Oral (including pharyngeal) cancer is the sixth most common cancer in the world [1], and four-fifths of oral cancer cases occur in developing countries [2]. Oral cancer is a very common disease in South and Southeast Asia [3]. In India, among the 30-69-year-old population of males, the three most common fatal cancers are oral (including lip and pharynx, 22.9%), stomach (12.6%), and lung (11.4%) [4].

Oral carcinoma and oropharyngeal carcinoma are also reported to be very common in Myanmar by hospital-based studies [3]. Sein et al. confirmed that oral cancer ranked fifth among all cancers for the period between 1985 and 1988 [5]. Oo et al. reported that oral cancer ranked 6th for males and 10th for females, with males predominating at a ratio of 2.1 : 1 [6].

Cigarette smoking and alcohol consumption are the most recognized risk factors for oral squamous cell carcinoma in developed western countries [7,8], and cigarette smoking causes 30% of all cancer deaths in devel-
oped countries [9]. In addition to lung cancer, smoking is an important cause of oral and oropharyngeal cancers [6, 9]. However, in South and Southeast Asian countries, betel quid (BQ) chewing and smoking are the major contributory risk factors for carcinoma incidence [7, 10, 11].

BQ chewing is a widespread habit in South- and Southeast Asia, with approx. 600 million people still indulging in this habit [12].

For example, among men in Taiwan, oral carcinoma is the fourth leading malignancy due to the popularity of BQ chewing [2]. There is a high-risk group of 2.5 million people in Taiwan who both chew BQ and smoke tobacco [2]. BQ chewing has been clearly implicated as a cause of oral cancer [3, 13]. Because of the scarcity of dentists in Myanmar, essentially only patients visiting hospitals with late advanced (rarely early) cases of oral cancer have been treated. Oral cancer screenings for early detection and treatment have been neglected. There are few reports in the literature of oral cancer screening for high-risk groups among the general population in Myanmar. Here we present the results of an oral cancer screening program among high-risk populations in South Myanmar rural Areas.

Materials and Methods

Oral cancer screening was conducted for regional residents at Hpa-an General Hospital, Kayin State, Myanmar in 2015 and Mawlamyaing General Hospital, Mawlamyaing, Mon State, Myanmar in 2016 with the cooperation of the Myanmar Dental Association, the University of Dental Medicine in Yangon and Mandalay, the People’s Health Foundation, and the NPO Myanmar-Japan Collaboration Project for Fostering Medical Human Resources. Ethical approval by the People’s Health Foundation in Myanmar was obtained.

Hpa-an and Mawlamyaing are areas with a high prevalence of BQ-chewing habits. The subjects were persons who hoped to receive free dental treatment including oral cancer screening on a specific day when Myanmar dentists provide necessary dental treatments free of charge to all subjects.

We surveyed the age, gender and oral habits using questionnaire, including the duration and level of consumption of all types of smoked tobacco, BQ and alcohol.

There were a total of 106 subjects, of whom 51 were males and 55 were females. The average ages were $48.5 \pm 13.9$ years for the men and $52.3 \pm 11.2$ years for the women (Fig. 1).

Of the 106 subjects, 96 were BQ chewers (90.6%, Table 1). The users of BQ and/or smokers comprised 99.1% of the subjects in the present cancer screening (Table 1). We examined the participants principally via ocular inspection and palpation. Toluidine blue staining and brush biopsy were conducted for lesions suggesting carcinoma. We referred participants with suspicious cancers or cancer-like lesions to a specialized medical hospital.

Statistical analysis

We examined the relationship between oral habits and cancer and pre-cancer incidence in the high-risk group. One subject who was in the low-risk oral habits
group (non-smoking + non-BQ-chewing) was excluded from the analysis. We thus examined 105 subjects of the high-risk group (Smoking or BQ-chewing), and divided them into the BQ group (non-smoking), Smoking group (non-BQ), and BQ + Smoking group. The group's values were analyzed using the Chi-square test, and $p$-values < 0.05 were considered significant. The analyses were performed using the SPSS 15.0 J software program for Windows (IBM Japan, Tokyo, Japan).

**Table 1** Oral Habits of Subjects

<table>
<thead>
<tr>
<th>Oral habit</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking only</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>5.7</td>
</tr>
<tr>
<td>BQ chewing only</td>
<td>28</td>
<td>41</td>
<td>69</td>
<td>65.1</td>
</tr>
<tr>
<td>Smoking and BQ chewing</td>
<td>6</td>
<td>7</td>
<td>13</td>
<td>12.3</td>
</tr>
<tr>
<td>Smoking, BQ chewing and Drinking</td>
<td>10</td>
<td>2</td>
<td>12</td>
<td>11.3</td>
</tr>
<tr>
<td>BQ chewing and Drinking</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Smoking and Drinking</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Drinking only</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>None</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0.9</td>
</tr>
<tr>
<td>Total</td>
<td>51</td>
<td>55</td>
<td>106</td>
<td>100</td>
</tr>
</tbody>
</table>

**Table 2** Lesions detected by oral cancer screening (High-risk oral habits group)

<table>
<thead>
<tr>
<th>Oral Lesion</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chewer’s mucosa</td>
<td>13</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Leukoplakia</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Lichen Planus</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Submucous fibrosis</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Candidiasis</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Ulcer</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Oral Carcinoma</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Oropharyngeal Carcinoma</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>15</td>
<td>39</td>
</tr>
</tbody>
</table>

(Total Subjects 105)

**Results**

Thirty-nine lesions were detected by this oral cancer screening in the high-risk oral habits group (Table 2). We found not only 2 oral carcinomas but also 1 oropharyngeal carcinoma (Fig. 2). Other lesions included 7 cases of leukoplakia, 4 lichen planus lesions, and 1 submucous fibrosis. In addition, 1 case of chewer’s mucosa was diagnosed as dysplasia after a biopsy was performed. Therefore, 8 cases of precancerous lesions

![Fig. 2](image_url)

A, Case 1, carcinoma at left palate; B, Case 1, the lesion was dyed with toluidine blue stain; C, Case 2, carcinoma at lower gingiva; D, Case 3 oropharyngeal carcinoma.
(leukoplakia and dysplasia) and 5 cases of precancerous conditions (lichen planus lesions and submucous fibrosis) were detected by the present screening.

The carcinoma detection rate was thus 2.9%, and the carcinoma and precancerous lesion detection rate was 10.5% (Table 3).

As for the oral habits of the three subjects in whom cancer was identified (Table 4), one subject was a BQ user, smoker and alcohol user. Of the others, one subject used only BQ, and the other smoked. As for the oral habits of the eight subjects with oral dysplasia cases with precancerous lesions, all used BQ (Table 5). Three of these subjects were also smokers.

The oral cancer and precancerous lesion detection rates according to oral habits are presented in Table 6. The BQ-chewing + smoking group showed the highest rate of carcinoma and precancerous lesion detection at 16.0%. However, there were no significant differences in these rates among the 3 groups ($p = 0.569$).

### Table 3 Carcinoma, precancerous lesion, and precancerous condition detection rates (High-risk oral habits group)

<table>
<thead>
<tr>
<th>Detection rates</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcinoma</td>
<td>2.9</td>
</tr>
<tr>
<td>Carcinoma and precancerous lesion</td>
<td>10.5</td>
</tr>
<tr>
<td>Carcinoma, precancerous lesion, and precancerous condition</td>
<td>15.2</td>
</tr>
</tbody>
</table>

### Table 4 Oral habits of carcinoma cases

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Site</th>
<th>Pathological diagnosis</th>
<th>BQ chewing</th>
<th>Smoking</th>
<th>Drinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>58</td>
<td>Male</td>
<td>Palate</td>
<td>SCC</td>
<td>8 quids/day for 7 years</td>
<td>Cheroots 5/day for 14 years</td>
<td>Cigarettes 7/day for 14 years</td>
</tr>
<tr>
<td>2</td>
<td>72</td>
<td>Female</td>
<td>Lower gingiva</td>
<td>SCC</td>
<td>3–5 quids/day for 10 years</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>70</td>
<td>Male</td>
<td>Oropharynx</td>
<td>SCC</td>
<td>None</td>
<td>5 cheroots/day for 50 years</td>
<td>Occasional for 50 years</td>
</tr>
</tbody>
</table>

### Table 5 Oral habits of oral dysplasia cases (Leukoplakia 7 cases, Chewer’s mucosa → Dysplasia 1 Case)

<table>
<thead>
<tr>
<th>Case</th>
<th>Age</th>
<th>Sex</th>
<th>Site</th>
<th>BQ chewing</th>
<th>Smoking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41</td>
<td>Male</td>
<td>Buccal mucosa</td>
<td>10 quids/day for 5 months</td>
<td>None</td>
</tr>
<tr>
<td>2</td>
<td>61</td>
<td>Female</td>
<td>Buccal mucosa</td>
<td>10 quids/day for 15 years</td>
<td>None</td>
</tr>
<tr>
<td>3</td>
<td>32</td>
<td>Male</td>
<td>Buccal mucosa</td>
<td>10 quids/day for 6 years</td>
<td>5 cigarettes/day for 6 years</td>
</tr>
<tr>
<td>4</td>
<td>41</td>
<td>Male</td>
<td>Buccal mucosa and retromolar region</td>
<td>15 quids/day for 5 years</td>
<td>None</td>
</tr>
<tr>
<td>5</td>
<td>38</td>
<td>Female</td>
<td>Buccal mucosa</td>
<td>3 quids/day for 20 years</td>
<td>2 cheroots/day for 28 years</td>
</tr>
<tr>
<td>6</td>
<td>63</td>
<td>Female</td>
<td>Buccal mucosa</td>
<td>15 quids/day for 8 years</td>
<td>None</td>
</tr>
<tr>
<td>7</td>
<td>60</td>
<td>Male</td>
<td>Buccal mucosa</td>
<td>20 quids/day for 15 years</td>
<td>None</td>
</tr>
<tr>
<td>8</td>
<td>48</td>
<td>Male</td>
<td>Buccal mucosa</td>
<td>10 quids/day for 6 years</td>
<td>Occasionally</td>
</tr>
</tbody>
</table>

### Table 6 Carcinoma and Precancerous lesion detection rates by oral habit

<table>
<thead>
<tr>
<th>Oral Habit</th>
<th>Total Subjects</th>
<th>Carcinoma</th>
<th>Precancerous lesion</th>
<th>Carcinoma and Precancerous lesion Detection Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoking (non-BQ chewing)</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>11.1%</td>
</tr>
<tr>
<td>BQ chewing (non-Smoking)</td>
<td>71</td>
<td>1</td>
<td>5</td>
<td>8.5%</td>
</tr>
<tr>
<td>BQ chewing + Smoking</td>
<td>25</td>
<td>1</td>
<td>3</td>
<td>16.0%</td>
</tr>
</tbody>
</table>
Discussion

An epidemiologic hospital-based study of 70 oral cancer cases in Myanmar demonstrated that the prevalence of smoking (regular and occasional) was 67.1% in the group of oral cancer cases, whereas the prevalence of BQ chewing (regular and occasional) was 71.4% in the same group [5]. In addition, 70% of the oral cancer patients were Stage IV (advanced stage), whereas only 7.1% were Stage I (early stage) [5].

Therefore, preventive medicine and oral cancer screening of high-risk groups are needed for early detection [2]. There are few reports of oral cancer screening for high-risk populations in Myanmar. Our present findings showed the utility of oral cancer screening in high-risk populations. In our screening, oral lesions were detected in 39 subjects (37.1%) in the high-risk group. Oral carcinoma mainly afflicts patients older than 40 years of age. In the present study, the average ages of the men and women were 48.5 years and 52.3 years, respectively. Furthermore, 83.0% of the subjects were 40 years of age or older.

An unexpected finding in our high-risk population was the high incidence of lichen planus lesions. Although not widely recognized, the existence of lichen planus lesions in a BQ-chewing population may be another precancerous condition leading to oral cancers [14, 15].

Betel quid consists of 3 major ingredients: the betel ‘nut’ (areca nut), the betel leaf (Piper betle), and lime (calcium hydroxide) [3]. Tobacco is often added [3].

Betel quid is associated with chemical carcinogenesis, and BQ ingredients have been shown to induce cytotoxicity and DNA strand breakage [2]. The genesis of oral squamous cell carcinoma is a complex process involving multiple genetic and epigenetic alterations, which can be affected by various risk factors [7].

The customs of BQ chewing seen in many Asian countries does not occur in Japan. As such, the situation in Japan differs markedly from Myanmar. The oral cancer detection rate in populations subjected to oral cancer screening in Japan has been reported to be 0.09-0.4% [16]. Nagao et al. reported that the cancer detection rate was 0.05% in an oral cancer screening in Japan, and that precancerous lesions were detected in 0.42% of cases (leukoplakia 0.4% and erythroplakia 0.02%) [17]. Their subjects were a general population of citizens (over 40 years age) [17]. In Japanese subjects, a significantly higher prevalence of oral pre-cancer was found among male smokers (2.5%) compared to male non-smokers (0.8%) \( (p<0.005) \) [17]. However, in our oral cancer screening of a high-risk group in Myanmar, the cancer detection rate and the cancer and precancerous lesion detection rate were 2.9% and 10.5%, respectively. Furthermore, the detection rate of cancer and precancerous lesions was 16.0% in the BQ chewing + smoking group \( (p=0.569, \text{ Table } 6) \). Of course, we cannot simply compare our data with other cancer screening data, but it is clear that nationwide oral cancer screening projects for high-risk groups are necessary in Myanmar in contrast to Japan, where oral carcinoma is uncommon, accounting for only 1-2% of all cancer deaths [18].

To reduce the incidence of oral cancer in Myanmar, education on tobacco- and BQ- related oral diseases along with oral cancer screening are of the utmost importance. However, BQ chewing is often related to manners and customs in the Myanmar population, especially among individuals of low socioeconomic status, some of whom rely on the sale of BQ to sustain their daily lives. Therefore, livelihood support should be considered in order to achieve the successful eradication of BQ use. The cooperation of the school education system, news media, and government support will also be necessary. In conclusion, we expect that oral cancer screening will contribute to oral cancer awareness, the early detection of oral cancer and thus to improvements in the quality of life.

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References