

### KEY MESSAGES

- Swedish snus causes a characteristic type of oral mucosal lesion. These lesions are considered to be harmless and regress following cessation of snus. There is no evidence that they progress to cancer, even with long-term use.
- There is no evidence that snus use is associated with dental caries, tooth wear, tooth loss, periodontitis, or gingivitis. There is weak and conflicting evidence that suggests snus use may be associated with gingival recession.
- Some studies have reported that these conditions occur more often among snus users than non-users, but the studies have significant weaknesses and firm conclusions cannot be drawn.

### QUESTIONS AND ANSWERS

#### **Why have researchers studied the relationship between snus use and non-cancerous oral conditions?**

Smoking is associated with oral conditions such as periodontitis and oral cancer; therefore, it is logical to investigate whether snus use may be associated with adverse oral conditions.

It is commonly accepted that a characteristic type of oral lesion may occur in conjunction with the use of Swedish snus. In addition, researchers have conducted studies to determine if other non-cancerous oral effects are observed in snus users, and whether any of these effects may be associated with potential pre-carcinogenic effects of the oral cavity.

#### **Is there evidence that snus use is associated with non-cancerous oral conditions?**

Yes, numerous studies have observed that snus use is associated with a characteristic reaction in the oral mucosa (*e.g.*, Axéll 1976, 1987, 1993; Axéll and Hedin 1982; Axéll and Henricsson 1985; Andersson and Warfvinge 2003; Andersson and Axéll 1989; Andersson et al. 1989; 1990, 1991, 1994, 1995; Axéll et al. 1976; Frithiof et al. 1983; Larsson et al. 1991; Martensson 1978; Mornstad et al. 1989; Roosar et al. 2006; Hirsch et al. 1982; Salonen et al. 1990; Rolandsson et al. 2006). This type of lesion has been referred to by various names, including snuff dipper's lesion, snuff-induced leukoplakia, or snus-induced lesions. The lesion generally appears at the location in the mouth where the snus is held. The prevalence of this condition varies widely, and appears to be related to characteristics of the user (such as age, salivary pH, patterns of tobacco use) and characteristics of the product (nicotine content, loose vs. portion bag, etc.).

Researchers have also studied snus use and associations with other dental effects. These effects can be generally divided into the following categories: (1) dental conditions (plaque, caries, tooth wear, and tooth loss); (2) gingivitis (inflammation of the gums); (3) gingival recession (receding gums); and (4) periodontitis (alveolar bone loss, pocket depth, attachment loss, bone height).

Five studies examined the association between various dental conditions and snus use (Rolandsson et al. 2005; Ekfeldt et al. 1990; Monten et al. 2006; Wickholm et al. 2004; Hirsch et al. 1991). Of these, the study by Ekfeldt and colleagues (1990) that examined various factors related to tooth wear, reported that snuff use was associated with tooth wear. Hirsch et al. (1991) found

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that teenage snuff dippers had significantly more decayed, missing or filled teeth compared to non-users of tobacco, but the authors cautioned that dietary and oral habits, other risk factors for these dental effects, were not examined in this study.

No studies that examined the prevalence of gingivitis among snus users reported a significant association with this dental effect (Bergstrom et al. 2006; Modeer et al. 1980; Monten et al. 2006; Rolandsson et al. 2005).

One of the three studies that examined gingival recession (Monten et al. 2006), reported a higher prevalence of gingival recession among snus users. Andersson and Axéll (1989), who studied only snus users, found that gingival recession was associated with use of loose snuff compared to those using portion-bag snuff. Wickholm and colleagues (2004) (as reanalyzed by Kallischnigg et al. 2008) did not find a statistically significant association between gingival recession and snus use.

No studies that examined the association between various measures of periodontitis, by any of the various measures, and snus use reported a significant association with this dental effect (Bergstrom et al. 2006; Julihn et al. 2008; Monten et al. 2006; Wickholm et al. 2004; Kallestal and Uhlin 1992).

These studies have many methodological limitations, including small numbers of subjects, lack of data on individuals who don't use snus, insufficient product identification and exposure levels, and failure to control for important confounders, such as dietary and oral hygiene habits. Despite these limitations, it appears that with the possible exception of gingival recession, snus use is not associated with dental effects.

The available epidemiologic data fail to support the hypothesis that snus use is associated with leukoplakia. Leukoplakia, a white patch or plaque of the oral mucosa, may transform into cancer under certain conditions, including tobacco use (i.e. smoking), but these factors are under study (Bouquot et al. 2006; Einhorn and Wersall 1967; Greenspan and Jordan 2004; Sudbo et al. 2004). Snus has also not been found to be associated with dysplasia (a precancerous change in cells) (Frithiof et al. 1983; Hirsch et al. 1982). Though slight dysplasia was observed in individuals who used snus for more years compared to individuals with no dysplasia (Hirsch et al. 1982), there is no clinical evidence to suggest that when dysplastic lesions occur in snus users, they transform into malignancies (cancer).

A review conducted by Kallischnigg and colleagues (2008), evaluated the relationship between *smokeless tobacco* products and non-cancerous oral diseases in Europe and the U.S. The reviewers conclude that the available evidence confirms a strong association of current use of *smokeless tobacco*, particularly snuff, with prevalence of oral mucosal lesions. Among the 15 Scandinavian studies described in the review, the severity of the snuff induced lesions was associated with the length of time snuff was used and with the amount consumed per day. The severity was lower in users of portion-bag snuff than in users of loose snuff. The authors concluded that the results from the Swedish studies reveal no significant relationship between snuff use and periodontitis. The authors described the evidence of an association between snuff use and gingival recession and gingivitis as weak, citing limitations in the studies such as failure to control for other risk factors for these dental effects.

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### **What conclusions have been reached by public health agencies about the association between snus use and non-cancerous oral conditions?**

The European Commission's Scientific Committee on Emerging and Newly Identified Health Risks concluded that use of *smokeless tobacco* almost always causes changes in the oral cavity, many of which appear as white and/or red patches (SCENIHR 2008). The Committee indicated, however, that though some of these changes have been classified as potentially cancerous or precancerous lesions, most of these lesions are reversible on quitting the habit.

### **Do these snus-induced lesions lead to cancer?**

The evidence indicates that snus-induced lesions do not lead to disease and regress after snus use is stopped (Larsson et al. 1991; Frithiof et al. 1983; Roosaar et al. 2006). These findings also indicate that oral mucosal lesions are generally not dysplastic (i.e., characteristic of a potentially irreversible process that might lead to cancer), and that progression to cancer may be confounded by HPV (human papilloma virus) infection (Greer et al. 2010). Only one long-time follow-up study (Roosaar et al. 2006) from Sweden is available that reported a non-statistically significant risk for subsequent cancer development in snus users with lesions.

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