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# A randomized, controlled trial of NRT-aided gradual vs. abrupt cessation in smokers actively trying to quit

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ABSTRACT

Most smoking cessation programs advise abrupt rather than gradual cessation. We conducted a randomized, controlled trial of gradual cessation ($n = 297$) vs. abrupt cessation ($n = 299$) vs. minimal treatment ($n = 150$) among smokers who wanted to quit now and preferred to quit gradually. Participants were recruited via newspaper and radio advertisements. The gradual and abrupt conditions received five phone calls (total = 90 min) and the minimal treatment condition received two calls (25 min total). The gradual condition received nicotine lozenge (via mail) to reduce smoking prior to their quit date. After the quit day, all participants received lozenge. The primary outcome was prolonged abstinence from 2 weeks post-quit day through 6 months. Prior to the quit day, the gradual condition decreased cigarettes/day by 54%, whereas the other two conditions decreased by 1% and 5%. Prolonged abstinence rates (CO < 10 ppm) did not differ among gradual, abrupt and minimal treatment conditions (4%, 7% and 5%), nor did 7-day point prevalence rates (7%, 11% and 11%). Fewer smokers in the gradual condition (48%) made a quit attempt than in the abrupt (64%) or minimal (60%) conditions ($p < .001$). In the gradual condition, every week delay to the quit date increased the probability of lapsing by 19% ($p < .001$). We conclude that among smokers who want to stop gradually in the near future, gradual cessation with nicotine pre-treatment does not produce higher quit rates than abrupt cessation. One liability of gradual reduction may be that it allows smokers to delay their quit date.



## 1. Introduction

Often alcohol and illegal drug abusers decide to quit when an urgent drug-related problem occurs and, thus, they are urged to stop abruptly as soon as possible (Kleber et al., 2006). In contrast, urgent problems are often not occurring when cigarette smokers decide to quit (Larabie, 2005). As a result, many wish to stop via "gradual cessation"; i.e., reducing the number of cigarettes/day (CPD) over several days or weeks prior to quitting. In recent surveys, 48–83% of those planning to quit wanted to quit gradually (Hughes et al., 2007; Shiffman et al., 2006), 39–51% had reduced in the last year (Meyer et al., 2003; Shiffman et al., 2006), and 43–57% of these reducers were trying to quit (Meyer et al., 2003; West et al., 2001). The most common rationales for gradual cessation are: (a) reduction is an intermediary step toward quitting (Skinner, 1969), (b) reduction increases self-efficacy (Bandura, 1977), (c) reduction breaks up conditioned responses to smoke (Bouton and Swartzentruber, 1991), and (d) reduction decreases nicotine dependence (Hughes and Carpenter, 2006).

Current guidelines, meta-analyses and reviews either explicitly recommend abrupt rather than gradual cessation or do not mention gradual cessation as a potential treatment (Fiore et al., 2008; West et al., 2000; Silagy et al., 2004; Law and Tang, 1995; Stead et al., 2008). However, the evidence for whether gradual cessation is as effective as abrupt cessation is unclear. In case–control studies, smokers who quit gradually have lower abstinence rates than those who quit abruptly; however, this may be because those who chose gradual cessation are more dependent and have failed more in the past (Peters et al., 2007; Hughes, 2007; Cheong et al., 2007).

Nine randomized, control trials (RCTs) have compared gradual vs. abrupt cessation in smokers actively trying to quit (Table 1). Although most (7/9) of these showed numerically superior abstinence rates for gradual cessation, most had small sample sizes such that only one showed statistically significant results (Cinciripini et al., 1994). The nine studies used a variety of designs and methods. Two studies examined combined instructed gradual reduction and nicotine replacement therapy (NRT) pre-treatment and compared this to abrupt cessation; i.e., a design similar to that of the current study. The first study using an internet-based treatment and nicotine gum showed no advantage for gradual over abrupt (Etter et al., 2009). The second used transdermal nicotine and reported

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**Table 1**
Prior randomized, controlled trials of gradual cessation or nicotine pre-treatment.

| Study | N/gradual condition | Psycho-social Tx | Pre-cessation medication | Percent reduction active/control | Placebo control | Percent quit active/control | OR[a] (95% CI) gradual > abrupt |
|---|---|---|---|---|---|---|---|
| Etter et al. (2009) | ~157 | Internet | Gum × 4 weeks | Not stated | No | 21/20 | 1.1 (0.6–1.9) |
| Rezaishiraz et al. (2007) | 47–51 | In person | Patch × 2 weeks + denic cigarettes | Not stated | No | 28/21 | 1.4 (0.6–3.6) |
| Cinciripini et al. (1994) | 17 | In person | None | −75/−26 | No | 41/6 | 11.2 (1.2–105.1) |
| Cinciripini et al. (1995) | 63–65 | In person | None | −76/−47 | No | 31/27 | 1.2 (0.6–2.6) |
| Cummings et al. (1988) | 252–257 | Written | None | Not stated | No | 9/6 | 1.6 (1.0–2.5) |
| Flaxman (1978) | 16 | In person | None | −23/−13 | No | 38/56 | 0.8 (0.3–2.2) |
| Gunther et al. (1992) | 55 | In person | None | Not stated | No | 25/22 | 0.9 (0.3–2.2) |
| Rose et al. (1998) | ~40 | In person | Patch × 4 weeks ± mecamylamine | 57/13 | Yes | 30/15 | 2.4 (0.8–7.3) |
| Schuurmans et al. (2004) | 100 | In person | Patch × 2 weeks | −3/−3 | Yes | 22/12 | 2.1 (1.0–4.5) |

CI = confidence interval; denic = denicotinized; OR = odds ratio; Tx = treatment.
[a] OR > 1.0 if quit rate with gradual > quit rate with abrupt; OR < 1.0 if gradual < abrupt.

an advantage for gradual, but this study was confounded by the use of a denicotinized cigarette in the gradual cessation condition (Rezaishiraz et al., 2007). Five RCTs compared gradual and abrupt cessation among smokers actively trying to quit but did not use NRT to aid in reduction and reported widely varying results (Cinciripini et al., 1994, 1995; Cummings et al., 1988; Flaxman, 1978; Gunther et al., 1992). Two RCTs examined "pre-treatment" with NRT prior to the quit date and did not instruct smokers to reduce but reported some smokers spontaneously reduced prior to their quit date (Rose et al., 1998; Becker et al., 2008; Schuurmans et al., 2004). In one of these, smokers who reduced more prior to the quit date were more likely to achieve abstinence than smokers who did not (Rose et al., 1998; Becker et al., 2008).

In contrast to the above studies, a separate literature has examined smoking reduction among smokers who do not plan to quit in the near future. These studies consistently found reduction increases the probability of making a quit attempt later and of subsequent abstinence (Hughes and Carpenter, 2006).

Although many of these studies suggest gradual cessation is at least as efficacious as abrupt cessation, the above trials had one or more methodological or reporting problems; e.g., small sample sizes, no matching on treatment contact time, confounding by including other interventions, no verification of reduction in the gradual condition and non-reduction in the abrupt condition prior to the quit date, or no biochemical verification of abstinence. Given this, we believed a large, stringent RCT test of gradual cessation vs. abrupt cessation was indicated. We hypothesized that gradual cessation would produce higher quit rates than abrupt cessation if (a) participants were smokers who wanted to quit gradually and (b) NRT was used to aid pre-treatment reduction.

## 2. Methods

### 2.1. Design

We recruited only smokers who preferred to quit gradually for three reasons. First, we thought that this would be the group most likely to benefit from gradual cessation. Second, in recent studies, over half of smokers who wished to quit, planned to do so gradually (Peters et al., 2007; Shiffman et al., 2006). Third, our anecdotal observation is that many treatment programs encourage smokers who wish to quit gradually to quit abruptly, and we wondered if abrupt cessation might actually be less efficacious in this group of smokers.

Smokers who wished to stop gradually were randomly assigned in a 2:2:1 ratio to a gradual cessation intervention, an abrupt cessation intervention, or a minimal treatment control condition. We included a minimal treatment condition, so that if both the outcomes of gradual and abrupt conditions were equivalent, we could know if both were effective (i.e., both had quit rates greater than the minimal treatment) or both were ineffective (both had quit rates similar to minimal treatment). All counseling was delivered via phone. The gradual cessation condition used nicotine lozenge to aid in reduction prior to their quit day. The major outcome was prolonged abstinence between 2 weeks and 6 months post-quit day.

The study methods and gradual intervention were designed to represent an intervention that might be used in clinical settings or a telephone quit-lines. Most gradual cessation interventions in clinical settings and in the RCTs in Table 1 differ from abrupt cessation interventions on several aspects other than gradual vs. abrupt cessation. For example, because the gradual treatment is usually a more extended treatment, the time between the start of treatment and the quit date is often longer than in the abrupt treatment, and the gradual treatment can have more sessions prior to the quit date and involve more treatment time. In the current study, we equated abrupt and gradual treatments on total treatment time because we believed this was the variable most likely to confound outcomes if it varied between treatments. We considered making the time between treatment entry and the quit date the same in abrupt vs. gradual treatments, but this would require the abrupt group to wait for several weeks, and we thought this was not externally valid and might unfairly disadvantage the abrupt treatment; thus, we allowed the abrupt condition to quit sooner after study entry than the gradual condition. We had those in the gradual condition use NRT for several weeks prior to the quit date to aid in reduction. We considered having the abrupt group also use NRT prior to the quit date but not reduce, but did not do so because this is currently not approved nor standard use of NRT. The resultant design, although equating for number of sessions and treatment time across abrupt and gradual groups, allowed abrupt and gradual groups to have different distributions of pre-cessation vs. post-cessation sessions; i.e., the gradual condition had four calls pre-cessation and one post-cessation call whereas the abrupt had two pre- and three post-cessation (the minimal had one pre- and one post-cessation call). As a result of these decisions, our study is *not* a test of reducing cigarettes/day per se, but rather is a comparison of gradual cessation and abrupt cessation treatments likely to be used in a clinical or quit-line setting.

### 2.2. Recruitment

To obtain a substantial number of minority smokers, we recruited in Columbia, SC, Albuquerque, NM and Florence, SC with newspaper and radio ads that stated "Want to quit smoking gradually? Receive free nicotine lozenges and confidential telephone support without leaving your home." Major inclusion criteria were: (a) ≥18-year-old daily smoker of ≥15 cigarettes/day, (b) want to quit smoking in the next 30 days and prefer to quit gradually rather than abruptly, (c) no change in cigarettes/day by ±20% or more in the last month, (d) willing to use nicotine lozenge, and (e) no FDA caution for use of lozenge requiring physician contact. We included only those who smoked ≥15 cigarettes/day because we believed that those who smoked less would be less likely to undertake a reduction program. We included those who wished to quit in the next 30 days because this indicates a serious intention to quit (DiClemente et al., 2004). About half of those screened were eligible, and about 75% of those eligible consented (Fig. 1). The study was approved by the University of Vermont Committees on Human Research.

### 2.3. Participants

Compared to population-based samples of US smokers (Giovino, 2002; Etter and Perneger, 2001; Fagerstrom and Furgerg, 2008; Hughes, 2004), our smokers were more likely to be women (54% vs. 48%), were older (48 vs. 39 years old), were as likely to be African American (10% vs. 12%) but were somewhat more likely to be Hispanic (13% vs. 8%), and were more likely to have completed high school (91% vs. 79%). The mean cigarettes/day upon entry was greater (23 vs. 15), the prevalence of use of light or ultra-light cigarettes was lower (58% vs. 87%), and the mean Fagerstrom Test for Nicotine Dependence (FTND) score was higher than the national sample (5.9 vs. 4.3–4.6). The above differences are likely due to our inclusion criteria and the fact that smokers who seek treatment are heavier and more dependent smokers (Haviland et al., 2003).

Marital status and confidence in quitting via gradual reduction statistically differed across experimental conditions (Table 2). When we entered these as covariates