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# The effect of progressive relaxation training on a selected Parkinsonian patient

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# THE EFFECT OF PROGRESSIVE RELAXATION TRAINING ON A SELECTED PARKINSONIAN PATIENT

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## Abstract

The present study was designed to determine if Progressive Relaxation exercises would be effective in reducing the response time of a single Parkinsonian on a specific reaction time/movement time task. A 75 year old man served as the subject for this study. He performed a simple response time task at two scheduled sessions per week, for a total of ten weeks. Starting the sixth week, the subject began relaxation training at each session. Data points that represented the average of ten response scores from each session were plotted on a graph and examined by regression analysis. Regression lines representing data points projected to 100 sessions were calculated for both treatment and non-treatment halves. The response time for the one hundredth session, without treatment, was calculated to be .5744 second. The response time for the one hundredth treatment session was .1628 second. Regression analysis indicated that the progressive relaxation program reduced the response time of the subject.

# The Effect of Progressive Relaxation Training on a Selected Parkinsonian Patient

In few diseases does an essential part of treatment rest so much upon the patient's personal effort as in Parkinson's disease. In fact, among early and mild cases, especially during stationary phases of the illness, exercise and activity are most important to the future welfare of the patient (Doshay, 1960). In an effort to retard the progress of the rigidity and slowness of movement, the present study was designed to determine whether the Parkinsonian patient could move more quickly and efficiently if the excessive muscular rigidity could be decreased through an exercise program which trains the patient to consciously relax the muscles needed for daily activity.

Historically, Parkinson's disease, also known as paralysis agitans, was first named and described by James Parkinson in 1817. Parkinson, cited in (Cotzias and McDowell, 1971), described the condition as: "involuntary tremulous motion, lessened muscular power, in parts not in action and even when supported; with a propensity to bend the trunk forwards and to pass from a walking to a running pace." The victim's intellectual level usually is unimpaired, and sensation is unaffected. The syndrome may also include the following symptoms or signs: a frozen facial expression, festinating gait and stooped posture (Erickson, 1956). The average onset seems to be about sixty to sixty one years, with a beginning that is so gradual, it can rarely be dated precisely. The patient may consult a physician about shaking or difficulty in moving. Usually the first symptoms noted are, to quote James Parkinson, as cited in Duvoisin (1978), "a slight sense of weakness, with a proneness to trembling . . . in one of the hands and arms." These symptoms tend to increase over a period of many years, with a progression that is so gradual that little change is seen from one year to the next.

## Pathology of Parkinson's disease

The symptoms of Parkinson's disease are due to a dysfunction of structures located in the basal ganglia region of the brain. Though it is wrong to describe the basal ganglia in terms of a single function, one of the general effects of basal ganglia excitation is to inhibit muscle tone throughout the body (Guyton, 1976). The most consistent morphologic change noted in

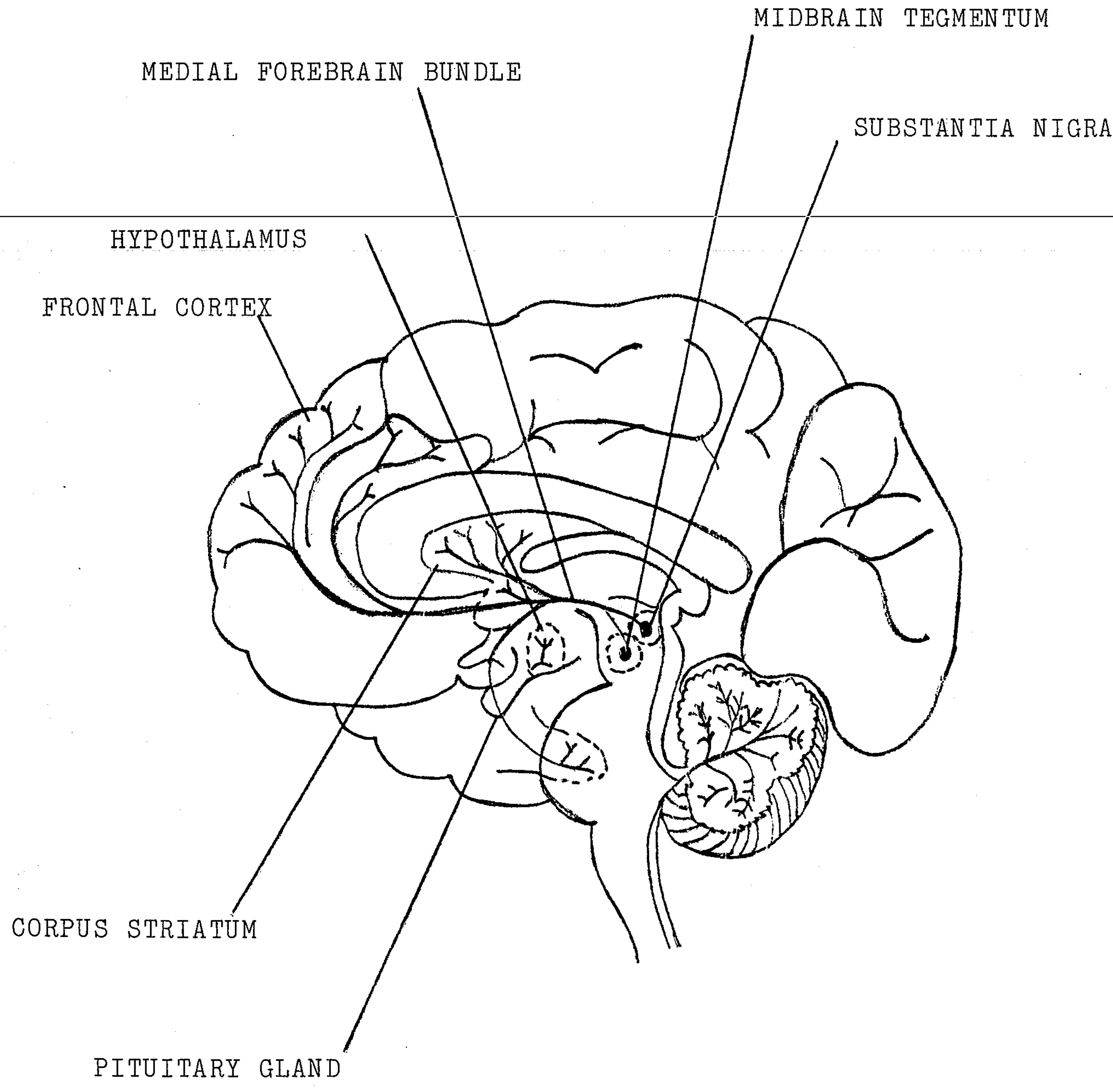
Parkinson's disease is degeneration of melanin-containing nerve cells in the substantia nigra (Cotzias and McDowell, 1971). Located within the basal ganglia, the cells of this region produce and store a neurotransmitter called dopamine (see Figure 1).

In the normal brain, regions of the basal ganglia: caudate nucleus, putamen, substantia nigra, and globus pallidus, produce about 80% of the total brain dopamine. Most of this dopamine is concentrated in terminals of the striatum. These terminals belong to nerve fibers which originate in the substantia nigra. This is referred to as a dopaminergic pathway. In Parkinson's disease, there is a severe reduction in the concentration of dopamine, as well as its metabolite, homovanillic acid (Cotzias and McDowell, 1971).

Symptomology

The classic triad of symptoms, tremor, rigidity and bradykinesia (slowness of movement), are the characteristic signs upon which a diagnosis is generally made (Duvoisin, 1978). Tremor is usually the first sign to appear, and the patient may feel it for months before it becomes visible. It is the most obvious symptom and initially it involves only one side of the body. The

FIGURE 1: A schematic diagram of the human brain.



tremor is generally most pronounced in the hands, but it may involve the legs, lips, tongue and neck muscles (Richardson and Adams, 1983). Tremor is usually present at rest and may not be present when the muscles are in action. Tremors usually worsen for the Parkinsonian when he is nervous, frightened, tense or excited.

The rigidity of Parkinson's disease can be appreciated by physically examining the patient for evidence of resistance to passive movement. A physician takes the patient's arm and actively flexes it while asking the patient to relax. Persistant resistance to such movement is termed rigidity (Duvoisin, 1978). The patient may be aware of the muscular rigidity as stiffness, soreness, aching and general fatigue.

The increased rigidity of the muscles in the extremities and neck contributes to a "dimunition of speed and range of movement and progressively handicaps the patient" (Erickson, 1956). This rigidity is not the result of hyperactivity of the muscle spindle system. Instead, both protagonist and antagonist muscles are contracting inappropriately throughout the range of movement (Guyton, 1976). Failure of the reciprocal action of the antagonist and protagonist muscles thus results in rigidity, an essential feature of Parkinson's disease. The rigidity impedes not only passive movement, but also active movement willed by the patient. Rigidity has been blamed for the slowness of movement of Parkinson's disease, which gives rise to the third major symptom of the disorder, bradykinesia (Duvoisin, 1978).

Bradykinesia is a complex phenomenon, comprising hesitancy in initiating a new movement or activity, slowness in its execution, and rapid fatiguing. Duvoisin (1978) stated, "It also encompasses a lack of spontaneity and diminution in the performance of the automatic movements of which we are usually unaware, such as eye-blinking, the swing of the arms while walking, expressive gestures of the hands while talking, and facial expressive movement." Poverty of spontaneous movement is also termed hypokinesia. Bradykinesia is most apparent in voluntary movements. It is seen as a hesitation in initiating an action, slowness in the movement, and finally rapid fatigue, which is most noticeable in repetitive movements. This phenomenon is evidence that the parts of the nervous system which control and coordinate all motor activity are intact, and that they can function normally if properly activated.

## Parkinson's Disease and Response Times

Parkinsonians are generally slower on a number of tasks involving movements of both the upper and lower extremities. Hoffmeister and Muller (1979) found that Parkinsonians were considerably slower than middle aged, younger and own age matched controls on complex reaction time tasks. Movement time is also substantially slower (Spirduso, 1979). Evarts, Teravainer and Calne (1981) concluded that movement time is the one measurement most profoundly and consistently affected in Parkinsonism. Spirduso (1983) found the greatest similarity of age motor function and Parkinson's motor characteristics is the decrement in motor speed. Gillian (1984) performed an investigation of psychomotor testing with Parkinsonian subjects and age-matched controls. The higher phased Parkinsonian subjects did not approach normal reaction time values even with practice. In all Parkinsonians, movement time values varied from normal values.

Response time is defined in the present study as the combined time of the subject's reaction time plus the movement time. It is the measure of the total time from the initiation of a task, to its completion.

Contradictory results exist in the literature regarding the impairment of simple reaction time performance in Parkinsonism. In a study which involved psychomotor testing in patients with varying degrees of Parkinson's disease, only the most severely disabled subjects had significantly reduced reaction times (Talland, 1963). Angle, Alston and Higgins (1970) found that the subject's difficulty in starting movement could not be attributed to any perceptual or decision-making disorder. They concluded that there is faulty transmission of motor commands from the decision making system to the motor apparatus. The bradykinesia seems to affect the motor system's spontaneity and drive.

## Treatment

Although there is no treatment that is known to halt or reverse the nerve cell degeneration that appears to underly Parkinson's disease, methods are available to the patient which can bring about a considerable degree of relief from the symptoms. An important part of any therapeutic program is the maintenance of optimum general health and neuromuscular efficiency by planned programs of exercise, activity and rest. Physical therapy may be a great help in achieving these ends (Richardson and Adams, 1983). Doshay (1960) suggests a flexible program of medication, physical therapy and exercise in the treatment of Parkinson's disease. In addition, the Parkinsonian patient needs much emotional support in meeting the stress of the illness. Patients generally require a carefully thought out program of treatment, "specifically aimed at counteracting the pathophysiologic disorder that produces their disabilities. This treatment is nearly always medication, but surgery is a possibility in selected cases" (Richardson and Adams, 1983).

Drug Therapy

The drugs that are most beneficial in the symptomatic treatment of Parkinson's disease are dopamine-repleting (Richardson and Adams, 1983). L-Dihydroxy-phenylalanine (L-dopa) has been shown to be an effective form of drug therapy in the treatment of Parkinsonism, and is currently the most widely used. L-dopa is now usually combined with an inhibitor which prevents the rapid destruction of L-dopa in the blood and allows more of it to enter the basal ganglia region.

A popular form is called Sinemet (Richardson and Adams, 1983).

Physical Therapy

Physical therapy plays an important role in the treatment of Parkinson's disease. Patients often feel stiff and slow, and physical therapy is valuable in the control of rigidity and the prevention of later contractures (Boshes and Doshay, 1964). This therapy must be practiced regularly, and, according to Boshes and Doshay, physical therapy should "be confined to modalities that provide health to the muscles. It should consist of massage to soften the muscles, and passive stretching to loosen and free the muscles and joints." This program may help to maintain the well being of the patient and provide him with greater freedom of movement.

Exercise

According to the related literature, physical exercise has a major role in the management of the symptoms of Parkinson's disease (Doshay, 1962) (Doshay and Boshes, 1960) (Spirduso, 1983) (Lavigne). Regularly performed exercises can increase mobility, improve balance and coordination, and increase the

Parkinsonian's independence in physical activities of daily living. Spirduso (1975) stated, "When neuronal cells fail to receive and process stimuli, eventually they involute and atrophy. Physical activity generates a storm of impinging stimuli, an excitation that affects the entire chain of neurons involved, including motor and cerebral neurons." It seems fair then to conclude, that for Parkinsonian patients, exercise and activity are important to their future welfare.

Progressive Relaxation Exercises

Progressive relaxation training, first discovered by Edmund Jacobson and later developed by Joseph Wolpe, is a method of systematically tensing and relaxing various muscle groups of the body, geared towards learning to discriminate between the tense state of the muscles versus their relaxed state (Bernstein and Borkovec, 1973). "The subject is taught to recognize even minute contractions of his or her muscles so that he or she can avoid them and achieve the deepest degree of relaxation possible" (Benson, 1975). In this manner, undesirable muscle stiffness and contraction may be consciously eliminated.

From experimentation with Progressive Relaxation training, decreased pulse rate and lowered blood pressure were demonstrated by Jacobson. Wolpe's muscle procedures, which were geared more towards the awareness of bodily sensations, demonstrated a lowering of skin conductance and respiration rate (Benson, 1975). Paul (1969) found that a group of subjects given muscle relaxation training exhibited greater decreases in heart rate, respiration rate, subjective tension and muscle tension than a group who were only told to relax themselves.

Parkinsonians are subject to a wide variation in severity of their symptoms, depending upon the state of mind of the patient. If he is relaxed, the tremor and rigidity are minimal. During periods of emotional excitement however, tremor and rigidity tend to increase (Schwab and Prichard, 1951). Brain (1955) noted that during stressful situations, Parkinsonian tremor may be inhibited by conscious effort. Schumaker (1980) used EMG biofeedback and Progressive Relaxation training and successfully reduced frontal EMG levels in a group of Parkinsonian patients. Relaxation therapy in the form of meditation was performed in a Parkinsonian case study (Szekely, Turner, and Jacob, 1982). When the subject terminated his meditation practice, his symptoms increased in severity. Upon the reinstatement of the meditation, the Parkinsonian symptoms decreased.

Bernstein (1973) stated, "The most obviously appropriate targets for relaxation training are uncomfortably high-level tension responses which interfere with the performance of other behaviors." From experimentation on the effects of Progressive Relaxation training in the treatment of Parkinson's disease, it seems reasonable to consider it an effective form of therapy.

## Method

### Subject

The subject for this study was a 75 year old male Parkinsonian patient. He was selected from a list of patients with Parkinson's disease at a medical clinic in Stockton, California. His mobility, early diseased condition and eagerness to participate in the experiment made him a desirable subject for this study.

### Case History

The following information was obtained from the medical records of the subject. He has a past medical history of hypertension and artheriosclerotic disease, ameliorated by appropriate drug therapy. He had a coronary bypass in 1976. In the same year, he had cataract surgery and a lens implant in the right eye. He was subsequently investigated for loss of memory by CT scan, which was shown to be normal. He denies any history of loss of consciousness or seizure disorder. He does not smoke or use alcohol. Until his clinical presentation in June of 1982, he was in fair health for the majority of his life except as noted.

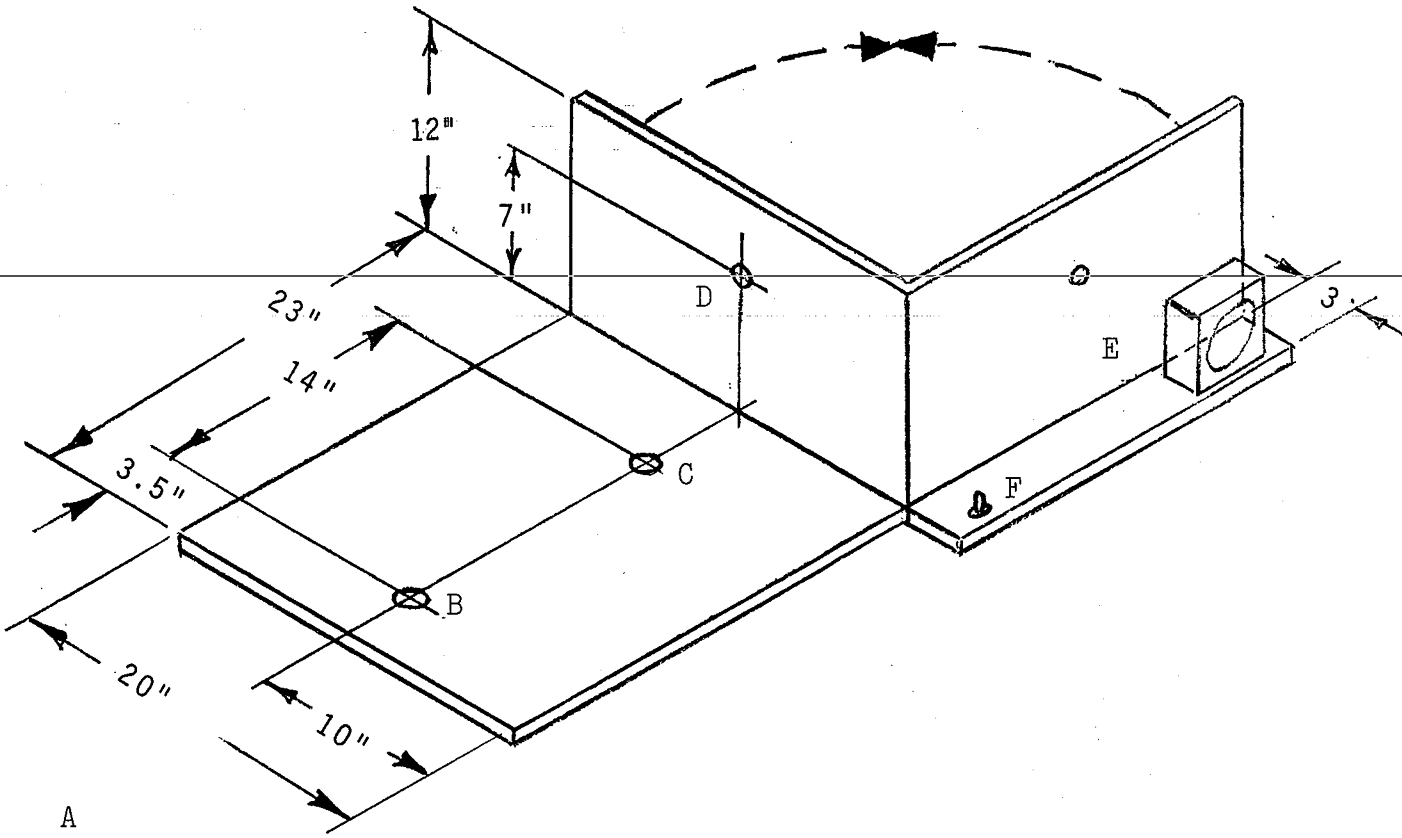
A neurologic evaluation performed by a local neurologist revealed the following: the subject is a 75 year old right handed male with normal gait and postural stance. The neurological exam revealed no alteration to touch pinprick, position vibration or general somatosensory appreciation. He was fully alert, cooperative, oriented to time, place and person. His speech was slow and contained normal phonation and pattern. Reflexes were present in both upper and lower extremities and were within normal limits for a man of his age. Tremor was noted in the upper right extremity. The clinical assessment of the subject revealed early Parkinson's disease. The subject was placed on Sinemet 25/100 (3/day). He is also maintained on tenormin and lanoxin for management of his hypertension and post bypass surgery.

Equipment for the Data Collection

Reaction time and movement time studies have been performed since the 1800's (Singer, 1975). The techniques used in measuring these factors have not varied much, but the devices have become more sophisticated. In this study, a Response Time Analyzer was used to collect the data. Devices similar to the one in this study have been used to determine the relationship between one's reaction time and his movement time. Although this particular instrument was not found in studies with Parkinsonians in the literature, tests for simple reaction time, complex reaction time, movement time, tapping and pursuit rotor testing are currently being done.

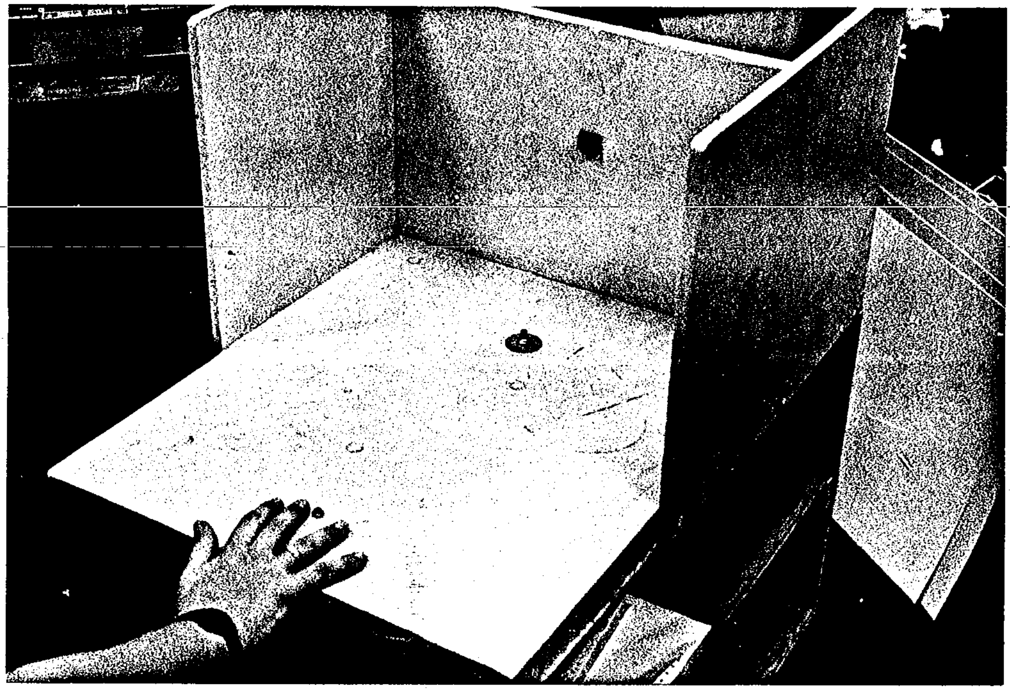
The device used in this study was a modification of a device used by Singer, Llewellyn and Darden (1973). The modified design did not incorporate the photoelectric cell to measure response time. The subject, after perceiving a visual stimulus, depressed a key to deactivate the timing device (see Figure 2 and Figure 3).

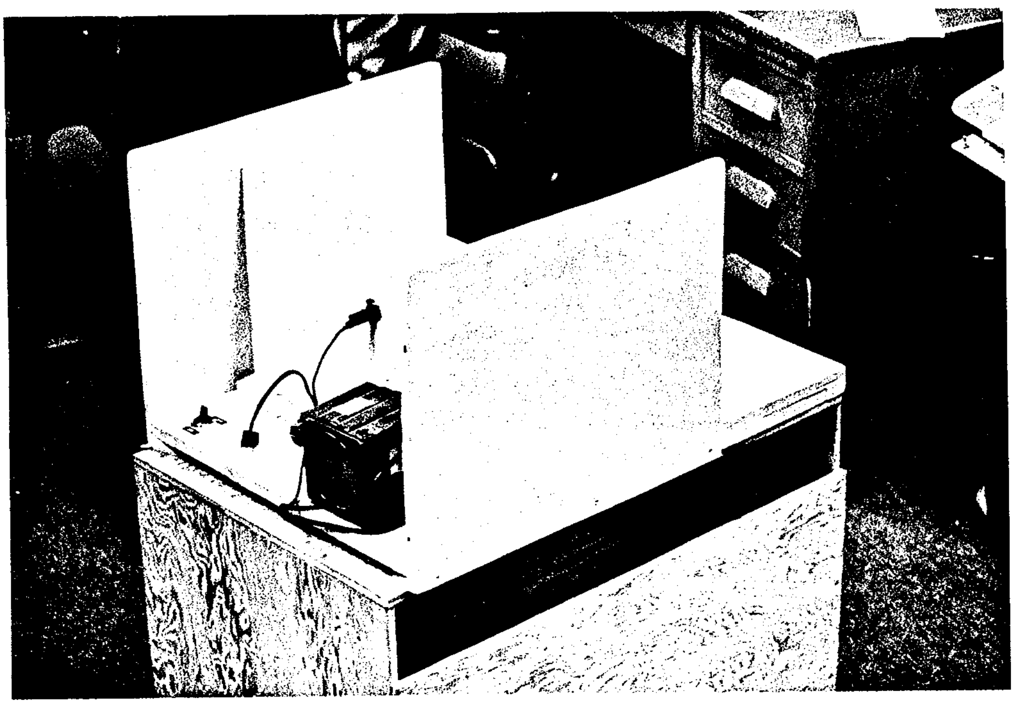
FIGURE 2: Response Time Analyzer




A= subject's position. B= hold switch. C= deactivating switch. D= visual stimulus. E= chronometer. F= ON switch for the chronometer.

FIGURE 3: Front and rear views of Response Time Analyzer.





Reliability of the Instrument

The test-retest method was used to determine the reliability of the instrument. Twenty-eight normal subjects were tested on the Response Time Analyzer and three scores were collected from each individual. This process was repeated one week later. The reliability coefficient for the response time task for the twenty-eight subjects was .97.

Procedure

Two sessions per week, for a total of ten weeks, were arranged for the data collection at a quiet and comfortable location. The room, approximately 12' x 12', was carpeted and spacious. During each of the twenty sessions the tester collected response time scores, and averaged them so that one value could be plotted on a graph for each session. The subject used his dominant (right) hand to perform the response task. The ambient conditions of the room were kept as constant as possible. The subject sat on a bench facing the Response Time Analyzer, with his right hand placed on the button closest to him, fingertips pointing forward. The tester was positioned on the other side of the apparatus, facing the subject. The subject focused on the red light in front of him and watched for it to illuminate. This light served as the visual stimulus, and it was activated by the tester turning the switch to the ON position. That switch activated a chromometer. The subject was instructed to depress the deactivating button, which was eleven inches further away from him, when he saw the red light illuminate. After the deactivating button was pressed, the chronometer, which measured response time in hundredths of a second, stopped.

The second half of the data collection period, five weeks in total, included the treatment variable, Progressive Relaxation exercises. The exercises were performed as directed by instructions recorded on a cassette tape. The subject was positioned lying down on the carpeted floor, with a pillow to provide greater comfort to his back. The Progressive Relaxation series involves the tensing and releasing of muscle groups of the body, coordinated with deep inhalations and exhalations. Muscles are tensed when the inhalation begins, and relaxed as the air is exhaled.

For this study, the body was divided into twelve muscle groups (see Table 1), with each group tensed and

TABLE 1

Progressive Muscle Relaxation*

Tense and relax each muscle group three times. Always recline while doing the series of exercises. Coordinate your breathing so that you inhale just before you tense and exhale completely each time you relax.

| MUSCLE GROUP | WHAT TO DO WITH THAT GROUP |
|---|---|
| 1. Feet | Point your feet away from your body. |
| 2. Calves | Tip the toes towards your face. |
| 3. Thighs | Squeeze the quadriceps so they bulge. |
| 4. Buttocks | Tighten the buttocks and squeeze together. |
| 5. Abdomen | Push the stomach region out as you inhale. |
| 6. Chest, shoulders and upper back | Throw the shoulders back, or forward as if to make them meet. |
| 7. Biceps | Draw the hands to the shoulders, as in "making a muscle." |
| 8. Forearms and hands | Make a fist and curl the wrist in. |
| 9. Lower cheeks, jaw and throat | Thrust the lower jaw forward. |
| 10. Upper cheeks and | Squint the eyes, wrinkle the nose and pull the eyebrows together. |
| 11. Forehead | Push the eyebrows up to the hairline and hold as high as you can. |
| 12. Back of the neck | Tip the head up and try to touch your chin to your chest. |

* Modified from the Progressive Muscle Relaxation program designed by Douglas W. Matheson, Department of Psychology, University of the Pacific, Stockton, California 95211.

released three times. The exercises were performed to the instructions of the tape, which also included soothing music and sounds and stimulating imagery. At the completion of the series of exercises, the subject remained on the floor for a period of time, and positioned himself at the testing device after a brief rest. Ten response scores were then collected. In addition to the two practice sessions with the tester, the subject practiced the relaxation series between sessions at home. The subject performed the Progressive Relaxation series a total of four times per week during the treatment phase of the experiment.

## Results

A mean score (x) and standard deviation ($\sigma$) were calculated for the ten baseline sessions and the subsequent ten treatment sessions (see Table 2). In order to test the significance of the treatment variable, Progressive Relaxation training, the baseline segment data and the treatment segment data of the experiment were subjected to regression analysis. This analysis permits the tester to predict the tendency of the data points if many more sessions took place. For this study, the Independent Variable (IV) was

TABLE 2

Raw Data

| | Session | Response Time (sec.) |
|---|---|---|
| | 1 | .4245 |
| | 2 | .4850 |
| Baseline | 3 | .4600 |
| sessions | 4 | .4660 |
| x = .4675 | 5 | .4790 |
| $\sigma$ = .026 | 6 | .4790 |
| | 7 | .4770 |
| | 8 | .5050 |
| | 9 | .4780 |
| | 10 | .4210 |
| | 11 | .4325 |
| | 12 | .4465 |
| Treatment | 13 | .4365 |
| sessions | 14 | .4180 |
| x = .4244 | 15 | .4265 |
| $\sigma$ = .026 | 16 | .4130 |
| | 17 | .3950 |
| | 18 | .4570 |
| | 19 | .3965 |
| | 20 | .3885 |

Progressive Relaxation exercises, which the experimenter controlled. The Dependent Variable (DV) was the response time and was the focus for the desired change. The regression line for the baseline sessions suggests that the tendency of the response time scores, without Progressive Relaxation treatment, would increase in value. Conversely the derived regression line from treatment session data predicted a decrease in response time, therefore, task performance improvement (see Tables 3 and 4).

## Conclusions and Discussions

As a result of the analysis of the data representing the subject's response time performance, it was concluded that perhaps the relaxation exercise treatment was effective in reducing the subject's response time over a ten week period. The practice factor was eliminated as a cause of the response time change, due to the regression analysis of the baseline phase of the study, which projectively indicated that the subject's response time would increase in value over a total of one hundred sessions. The reason for the projected increase cannot be determined, but the subject's predicted worsened performance might reflect

TABLE 3

Regression Analysis

| | Session | Response time without treatment | Response time with treatment |
|---|---|---|---|
| | 15 | .4783 | .4032 |
| | 20 | .4839 | .3891 |
| | 25 | .4895 | .3749 |
| | 30 | .4952 | .3601 |
| Projection | 35 | .5008 | .3466 |
| to 100 | 40 | .5065 | .3323 |
| Sessions | 45 | .5121 | .3183 |
| | 50 | .5178 | .3042 |
| | 70 | .5410 | .2476 |
| | 80 | .5518 | .2144 |
| | 90 | .5631 | .1911 |
| | 100 | .5744 | .1628 |

Regression equation
<u>for the baseline sessions</u>:

$Y = 46.133 + .1130303X$

$r = .1296$

$+/- \quad .02776$

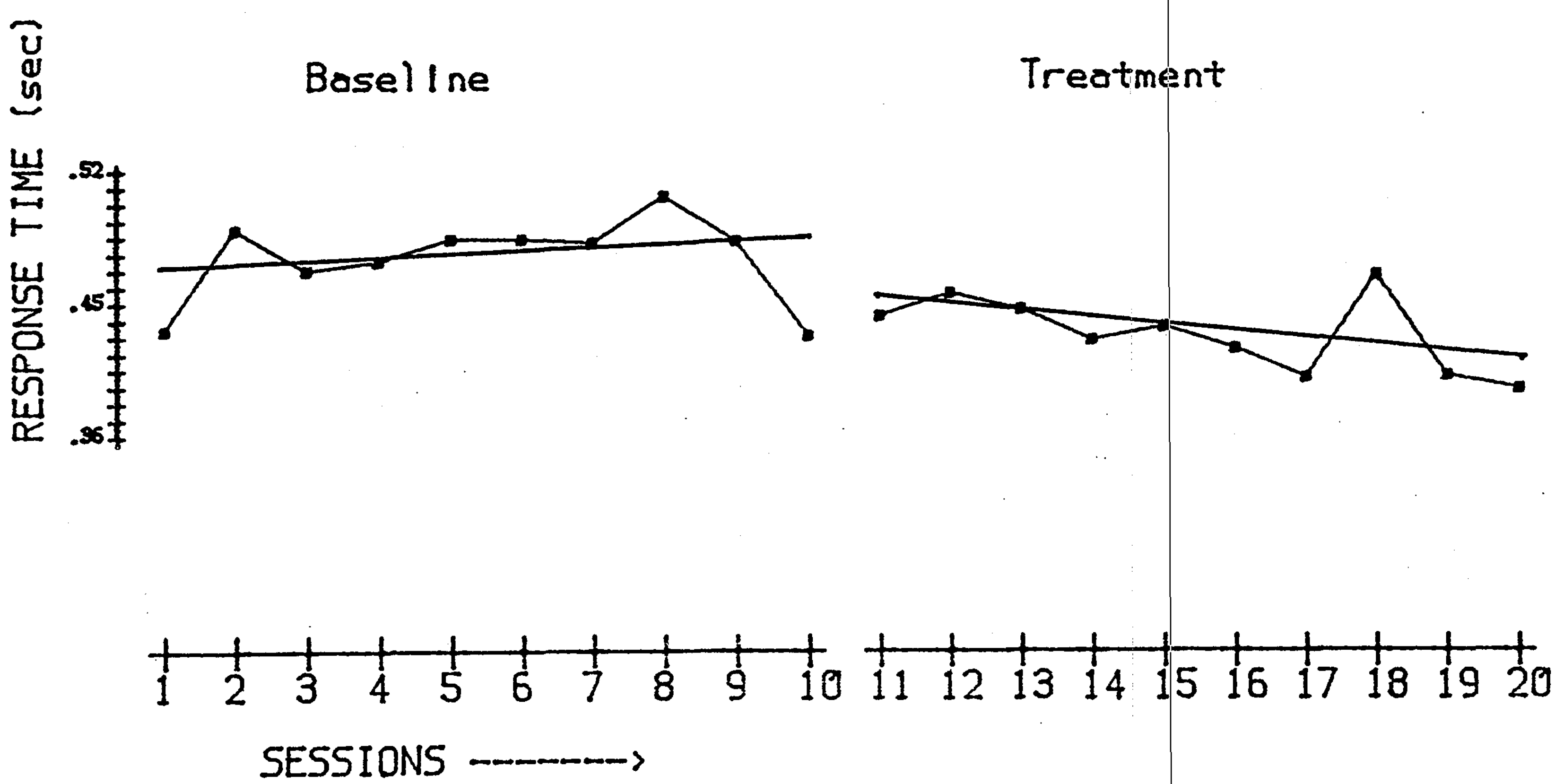
Regression equation
<u>for the treatment sessions</u>:

$Y = 44.564286 + -.28285714X$

$r = -.5469$

$+/- \quad .01885$

TABLE 4 PERFORMANCE by SESSION



his aging and Parkinsonian condition.

The change that was introduced in the treatment phase was the Independent Variable, Progressive Relaxation exercises. The subject performed the exercises four times per week, two in-session and two between sessions. At the time of the data collection, the subject was not engaged in other physical activity or exercise, and this exercise treatment was his main movement activity. In addition to improved (decreased) response time, it was observed that the subject's general mental and physical states improved. The tremor in the right arm ceased, his walking gait showed greater confidence, and mental alertness was visible to the researcher.

In a follow up examination with his physician, the subject reported improvement in his tremor and a benefit from his participation in this study. His medication did not change at the follow up examination. The patient has since established a regular pattern of exercise for himself and he continues to practice Progressive Relaxation to the cassette tape at home.

Further research is recommended in the area of relaxation therapy in the treatment of Parkinson's disease. The patient may reduce physical discomfort through the use of the muscles in their contraction, improve circulation to the brain and extremities by this action, and improve respiration through deep inhalations and exhalations, coordinated with the tensing and releasing of the muscles.

The conclusion drawn from this investigation was that Progressive Relaxation exercises were an effective tool in reducing the response time of a single Parkinsonian patient. The results suggest a need for further investigation in the area of relaxation therapy as a method of treating Parkinson's disease.

Appendix

## Subject Consent Form

PATIENT'S NAME________________________________________

RESEARCHER'S NAME_____________________________________

### DESCRIPTION OF THE RESEARCH

The program which is being proposed to you is investigating the possibility of exercise and relaxation training as methods of reducing muscular tension and rigidity, therefore helping the Parkinsonian patient perform comfortably, move confidently, and feel better about himself. The failure to use and exercise rigid muscles will eventually lead to greater resultant rigidity. Therefore, the value in participating in this program is the opportunity to move the muscles of the body and learn to live more comfortably.

As a means of testing the movement of the patient, a reaction time device will be used throughout the ten (10) week training program. Two meeting sessions per week will be arranged for the data collecting period, and will be held in a quiet, carpeted room. At the midpoint of the data collecting period, the treatment of progressive relaxation exercises will begin. The exercises will be performed to the instructions of a cassette tape, at the two weekly sessions, in addition to the response time testing. All data will be kept confidential and will be used towards helping understand his condition.

By signing below, I, ______________________________, agree to participate in this program, which is under the direction of the researcher named above. I understand the purpose of the study and the need for my participation.

| | |
|---|---|
| ____________________ | ________________________________ |
| Date | Signature |

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