ABSTRACT

Physiologic data from human subjects was collected for six dependent variables. There were four recording periods: baseline, pre-feedback voluntary control, biofeedback training, and post-feedback voluntary control. Each experimental period was five minutes in duration and the physiologic data was printed at fifteen second intervals. SAS statements were used to transform the raw data and, then, SAS multivariate analysis of variance with repeated measures design was used to determine an optional data recording time interval to be used in future research on migraine headache pain.

INTRODUCTION

The present investigation was conducted prior to beginning an experimental treatment project for the behavioral control of migraine headache pain. The protocol for these treatment sessions was lengthy, and to insure maximal subject compliance it was necessary to make the sessions as brief as possible without risking data loss and/or distortion by using recording time intervals of insufficient length.

The present investigation utilized university students in a pilot study in which six physiologic measures were recorded during four discrete measurement periods. The primary objectives of the study were: 1) to determine whether the rather standard 5 minute measurement periods reported in much of the literature could be curtailed to 2 minute intervals to economize subject treatment time without diminishing the quality of the data collected and 2) to ascertain whether or not the physiologic measurement and recording equipment was properly programmed and functioning. Specifically, it was hypothesized that there would be no significant differences between the means of the 2 minute measurement intervals that were desirable to use compared to the means of the more standard 5 minute intervals. It was recognized that, as a result of subject, equipment, and environmental variables, initial data could be rather erratic, i.e., significant variations were likely to be detected in the data between minute recording periods, especially between the first and second minute. However, it was hypothesized that such variation would be insufficient to vitiate the major hypothesis.

METHOD

Coulbourn Instruments equipment was used to record six physiologic responses from ten subjects. The recorded responses were frontal facial muscle electrical activity, forearm muscle electrical activity, two sites of finger temperature, peripheral heart beat, and temporal artery vascular pulse. The subjects were students in general psychology courses who participated as partial fulfillment of course requirements. They were instructed to rest quietly in a darkened, shielded room (baseline period), to attempt to raise their finger temperature (pre-feedback voluntary control period), to attempt to raise their finger temperature by reducing the amplitude of a tone, the amplitude of which reflected changes in finger temperature (biofeedback training period), and to attempt again to raise finger temperature without feedback (post-feedback voluntary control period). Each experimental period was five minutes in length, and data from each of the six physiologic dependent variables were printed at 15 second intervals.

RESULTS AND DISCUSSION

The raw data, counts reflecting microvolt changes in each dependent measure, were entered into SAS and transformed by formulae to meaningful information for each measure, e.g., degrees centigrade for temperature. Requisite program statements then looped and manipulated the data so that the mean value for one minute of measurement for each dependent variable was established for the 15 second data printout intervals. This was done for each subject. Multivariate analysis of variance with repeated measures design was then used to test the significance of any differences that occurred when the mean of the first 2 minutes of each recording interval was compared to the total 5 minute recording period mean. This analysis was conducted for each recording period to test the hypothesis of no overall group effect for each period. The same procedure was then used to detect the differences between the mean of the first minute and the mean of the fifth minute for each experimental period.

The results of the multivariate analysis of variance (MANOVA) indicated that there were no significant differences (p > .05) between the mean of the first two minutes of recording and the mean for the entire 5 minute interval in each period for the six dependent physiologic variables (see Table 1). Thus, the major hypothesis that multiple period treatment intervals could be shortened without significant loss of data and/or data distortion was confirmed.

However, the expectation that subject, equipment, and environmental variables would produce erratic measurement effects, especially in the initial phases, was not supported. MAXOVA comparison of the first minute physiologic data to the fifth minute data revealed no significant mean differences for the six dependent variables in any of the measurement periods. (See Table 2)
Although the MANOVA results reported above were not significant and therefore ANOVA results would not usually be considered, the importance of insuring the reliability of the main finding for each measurement period and each physiologic variable was sufficient to indicate that ANOVA results should be considered. Such evaluation indicated that there was a significant difference between the mean temperature at site 2 (i.e., the fourth digit of the hand) for the measurement interval minutes one and two versus the mean for the entire 5 minutes of recording in the pre-feedback voluntary control period (p>.0458). In the same analysis there were no significant differences found for any of the other recording periods or the other physiologic variables. To further investigate this finding, a comparison of the mean of minute one data for each period of the mean for minute 5 data for each of the six physiologic variables was conducted. Again, temperature site 2 showed the only significant difference, and, again, only in the pre-feedback voluntary control condition (p>.0425).

Finally, results of the SAS analyses conducted and the data transformations performed provided reasonable results and confirmed that the Coulbourn Instruments equipment was programmed and working properly.

It can be concluded that the reduction of measurement periods in multiple period assessments of behavior treatments involving dependent physiologic variables from the rather standard 5 minute periods to two minute periods satisfactorily reduces total subject treatment time. It also possibly enhances maximal compliance with the treatment research protocol without significant loss of data and/or data distortion. The generally negative findings concerning erratic measurement, especially in initial portions of periods, was unexpected but provided further evidence for reliable measurement. These findings may be the result in part of the time period required to attach the physiologic transducers to the subject (about 15 minutes). During this time the subjects are acclimating to the lab and rapport with the experimenter is being established.

The two univariate findings of significant differences in initial measurement intervals to later intervals in the pre-feedback voluntary control period is ambiguous in meaning at this time. Most subjects report experiencing an increase in anxiety/tension during the initial phase of any required performance and often show temperature decrement at that time. This could account for the sequential decreases in temperature found across the five minutes that occurred in the pre-feedback voluntary control period (see Table 3).

That both temperature sets did not show the same effect might be explained by vascular anatomy. However, it is also possible the results were produced by the specific properties of the thermistors attached to each site, although no specific routine was followed in this regard.

Summary, this study indicates that under the conditions described, the experimenter/clinician involved with multiple time period experiments and treatments can possibly enhance subject compliance to treatment protocol by shortening measurement periods without significant loss of data and/or data distortion.

ACKNOWLEDGEMENT

This research was supported in part by the Marie Wilson Howells Memorial Fund for Research in Psychology.

For further information about this paper contact:

Clifford L. Hirsch
Psychology Department
University of Arkansas
Fayetteville, Arkansas 72701