

Smokeless Tobacco Use and Oral Pathology in a Professional Baseball Organization

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Background. Smokeless tobacco has been implicated as a risk factor for numerous oral conditions. Since baseball players are known to have a high incidence of smokeless tobacco use, they are an excellent group in which to study the effects of smokeless tobacco on the oral cavity. We report our findings in 206 of 220 eligible men during spring training of a professional baseball organization. Major and minor league ballplayers, coaches, and management personnel were included.

Methods. Participants completed a 2-page, 23-item questionnaire on smokeless tobacco use. This was followed by a detailed examination for oral leukoplakia, periodontal disease, and dental caries performed by a physician who was blinded to the results of the questionnaire. Oral leukoplakia was graded I, II, or III according to severity.

Results. Eighty-eight of 206 participants (42.7%) reported current use of smokeless tobacco; 62 of these men used smokeless tobacco year round, while 26 used

smokeless tobacco only during the baseball season. The 88 smokeless tobacco users often used more than one form of tobacco. Moist snuff was the most common form (73.9% of users) followed by loose leaf tobacco (53.4%) and plug tobacco (9.1%). Oral leukoplakia was found in 25 of 88 current users (28.4%). Only the year-round users, however, had an incidence rate (37.1%) that was significantly different from all others (odds ratio = 9.35, 95% CI = 3.46 to 26.21). Year-round users were also more likely to have a higher grade of oral leukoplakia. Periodontal disease and dental caries were no more prevalent among smokeless tobacco users than nonusers.

Conclusions. We conclude that the use of smokeless tobacco products is a significant risk factor for the development of oral leukoplakia, and that this risk is greatest in those individuals who use smokeless tobacco continuously throughout the year.

Key words. Smokeless tobacco, leukoplakia; pathology, oral; sports. *J Fam Pract* 1992; 34:713-718.

Over 12 million Americans use smokeless tobacco, and approximately one half of this large segment of the population use smokeless tobacco on a regular basis.¹ Population studies have shown that smokeless tobacco use is predominantly found among white men. There is considerable regional variation; in 12 states the incidence of smokeless tobacco use by men exceeds 10% of the population, with West Virginia topping the list at 23.1%.² More disturbing is the growing number of adolescent smokeless tobacco users. McGinnis et al³ compared data

from 1970 and 1985 and found a ninefold increase of snuff dipping and a doubling of chewing tobacco use among teenagers 17 to 19 years old. Boyd and Glover⁴ surveyed a younger age group and found that 21% of boys 12 to 17 years of age have tried smokeless tobacco.

There are a number of smokeless tobacco products available. The two most popular forms are chewing tobacco and moist snuff. Chewing tobacco consists of shredded tobacco leaves that are packed loosely in plastic pouches. Flavoring is often added in the form of sweeteners, such as licorice. The user places a small amount inside his cheek. This "wad," "quid," or "chaw" is left in place for long periods and generates excess amounts of saliva, which the user liberally expectorates. Plug tobacco is a form of chewing tobacco that is compactly processed into bricks. It is used in the same manner as loose leaf chewing tobacco.

Moist snuff is more finely ground than chewing tobacco. It is marketed in small cans and is also flavored

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with sweeteners and sometimes mint. The snuff user places a pinch of tobacco between the lower lip and gum. This "dip" is left in place and is not actively chewed as is the loose-leaf form of tobacco. For novices the tobacco industry has manufactured small individual-use packets. These tea-bag-like packets can be placed in the mouth without the usual mess of finely ground moist snuff.

There are a number of known clinical sequelae from the use of smokeless tobacco products. Perhaps the most complete compilation of information about smokeless tobacco is found in the report of the Surgeon General's Advisory Committee entitled *The Health Consequences of Using Smokeless Tobacco*.¹ The report concludes that smokeless tobacco is not a safe substitute for cigarette smoking and that users are at risk for developing oral leukoplakia, oral cancer, gingival recession, and nicotine addiction. The report further notes evidence of the potential pathogenetic role of smokeless tobacco in coronary artery disease, peripheral vascular disease, hypertension, peptic ulcers, and fetal mortality and morbidity.

Professional baseball players are a very visible group of smokeless tobacco users.⁵⁻⁸ The incidence of smokeless tobacco use in this group ranges from 34% to 42%.⁸⁻¹¹ Logically, if this group is at high risk for smokeless tobacco use, it should also be at high risk for the consequences of smokeless tobacco. This has in fact been demonstrated. Ernster and colleagues¹¹ found a 46% incidence of oral leukoplakia in current users of smokeless tobacco.

The present study examined the epidemiology of smokeless tobacco use among the players and management of a professional baseball organization. The incidence of oral pathology among users and nonusers of smokeless tobacco was compared.

Methods

Study Subjects

The subjects for this study were the players and management of a professional baseball organization. The organization included the parent major league club as well as five minor league teams for a total of 220 men. The study was conducted during 1 week in March 1990 at the spring training camp of the organization.

All players, coaches, and management personnel were required by the organization to have a physical examination at the start of their participation in the training camp. This opportunity was used to administer a survey inquiring about smokeless tobacco use and to perform a detailed oral examination. All participants were informed that the survey and examination were

optional and that the information obtained would be held confidential.

Variable Measurement

All participants were asked to complete a 2-page, 23-item questionnaire that asked for detailed information about their use of smokeless tobacco products. A Spanish-language version of the survey was available to participants of Hispanic origin.

Inquiry was made as to age at first use, type of smokeless tobacco used, and amount of smokeless tobacco used both during the baseball season and during the off-season. Reasons for using smokeless tobacco were surveyed, with this question being modeled after information obtained by Connolly et al⁸ in a prior study. Brief demographic information was sought regarding age, education, and state or country of origin. Participants were asked about prior attempts at quitting and whether they wished to try and quit during spring training. Those who wished to quit were invited to participate in a cessation program.

Smokeless tobacco type was divided into two groups: moist snuff and chewing tobacco. The latter group consisted of loose-leaf chewing tobacco and plug tobacco, since these two forms of smokeless tobacco are used similarly. A 4-level ordinal scale of smokeless tobacco use was created consisting of men who (1) never used smokeless tobacco, (2) formerly used smokeless tobacco, (3) used smokeless tobacco during baseball season only, and (4) used smokeless tobacco year round.

Oral Examination

The majority (89.3%) of the oral examinations were performed by one of the principal investigators (M.D.S.), who received several hours of special training in oral examination techniques provided by a dentist. The training consisted of a self-study course with hundreds of 35-mm slides depicting normal and abnormal oral anatomy, as well as participation in an oral pathology clinic. The remainder of the examinations were performed by only one other person (J.G.C.), an experienced clinician who did not receive any additional training.

Participants were asked to rinse their mouths before reporting to the oral examination station. In an attempt to blind the study as much as possible, examiners were not permitted to review the survey results. Oral examinations were performed with a bright, hand-held light and a tongue depressor. Calibrated periodontal probes were used to measure bidimensionally any lesions found.

The results of the examination were recorded on a uniform report form designed specifically for this study.

Oral mucosal condition was examined for the presence of oral leukoplakia and was either described as "normal" or classified into one of three grades of oral leukoplakia modified from the classification systems used by Greer and Poulson¹² and Axéll^{13,14} as follows:

Grade I: superficial lesion with color similar to surrounding mucosa with slight wrinkling and no obvious thickening

Grade II: superficial whitish or reddish lesion with moderate wrinkling and no obvious thickening

Grade III: red or white lesion with intervening furrows of normal mucosal color, obvious thickening and wrinkling

The mouth was examined for evidence of periodontal disease and was described as either "normal" or "evidence of periodontal disease present." Periodontal disease was considered present if there was gingival recession or gingival thickening and erythema.

The examiner then looked for evidence of dental caries. Based on the examination, participants were classified as "no active caries seen," "some evidence of caries seen," or "severe dental caries noted, multiple deep caries."

Statistical Analysis

In bivariate analysis, the 4 levels of the ordinal scale of smokeless tobacco use (never used, former user, seasonal use only, and year-round use) were compared with reference to the prevalence of oral leukoplakia. A likelihood ratio chi-squared statistic (G^2) was calculated and partitioned using the method described by Agresti.¹⁵

Periodontal disease and dental caries were compared among current nonusers (never used and former users) vs current users (seasonal users and year-round users). For both of these oral conditions, odds ratios with 95% confidence intervals were calculated.

Smokeless tobacco type was divided into two groups, moist snuff and chewing tobacco, and these were compared with reference to the presence of oral leukoplakia. The few users of plug tobacco were included in the chewing tobacco group, since these two forms of tobacco are similar in origin and method of use.

Results

Of the 220 men in the spring training camp, 206 satisfactorily completed a questionnaire and were examined

Table 1. Type of Smokeless Tobacco Used by 122 Current and Former Users During Spring Training, 1990

Type of Smokeless Tobacco	Current Users n=88 No. (%)	Current and Former Users n=122 No. (%)
Moist snuff		
At any time*	65 (73.9)	74 (60.7)
Exclusively†	40 (45.5)	45 (36.9)
Chewing tobacco		
At any time	47 (53.4)	64 (52.5)
Exclusively	20 (22.7)	33 (27.0)
Plug tobacco		
At any time	8 (9.1)	12 (9.8)
Exclusively	1 (1.1)	2 (1.6)

*"At any time" indicates that this type of smokeless tobacco was used either alone or in combination with other types of smokeless tobacco.

†"Exclusively" means that this was the only type of smokeless tobacco being used at the time of the study.

according to protocol. The average age of the participants was 25.4 years (range, 17 to 58 years). The average education was 14.2 years (range, 8 to 18 years). Of 199 men who identified their home country, 163 (81.9%) were from the United States, 33 (16.6%) participants were from a Spanish-speaking country, and 2 (1.0%) were Canadian.

Current use of smokeless tobacco products was reported by 88 of 206 participants (42.7%); 62 of these men used smokeless tobacco year round and 26 used smokeless tobacco during the baseball season only. Past use of smokeless tobacco was reported by an additional 34 men (16.5%). Eighty-four men (40.8%) reported that they had never tried smokeless tobacco.

The average age of first use was 18.1 years old for both current and former users. The youngest reported age of first use was 10 years old.

The most common form of smokeless tobacco used was moist snuff (Table 1). Of the 88 current users, 65 men (73.9%) had used moist snuff; 40 (45.5%) indicated that moist snuff was the only form of smokeless tobacco they used. Chewing tobacco was used by 47 (53.4%) of the current users; 20 men (22.7%) used chewing tobacco exclusively. Plug tobacco was less popular with current users. Eight participants (9.1%) used it at some time during the year, and only one man (1.1%) used plug tobacco exclusively.

There was a definite seasonal difference in the frequency and amount of smokeless tobacco used by the participants. Of the 88 men who were current users of smokeless tobacco, 25 (28.4%) used smokeless tobacco products only during the baseball season and reported that they "never" used smokeless tobacco in the off-season. There was also a trend to use less smokeless tobacco in the off-season. Among year-round moist snuff users the number of 34-g cans consumed per week was

Table 2. Relationship of Use of Smokeless Tobacco to Oral Leukoplakia, by Grade, Among 206 Baseball Players During Spring Training, 1990

Leukoplakia Status	Current Nonusers		Current Users		All Participants No. (%)
	Never Used No. (%)	Former Use No. (%)	Seasonal Use Only No. (%)	Year-round Use No. (%)	
No lesions	79 (94.0)	32 (94.1)	24 (92.3)	39 (62.9)	174 (84.5)
Oral leukoplakia					
Grade I	5 (6.0)	2 (5.9)	1 (3.8)	9 (14.5)	17 (8.3)
Grade II	0 (0.0)	0 (0.0)	1 (3.8)	13 (21.0)	14 (6.8)
Grade III	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.6)	1 (0.5)

2.35 during the baseball season and 1.72 during the off-season. Year-round chewing-tobacco users consumed an average of 2.80 pouches (85 g each) per week in season and 2.02 pouches per week in the off-season. This represents a reduction in smokeless tobacco use by approximately 25% in either group.

The relationship between smokeless tobacco use and the presence of oral leukoplakia was clearly significant (Table 2). A closer examination of the cells demonstrates that year-round smokeless tobacco users accounted for most of this significant association. Of the 62 men who did not stop their use of smokeless tobacco in the off-season, 23 (37.1%) had evidence of leukoplakia.

When year-round users were compared with all others with regard to the presence of leukoplakia, an odds ratio of 9.35 was found (95% CI = 3.46 to 26.21).

Table 2 also depicts the relationship between smokeless tobacco use and the grade of mucosal lesion found. Notably, none of the lesions in the smokeless tobacco nonusers was greater than a grade I lesion. Grade II lesions and one grade III lesion were found exclusively in current smokeless tobacco users; the only grade III lesion was found in a man who had been using large amounts of chewing tobacco for 36 years.

All but four of the oral leukoplakias were located on either the buccal mucosa or lower labial mucosa. Lesions of the buccal mucosa were generally found in chewing tobacco users, while lower labial mucosal lesions were more common in moist snuff users.

The association of the type of smokeless tobacco

used with the presence of oral leukoplakia indicates that moist snuff may be a greater risk factor for the development of oral lesions (Table 3). Of the 38 men who used moist snuff exclusively, 13 (34.2%) had oral mucosal lesions found on examination, whereas only 4 of 24 men (16.7%) who used chewing or plug tobacco exclusively had such lesions. This difference, however, did not reach statistical significance, probably owing to the small sample size.

Cigarette use was uncommon in this population. Only 7 of 206 men (3.4%) were smokers. Four smokers also used smokeless tobacco. The only leukoplakia lesion among the 7 smokers was in a man who also used smokeless tobacco.

Self-reported use of alcohol was found among 131 of 206 men (63.6%), with 18 men (8.7%) reporting consumption of seven or more alcoholic beverages per week. Twelve men in this latter group also used smokeless tobacco. There was only one leukoplakia found in the \geq seven drinks per week group. This man also used smokeless tobacco.

Periodontal disease was found in 17 of 88 smokeless tobacco users (19.3%) and in 25 of 118 nonusers (21.2%) (odds ratio = 0.89; CI = 0.42 to 1.87). Dental caries were present in 7 of 88 smokeless tobacco users (7.9%) and in 16 of 118 nonusers (13.6%) (odds ratio = 0.55; CI = 0.19 to 1.51). The differences did not reach statistical significance in either case.

Discussion

We have studied in detail the use of smokeless tobacco by members of a professional baseball organization, including players on both the major and minor league level as well as those involved in management. Our results support previous findings regarding the high prevalence of smokeless tobacco use among baseball players.⁸⁻¹¹ We found that 42.7% of our study group considered themselves "current" users of smokeless tobacco. Connolly et

Table 3. Presence of Oral Leukoplakia Among Exclusive Moist Snuff Users Compared with Exclusive Chewing Tobacco or Plug Users

Leukoplakia Status	Exclusive Use of Moist Snuff No. (%)	Exclusive Use of Chewing or Plug Tobacco* No. (%)
No lesions	25 (65.8)	20 (83.3)
Oral leukoplakia	13 (34.2)	4 (16.7)
Totals	38 (100.0)	24 (100.0)

*Odds ratio = 2.60; 95% CI = .64 to 11.27; P = .13

al⁸ reported smokeless tobacco use by 34% of 282 men surveyed. In a larger study by Ernster et al,⁹ 38.7% of 1109 baseball players had used smokeless tobacco within 1 week of being surveyed.

Moist snuff was the most common form of smokeless tobacco used by participants. Almost three quarters (73.9%) of current users "dip snuff" at some time, and 45.5% of current users reported this as their only form of smokeless tobacco. Since moist snuff has been proven to increase the risk of oral cancer 50-fold,¹⁶ this is most disconcerting.

When the prevalence of oral leukoplakia in current users as compared with current nonusers was examined, there was a very clear increase in lesions among smokeless tobacco users. Only 5.9% of current nonusers were found to have oral leukoplakia, whereas 28.4% of current users had such lesions. This figure is less than the 46.3% incidence of leukoplakia reported by Ernster et al¹¹ in a similar population. The incidence of oral leukoplakia in our study was higher, however, among the year-round smokeless tobacco users (37.1%). In fact, the men who did not use smokeless tobacco in the off-season had a 7.7% incidence of lesions, which is essentially the same as the current nonusers. This finding is not unexpected since most participants had been in training camp for less than 1 week at the time of their examination and, in essence, the "in-season-only users" had been nonusers for the previous 6 months.

The ballplayers themselves were clearly aware of the increase in oral mucosal lesions among users. The term "dip lip" is the colloquialism they used to describe the lesions found in the lower labial mucosa of moist snuff users.

Cigarette smoking and alcohol consumption have each been shown to be risk factors for oral cancer.¹⁷ Further, the combination of cigarettes and alcohol may compound the increased risk for oral cancer.¹⁷ It is not known whether smokeless tobacco in combination with either cigarettes or alcohol poses an added risk for oral lesions. The findings in this study, that only 1 of 4 men who smoked and used smokeless tobacco and 1 of 12 men who drank alcohol and used smokeless tobacco had leukoplakia, involve numbers so small that meaningful conclusions cannot be drawn with respect to cigarettes, alcohol, and smokeless tobacco as co-factors in leukoplakia induction.

No increased incidence of periodontal disease was found in our study among men who currently use smokeless tobacco. This differs from the findings of Ernster et al,¹¹ who noted an increased incidence of attachment loss of 4 mm or more among smokeless tobacco users in their large study. These same investigators found no increase of dental caries among smokeless tobacco users, a finding

that the current study confirms. Our data on periodontal disease and dental caries are less reliable, since the training of the examiner concentrated on the recognition of oral mucosal pathology. Nevertheless, as primary care providers, family physicians must screen for a variety of disorders, including dental problems.¹⁸ Family physicians should be able to identify periodontal disease and dental caries and then make the appropriate referral to a dentist.

Further study is needed on the long-term effects of smokeless tobacco use with respect to oral pathology. A longitudinal study of this high smokeless-tobacco use group (baseball players) would be most welcome. However, there remain a few significant impediments to such a study. Baseball players are often traded between organizations, making long-term follow-up difficult. Further, players remain in professional baseball for only a few years, with the exception of major league players. After leaving baseball, they relocate in various areas of the United States and in many Latin American countries. Perhaps a retrospective review of Major League Baseball pension holders would provide a potential study population.

Smokeless tobacco use is increasing among adolescents.^{1-4,19} The men we studied began using smokeless tobacco as early as age 10 years, with an average starting age of 18 years. The average age of first use at 18 years would correspond to their participation in baseball beyond the high school level. Initiation of smokeless tobacco use may be a response to peer pressure from older players once a "rookie" enters the world of professional or college baseball.

Screening for smokeless tobacco use among adolescents should be a priority for all primary care physicians and dentists,²⁰ but especially for those clinicians who perform preparticipation physical examinations or who serve as team physicians. A question on smokeless tobacco use might be a worthwhile addition to current preparticipation physical examination forms.

When an athlete or any other individual is identified as a smokeless tobacco user, he must be examined carefully for oral pathology and especially leukoplakia. He must then be counseled to discontinue his use of smokeless tobacco products. Only one of 34 men in this study who had quit using smokeless tobacco reportedly did so on the advice of a physician. Presumably, these men had a preparticipation history taken and a physical examination done on an almost annual basis beginning in high school. One wonders whether a question on smokeless tobacco use was ever asked and, if a positive response was elicited, whether counseling was ever done.

Effective smokeless tobacco cessation programs must be created to assist those who wish to end their

nicotine habit. While there are many smoking cessation programs available,²¹ there are very few for those who use smokeless tobacco.²²⁻²⁶ Use of nicotine polacrilex gum as an adjunct to a cessation program has been reported anecdotally.²² We are currently studying its effectiveness among several of the participants of the current study.

Smokeless tobacco use by major league ballplayers is a highly visible activity.⁵⁻⁷ The effect of professional athletes as role models should not be underestimated. In view of recent incidents involving anabolic steroids, drugs, alcohol, and gambling by professional athletes, it is incumbent upon the parent organizations to promote healthy and ethical behavior by their members. Positive steps in this direction have already been taken by major league baseball officials who have banned the use of smokeless tobacco products among players and coaches in the rookie leagues.²⁷ An educational pamphlet on the health hazards of smokeless tobacco is being distributed to all players,²⁸ and a cessation program has been developed in cooperation with the National Cancer Institute for those players who wish to quit.²⁶ Efforts like these will make players of our national pastime role models for healthy behavior.

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