EVALUATION OF A DENTAL OFFICE TOBACCO CESSATION PROGRAM: EFFECTS ON SMOKELESS TOBACCO USE[1,2]

Judy A. Andrews, Ph.D., Herbert H. Severson, Ph.D., Edward Lichtenstein, Ph.D., Judith S. Gordon, Ph.D., and Maureen F. Barckley, M.S.
Oregon Research Institute

ABSTRACT

We describe a randomized trial designed to evaluate the effectiveness of a smokeless tobacco cessation intervention delivered by dental hygienists as part of a patient's regularly scheduled cleaning visit. Seventy-five practices were randomized to continue their usual care (n = 25; 239 smokeless tobacco using patients enrolled) or to receive training to provide a tobacco cessation intervention (n = 50; 394 smokeless tobacco using patients enrolled). Patient reports indicated that the training program was successful in getting hygienists to implement the intervention. The intervention produced a strong effect on sustained quitting for smokeless tobacco users but had no impact on secondary outcomes, including unsuccessful quit attempts, future intent to quit using smokeless tobacco, and change in readiness to quit using. Frequency of smokeless tobacco use and receipt of specific components of the intervention, including the video and written materials, predicted sustained cessation. Since this intervention was delivered by dental hygienists as part of a patient's regularly scheduled cleaning visit, it is easily disseminable.

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INTRODUCTION

Strong scientific evidence has linked the use of smokeless tobacco (SLT) with cancer of the oral cavity, particularly where the tobacco is kept (1,2). The use of smokeless tobacco has also been related to an increased risk of cancer of the esophagus, larynx, and stomach (3). A recent study reported that 73% of daily smokeless tobacco users had noncancerous and precancerous oral lesions when examined by a dentist or hygienist (4). Despite the known health hazards of smokeless tobacco use, few smokeless tobacco cessation programs have been developed and evaluated (5–8).

This article describes a randomized trial designed to evaluate a population-based or public health intervention targeting smokeless tobacco users, as well as smokers, conducted in fee-for-service dental practices. Within the context of the hygiene visit, the hygienist gave the patient brief advice and materials regarding tobacco cessation. As reviewed elsewhere (9), the intervention was not effective in producing cessation for smokers, but produced a significant effect on cessation for smokeless tobacco users. The purpose of this article is to present the intervention outcomes for smokeless tobacco users and to explore individual and process variables associated with outcomes.

It has been estimated that over 50% of tobacco users see a dentist at least once in a given year (10). This office visit represents a clinical opportunity in which a patient may be more receptive to hearing cessation advice, particularly if their presenting health concerns can be related to their use of tobacco (11). Hygienists are trained to provide educational and preventive services to patients. Given the oral health effects associated with smokeless tobacco use, the oral hygiene visit provides a "teachable moment" during which the hygienist can relate oral health problems to tobacco use and in this context provide brief counseling to dental patients who use tobacco (8,12).

In a previous randomized trial study conducted in managed care dental clinics, hygienists provided cessation advice, brief counseling, and materials to patients who reported SLT use. The intervention resulted in significantly more cessation of smokeless tobacco use compared to patients receiving usual care (18.4% versus 12.5%) (8). However, this study's results were limited in their generalizability since dental health maintenance organizations (HMOs) serve only a small percentage of dental patients in the United States. The current study was designed to test a brief office-based intervention with all tobacco users in fee-for-service dental offices. This report focuses on the results of the smokeless tobacco intervention.

METHODS

Design

Seventy-five dental practices were blocked and then randomized to Usual Care (25 practices), Minimal intervention (26 practices), or Extended intervention conditions (24 practices). For smokeless tobacco, we used a two-arm design, usual care and intervention, necessitated by the relatively small number of expected smokeless users. The intervention for smokeless use was identical in both the Minimal and Extended conditions. Practices were blocked on the average number of hygiene visits per week (range = 5 to 85) and years the dentist had been in practice (range = 1 through 35) to ensure that these factors did not bias the results. Hygiene patients in these practices were the subjects and patients were the unit of analysis.

Dental Office Recruitment and Training

Dental offices in Western Oregon, from Medford to Portland, received a letter, followed by a brief phone call, inviting them to schedule—usually at the practice site—an informal presentation describing the study. This procedure was supplemented by presentations at local dental and dental hygiene societies and study groups. Dental health care workers from 90 practices attended the

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Reprint Address: J. A. Andrews, Ph.D., Oregon Research Institute, 1715 Franklin Boulevard, Eugene, OR 97403-1983.

descriptive presentations and 69 (77%) of these practices participated in the study. Six additional practices were recruited through other means. Participating hygienists averaged 35 years of age, 10 years in practice, and reported an average of 30 patients per week for an average 60-minute visit.

After randomization, we conducted 3-hour workshops for staff in practices assigned to the intervention conditions. The workshops provided didactic and interactive training for identifying and counseling dental patients to quit using tobacco. Hygienists and dentists in usual care practices received no training and were expected to treat tobacco using hygiene patients in their usual manner.

Workshop participants from the intervention practices were instructed to follow a specific protocol for smokeless tobacco using patients. This protocol consisted of seven components: (a) Determine tobacco use status from the patient's chart and enrollment survey; (b) Identify and measure any stains, recession, lesions, halitosis, and pocket depths related to the patient's tobacco use. Specific training was provided in the identification of Degree 1–3 leukoplakic lesions (13), as well as the need to measure and palpate all lesions discovered during the oral exam. Participating hygienists were also instructed to document all findings from the oral exam in the patients' charts; (c) Give direct advice to quit, relating this advice to oral health; (d) Give the patient a packet of written materials, including pamphlets on health problems due to tobacco use and how to stop using tobacco, and a quit kit comprised of a cup filled with items to help the cessation process (e.g. sugarless candy and gum, flavored toothpicks, rubber bands); (e) Ask the patient to set a quit date within 2 weeks of the visit; (f) Give the patient a motivational video, *In Good Taste;* and (g) Call the patient within 2 weeks after the visit to ask if the patient read the materials, looked at the video, and either quit or is now willing to set a quit date. In the typical hygiene visit, the dentist briefly sees the patient toward the end of the visit. Dentists were asked to briefly reinforce the advice given to the patient by the hygienist.

During the workshops, hygienists received education in brief tobacco cessation counseling techniques. These techniques included: (a) Methods of determining SLT using patients' readiness to quit (e.g. using the Stages of Change Model); (b) Ways of engaging patients in discussion about their use of SLT (e.g. asking questions such as "Have you ever experienced any problems due to your use of chew or snuff"); (c) Procedures for giving appropriate, direct advice to quit (e.g. using statements such as "As your hygienist, I want to tell you that the single best thing you could do for your oral and overall health is to stop using tobacco now."); (d) Types of questions used to help patients set a date to quit (e.g. using staging questions, including "Are you considering quitting in the next 6 months?"); (e) Procedures for giving written materials and videos to patients (e.g. using statements such as "Here are some materials on SLT use and oral health. I think you will find them interesting and helpful."); and (f) Methods for talking with patients following their visit (e.g. making a follow-up phone call, sending a letter, discussing tobacco use at recall visits, etc.).

Enrollment

Study enrollment occurred over an average 38-week period per practice. At their hygiene visit, 34,897 patients, 15 years and older, completed a health survey prior to their oral exam and cleaning. Based on information provided by 59 of the 75 practices (16 practices did not provide data), 81% of eligible patients completed the survey; 6% refused to complete the survey; and 13% were mistakenly not given the survey by front office personnel. If the patient answered "Yes" on the questionnaire to either "Do you currently smoke cigarettes" or "Do you currently use chew or snuff," they were enrolled in the study. This classification resulted in 4,029 smokers, 633 smokeless users, and 99 participants who both smoked and used SLT. Of the 633 smokeless users, 239 were in usual care practices and 394 were in intervention practices. Among males, the prevalence of cigarette use, smokeless tobacco use, and the combination of both cigarette and smokeless tobacco use in this sample was 11.2%, 4.3%, and .7%, respectively. The prevalence for cigarette use among females was 11.8%. Only one female used smokeless tobacco and no females used both. The focus of the current paper is on the hygiene patient who used only smokeless tobacco. Smokeless tobacco using patients were an average of 36.2 years old (SD = 12.9). Most smokeless tobacco users were male (99.8%), Caucasian (94.2%), married (69.3%), and had more than a high school education (61.2%). A substantial proportion of smokeless tobacco users reported bleeding gums (17.7%) and receding gums (26.4), with fewer reporting mouth sores (4.0%). Smokeless users used chew or snuff an average of 6.0 (SD = 1.7) days a week and a tin of chewing tobacco or snuff lasted smokeless users an average of 4.5 (SD = 2.2) days.

Follow-Up Assessments of Patients

Follow-up data were obtained at 3 and 12 months postenrollment. Questionnaires were mailed to all participants with an enclosed $2 bill as an incentive for returning forms. Respondents were eligible for a $100 monthly lottery. Subjects not returning questionnaires were mailed a second questionnaire 2 weeks after the first mailing; those not responding to the second mailing were then telephoned and the questionnaire was administered over the phone. Of the 633 smokeless tobacco using hygiene patients enrolled in the study, 469 (74.1%) completed both the 3- and 12-month questionnaire. Of these 469 smokeless tobacco using patients, 177 were in usual care practices and 292 were in intervention practices. The proportions of smokers (76.1%), smokeless users (74.1%), and users of both tobacco products (66.7%) who completed both assessments were similar. Of the 164 smokeless tobacco users who completed only one assessment, 41 refused to answer the survey and 123 could not be located for one or both assessments. Smokeless tobacco using patients who completed both assessments were more likely to be married than single (76.4% versus 68.8%); Chi square (1, N = 633) = 4.09, $p < .05$. However, there were no differences between smokeless tobacco users who completed both follow-up assessments and those who did not in intervention condition, age, race/ethnicity, education, socioeconomic status, amount of tobacco chewed per day, number of serious oral health problems, and whether they drank coffee or alcohol.

Measures

Outcome Measures: Hygiene patients who were smokeless users at enrollment were considered abstainers if they reported that they had quit all tobacco use and that they "had not used chew/snuff at all, not even one dip or chew," and "had not smoked at all, not even a puff" during the last 7 days. The primary outcome, sustained abstinence, was defined as self-reported abstinence at both the 3- and 12-month assessments. For those who continued to use smokeless tobacco at 12 months, secondary outcomes, measured at the 12-month assessment, included change from baseline in readiness to quit using smokeless tobacco, report of at least one quit attempt in the last 12 months, and thinking of quitting in the

next 30 days. Readiness to quit using was measured using a contemplation ladder (14), an 11-item scale ranging from no thought of quitting (score = 0) to taking action to quit smoking or chewing (score = 10).

Baseline Measures: Variables measured at enrollment included frequency of brushing and flossing; number of serious oral health problems (bleeding gums, receding gums, mouth sores) typically associated with smokeless tobacco use; number of cups of coffee drunk per day; number of alcoholic drinks over the past 7 days; receiving advice from a dentist, doctor, or hygienist; number of previous quit attempts; and thinking of quitting in the next 30 days. Oral health problems were not directly assessed and were measured using the self-report of the patient only. The baseline assessment also included measures of tobacco dependence including the number of days per week smokeless tobacco is used, number of days a can/pouch lasts, average time to first use of chew or snuff each day, extent of swallowing tobacco juice, and years of smokeless tobacco use.

Provider Protocol Adherence

In the 3-month follow-up assessment, patients reported if the hygienist, dental assistant, or dentist talked to them about their tobacco-related oral health problems; if they were encouraged to set a date to quit tobacco use; or if they received tips to help them quit tobacco use during their hygiene visit 3 months ago. Patients also reported whether they received written materials about their tobacco use, a videotape, or a phone call from their dental office, or if they read the materials or watched the video.

RESULTS

Comparison of Patients in Usual Care and Intervention Conditions

Smokeless users in the intervention conditions were more likely to have been previously advised by a dental care provider to quit their use of chewing tobacco, 54.5% versus 42.4%; X^2 (1, N = 469) = 6.0, $p < .05$, and were less likely to be single, 25.3% versus 33.7%; X^2 (1, N = 464) = 3.4, $p = .064$, than those in the usual care condition. Both variables are likely to affect outcomes in the hypothesized direction and therefore were included as covariates in all outcome analyses. Among smokeless users, there were no differences across the two conditions on age, gender, race/ethnicity, socioeconomic status, extent of brushing or flossing, number of total oral health problems at enrollment, or number of alcoholic drinks per day.

Intervention Outcomes

We used data from only 65 of the 75 practices to assess the effect of the intervention on sustained cessation. The remaining 10 practices had either no smokeless users at enrollment ($n = 4$) or only one smokeless user at enrollment ($n = 6$) resulting in no variance within the practice. Data from 62 practices were used to evaluate secondary outcomes as three additional practices had fewer than two smokeless users that did not quit using smokeless tobacco.

We used Generalized Estimating Equations (GEE) (15,16) to evaluate the effect of the intervention on the dichotomous outcomes, sustained cessation, at least one quit attempt during the last 12 months, and intent to quit chewing in the next 30 days. GEE allows for correlated observations within practices (i.e. the intraclass correlation within practices) and for the specification of the underlying distribution, including the binomial distribution. The intrapractice dependence, as measured by the intraclass correlation, was essentially zero across outcomes (all less than .0009) and the practice effect was nonsignificant. The general analytic strategy of GEE is to view the analysis as a regression model with correlated residuals. The correlations of observations within practices, or the intraclass correlation, is viewed as a nuisance parameter. We used a mixed model analysis of covariance, with practices nested within intervention condition, to evaluate the effect of the intervention on readiness to quit using smokeless tobacco at the 12-month assessment, controlling for baseline readiness. For all outcome analyses, we included the covariates, marital status, and previous cessation advice received from a dental care provider.

For the primary outcome, sustained abstinence, we used the conservative approach of treating smokeless users at enrollment who did not return both questionnaires as smokeless tobacco users at follow-up. Using this conservative "intent to treat" model and GEE, with patients nested within practices, the intervention effect was significant (Beta = 1.15; $t = 2.58, p < .01$). Collapsing across practices, the sustained quit rate for usual care was 3.3% ($n = 8/239$) compared to 10.2% ($n = 40/394$) for the intervention, X^2 (1, N = 633) = 9.83, $p < .01$.

Secondary outcomes, attempting to quit in the past 12 months, thinking about quitting in the next 30 days, and changes in readiness to quit smoking were measured at the 12-month assessment. Only those who completed the 12-month follow-up assessment and did not attain sustained abstinence were included in these analyses. GEE analysis suggested that the intervention had no effect either on making a quit attempt between enrollment and the 12-month assessment (Usual Care: 32.7%; Intervention: 37.5%; ns) or thinking of quitting in the next 30 days (Usual Care: 23.4%; Intervention: 24.1%; ns). In addition, the results of a mixed model analysis of variance, with patients nested within practices, suggested that the intervention was not effective in producing change in readiness to quit using smokeless tobacco (Adjusted Means: Usual Care, 4.87; Intervention, 5.32; ns).

Prediction of Outcomes from Demographic and Baseline Variables

We predicted sustained abstinence for smokeless users at enrollment and, for smokeless users who did not quit, postenrollment quit attempts, intent to quit using smokeless, and change in readiness to quit, from several demographic and baseline variables. To evaluate possible differential effects of the intervention on the prediction of these outcomes, the significance of the interaction of intervention condition with each variable was assessed. First, to control for demographic variables (i.e. marital status, age, education, and race/ethnicity), these variables were retained in the models. Second, interactions of demographic variables with the intervention condition were entered using forward regression and retained if significant ($p < .05$). Third, the significance of the interaction of intervention with each baseline variable—frequency of brushing and flossing; the number of serious self-reported oral health problems; number of alcoholic drinks; receiving advice from a dentist, doctor, or hygienist; number of previous quit attempts; interest in quitting; and several measures of smokeless tobacco dependence—was assessed in separate regressions. All interactions with demographic and baseline variables were nonsignificant. Fourth, baseline variables were entered into the model using forward regression.

In the model predicting sustained abstinence (abstainers [$n = 48$] versus continued users [$n = 585$]), after controlling for

TABLE 1
Patient Report of Receipt of Intervention Components

	Condition	
	Usual Care %	Intervention %
Identified tobacco-related oral health problems	54.8	77.4**
Received tips on quitting	14.1	64.7**
Encouraged to set a quit date	8.5	42.8**
Received a video	0.0	77.1**
Received written materials	10.7	84.6**
Received phone call from hygienist	1.1	42.5**
Watched video	0.0	40.1
Read materials	7.9	67.8**

** $p < .01$.

demographic variables, extent of smokeless tobacco use at baseline, measured by the number of days per week that smokeless tobacco was used, Beta = .28; Odds Ratio = .76 (reciprocal: 1.32); 95% CI = 1.10, 1.57, $p < .01$, was the only significant predictor in addition to the intervention. All demographic variables were nonsignificant. In contrast to our expectations, number of days a tin/pouch lasts was not a significant predictor. Although this variable was a significant univariate predictor (Odds Ratio = 1.24, 95% CI: 1.07, 1.45, $p < .01$), it was correlated with number of days used ($r = -.47$) and was eliminated from the final model.

Prediction of Outcomes from Intervention Components

Table 1 shows the proportion of patients in each condition who report receiving each intervention component. Across intervention components, patients in the intervention practices were markedly more likely to receive the intervention than patients in usual care practices. With the exception of giving patients information relating their oral health problems to tobacco use, the delivery of advice and materials regarding smokeless cessation by hygienists in usual care offices was practically null. In contrast, receipt of information relating oral health problems to tobacco use, tips, written materials, and a video were reported by over half of the patients in the intervention condition. Moreover, 46.2% of the patients in intervention practices reported that they received all four of these components. Among patients in the intervention practices, approximately 40% reported receiving encouragement to set a quit date and a follow-up phone call, and only 18.5% reported receiving all six intervention components.

We used logistic regression to predict each outcome from the patients' reports of receipt of the components of the intervention and their reports of having read the materials and watched the video—all assessed by means of the 3-month follow-up survey. The unique variance in the outcome variable explained by each intervention component (receipt of dental provider's advice regarding their tobacco-related oral health problems, receipt of cessation tips, receipt of written materials, if they read the materials, report of dental provider's encouragement to set a quit date, receipt of a video, receipt of a follow-up phone call from the hygienist, and patient's report that they watched the video) is shown in Table 2. Forward regression was used to identify the intervention component which explained the most variance in outcome.

As Table 2 shows, receipt of a video and written materials and watching the video predicted sustained abstinence (abstainers [$n = 48$] versus continued use [$n = 585$]). The most effective intervention component was receipt of the video. With receipt of the video in the regression equation, none of the other components

TABLE 2
Significant Univariate Predictors of Outcomes

Intervention Components	Outcome		
	Sustained Abstinence	Quit Attempt	Thinking of Quitting
	Odds Ratio	Odds Ratio	Odds Ratio
Identified tobacco-related oral health problems	1.12 (.59, 2.11)[1]	1.13 (.73, 1.75)	1.13 (.70, 1.83)
Received tips on quitting	1.01 (.55, 1.84)	1.78** (1.18, 2.67)	1.57* (1.01, 2.44)
Encouraged to set a quit date	1.47 (.79, 2.74)	1.75* (1.12, 2.74)	1.43 (.89, 2.29)
Received a video	2.62** (1.38, 4.97)	2.21*** (1.46, 3.34)	1.50 (.96, 2.32)
Received written materials	2.82** (1.40, 5.67)	2.02*** (1.33, 3.05)	1.96** (1.25, 3.09)
Received phone call from hygienist	1.73 (.93, 3.24)	2.10** (1.32, 3.35)	1.55 (.96, 2.51)
Watched video	2.16* (1.16, 4.02)	1.71* (1.05, 2.77)	1.29 (.77, 2.14)
Read materials	1.80† (.98, 3.30)	1.96** (1.30, 2.96)	2.22*** (1.42, 3.47)

[1] 95% Confidence Interval.
† $p < .10$.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

predicted cessation, suggesting considerable multicollinearity among the predictors, receipt of intervention components. Number of intervention components received (maximum = 6) predicted sustained abstinence (Odds Ratio: 1.61, 95% CI 1.004, 1.35, $p < .05$) with those receiving more intervention components more likely to quit using smokeless tobacco.

With the exception of receipt of feedback regarding the patient's tobacco-related oral health problems, all of the intervention components predicted quit attempts. Again, receipt of the video was the most effective component. With receipt of the video in the equation, none of the other components predicted the quit attempts. Receipt of tips on quitting, receipt of written materials, and reading those materials predicted thinking of quitting in the next 30 days. Reading the materials was the most significant component, and other components did not enter the regression following reading the materials. Both quit attempts and thinking of quitting were positively related to the reported number of intervention components received (Quit attempts: Odds Ratio, 1.21, 95% CI 1.09, 1.33, $p < .001$; Thinking of quitting: Odds Ratio, 1.14, 95% CI 1.03, 1.27, $p < .05$). The intervention components did not predict change in readiness to quit using smokeless tobacco.

DISCUSSION

An intervention delivered by dental hygienists as part of a patient's regularly scheduled cleaning visit produced a strong effect on sustained quitting for SLT users. A key element to the success of the intervention was the adherence to the protocol by providers. Even in a busy dental practice, approximately one-half of enrolled patients in intervention practices received most of the components of the intervention. Thus, the training was successful in encouraging hygienists to implement the intervention protocol. Secondary analyses on those who did not quit using smokeless tobacco, indicated that the intervention had no significant effects on secondary outcomes. Although a limited number of predictors

were examined, the results suggested that the intervention with SLT users was equally effective across a range of demographic, tobacco dependence, and general health measures. Extent of smokeless use at baseline and receipt of the intervention components, particularly the video and written materials, were related to outcomes.

The tripling of quit rates for the SLT intervention, relative to usual care, essentially replicates an earlier finding in a managed care dental setting. However, differences in the managed care setting between usual care (12.5%) and intervention (18.5%) were much smaller than that of the present study (8). We suspect that the smaller difference between intervention and usual care in the managed care study was due to contamination, whereby hygienists were sensitized to be more active with usual care patients. In the managed care study, patients were randomized within clinics so that a single hygienist worked with both usual care and intervention patients. The replication across two intervention studies conducted in two different dental settings, together with the fact that in both studies hygienists implemented the intervention in the course of routine dental visits, suggests that an effective, feasible, and potentially disseminable intervention protocol has been developed. Further research to investigate the disseminability of this smokeless tobacco cessation intervention is needed.

Identification of Variables Related to Outcomes

The finding that the effectiveness of the intervention on SLT cessation did not vary over a wide range of variables suggests that all smokeless users benefited equally from the intervention. Supporting results from other smokeless cessation studies (6,17), an examination of the predictors of cessation suggested that in addition to the intervention effect, lighter users in both the usual care and the intervention practices were more likely to quit. In contrast to the findings of Hatsukami (5), age was not a significant predictor of cessation.

Analysis of patients' reports of receipt of intervention components measured at the 3-month follow-up suggests which specific intervention components are related to outcome. Although findings are based on analysis of cross-sectional data and therefore must be interpreted cautiously, they are nevertheless suggestive of the most effective intervention components. For smokeless tobacco users, receipt of a video and written materials to watch and read at home predicted sustained abstinence, with the video the most effective component. This finding reinforced the importance of a video in tobacco cessation interventions (18). Watching the video and reading the materials were also related to cessation, but less than half of those who received the materials used them. If all smokeless tobacco using patients were given the materials, along with advice to quit, and watched or read the materials, this quit rate could more than double. The follow-up phone call, if implemented, could be used to encourage patients to watch the video and read the materials, if they had not already done so.

In addition to the video and written materials, tips, encouragement to set a quit date, and a follow-up phone call predicted secondary outcomes. Receiving information relating oral health findings to tobacco use was not related to either cessation or secondary outcomes. The substantial proportion in usual care that reported receiving information relating oral health findings to tobacco use suggests that smokeless tobacco using patients in practices interested in tobacco cessation typically receive this information. However, only 10% to 15% of patients in usual care received advice and written materials. The lack of available smokeless tobacco cessation materials may deter hygienists from providing direct cessation advice to their patients. This study shows that giving something tangible to patients which reinforces the hygienist's message that smokeless tobacco use has harmful oral effects is useful in providing patients with the means to follow through with their quit attempt. Taken together, these process analyses suggest that dental office based tobacco cessation programs should be conducted in the context of the hygiene visit and should include all the components of the intervention, but at a minimum the patient should receive and be encouraged to use both written materials and a video. Implementation of these intervention components would be fairly easy and cost-effective for dental health care workers and could increase by two to six times the number of SLT users quitting smokeless tobacco.

Strengths and Limitations

The strengths of this study include the assessment of and intervention with a large number of tobacco using dental hygiene patients, the consistent implementation of the protocol, and the inclusion of two follow-up assessments with modest attrition from baseline to the 12-month follow-up. To our knowledge, it is the first randomized clinical trial conducted in private practice dental offices with smokeless tobacco users. In terms of the implications for public health, a primary strength of this intervention is that it was implemented by hygienists with their tobacco using patients within the context of the hygiene visit in a real world setting and could easily be disseminated.

Some limitations of this study require mention. Dental practices that were recruited to participate had expressed interest in providing tobacco cessation activities to their patients. Patients in these practices may have been more likely to receive cessation advice in the past and thus may not be representative of tobacco using hygiene patients in general. Results are based on self-reported quitting with no biochemical verification. We randomized dental practices, but patients were the unit of analysis. However, intraclass correlations were very low. The brevity of the baseline assessment was necessary to minimize disruption of patient flow and avoid negative reactions from dental patients, but it limited the number of potential predictor variables. Finally, cost considerations prevented the direct assessment of oral health problems through an oral health examination or examination of patients' records.

Conclusion

In summary, our training program was successful in getting hygienists to implement the intervention protocol and our dental office based tobacco cessation program was successful in getting smokeless tobacco users to quit. Process analyses suggest that the intervention was equally effective in producing cessation for smokeless tobacco users, irrespective of demographic or use patterns. In addition to the intervention, frequency of SLT use predicted sustained cessation for smokeless tobacco users. Receipt of a video and written materials were the most effective intervention components for producing cessation. This intervention is unique in that few cessation materials are available for smokeless tobacco users and dental professionals are an underutilized resource for providing cessation advice in the context of health care. The provision of brief advice and materials to smokeless tobacco users during the hygiene visit could impact up to 50% of all SLT users with 10% to 20% of them quitting smokeless tobacco. If implemented by dental practices nationwide, this could result in over 500,000 smokeless tobacco users quitting snuff or chew every year.

REFERENCES

(1) U.S. Department of Health and Human Services: *The Health Consequences of Using Smokeless Tobacco. A Report to the Advisory Committee to the Surgeon General,* NIH Publication No. 86-2874. Bethesda, MD: Public Health Service, 1986.

(2) Winn DM, Blot WJ, Shy CM, et al: Snuff dipping and oral cancer among women in the southern United States. *New England Journal of Medicine.* 1981, *304:*745–749.

(3) Mattson ME, Winn DM: Smokeless tobacco: Association with increased cancer risk. *National Cancer Institute Monograph.* 1989, *8:*13–16.

(4) Little SJ, Stevens V, LaChance P, et al: Smokeless tobacco habits and oral mucosal lesions in dental patients. *Public Health Dentistry.* 1992, *52*(5):269–276.

(5) Hatsukami D, Jensen J, Allen S, Grillo M, Bliss R: Effects of behavioral and pharmacological treatment on smokeless tobacco users. *Journal of Consulting and Clinical Psychology.* 1996, *64:*153–161.

(6) Williams NJ, Arheart KL, Klesges R: A smokeless tobacco cessation program for postsecondary students. *Health Values.* 1995, *19*(3): 33–42.

(7) Boyle RG, Stilwell J, Vidlak LM, Hŭneke MA: "Ready to quit chew?" Smokeless tobacco cessation in rural Nebraska. *Addictive Behaviors.* 1999, *24*(2):293–297.

(8) Stevens VJ, Severson HH, Lichtenstein E, Little SJ, Leben J: Making the most of a teachable moment: A smokeless tobacco cessation intervention in the dental office. *American Journal of Public Health.* 1995, *85:*231–235.

(9) Severson HH, Andrews JA, Lichtenstein E, Gordon JS, Barckley MF: Using the hygiene visit to deliver a tobacco cessation program: Results of a randomized clinical trial. *Journal of the American Dental Association.* 1998, *129*(7):993–999.

(10) Tomar SL, Husten CG, Manley MW: Do dentists and physicians advise tobacco users to quit? *Journal of the American Dental Association.* 1996, *127:*259–265.

(11) Lichtenstein E, Hollis JF, Severson HH, et al: Tobacco cessation interventions in health care settings: Rationale, model, outcomes. *Addictive Behaviors.* 1996, *21*(6):709–720.

(12) Little SJ, Stevens VJ, Severson HH, Lichtenstein E: An effective smokeless tobacco intervention for dental hygiene patients. *Journal of Dental Hygiene.* 1992, *66*(4):185–190.

(13) Greer RO, Poulson TC: Oral tissue alterations associated with the use of smokeless tobacco by teenagers. *Oral Surgery.* 1983, *56:*275–284.

(14) Biener L, Abrams DB: The contemplation ladder: Validation of a measure of readiness to consider smoking cessation. *Health Psychology.* 1978, *10:*360–365.

(15) Hill HA, Schoenbach VJ, Kleinbaum DG, et al: A longitudinal analysis of predictors of quitting smoking among participants in a self-help intervention trial. *Addictive Behaviors.* 1994, *19:*159–173.

(16) Zeger SL, Liang KY: The analysis of discrete and continuous longitudinal data. *Biometrics.* 1986, *42:*121–130.

(17) Eakin E, Severson HH, Glasgow RE: Development and evaluation of a smokeless tobacco cessation program: A pilot study. *National Cancer Institute Monograph.* 1989, *8:*95–100.

(18) Eakin EG, Lichtenstein E, Severson HH, et al: Use of tailored videos in primary care smoking cessation interventions. *Health Education Research.* 1999, *13:*519–527.