

BRIEF REPORT

NICOTINE FADING, BEHAVIORAL CONTRACTING, AND EXTENDED TREATMENT: EFFECTS ON SMOKING CESSATION

THOMAS G. BOWERS, RICHARD A. WINETT, and LEE W. FREDERIKSEN

Virginia Polytechnic Institute and State University

Abstract — Twenty-eight subjects were randomly allocated to either a nicotine fading or a maintenance condition. The maintenance condition utilized behavioral contracting and extended treatment in addition to the nicotine fading to improve treatment outcome and avoid relapse. The maintenance condition achieved superior outcome on smoking measures at post-treatment and follow-up periods for self-reported smoking levels. Carbon monoxide levels were significantly lower for the maintenance condition at post-treatment, three month and six month follow-up. Saliva thiocyanate levels were significantly lower for the maintenance condition at the three month follow-up. Changes in health functioning indicated significantly lower diastolic and systolic blood pressure at six month follow-up for the maintenance condition. Additional research on nicotine regulation during nicotine fading and thiocyanate levels during experimental smoking would be useful. The use of behavioral contracting to enhance maintenance without therapeutic support warrants further research as well.

Reviews of smoking cessation programs have indicated that relapse nearly eliminates treatment effects (Leventhal & Cleary, 1980; Marlatt & Gordon, 1979). There has been relatively little research on contingent contracts for smoking cessation treatment maintenance, despite some positive findings for initial cessation rates (Elliott & Tighe, 1968; Paxton, 1980, 1981; Spring, Sipich, Trimble & Goekner, 1978; and Winett, 1973). The purpose of this study was to examine the use of contingent monetary contracts on maintenance and cessation in a nicotine-fading smoking program. Health functioning was also evaluated in the study.

Subjects were randomly assigned to either a maintenance or standard condition. The standard condition met once weekly for six weeks and maintenance condition met once weekly for eight weeks. Both treatment conditions utilized nicotine fading (Foxx, Brown & Katz, 1981) but varied contingent monetary contracts. For the maintenance condition, the deposit was returned each follow-up period for stopping smoking. The standard condition deposits were returned for completing treatment and assessments. The deposits were returned to both conditions according to the following schedule: post quit date 30%; one month follow-up 20%; two month follow-up 20%; three month follow-up 20%; six month follow-up 10%. The six month follow-up deposit was returned for completing the assessment, regardless of smoking status.

Physiological measures were assessed including resting heart rate (HR), blood

This research was aided by the use of Dr. William Herbert's Human Performance Laboratory and Dr. Young's Laboratory for the biochemical assay, both of Virginia Tech. Preparation of the manuscript was aided by the Coatesville Veterans Administration Medical Center's Research and Development Service. The assistance of Donna Chinn, Marcia Degnan, Nancy Miniszek, Ann Riley, and Debbie Weaver are gratefully acknowledged.

Requests for reprints can be sent to Thomas G. Bowers, Mental Health Services of the New River Valley, 409 Norwood Street, Radford, VA 24141.

pressure (BP), vital capacity (FEV_{.5}, FEV_{1.0}) and weight (KG). These measures were readministered at follow-up. The subjects were instructed to record cigarette and nicotine content on small cards. Carbon monoxide (CO) assessment was provided by the Ecolyzer (Frederiksen & Martin, 1979). The correlation between the reported smoking and COa% was $r = .82$. The saliva thiocyanate (SCN) analysis utilized the methods described by Densen, Davidow, Bass & Jones (1967). The SCN levels agreed with the reported smoking or nonsmoking status in 86 to 93% of the cases. The correlation between the SCN and self-reported smoking rates was $r = .51$. The test-retest correlation between the multiple readings of both the FEV_{1.0} and FEV_{.5} readings were $r = .90$. The correlations between the repeated blood pressures was $r = .92$ for the SBP and $r = .88$ for the DBP. The retest correlation for the HR readings was $r = .69$.

For cigarettes smoked per day, there was a significant group \times follow-up period interaction ($F(5,125) = 2.40, p < .05$). Both the maintenance ($F(5,125) = 31.38, p < .01$) and the standard treatment condition ($F(5,125) = 16.82, p < .01$) significantly reduced the number of cigarettes smoked per day over the follow-up periods. There were no reliable differences between the standard and maintenance conditions on the number of cigarettes smoked per day at pretreatment. The maintenance condition reported smoking significantly fewer cigarettes per day at post quit date ($F(1,150) = 7.65, p < .01, M = .15$ to 1.21 cigarettes/day), the one month follow-up period ($F(1,150) = 4.74, p < .05, M = .62$ versus 8.50), the two month assessment ($F(1,150) = 7.16, p < .01, M = 1.01$ versus 10.68), the three month assessment ($F(1,150) = 8.83, p < .01, M = 4.00$ versus 15.96) and the six month assessment ($F(1,150) = 6.19, p < .05, M = 7.98$ versus 17.90).

Both the maintenance ($F(5,125) = 15.90, p < .01$) and the standard ($F(5,125) = 7.09, p < .01$) conditions reduced COa% levels significantly over the follow-up periods. The maintenance condition was significantly lower on COa% at post-cessation follow-up ($F(1,150) = 6.93, p < .01, M = .55$ versus 3.24 COa%). The COa% for the one month and two month follow-up periods were not reliably lower for the maintenance condition ($F(1,150) = 3.89, p < .10, M = 1.10$ versus 3.18, and $F(1,150) = 3.31, p < .10, M = 1.26$ versus 3.10, respectively). The three month COa% levels were reliably lower for the maintenance condition, ($F(1,150) = 4.54, p < .05, M = 1.26$ versus 3.68), as were the six month COa% ($F(1,150) = 4.78, p < .05, M = 2.04$ versus 4.33). The maintenance condition had significantly lower SCN levels when compared to the standard condition at the three month follow-up ($F(1,150) = 4.39, p < .05, M = 93.08$ versus 129.16 $\mu\text{g/ml}$). The treatment conditions were not significantly different at any of the other assessment periods.

A MANOVA considered SBP, DBP, HR, KG, FEV_{1.0}, and FEV_{.5} across the six assessment periods. Across all health measures there was a significant effect for improvement over periods ($F(30,482) = 2.11, p < .01$). There was also a trend for a significant interaction between groups \times periods ($F(30,482) = 1.39, p = .08$). There was multivariate significance for reduction in SBP ($F(5,21) = 2.77, p < .05$), HR reduction ($F(5,21) = 2.15, p < .05$) and KG increases ($F(5,21) = 5.92, p < .01$). Both FEV_{1.0} and FEV_{.5} levels changed reliably over the periods ($F(5,21) = 2.98, p < .05$ and $F(5,21) = 2.69, p < .05$, respectively). There was also a trend toward significance in the group \times periods interaction for the HR levels ($F(5,21) = 2.30, p = .08$). Subjects in the maintenance condition recorded significantly lower SBP and DBP measures at the six month follow-up period than subjects in the standard condition

($F(1,150) = 3.96, p < .05, M = 112.8$ versus 121.1 mm Hg and $F(1,150) = 4.54, p < .05, M = 67.7$ versus 75.1 mm Hg respectively).

The maintenance condition smoked significantly fewer cigarettes than the standard condition over each assessment period. This was substantiated by the COa% levels at post assessment, three month follow-up, and six month follow-up and the SCN levels at the three month follow-up. These findings were consistent with other research indicating behavioral contracting procedures positively influence outcome (Elliot & Tighe, 1968; Paxton, 1980, 1981; and Winett, 1973). Relapse was delayed in the maintenance condition and not as marked as in the standard condition.

The COa measure correlated more strongly with the average number of cigarettes smoked per day than did the SCN results. COa and SCN levels accurately distinguished smoking from nonsmoking subjects. The moderate correlation of the SCN with reported smoking levels may reflect either limitations of the SCN analysis or demand qualities of the study influencing the reported levels of smoking. The correlation of SCN concentrations with cigarette smoking, combined with the large relative variability of the SCN values, implies that the SCN concentrations were sensitive to the presence or absence of smoking, but not responsive to variations in levels of smoking. Further research on smoking under experimentally controlled conditions while monitoring plasma SCN levels is needed.

Insurance companies and health maintenance organizations already have practices which resemble behavioral contracting procedures for smoking cessation, such as reduced fees or rebates. Monetary incentives may not work without therapeutic support, but experimental trials are needed to yield data on the influence of incentives without therapeutic support. A premise of nicotine fading (that cigarette smoking is an addiction) has led to the use of brand fading procedures. Benowitz, Hall, Herning, Jacob, and Osman (1983) have presented evidence which suggested that the fading procedures utilized in nicotine fading programs may not be as effective as thought, because of compensation for low nicotine levels. Benowitz et al. (1983) demonstrated that low tar and nicotine level smokers have blood cotinine (a metabolic byproduct of nicotine) concentrations similar to the blood cotinine levels of smokers of high tar and nicotine content cigarettes. Monitoring blood cotinine or nicotine during nicotine fading appears to be the optimal method to evaluate nicotine regulation under fading conditions (McMorrow & Foxx, 1983).

REFERENCES

- Benowitz, N., Hall, S., Herning, R., Jacob, P., & Osman, A. (1983). Smokers of low-yield cigarettes do not consume less nicotine. *New England Journal of Medicine*, *309*, 129-142.
- Densen, P., Davidow, B., Bass, H., & Jones, E. (1967). A chemical test for smoking exposure. *Archives of Environmental Health*, *14*, 865-874.
- Elliott, R., & Tighe, T. (1968). Breaking the cigarette habit: Effects of a technique involving threatened loss of money. *Psychological Record*, *18*, 503-513.
- Foxx, R., Brown, R., & Katz, I. (1981). Nicotine fading and self-monitoring for cigarette abstinence or controlled smoking. *Behavior Research & Therapy*, *21*, 17-27.
- Frederiksen, L., & Martin, J. (1979). Carbon monoxide and smoking behavior. *Addictive Behaviors*, *4*, 21-30.
- Leventhal, H., & Cleary, P. (1980). The smoking problem: A review of the research and theory in behavioral risk modification. *Psychological Bulletin*, *88*, 370-405.
- McMorrow, M., & Foxx, R. (1983). Nicotine's role in smoking: An analysis of nicotine regulation. *Psychological Bulletin*, *93*, 302-327.
- Marlatt, G., & Gordon, J. (1979). Determinants of relapse: Implications for the maintenance of behavior change. In P. Davidson & S. Davidson (Eds.), *Behavioral medicine: Changing health lifestyles* (pp. 410-452). New York: Brunner/Mazel.

- Paxton, R. (1980). The effects of a deposit contract as a component in a behavioral program for stopping smoking. *Behavior Research & Therapy*, **18**, 45-50.
- Paxton, R. (1981). Deposit contracts with smokers: Varying frequency and amount of repayments. *Behavior Research & Therapy*, **19**, 117-123.
- Spring, F., Sipich, J., Trimble, R., & Goeckner, J. (1978). Effects of contingency and noncontingency contracts in the context of a self-control oriented smoking modification program. *Behavior Therapy*, **9**, 967-968.
- Winett, R. (1973). Parameters of deposit contracts in the modification of smoking. *Psychological Record*, **23**, 49-60.