

Effect of chewing a mixture of areca nut and tobacco on periodontal tissues and oral hygiene status

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(Received 12 June 2007 and accepted 6 February 2008)

Abstract: The present study was conducted to clarify the effects of chewing a quid containing areca nut and tobacco on periodontal tissue and oral hygiene status. A total of 365 subjects (168 chewers and 197 non-chewers with a mean age of 32.5 ± 0.7 and 30.4 ± 0.8 years, respectively) were enrolled. Clinical data on periodontal tissues, oral hygiene status, as well as information on bleeding from gums, ulcers in the oral cavity, or a burning sensation in the soft tissues, were collected as indicators of the possible presence and extent of periodontal lesions. The results indicated that a significantly higher number of quid-chewers suffered bleeding from the gums, halitosis, difficulty in opening the mouth and swallowing solid food, a burning sensation in the soft tissues, and ulcers in the oral cavity than non-chewers. There was no significant difference between quid-chewers and non-chewers with respect to oral hygiene measures adopted. However, clinical examination using the oral hygiene index score indicated that the oral hygiene status of quid-chewers was significantly deteriorated. The effect of quid-chewing on the periodontium, i.e. the occurrence of periodontal pockets, gingival lesions and gum recession, were significantly higher in quid-chewers than in non-chewers. Age, sex and smoking adjusted odds ratios for quid-chewers against non-chewers using logistic regression analysis indicated that, in general, chewers were at significantly higher risk for various oral

complaints and periodontium status. The present data indicate that chewing quid comprising areca nut and tobacco has adverse effects on periodontal tissues, oral hygiene and incidence of oral lesions. (*J. Oral Sci.* 50, 57-62, 2008)

Keywords: periodontal; chewers; tobacco; areca nut; smokeless tobacco; gingival lesions; oral hygiene.

Introduction

A number of diseases are associated with food habits, lifestyle and environmental factors. It is estimated that about 600 million people chew areca nut (1), among whom a large proportion use tobacco with it. Gupta and Warnakulasuriya reported that a substantial proportion of the world's population is engaged in chewing areca nut, and that the habit is endemic throughout the Indian subcontinent, large parts of south Asia and Melanesia. A large variety of ingredients, including tobacco, may be used along with areca nut constituting a betel quid (2). Furthermore it has been reported that use of betel quid and areca nut in any form is unsafe for oral health, and that commercial forms seems to pose an even higher risk (3). Both areca nut and tobacco are addictive. From the viewpoint of the various effects of areca nut-chewing on health, and its carcinogenic potential designated recently by the IARC (4), we consider that chewing areca nut with or without tobacco poses one of the greatest threats to global health today. The habit is widespread in Southeast Asia and the South Pacific and among people of Indian origin who have migrated elsewhere. There has been a sharp rise in this habit

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especially amongst the young. In addition, the new habit of chewing panmasala [consisting of areca nut (*Areca catechu*), catechu (*Acacia catechu*), lime, cardamom (*Elettaria cardamomum*), and unspecified flavoring agents with tobacco (gutaka) or without tobacco (plain or meetha-sweetened)] is increasing rapidly, even among those who generally refrain from smoking and tobacco-chewing. Increasing use of tobacco and betel nut chewing, especially panmasala with or without tobacco, by vulnerable members of society, i.e. children and pregnant women, and available data on the role of different chewing habits and cancer, suggest that the hazardous effects of these habits need to be reassessed (5).

A wide variety of chewing and smoking habits are believed to be linked to oral and pharyngeal cancer. These habits also contribute to other diseases of the oral cavity and may also affect teeth and supporting periodontal tissues due to the excessive mastication load and exposure to various components of the chewing quid. Recently we have published a letter indicating that chewing quid composed of areca nut and tobacco affects the oral hard tissues, based on data suggesting that quid-chewers have a higher prevalence of dental attrition and sensitivity than non-chewers (6). In addition, chewing areca nut and tobacco might also affect other organ systems, as it has been reported that panmasala plain and panmasala with tobacco both induce a higher incidence of sperm head morphological abnormality in Swiss albino mice than in controls (7). Very little attention has been paid to the association of smokeless tobacco and areca nut-chewing and the health of gingival and periodontal tissues, although a few reports have addressed the chewing of betel or areca nut and its effects on the periodontium (8). Recently, in an *in vitro* study, Jeng et al. found that arecoline (one of the major areca nut alkaloids) and areca nut extract suppressed the growth of cultured gingival keratinocytes (9). Furthermore, Chang et al. have demonstrated that areca nut extracts suppress growth and protein synthesis in cultured human periodontal fibroblasts (10). These *in vitro* findings suggest a role of areca nut-chewing in the deterioration of gingival and periodontium tissues. The present study assessed the gingival, periodontium, and oral hygiene status of chewers of a mixture of areca nut and tobacco in comparison with non-chewers.

Materials and Methods

Participants

A cross-sectional study was conducted among apparently healthy patients attending the Outpatient Department (OPD) of the Government Dental College and Hospital, Ahmedabad, Gujarat, India, because of various dental

diseases, as well as subjects attending the OPD of the Civil Hospital, Ahmedabad, Gujarat, India. Written consent was obtained from each subject after explaining the objective of the study. The present study was part of a project approved by the institutional ethics committee. The subjects were divided into two groups – quid-chewers (n = 168) and non-chewers (n = 197) – for comparison purposes. About 80.5% of the subjects were male. The mean age (\pm SE) of the quid-chewers and non-chewers was 32.5 ± 0.7 and 30.4 ± 0.8 years, respectively. About 22.62% of quid-chewers and 5.06% of non-chewers were smokers. The subjects were examined at the Government Dental College, Ahmedabad, under artificial light using a mouth mirror, explorer and curved probe.

Data related to bleeding of the gums, halitosis, ability to swallow solid food, presence of a burning sensation in the soft tissues, etc., were collected by questionnaire, and the presence of ulcers in the oral cavity was checked clinically. These data were considered to be possible indicators of the presence and extent of lesions. In addition, each subject was asked to open his/her mouth in order to confirm whether there was any difficulty with mouth opening.

Oral Hygiene Status

The oral hygiene status of the enrolled subjects was determined by using the Simplified Oral Hygiene Index (OHI-S). The OHI-S, introduced by Greene and Vermilion (11) in 1964 and quoted by Peter (2004), comprises the Simplified Debris Index (DI-S) and Simplified Calculus Index (CI-S). Each of these indices is based on numerical determinations representing the amount of debris or calculus on six pre-selected tooth surfaces.

Debris Index (DI-S):

DI-S was used for evaluating the extent of debris present on the six pre-selected tooth surfaces, i.e. buccal surface of the selected upper first molars, lingual surface of the selected lower first molars, and labial surface of the upper right and lower left central incisors. The surface area covered by debris was estimated by running the side of Shepard crook explorer along each tooth surface.

Debris Index – Simplified – Scoring System

Score

- 0: Absence of debris
- 1: Soft debris covering less than the cervical one-third of the tooth surface.
- 2: Soft debris covering more than the cervical one-third of the exposed tooth surface but less than the cervical two-thirds.

3: Soft debris covering more than the cervical two-thirds of the exposed tooth surface.

Calculus Index – Simplified (CI-S):

An explorer was used for scoring of calculus. The same tooth as those for evaluation of the debris index was examined. The surface area covered by calculus was detected supragingivally, and subgingival calculus was explored on a randomly selected tooth quadrant.

Calculus Index – Simplified – Scoring System:

Score

0: Absence of calculus

1: Calculus covering less than the cervical one-third of the exposed tooth surface.

2: Supragingival calculus covering more than the cervical one-third, but not more than the cervical two-thirds of the exposed tooth surface, or presence of individual flecks of subgingival calculus around the cervical portion of the tooth.

3: Supragingival calculus covering more than the cervical two-thirds of the exposed tooth surface, or a continuous heavy band of subgingival calculus around the cervical portion of the tooth.

The Simplified Oral Hygiene Index score for each individual was obtained by combining the Simplified Debris Index and the Calculus Index. Totaling the debris score per tooth surface and dividing by the number of the surfaces examined yielded the Simplified Debris Index (DI-S) score for an individual. The same method was used to obtain the CI-S

Thus,

$$OHI-S = DI-S + CI-S$$

The Simplified Oral Hygiene Index (OHI-S) values range from 0 to 6. The clinical levels of oral hygiene that can be associated with group OHI-S scores are as follows; Good: 0.0 to 1.2; Fair: 1.3 to 3.0; Poor: 3.1 to 6.0

Gingival Recession:

Assessment of gingival recession was done to specifically determine its extent, i.e. displacement of the gingival margin at least 1 mm apical to the cemento-enamel junction in all the subjects.

Statistical analysis

Logistic regression analysis, Student’s *t* test and chi-squared test were employed according to which hypotheses were being tested.

Results

Various oral hygiene measures practiced routinely by the quid-chewers and non-chewers are shown in Table 1. The data show that quite a large number of quid-chewers (87.5%) and non-chewers (90.86%) used paste/powder regularly for maintenance of oral hygiene. However, 8.93% of chewers did not use toothpaste or powder, as compared to 5.08% of non-chewers. There was no significant difference between quid-chewers and non-chewers with respect to oral hygiene measures adopted. About 49.2% of non-chewers had good oral hygiene status, as compared to only about 14.9% of quid-chewers (Table 2). The oral hygiene status of non-chewers was significantly better than that of chewers. Poor oral hygiene status was also observed in a higher proportion of quid-chewers (17.86%) than in non-chewers (11.17%). The mean oral hygiene index of chewers was 2.12 ± 0.86 while that of non-chewers was 1.54 ± 1.12 , the difference being statistically significant ($P < 0.001$).

Table 3 shows the different complaints of the subjects pertaining to the oral cavity. The incidence of bleeding gums was significantly higher in quid-chewers than in non-chewers, and more chewers (58.3%) had halitosis. About 22.6% chewers complained of difficulty in mouth-opening, as compared with only about 1% of non-chewers. Furthermore, 10.1% chewers had difficulty in swallowing solid food, whereas none of the non-chewers had this

Table 1 Oral hygiene measures adopted by subjects

Oral Hygiene Measures	Non-chewers-197	Chewers-168	Total- 365
Do not use brush/powder	10 (5.08)	15 (8.93)	25
Use brush/powder occasionally	8 (4.06)	6 (3.57)	14
Use brush/powder regularly	179 (90.86)	147 (87.50)	326
Total	197	168	365

Figure in parenthesis is the percentage of oral hygiene measure

problem. A burning sensation in the soft tissues was also found in a higher proportion of quid-chewers than in non-chewers. Similarly, ulcers on the oral mucosa were present in about 6.5% of chewers, as compared to 0.51% of non-chewers. Logistic regression analysis revealed that, in general, chewers had significant odds ratios for the various oral complaints studied with respect to non-chewers after

adjustment for age, sex and smoking (Table 3). Sex and smoking did not have any significant impact on the odds ratio. Furthermore, age had no significant impact on the odds ratio for difficulty in mouth-opening, difficulty with swallowing, burning sensation in soft tissues, and ulceration.

An effect of quid-chewing on the periodontium, i.e. the occurrence of periodontal pockets, gingival lesions and gum recession, was observed clinically. Periodontal pockets, occurrence of gingival lesions, as well as gum recession also had a higher incidence in quid-chewers than in non-chewers (Table 4). Gingival recession was present in about 50% and 26% of chewers and non-chewers, respectively. Logistic regression analysis also showed significant odds ratios for these conditions for chewers as compared with non-chewers (Table 4). This analysis showed that quid-chewers are at higher risk for the various conditions studied, irrespective of sex, indicating a causative role of areca nut and tobacco in periodontal diseases.

Table 2 Oral hygiene status of the chewers and non-chewers

Oral hygiene status	Non-chewers-197	Chewers-168
Good	97 (49.24)	25 (14.88) *
Fair	78 (39.59)	113 (67.26)
Poor	22 (11.17)	30 (17.86)
Total	197	168

Figure in parenthesis shows the percentage of oral hygiene status

* $P < 0.001$ on comparing with non-chewers

Table 3 Distribution of subjects according to their complaints

Complaints of subjects	Non-chewers (197)	Chewers (168)	*Odds-ratio	95% CI
Bleeding gums	52 (26.40)	67 (39.88)	1.381	(1.08, 1.77)
Bad odor (halitosis)	67 (34.01)	98 (58.33)	1.566	(1.23, 1.99)
Difficulty in opening mouth	2 (1.02)	38 (22.62)	4.843	(2.32, 10.1)
Difficulty in swallowing	0 (0.0)	17 (10.12)	-	-
Burning sensation of soft tissue	1 (0.51)	47 (27.98)	9.998	3.55, 28.15
Ulceration	1 (0.51)	11 (6.55)	-	-

Figure in parenthesis is the percentage of complaints

- Indeterminate

* Age, sex and smoking adjusted

Table 4 Periodontal condition of chewers and non-chewers

Periodontal condition	Non-chewers	Chewers	*Odds-ratio	95% CI
Periodontal pocket	61 (30.96)	92 (54.76)	1.643	(1.26, 2.14)
Gingival lesions	2 (1.02)	10 (5.95)	2.868	(1.24, 6.65)
Gingival recession	52 (26.40)	85 (50.60)	1.729	(1.32, 2.32)

Figure in parenthesis is the percentage of periodontal condition

*Age, sex and smoking adjusted odds ratio of chewers against non chewers

Discussion

This study revealed no significant difference between quid-chewers and non-chewers with respect to oral hygiene measures adopted. However, the mean value of the OHI among chewers was higher than among non-chewers. This suggests that quid-chewers had a poorer oral hygiene status than non-chewers, even though both groups undertook almost the same oral hygiene measures, and that quid-chewing plays a significant role in deterioration of oral hygiene. Complaints such as bleeding gums, halitosis, difficulty with mouth-opening and swallowing solid food, and a burning sensation in the soft tissues were significantly more common among chewers than among non-chewers. These data indicate a potential role of areca nut and tobacco-chewing in oral health status. Previously, Ling et al. reported that betel quid-chewing was associated with a higher prevalence of bleeding where higher clinical disease existed, and with a likelihood of higher subgingival infection with *A. actinomycetemcomitans* and *P. gingivalis* (12). However, in the present study we were unable to determine whether the subjects had these infections or diabetes.

The hardness of the areca nut and interactions among the various ingredients of chewing materials with periodontal tissues might be responsible for the poor periodontal status of chewers. Areca nut, which contains alkaloids such as arecoline, might have a significant causative role in periodontal diseases along with other variables such as the level of oral hygiene, dietary factors, general health and dental status, and tobacco-smoking. This lends support to the earlier *in vitro* findings of Chang et al. (10), who reported that areca extracts containing arecoline inhibit the growth and attachment of, and protein synthesis in, human cultured periodontal fibroblasts. On the basis of these findings, they proposed that areca might be cytotoxic to periodontal fibroblasts and may exacerbate pre-existing periodontal disease as well as impairing periodontal reattachment. The present data on periodontal status confirm the earlier findings of Waerhaug (13), who reported that more areca consumers had periodontitis than non-consumers, even when comparative levels of oral hygiene were present. He suggested that areca nut consumption might act as a factor that lowers resistance to local irritants. The present study also indicated deterioration of periodontal condition among quid-chewers. Periodontal pockets, gingival lesions and gingival recession were more prevalent among chewers than among non-chewers, even though both groups adopted approximately the same oral hygiene measures. Furthermore, loss of periodontal attachment and greater calculus formation has also been reported in areca nut-chewers (14,15), and

Baelum et al. have reported a higher prevalence of attachment loss in older age groups than in younger age groups (16), suggesting that age could be a factor affecting such changes. The present study also suggests that age has a significant impact on the prevalence of oral complaints and periodontal conditions. The age-, sex- and smoking-adjusted odds ratios for quid-chewers against non-chewers were statistically significant for various complaints and conditions, suggesting a role of the chewing habit in the deterioration of periodontal status as well as various oral conditions in quid-chewers compared with non-chewers. Furthermore, areca nut might be cytotoxic to periodontal fibroblasts and thus exacerbate pre-existing periodontal disease as well as impairing periodontal reattachment. Recently, Chatrchaiwiwatana reported that betel quid-chewing was directly associated with periodontitis in the presence of several confounding factors (17). The present study indicated that chewing areca nut and tobacco has a potentially causative role in the development of oral lesions, and deterioration of oral hygiene and periodontal status, as higher odds ratios were observed for various lesions and periodontal status after adjustment for age and sex.

Acknowledgments

The authors are grateful to the Director, NIOH and Ex-Dean, Government Dental College, Ahmedabad, Gujarat, for the use of facilities and encouragement, and also to the subjects for their cooperation.

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