RELAXATION EXERCISE WITH CEREBRAL PALSIED ADULTS SHOWING SPASTICITY

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A method for improving the muscle incoordination associated with cerebral palsy was empirically tested. Relaxation exercises, involving the successive tensing and relaxing of the major muscle groups of the body, were performed by four adults with spastic quadraplegia. All four subjects were sheltered workshop employees. Their IQs ranged from normal to mentally deficient. Testing consisted of two timed-trials of both the Placing Test and the Turning Test from the Minnesota Rate of Manipulation Tests. These tests measured the amount of time required to complete various manual manipulations involving pegs and pegboard. A multiple baseline across subjects design was employed to provide experimental control. All subjects showed significant improvement over baseline performance on the tests following the relaxation training. Limitations of this preliminary investigation and implications of these results for future research were noted.

DESCRIPTORS: cerebral palsy, manual manipulations, relaxation training, retarded adults

The diagnostic term *cerebral palsy* is used to label any functional incoordination, paralysis, or aberration of the motor system resulting from prenatal, perinatal, or postnatal damage to the motor strip of the brain (Marcs, 1974; Wolf, 1969). Although cerebral palsy may appear to follow a degenerative course because of increased deformity resulting from muscle disuse, muscle spasms, or contractures, the disorder is not progressive in nature. Once it has occurred, the damage to the brain is stationary, neither improving nor growing worse (Wolf, 1969).

Although there are many types of therapy and numerous systems of treatment, the basic principle of all intervention, irrespective of the method used, is the physical re-education of the body's motor apparatus in order to facilitate more adequate functioning. Stated another way

by Pohl (1950), "the first endeavor in treatment is to reduce excessive tension and involuntary activity of the muscle" (p. 27).

Muscular relaxation training in one form or another has been suggested as a means to control involuntary muscular activity. The techniques used have ranged from massage (Fischel, 1934), to resisted movement (Phelps, 1948), to "guided" or passive movement (Pohl, 1950). Unfortunately, nowhere in these reports have adequate outcome data been presented. Some writers (Paine, 1962; Tizard, 1961) have expressed doubt about the value of physical therapies such as those cited above, yet such treatments continue to be used extensively in centers and schools throughout this country.

The present study was a preliminary investigation of the effectiveness of progressive relaxation training (Jacobsen, 1938) on the treatment of cerebral palsied adults. The basic premise behind the use of this deep muscle relaxation training is that muscle hypertonicity is related to incoordination and spastic body movements. It is presumed that the frequency of spasms will decrease if tense muscles are relaxed, with both speed and coordination increasing.

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METHOD

Subjects

Four sheltered workshop employees, all diagnosed by a physician as having spastic cerebral palsy, ranged in age from 29 to 49 yr.

Subject 1 was a female with quadraplegia and mild mental retardation. Subject 2 was a male with contractures of the back and all four limbs. His intelligence and learning achievement scores were at or above normal levels. Subject 3 was a mildly retarded female with quadraplegia and contractures of the left arm and leg. Subject 4 was a female with physiological muteness due to cerebral palsy, as well as contractures of all four limbs. Intelligence test scores indicated that she was severely mentally retarded. Because of the extent of her disability, however, it was felt that intelligence testing had not accurately reflected her learning ability. She was able to follow instructions both in performing the relaxation exercises and completing the motor performance tests.

Setting

The subjects were employed at the Franklin-Williamson Sheltered Workshop and Activity Center. These employees performed industrial tasks, including assembly-line packaging, parts construction, and hardware sorting. All testing and training for this experiment took place outside the production areas in counselling offices. These rooms contained large chairs, which afforded the subjects ample support and comfort in quiet surroundings.

Apparatus

To measure motor performance two subtests from the Minnesota Rate of Manipulation Tests (MRMT) were used: The Placing Test, which measures "hand speed", and the Turning Test, which measures "finger speed" (The MRMT Examiner's Manual, 1969). The materials consisted of a board (83 by 22.7 by 2.7 cm) containing 60 holes (3.8 cm diameter, 1.3 cm depth) with 60 circular pegs (3.5 cm diameter,

2.3 cm height). Performance on these standardized tests was considered to be analogous to such industrial tasks as sorting, packaging, and assembly. The Placing and Turning Tests were scored, respectively, as the time required to place 60 pegs in the holes with the preferred hand and the time required to turn the pegs over using both hands. Performance was dependent on speed and coordination of finger, hand, and arm movements.

A cassette tape and recorder were used to administer the muscle relaxation exercises, providing consistent training instructions.

Procedure

Design. A multiple baseline across subjects was employed (Baer, Wolf, and Risley, 1968). All four subjects completed five sessions of MRMT testing during baseline. The subject showing the greatest intersession test-score stability (*i.e.*, the smallest variance for the five sessions) was then chosen as the first subject to begin relaxation training. Subsequently, following the next five MRMT testing sessions, the second subject was chosen, according to the above stability criterion, to begin relaxation training, and so on until all four subjects had undergone relaxation training. All subjects received standardized instructions for testing and training at each phase of the experiment.

Baseline. Every third working day, all four subjects were administered two timed trials each of the Placing and Turning tests. When five test days had elapsed, the first subject entered the relaxation condition while the remaining three subjects continued in baseline as described above. Numerical feedback, the time required to complete the task, was provided verbally to the subject after each test trial during all baseline, treatment, and followup MRMT testings.

Treatment. The subject completed a set of modified Progressive Relaxation exercises every working day. The method used was similar to that described by Wolpe and Lazarus (1966) and by Rimm and Masters (1974). It "involves the successive tensing and relaxing of voluntary

muscles in an orderly sequence until all of the main muscle groups of the body are relaxed" (Rimm and Masters, 1974, p. 46). As during baseline, the Placing and Turning Tests from the MRMT were administered every third working day. This was done immediately after the relaxation exercises had been completed at a nearby desk.

RESULTS

For purposes of presentation, each data point reflects the total time required for the two trials of each MRMT subtest (time 1 + time 2).

Figure 1 presents the results of the experiment. A comparison of the mean scores from baseline and treatment conditions indicates that an overall performance improvement of 24% was obtained following the treatment intervention. Another indicator of the effectiveness of the intervention is a "best score" comparison, contrasting an individual's best baseline performance with best treatment performance. This analysis shows an average performance improvement of 29%. None of the timed scores recorded during the treatment phase overlapped those of the baseline condition, further indicating the effectiveness of the intervention.

Within the treatment phase, three of the four subjects completed the Placing Test more rapidly than the Turning Test. Yet, all four subjects made greater improvements on the Turning Test, the more complex task. A mean improvement of 28% was achieved on the Turning Test, as compared with only 21% improvement for the Placing Test. The effects of treatment, however, cannot be described as simply delaying what might normally be the rapid performance deterioration of these cerebral palsied subjects. Retest scores, the second trial for each task, bettered first test scores by 2% (1% Placing Test, 3% Turning Test) during baseline and 1% during treatment (2% Placing Test, 1% Turning Test). This also indicates that the effect of treatment did not attenuate over the course of MRMT testing.

A followup was conducted three weeks after completion of the treatment phase. One session of MRMT testing was conducted after three days of relaxation training. Results showed that performance had deteriorated only slightly from the final treatment session, remaining superior to treatment mean scores in all cases.

A number of reliability measures were taken during this research, including interobserver reliability, intersession reliability, and test-retest reliability. The dependent variable of this experiment, the time elapsed from the observer's "GO" instruction to the subject's release of the final block after the required manipulations were completed, could be accurately and reliably recorded. Four individual interobserver reliability testing sessions, one with each subject, were conducted during the experiment. In all, reliability was above 0.99 on all of these trials. The baselines of Figure 1 show the intersession test-score reliability to be very high. This day-to-day comparison produced an overall reliability coefficient of 0.96:

$$\Sigma \frac{\text{low score}}{\text{high score}} / N.$$

The test-retest format of the experiment provided continuous within-day reliability measures. The overall average reliability coefficient for the Placing Test was (Pearson r) 0.96, with 0.95 reliability for the Turning Test.

DISCUSSION

The present results suggest that relaxation training can directly influence the muscle incoordination associated with spastic cerebral palsy. Following the daily relaxation routine, subjects were able to reduce the time required to complete the manipulation tests by 11 to 40%. In addition to improved manual coordination, a number of benefits, though not systematically monitored, appeared to result from relaxation training. The six exercises focusing on the mouth and tongue seemed to reduce the subjects' drooling problems. Immediately after completion of the entire exercise sequence, the posture and gait

Fig. 1. The time required to complete two trials of both the Placing Test and the Turning Test, from the Minnesota Rate of Manipulation Tests, during baseline, treatment, and followup phases of the research. Testing sessions, which measured the amount of time required to complete various manual manipulations involving pegs and pegboard, were conducted every third working day throughout the experiment. During the treatment condition, relaxation exercises were performed every working day. Subject 1 was absent throughout test period 26 due to illness. Subject 4 was vacationing during periods 5 and 6. Severe cold weather and heavy snows forced closure of both sheltered workshops' facilities for eight working days, so test period 30 was cancelled.

of the subjects also seemed improved. However, this effect was informally reported to attenuate as the subjects resumed normal activities.

In this preliminary study it must, however, be emphasized that the results indicate only that the intervention, not relaxation training *per se*, produced the measured improvement in performance. It is possible that simply sitting quietly or relaxing unaided for a similar period of time could have produced the same result. Likewise, the treatment may have served only to increase performance motivation. Carefully designed control-group studies or multiple-baseline designs that counterbalance, following baseline, components of the relaxation training (*e.g.*, sitting quietly) with relaxation training itself will be required to single out the specific effects of relaxation.

Another limitation of the present study concerns the measurement of performance improvement solely with standardized test analogs of real-life performance, *i.e.*, the MRMT. The ecological validity of the measures used, while reasonable, remains to be demonstrated. Future investigations should focus on measurement of both immediate and generalized effects in the natural environment. Further, the rate at which the effects of training may attenuate must also be ascertained, and research must be conducted to determine methods for reducing attenuation if it occurs. Lastly, the comparative therapeutic utility to be derived from various alternative methods of relaxation induction should be evaluated.

One asset of a training program in which relaxation is induced via techniques like progressive relaxation, rather than through massage or guided motion techniques, is that the exercise sequence can be performed without the assistance of a therapist. Once the subject has learned the method, (s)he can practice alone, using only the simple taped or written instructions for guidance if needed. The present subjects were informally observed performing various relaxation exercises, without prompting, during MRMT sessions and on the job, presumably when mus-

cle hypertonicity interfered with ongoing task performance. Continued use of the relaxation exercises, even after termination of the treatment phase, might have been a major facilitating factor for their level of followup performance.

In sum, the present results suggest that the overt spastic symptoms of cerebral palsy may be reduced via relaxation training. While a definitive demonstration of the specific effectiveness of relaxation in this application awaits a more carefully controlled investigation, empirically based strategies and behavior modification techniques should be increasingly emphasized and tested in the treatment of cerebral palsy. The research reported here is an initial indication of the feasibility of such an approach.

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