 20-30 years, 6 men and 6 women. The test environment is in a quiet laboratory. All subjects are prohibited from taking caffeine, smoking, and eating 2 hours before the measurement. Because it is a finger sensor, you need to rest your nails. Maintain a comfortable sitting posture during the measurement, without moving or talking. The test is divided into two parts. The first part: breathe normally and record the heart rate for 5 minutes. Part 2: Use Vo breathing method and record heart rate for 5 minutes. [13]

The measuring instrument is a Pulse Oximeter (Pulse Oximeter). This instrument can calculate the instantaneous heart rate from the blood oxygen saturation signal and the heartbeat interval, and finally obtain the instantaneous heart rate graph from the instrument, and then use the SDNN calculation formula to obtain the result from the collected heart rate data in the Matlab software. Finally, compare the SDNN value of normal breathing and Vo breathing

B. Experimental results

Studies have shown that the range of SDNN indicators is related to age and gender (with less impact). At the age of 10 to 40, ignoring gender differences, 35 to 50 belong to the normal pressure range, below 35 indicates high pressure and risk of disease, and above 50 indicates a stress-free health level. The following is a graph of the test results of 4 subjects. The figure includes the NN-interval line, the average line and the SDNN value when the four testers are normally and "Voo" Vocal Breathing Method. The larger the value of NN-interval deviates from the average, the larger the SDNN. Therefore, the size of SDNN can be intuitively compared from the figure. From the results, under normal circumstances, two of the four test subjects have SDNNs near 35, which is under great pressure. One tester is stress-free. But when using the "Voo" Vocal Breathing Method, the SDNN of all testers increased and exceeded 50, reaching a very good level. [14]

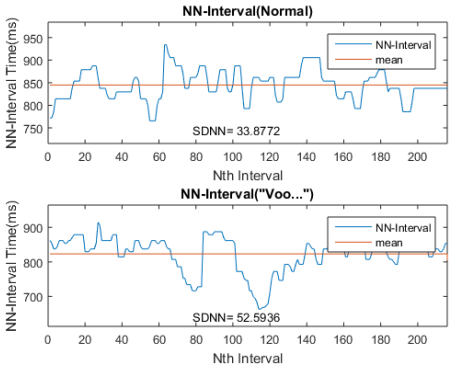

Figure 4. Test result of testee 1

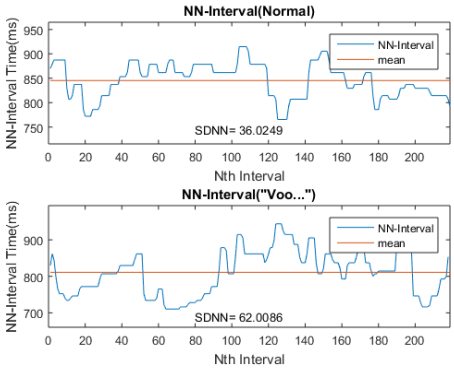

Figure 5. Test result of testee 2

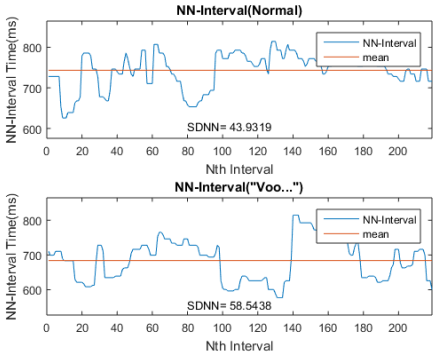

Figure 6. Test result of testee 3

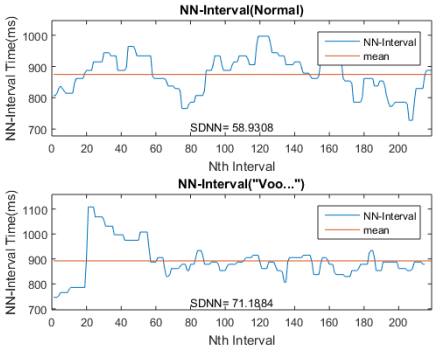

Figure 7. Test result of testee 4

Then the SDNN values of all 10 subjects were counted, and the SDNN values of the normal state and the state using the "Voo" Vocal Breathing Method were compared. It can be seen from Figure 8 that all lines are in an upward trend. Therefore, all SDNN values increase after using this method. In Figure 9, under normal conditions, there are two subjects whose SDNN exceeds 50, accounting for only 20%. The others are in sub-healthy and unhealthy conditions, and three of them are under great pressure. This also shows that most people need to reduce stress. However, after use the "Voo" Vocal Breathing Method, everyone's SDNN exceeded 50. In other words, this method can be very effective in reducing stress.

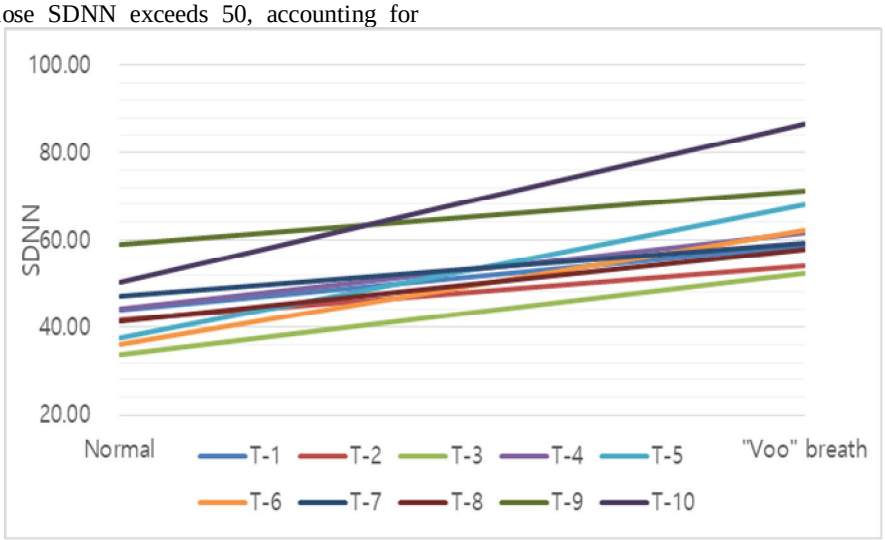

Figure 8. SDNN statistical results 1

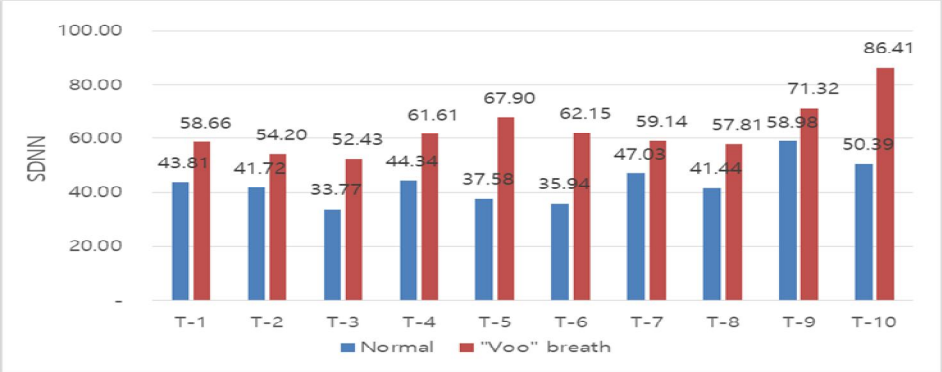

Figure 9. SDNN statistical results 2

V. CONCLUSIONS

People will always get a lot of pressure because of life, work and study, and long-term pressure will damage people's health. This paper proposes a new method of decompression, that is the "Voo" Vocal Breathing Method. And through the experiment of measuring the HRV of the tested person, and finally through the SDNN analysis result to illustrate the effectiveness of this method.

HRV test results show that indeed most people are plagued by stress problems. However, after using this method, their SDNN values have increased significantly, exceeding 50. This is a good level. This shows that the "Voo" Vocal Breathing Method is very effective in reducing stress. Therefore, we suggest that when you feel a lot of stress, try to use it to reduce stress. Or in the rest time after work, spend 5 minutes doing it, you can get a good

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