The Feasibility and Efficacy of Tobacco Use Prevention in Orthodontics

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Abstract: SMILES PLUS was the first study to extend the clinician-delivered logic model to prevention of tobacco use among adolescents. This multi-site trial with 154 participating offices, based on social learning theory and a behavioral ecological model, was designed to test whether orthodontists can prevent preteens from initiating smoking. The study found that orthodontists do not automatically adhere to anti-tobacco prevention services. Social learning variables can enhance both adherence to counseling guidelines and content of counseling to increase prevention effects. Providing financial incentives, tracking prescriptions, prompting positive feedback from patients, and adopting anti-tobacco counseling models in the office are likely to enhance anti-tobacco preventive services. Training orthodontists to be comfortable when advising nonsmoking youth not to start and to use social consequences to justify youth avoidance of tobacco might increase adherence to protocols and make their counseling more powerful. Adolescent smokers prior to intervention were more likely to start other risky behaviors later. Preventing tobacco use may halt additional risk behaviors and thereby reduce morbidity/mortality even more than expected from tobacco control alone. New and refined clinical trials should be conducted to determine the most effective interventions for adolescent tobacco control by clinicians.

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Key words: tobacco, adolescents, prevention, clinician, intervention, counseling

Tobacco represents an incredible burden in terms of disability and death, which will exceed that of any other disease worldwide. Evidence also suggests that increasing initiation rates among adolescents offsets gains from tobacco cessation.

Adolescent Tobacco Use

Surveys of high school students have shown an increase in smoking prevalence of 7.3 percent to 38.4 percent. The 1996 Monitoring the Future Survey showed an increase in cigarette smoking by eighth and tenth graders, and the Centers for Disease Control (CDC) reported that 12.8 percent of middle-school students used tobacco. As a consequence, CDC estimated that 5 million children will die prematurely as a result of tobacco use.

Adolescents underestimate tobacco risks and overestimate their ability to stop, at the same time that most have experimented with cigarettes. About 80 percent of adult smokers smoked by the time they reached the age of eighteen, and over 50 percent were regular smokers by 18 years. Survey results indicate an increase in smoking incidence beginning at age eleven and peaking at age eighteen. However, if adolescent tobacco use is prevented, it is unlikely to be initiated in adulthood.

Nationally, tobacco use is responsible for 87 percent of all lung cancers and is associated with 20 percent of all deaths, yet social policies fail to reflect these realities. Increases in adolescent smoking have been related to peer norms, to price cuts, and to promotional efforts aimed at youth. The CDC suggests that the continued high rate of adolescent initiation yields 1.5 million new tobacco users per year. Escobedo et al. concluded that “efforts to prevent smoking initiation have been less effective than . . . cessation” and that more emphasis should be directed toward prevention, a conclusion shared by others.

Most tobacco control studies of adolescent tobacco use have been school- or community-based and have been founded on learning theories. These programs use modeling imitation and media to increase resistance to social pressures to use tobacco. Larger trials have achieved prevention rates from about 4.0 percent to 10 percent. However, the effectiveness of school-based programs remains questionable. A survey of 234 schools showed that 47 percent had no smoking pre-
vention programs; while the remainder listed programs, none were operating.\textsuperscript{24} (Our study, by contract, reduced the incidence of tobacco use by adding research based counseling.\textsuperscript{25}) In order to reduce adolescent tobacco use to 16 percent (the Healthy People 2010 goal),\textsuperscript{3} more than public school programs are needed.

**Clinician-Initiated Studies**

Russell et al. showed that clinicians produced a cessation rate 4.8 percent higher than controls in which a clinician was not involved.\textsuperscript{26} A review of 231 clinical trials rated clinician interventions as among the most effective cessation strategies, with a median quit rate of 6 percent.\textsuperscript{27} A meta-analysis of thirty-nine controlled cessation trials reported an average cessation rate of 5.8 percent; subsequent analyses showed that the number of clinician contacts, length of intervention, multiple interveners, multiple modalities, and face-to-face advice were all associated with decreased tobacco use.\textsuperscript{28} Cohen et al. showed that dentist- and staff-delivered advice\textsuperscript{29} resulted in a 7.7 percent quit rate.\textsuperscript{30}

Glynn and colleagues estimate that there are 50 million smokers in the United States and that each averages 4.3 physician visits annually but fewer than half report ever being counseled to quit.\textsuperscript{31-33} Glynn et al.\textsuperscript{31} also estimated that 2 million smokers would quit per year if 30 percent of U.S. clinicians offered tobacco counseling.\textsuperscript{34} This success rate could yield an average of twenty-one additional years to life expectancy\textsuperscript{35} and save the lives of one out of every four quitters.\textsuperscript{36} Cummings et al. estimated costs savings from $705 to $2,058 per year of increased life expectancy and concluded that tobacco control is more cost-effective than treatment of mild hypertension or hypercholesterolemia.\textsuperscript{37} These results have led the National Cancer Institute (NCI) to conclude that physicians and dentists should provide tobacco control services.\textsuperscript{38}

The NCI has supported trials involving over 30,000 patients from which the efficacy, effectiveness, and cost-effectiveness of clinician cessation services have been demonstrated.\textsuperscript{31-33} From these studies the NCI has published protocols for clinician-delivered cessation services.\textsuperscript{27,39-43} These studies and the COMMIT program\textsuperscript{44} were precursors to the larger American Stop Smoking Intervention Study (ASSIST).\textsuperscript{38} The ASSIST program was designed to reduce tobacco use in seventeen states by community interventions and policy changes.\textsuperscript{45} By 1996, cigarette consumption of ASSIST states was 7 percent less than non ASSIST states. The CDC’s IMPACT Program funded an additional thirty-two states, and the Robert Wood Johnson Foundation’s Smokeless State Program funded thirty state coalitions directed to youth.\textsuperscript{46} The COMMIT program resulted in a 3 percent increase in quit rates in light to moderate smokers, but did not emphasize use of clinicians or prevention services.\textsuperscript{44} Several authors suggest methods by which clinicians might prevent initiation of tobacco use among youth.\textsuperscript{27,39,46} However, previous to SMILES PLUS, none had been empirically evaluated.\textsuperscript{47}

**SMILES PLUS**

SMILES PLUS was the first study to extend the clinician-delivery model to prevention of tobacco use among adolescents.\textsuperscript{48} A multi-site trial based on social learning theory\textsuperscript{49} and our Behavioral Ecological Model,\textsuperscript{50} it consisted of a randomized trial of 154 orthodontists, seventy-seven of whom were asked to prevent pre-teens’ smoking initiation. Results from SMILES analyses inform prevention services and assist the development of new efficacy trials of tobacco control programs by clinicians.

**Design**

Orthodontists were selected because they see preteen youth frequently and thereby provide a powerful test of preventive services. One orthodontist per office (n = 154) was recruited and randomly assigned to usual care or counseling. Over 15,000 eleven- to eighteen-year-old youth were selected and interviewed prior to intervention and two years later.

Orthodontists were identified with the assistance of the American Association of Orthodontists, the California State Society of Orthodontics, and the yellow pages. Co-investigators (dentists and orthodontists), contacted practitioners and explained the study. A signed consent to participate was completed by participants.

A sample of youth from each office was selected, the family was sent a letter explaining the study, and youth were telephoned. Those who became part of the study agreed to answer a short tobacco use questionnaire as a baseline and at a two-year follow-up. Baseline interviews were completed by 16,915 youth.
About 54 percent of the youth in the study were female, the mean age was fourteen years, and most (65 percent) of the parents were college graduates. About 72 percent were white, 13 percent Hispanic, 9 percent Asian, and 2.8 percent African-American. About 6 percent of the sample reported cigarette use in the last thirty days and 20 percent had ever used tobacco. These tobacco use rates were lower (e.g., 6 percent v 9.3 percent or 15.7 percent, respectively) than for California and the United States. 51

The relationship between demographic and social factors for tobacco use was similar to that from other samples. Orthodontic patients were more likely to use tobacco if they had used alcohol (odds ratio [OR]; +7.88), lived with a smoker (OR = 1.7), and had friends who thought smoking was “cool” (OR = 1.6). These findings suggest that orthodontic patients are representative of the etiological processes responsible for tobacco initiation, even if not for prevalence.51

Implementation

Orthodontists and staff were provided with NCI-recommended training that included establishment of a smoke-free office, tobacco control counseling, and support from the research staff. Details, which have been published elsewhere,49,52 followed national guidelines.32

Staff and doctors provided preteens with pre-printed written “prescriptions,” indicating reasons (e.g., avoid peer criticism) not to start smoking. Doctors were paid $.50 for each of four prescriptions per year delivered with counseling not to smoke. One copy was given to patients, one was kept in the chart, and one was given to investigators.

We assessed the office environment by comparing experimental and control offices among the first forty involved in the trial.52 Direct observation of waiting rooms and interviews to assess the tobacco-free status showed highly significant and dramatic increases in anti-tobacco material in experimental office environments. For instance, 100 percent of experimental offices added printed materials to their waiting rooms, while none of the controls did. However, although there were differences, such as the use of anti-tobacco posters (30 percent in the experimental group and 0 percent in controls), room for improvement remained. Subsequent analyses considered the types and sources of preferred posters (e.g., those from the American Heart Association); and as a result, significantly more patients from the experimental group then recalled seeing anti-tobacco print materials.53 These findings suggest that office environments may help to influence adolescents’ tobacco use.

Program Efficacy

The tobacco use incidence in the control group was 12.6 percent and 12.0 percent in the experimental group. The difference was in the hypothesized direction, but was not significant.

Clinicians’ adherence to protocol and dose effects

The average number of prescriptions actually delivered to preteens was 64.4 percent of the target of eight prescriptions over two years. Youth who obtained four or more prescriptions were significantly (p < 0.05) less likely to start smoking than youth who obtained fewer than two prescriptions.49 These results suggest that, had all patients received the full counseling of eight prescriptions, a significant experimental effect might have been achieved.

Determinants of clinicians’ preventive services

Two adherence studies were also conducted. In the first study,54 staff members were interviewed midway through the intervention, enabling us to explore retrospective and prospective associations with prescription delivery. About 20 percent of the variance in prescribing practices was explained significantly. Results suggested that clinicians and their staff were most likely to deliver prescriptions if prescriptions were tracked, patients provided feedback, and models were available.

In the second study, orthodontists were interviewed.55 Clinicians in the counseling group delivered significantly more prescriptions than did the controls, confirming training effects. However, only 25.4 percent (versus 3.2 percent among controls) reported offering anti-tobacco counseling. These results show that most orthodontists were not delivering the planned intervention. Anecdotal observations suggested that they were uncomfortable talking to youth for whom there was no evidence of “misbehavior.” This suggests that orthodontists need more training to become comfortable counseling youth not to start smoking.
Predictors of prevention counseling that reached significance included being in the experimental group, assessing the history of tobacco use of their patients, the belief that all youth should be counseled, and philosophical agreement with prevention services. While 40 percent of clinicians in the experimental group explained the social consequences of tobacco use (e.g., your clothes smell), only 17 percent of those in the control group did so. This is in contrast to the similarity found between control and experimental groups (83 percent and 85 percent) in explaining health consequences. These results showed that most orthodontists were not providing the requisite preventive services and did not offer the most powerful prevention advice.

Determinants of Initiation

In addition to our baseline exploratory analyses, we computed the relationship between a number of social learning variables and tobacco use. We showed that older youth, Caucasians, and males were more likely to initiate tobacco use in two years than younger individuals, other ethnic groups, or females. We also found that youth who drank alcohol (OR = 1.86), lived with a smoker (OR = 1.33), were offered a cigarette (OR = 2.87), and had friends who did not avoid smokers (OR = 1.75) were most likely to start smoking. A number of health protective behaviors were associated with non-initiation, including flossing (OR = 1.25), getting eight hours of sleep (OR = 1.32), and wearing a seat belt (OR = 1.37).

A second analysis replicated most of the associations found in the earlier analysis. However, new associations included three interactions: age by gender, age by offered cigarettes, and experimental group by “friends think smoking is cool” (Figure 1). In the first instance, the pattern of tobacco initiation is essentially the same for girls and boys up to thirteen years of age. However, the initiation rate for boys accelerates after age seventeen. Girls stabilize and then decrease rates of initiation after age fifteen or sixteen. These patterns suggest that preventing girls from starting at the earlier ages might prevent lifelong tobacco use and that interventions for prevention should be sustained for boys well into young adulthood.

The effect of age on initiation was modified by “being offered cigarettes.” Initiation rates increased dramatically for eleven-to-thirteen-year-olds who had been offered cigarettes and then stabilized at about 50 percent of that for older youth. Youth who had not been offered cigarettes showed a slower increase in initiation from age eleven to fourteen years and then stabilized at about 30 percent of that for older youth. These results suggest that offering cigarettes is more damaging to younger than older youth although it is damaging at all ages. Interventions should teach children to resist peer pressure, and the focus should be on younger youth.

Finally, youth assigned to the intervention group who had friends who think it’s cool to smoke were less likely to initiate tobacco use than similar youth in the control group. This interaction may represent the sensitivity of the intervention for susceptible youth. When youth are likely to start tobacco use as a result of social pressures, anti-tobacco counseling appears to limit the effects of peer pressure.

Recommendations

The first conclusion is that it is feasible to conduct a trial on the prevention of tobacco use using orthodontists. Results also suggest that orthodontists do not automatically adhere to anti-tobacco prevention services and that social learning variables may be used to increase adherence to counseling guidelines and to enhance the content of counseling so as to increase the preventive effects. Financial incentives, prescription tracking, prompting positive feedback from patients, and designing specific anti-tobacco counseling models are likely to enhance

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**Figure 1.** Proportion of participants who initiated tobacco use during follow-up, stratified by experimental group and whether they had “friends who think smoking is cool” at baseline
anti-tobacco preventive services in the dental office. Results also suggest that training orthodontists so that they are comfortable advising nonsmoking youth not to start and to use social consequences to justify the avoidance of tobacco might increase adherence to a protocol and make their counseling more powerful.

Similarly, peer pressures and other social learning factors, including experience with counseling, influence the use of tobacco by orthodontic patients. The interactions identified suggest that targeting youth most susceptible to tobacco initiation might focus services on youth who will be responsive, thereby enabling future trials to detect significant prevention effects. New trials should recruit youth who live with a smoker, have friends who smoke, have friends who believe smoking is cool, and who have other risk conditions for tobacco use in order to deliver prevention services to youth most at risk and for whom the interventions might be efficacious.

Lest there be any hesitancy to offer tobacco preventive services, our last study showed that youth who were smokers prior to intervention were more likely to start other risk behaviors two years later. This finding suggests that preventing tobacco use may prevent additional risk behaviors and thereby reduce morbidity/mortality even more than might be expected from tobacco control alone. In view of these findings, further clinical trials should be conducted to determine the most effective interventions for adolescent tobacco control that can be provided by clinicians.

Acknowledgments

This work was supported by funds awarded to Dr. Hovell by the Cigarette and Tobacco Surtax Fund of the State of California through the Tobacco-Related Disease Research Program of the University of California, Grant 2RT106, and by the Center for Behavioral Epidemiology and Community Health (C-BEACH).

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