Association of Psychological Well-Being with Oral Conditions in Japanese Workers

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Abstract: Association of Psychological Well-Being with Oral Conditions in Japanese Workers: Reiko IDE, et al. Department of Clinical Epidemiology, Institute of Industrial Ecological Sciences, University of Occupational and Environmental Health—Although the effect of disorders on psychological well-being is well-known, there are few studies focusing on oral conditions at the worksite. The present study examined the association between psychological well-being and oral conditions of Japanese workers. A cross-sectional study was performed using data from 1381 Japanese civil service officers aged 20–59 yr old. Psychological well-being was measured with the 12-item version of the General Health Questionnaire (GHQ-12) in a comprehensive health questionnaire, while measures for oral condition included self-rated oral health, oral symptoms and clinical indicators: dental caries, periodontal status and number of missing teeth. The mean GHQ scores according to the levels of each oral condition were estimated by analysis of variance, separately for males and females. Higher scores corresponded to poorer psychological well-being. Age, gender, smoking and type of occupation were adjusted in a multivariate analysis. Psychological well-being was not associated significantly with dental caries, periodontal status or number of missing teeth. The adjusted means of the GHQ scores for ‘conscious of appearance of mouth’ were significantly different among the categories for both genders (male: \( p<0.001 \), female: \( p=0.018 \)). For five of six oral symptoms, the adjusted means of GHQ scores were lowest for those respondents who rated their oral symptoms as ‘never or hardly ever.’ Our results did not show that psychological well-being was associated with oral conditions measured by clinical indicators. However, an association was found between some oral symptoms and psychological well-being. Absence of oral symptoms seems to be related to better psychological well-being. (J Occup Health 2006; 48: 487–493)

Key words: Oral health, Psychological factors, Cross-sectional study

Several studies have shown an interest in the effects of oral diseases and disorders on general health and quality of life. It has been suggested that anxiety, depression and emotional fatigue are common complaints among individuals with chronic disorders. These studies have brought about some advances in the concept of oral health-related quality of life (OHRQoL), in which psychological well-being plays an important role\(^1\). Many older people with poor oral health suffer from problems in daily living (chewing, pain, difficulties in eating), affecting overall psychological well-being. A prospective study in older adults aged 50 years and over found that self-perceived oral health had a significant independent effect on psychological well-being and life satisfaction\(^2\). However, to date, relatively few studies have looked at the association between psychological well-being and oral conditions of young and middle aged adults.

During recent decades, psychological well-being (mental health) at work has become a subject of growing concern in the developed countries due to changes in the working environment. Mental health is a major occupational issue in Japan, and in view of this problem, guidelines for the promotion of mental health in the workplace were established in 2000 by the Ministry of Labour, Health and Welfare. In addition to mental health, a large proportion of working adults suffer from oral diseases, particularly periodontal diseases. It has been reported that 88% of adults aged 45–54 yr have experienced some degree of periodontal diseases (gingival
bleeding, calculus, pocket depths of 4 mm and more). For this reason, it may be necessary to consider the association of psychological well-being with oral conditions when planning or implementing health promotion programs at the worksite.

Psychological well-being is influenced by multiple factors, such as age, gender and socioeconomic status. Therefore, the possible effects of these factors on psychological well-being must be taken into account when investigating the relationship of psychological well-being to oral conditions. In the present study, we evaluated the association between psychological well-being and oral conditions, while adjusting for potential confounding factors, using cross-sectional data from an oral examination and a health-assessment questionnaire of Japanese civil service officers. Oral conditions were measured by clinical indicators, self-rated oral health and oral symptoms.

Methods

Data source

The target population consisted of civil service officers (about 25,000) from a prefecture in southwestern Japan. They were responsible for administering various social welfare programs, including health insurance and welfare pensions, in accordance with Japanese government regulations. They had received annual periodic health examinations and biennial oral examinations.

A comprehensive health questionnaire survey was conducted to ascertain the health status of about 4,000 people at ten offices who were a convenient sample. The self-administered questionnaires were distributed to them and collected at periodic health examinations in each workplace. The questionnaire consisted of perceived systemic health, psychological well-being, diet, smoking, drinking, working status, exercise, etc. Psychological well-being was measured with the 12-item version of the General Health Questionnaire (GHQ-12) that has been in widespread use in general practice for screening of psychiatric disorders. It has been reported that the Japanese version of the GHQ-12 can be used as a reliable and valid scale for Japanese adults. Other items included in the questionnaire were smoking status, occupation, gender and age.

The oral examinations were carried out in four of ten offices by seven trained dentists. The measures of oral condition included clinical indicators, self-rated oral health and oral symptoms. Periodontal status was defined by the Community Periodontal Index of Treatment Needs (CPITN). Ten index teeth in six sextants were probed and scores ascribed to each sextant for the following assessment: 0, healthy; 1, bleeding on probing; 2, supra or subgingival calculus; 3, pocket probing depth 4 or 5 mm; and 4, pocket probing depths 6 mm or more. The highest score of the six sextants determined the CPITN score assigned to each individual. The occurrence of decayed and missing teeth was recorded separately for each tooth. By means of a questionnaire at the oral examinations, we also collected information on self-rated oral health and oral symptoms, namely, bleeding gums, painful (sensitive) teeth or gums, food catching, difficulty in chewing, conscious of appearance of mouth, and stale breath.

The comprehensive health questionnaire survey and the oral examinations were performed independently within three months from July to November 2002. Both the comprehensive health questionnaire and the oral examination data were linked by ID number. The present study was approved by the Ethics Committee of Medical Care and Research, University of Occupational and Environmental Health, Japan.

Study participants

The flow of selection of study subjects is shown in Fig. 1. Of the 2,128 eligible participants who were employed for the full study period, 1,420 (66.7%) completed both the health questionnaire survey and the oral examinations. Of these, after some exclusions, 1,381 subjects (male: 873; female: 508) remained for the analyses.

Variables

Periodontal status was divided into three categories according to the CPITN: no pathological pocket (CPITN score: 0, 1, or 2), moderate periodontitis (CPITN score: 3), and severe periodontitis (CPITN score: 4). The self-rated oral health, assessed from four responses in the questionnaire, was categorized into three grades: excellent or good, not good, and bad. Similarly, the frequency of oral symptoms was categorized into three grades: never or hardly ever, occasionally, and very often. Covariates used in the multivariate analysis were age (in ten-year age groups: 20–29, 30–39, 40–49, and 50–59), smoking (current, past, and non-smoker), and type of occupation. Based on their self-rated occupational status, subjects were grouped into the following categories: clerk, executive, professional (e.g. medical practitioner, engineer), emergency personnel (e.g. fireman, rescuer), and others (e.g. telephone operator, sailor, garbage collector).

Items on the GHQ-12 are scored using 0-1-2-3 Likert scores for response categories. The GHQ score rates each item on a dichotomous response scale as present or absent. The responses are coded 0-0-1-1 and the codes are summed (range, 0–12). Higher scores correspond to poorer psychological well-being.

Analysis

To evaluate the association between psychological well-being and oral conditions, the mean GHQ scores according to the levels of each oral condition were
estimated by an analysis of variance. The analysis included as covariates the variables of age, smoking, and type of occupation. Oral conditions were measured by clinical indicators (number of decayed and missing teeth, CPITN), self-rated oral health, and oral symptoms: bleeding gums, painful (sensitive) teeth or gums, food catching, difficulty in chewing, conscious of appearance of mouth, stale breath. The above calculations were executed using the Statistical Analysis System Version 8.02.

Table 1 shows the basic characteristics of the subjects by gender. The mean ages of males and females were 41.5 and 40.0 yr, respectively. The majority of both males and females were clerks and professionals. The proportion of subjects with severe periodontitis in males and females were 13.2% and 5.3%, respectively. The mean number of decayed teeth was small (< 1) in both genders. The prevalence of food catching in males and females appeared to have high values, 86.3% and 83.5%, respectively.

The adjusted means of GHQ scores in relation to oral health status measured by clinical indicators according to gender are presented in Table 2. In males, the adjusted mean GHQ scores for no pathological pocket, moderate periodontitis, and severe periodontitis, respectively (p=0.417). The corresponding GHQ scores in females were 3.2, 3.4, and 2.6, respectively (p=0.410). For decayed and missing teeth, there was also no clear trend in the GHQ scores for either gender.

The adjusted mean GHQ scores in relation to oral health status measured by self-rated oral health and oral symptoms are presented in Table 3. Subjects who rated their oral health as “poor” had higher GHQ scores than those who rated their oral health as “excellent or good,” although there was a significant difference only in females (p=0.004). The adjusted means of GHQ scores for ‘conscious of appearance of mouth’ were significantly different among the categories in both genders (male: p<0.001; female: p=0.018), and were highest for those respondents who rated their oral symptoms as “very often.” There were significant differences among the adjusted means of GHQ scores in each category for the ‘bleeding gums’ item in females and ‘food catching’ and ‘stale breath’ items in males. There was no association between ‘painful teeth or gums’ and ‘difficulty in chewing’ symptoms. For almost all oral symptoms, the adjusted means of GHQ scores were lowest for those respondents who rated their oral symptoms as “never” or “hardly ever.”

Discussion

The present study provides evidence for associations of psychological well-being and oral conditions in young and middle-aged adults. Our results did not show that
Table 1. Demographic characteristics and oral condition of the study subjects

<table>
<thead>
<tr>
<th></th>
<th>Male (N=873)</th>
<th>Female (N=508)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD)</td>
<td>41.5 (10.5)</td>
<td>40.0 (10.6)</td>
</tr>
<tr>
<td>Smoking status (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current</td>
<td>49.9</td>
<td>2.6</td>
</tr>
<tr>
<td>Past</td>
<td>23.3</td>
<td>2.0</td>
</tr>
<tr>
<td>Type of occupation (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clerks</td>
<td>61.1</td>
<td>48.4</td>
</tr>
<tr>
<td>Executives</td>
<td>1.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Professionals</td>
<td>21.0</td>
<td>36.8</td>
</tr>
<tr>
<td>Emergency personnel</td>
<td>4.1</td>
<td>0.0</td>
</tr>
<tr>
<td>Others</td>
<td>12.8</td>
<td>14.6</td>
</tr>
<tr>
<td>Periodontal status (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate periodontitis (CPITN score 3)</td>
<td>36.9</td>
<td>29.3</td>
</tr>
<tr>
<td>Severe periodontitis (CPITN score 4)</td>
<td>13.2</td>
<td>5.3</td>
</tr>
<tr>
<td>No. of decayed teeth (SD)</td>
<td>0.7 (1.5)</td>
<td>0.4 (1.1)</td>
</tr>
<tr>
<td>No. of missing teeth (SD)</td>
<td>1.4 (2.2)</td>
<td>1.4 (2.2)</td>
</tr>
<tr>
<td>Self-rated oral health (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not good</td>
<td>56.7</td>
<td>56.7</td>
</tr>
<tr>
<td>Poor</td>
<td>19.8</td>
<td>16.7</td>
</tr>
<tr>
<td>Oral symptom (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bleeding gums</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>32.9</td>
<td>33.3</td>
</tr>
<tr>
<td>Very often</td>
<td>10.0</td>
<td>7.9</td>
</tr>
<tr>
<td>Painful (sensitive) teeth or gums</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>36.7</td>
<td>32.1</td>
</tr>
<tr>
<td>Very often</td>
<td>6.2</td>
<td>6.9</td>
</tr>
<tr>
<td>Food catching</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>45.6</td>
<td>49.6</td>
</tr>
<tr>
<td>Very often</td>
<td>40.7</td>
<td>33.9</td>
</tr>
<tr>
<td>Difficulty in chewing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>18.2</td>
<td>15.6</td>
</tr>
<tr>
<td>Very often</td>
<td>5.2</td>
<td>5.5</td>
</tr>
<tr>
<td>Conscious of appearance of mouth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>29.2</td>
<td>34.3</td>
</tr>
<tr>
<td>Very often</td>
<td>13.1</td>
<td>23.6</td>
</tr>
<tr>
<td>Stale breath</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Occasionally</td>
<td>45.8</td>
<td>40.2</td>
</tr>
<tr>
<td>Very often</td>
<td>8.3</td>
<td>10.2</td>
</tr>
</tbody>
</table>

Table 2. Mean GHQ scores according to oral health status measured by clinical indicators

<table>
<thead>
<tr>
<th></th>
<th>Male (N=873)</th>
<th>Female (N=508)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean GHQ† (S.E.)</td>
</tr>
<tr>
<td>Periodontal status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No pathological pocket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CPITN score 0,1,2)</td>
<td>436</td>
<td>2.5 (0.3)</td>
</tr>
<tr>
<td>Moderate periodontitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CPITN score 3)</td>
<td>322</td>
<td>2.2 (0.3)</td>
</tr>
<tr>
<td>Severe periodontitis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(CPITN score 4)</td>
<td>115</td>
<td>2.3 (0.4)</td>
</tr>
<tr>
<td></td>
<td>p=0.417</td>
<td></td>
</tr>
<tr>
<td>No. of decayed teeth*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>610</td>
<td>2.3 (0.3)</td>
</tr>
<tr>
<td>&gt;0</td>
<td>263</td>
<td>2.4 (0.3)</td>
</tr>
<tr>
<td></td>
<td>p=0.765</td>
<td></td>
</tr>
<tr>
<td>No. of missing teeth*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>448</td>
<td>2.5 (0.3)</td>
</tr>
<tr>
<td>1–2</td>
<td>170</td>
<td>2.1 (0.3)</td>
</tr>
<tr>
<td>&gt;2</td>
<td>255</td>
<td>2.2 (0.3)</td>
</tr>
<tr>
<td></td>
<td>p=0.358</td>
<td></td>
</tr>
</tbody>
</table>

*Except third molar. †Adjusted for age categories (20–29, 30–39, 40–49, and 50–59), smoking status (current, past, and never), type of occupation (clerks, executives, professionals, emergency personnel, and others).
psychological well-being was associated with dental caries, periodontal status or number of missing teeth. An association was found between ‘food catching’ and ‘conscious of appearance of mouth’ and psychological well-being. Absence of oral symptoms seems to be related to better psychological well-being.

Age, gender, socioeconomic factors and smoking are considered to influence the association between psychological well-being and oral conditions. In a study investigating the association between psychosocial factors and periodontitis, it was indicated that the above factors were associated with periodontitis\(^8\). Smoking has been shown to be associated with depression\(^9,10\). In our study, the associations of psychological well-being with oral conditions were analyzed by gender, adjusted for age, smoking status, and type of occupation. One advantage of the study was that the participants were a relatively homogeneous social group in terms of socioeconomic status comprised of civil officers from one prefecture.

### Table 3. Mean GHQ scores according to self-rated oral health and frequency of oral symptoms

<table>
<thead>
<tr>
<th></th>
<th>Male (N=873)</th>
<th></th>
<th>Female (N=508)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>Mean GHQ* (S.E.)</td>
<td>N</td>
<td>Mean GHQ* (S.E.)</td>
</tr>
<tr>
<td><strong>Self-rated oral health</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent or good</td>
<td>205</td>
<td>2.3 (0.3)</td>
<td>135</td>
<td>2.5 (0.9)</td>
</tr>
<tr>
<td>Not good</td>
<td>495</td>
<td>2.3 (0.3)</td>
<td>288</td>
<td>3.4 (0.9)</td>
</tr>
<tr>
<td>Poor</td>
<td>173</td>
<td>2.8 (0.3)</td>
<td>85</td>
<td>3.8 (1.0)</td>
</tr>
<tr>
<td><strong>p=0.169</strong></td>
<td></td>
<td></td>
<td><strong>p=0.004</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Oral symptoms</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Bleeding gums</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or hardly ever</td>
<td>499</td>
<td>2.2 (0.3)</td>
<td>299</td>
<td>2.9 (0.9)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>287</td>
<td>2.4 (0.3)</td>
<td>169</td>
<td>3.7 (0.9)</td>
</tr>
<tr>
<td>Very often</td>
<td>87</td>
<td>2.7 (0.4)</td>
<td>40</td>
<td>3.9 (1.0)</td>
</tr>
<tr>
<td><strong>p=0.310</strong></td>
<td></td>
<td></td>
<td><strong>p=0.018</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Painful (sensitive) teeth or gums</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or hardly ever</td>
<td>499</td>
<td>2.3 (0.3)</td>
<td>310</td>
<td>3.1 (0.9)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>320</td>
<td>2.5 (0.3)</td>
<td>163</td>
<td>3.5 (0.9)</td>
</tr>
<tr>
<td>Very often</td>
<td>54</td>
<td>2.3 (0.5)</td>
<td>35</td>
<td>3.8 (1.1)</td>
</tr>
<tr>
<td><strong>p=0.473</strong></td>
<td></td>
<td></td>
<td><strong>p=0.288</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Food catching</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or hardly ever</td>
<td>120</td>
<td>1.9 (0.3)</td>
<td>84</td>
<td>2.5 (1.0)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>398</td>
<td>2.2 (0.3)</td>
<td>252</td>
<td>3.4 (0.9)</td>
</tr>
<tr>
<td>Very often</td>
<td>355</td>
<td>2.7 (0.3)</td>
<td>172</td>
<td>3.5 (0.9)</td>
</tr>
<tr>
<td><strong>p=0.024</strong></td>
<td></td>
<td></td>
<td><strong>p=0.060</strong></td>
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</tr>
<tr>
<td><strong>Difficulty in chewing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or hardly ever</td>
<td>669</td>
<td>2.3 (0.2)</td>
<td>401</td>
<td>3.2 (0.9)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>159</td>
<td>2.5 (0.3)</td>
<td>79</td>
<td>3.3 (1.0)</td>
</tr>
<tr>
<td>Very often</td>
<td>45</td>
<td>3.0 (0.5)</td>
<td>28</td>
<td>3.8 (1.1)</td>
</tr>
<tr>
<td><strong>p=0.303</strong></td>
<td></td>
<td></td>
<td><strong>p=0.655</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Conscious of appearance of mouth</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or hardly ever</td>
<td>504</td>
<td>2.1 (0.3)</td>
<td>214</td>
<td>3.1 (0.9)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>255</td>
<td>2.5 (0.3)</td>
<td>174</td>
<td>3.0 (0.9)</td>
</tr>
<tr>
<td>Very often</td>
<td>114</td>
<td>3.2 (0.4)</td>
<td>120</td>
<td>4.0 (1.0)</td>
</tr>
<tr>
<td><strong>p&lt;0.001</strong></td>
<td></td>
<td></td>
<td><strong>p=0.018</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Stale breath</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never or hardly ever</td>
<td>401</td>
<td>2.2 (0.3)</td>
<td>252</td>
<td>3.2 (0.9)</td>
</tr>
<tr>
<td>Occasionally</td>
<td>400</td>
<td>2.4 (0.3)</td>
<td>204</td>
<td>3.4 (1.0)</td>
</tr>
<tr>
<td>Very often</td>
<td>72</td>
<td>3.2 (0.4)</td>
<td>52</td>
<td>3.7 (1.0)</td>
</tr>
<tr>
<td><strong>p=0.022</strong></td>
<td></td>
<td></td>
<td><strong>p=0.454</strong></td>
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</table>

*Adjusted for age categories (20–29, 30–39, 40–49, and 50–59), smoking status (current, past, and never), type of occupation (clerks, executives, professionals, emergency personnel, and others)
group was fewer, the number of missing teeth and CPITN
distribution were almost similar to those of the general
Japanese population\(^1\), so the study subjects can be
considered to be moderately representative of Japanese
adults with respect to oral conditions. However, there
were limitations as a cross-sectional study.

The present study observed no clinical oral indicators
correlating with the psychological well-being parameter
(Table 2). This concurs with the finding of a cross-
sectional study by Anttila et al. that depressive symptoms,
measured by the Zung Self-Rating Depression Scale
(ZSDS), were not associated with dental caries,
periodontal status, or number of teeth\(^1\). Their results
also showed that edentulousness was independently
associated with depressive symptoms. Since there was
no edentulous subject in our study, it was not possible to
evaluate the association between edentulousness and
psychological well-being. In our study, our finding of
no significant relationship between periodontal disease
and psychological well-being, needs to be interpreted with
a degree of caution, because the CPITN index is known
to be biased towards underestimation of periodontal
disease\(^12\).

A prospective analysis indicated no association
between self-perceived oral health and the GHQ scores
in older adults\(^2\). On the other hand, a cross-sectional
between self-perceived oral health and the GHQ scores
aged adults in the UK\(^13\). In our study, the health survey
significant psychological distress for young and middle
disease\(^12\).

The findings presented here do not reveal an association
of oral conditions measured by clinical indicators with
the GHQ scores as expected. This may be explained in
part by the rationale, “Clinical indicators which measure
disease, and subjective indicators which measure health,
document different dimensions of human experience”\(^14\).
The GHQ scores for respondents who rated their oral
symptoms as “never” or “hardly ever” were lowest for
almost all oral symptoms (Table 3). This suggests that
the absence of oral symptoms is related to better
psychological well-being.

A key point in research for psychological well-being
is the choice of instrument from among the psychological
measurements that have been developed. We selected
the GHQ-12 as an appropriate measure for this study, in
Japanese workers. It is a well-validated inventory of self-
reported, non-psychotic psychological well-being. The
questionnaire asks whether the respondent has
experienced any symptoms of depression, anxiety, sleep
disturbance or difficulties in social functioning\(^15\).

Previous studies using the GHQ have appeared in
prosthodontic research including denture and implant
therapy\(^16–18\). For patients provided with implant
supported overdentures, significant improvement in GHQ
scores were demonstrated\(^18\). In another study, there were
significant declines in psychological distress in implant
patients, although there was no such change for the
denture patients\(^20\). The kinds of oral disorders affecting
the individuals studied were likely to be severe, so the
expected outcome of the psychological aspect of the study
could be realized. In contrast, our study found significant
differences in the GHQ scores according to the severity
of some oral symptoms (Table 3), even though the study
participants were workers, rather than patients in clinical
settings.

There were limitations to this study, as there are to all
cross-sectional studies, in that they cannot identify causal
relationships. In addition, it has been shown that many
factors, other than oral conditions, are related to
psychological well-being. These difficulties also emerged
in our study in the interpretation of the results. However,
an independent association was found between the GHQ
score and the ‘conscious of appearance of mouth’
symptom, indicating the importance of aesthetic
appearance to the subjects. This should emphasize the
need to pay attention to aesthetics in the field of dental
care. Moreover, we can suggest that the absence of oral
symptoms contributes to better psychological well-being.
The inclusion of oral symptoms appeared to be useful in
understanding the relationship between oral health and
psychological well-being in Japanese workers. In other
words, oral symptoms can be regarded as a readily visible
identification of a person’s mental health status, therefore,
consideration for the inter-relation between mental and
oral health would help promote more effective worksite
health promotion.

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### Appendix

Contents of questionnaire for self-rated oral health and oral symptoms

<table>
<thead>
<tr>
<th>How do you feel about your oral condition (incl. teeth, gum, and/or denture)?</th>
<th>Excellent</th>
<th>Good</th>
<th>Not good</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you had any of the following symptoms within the last month?</td>
<td>Never</td>
<td>Hardly ever</td>
<td>Occasionally</td>
<td>Very often</td>
</tr>
<tr>
<td>1) Have you noticed your gums bleeding?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>2) Have you had painful or sensitive teeth or gums?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>3) Have you had food catching in between your teeth?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>4) Have you had difficulty chewing any foods?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>5) Have you been self-conscious of the appearance of your mouth?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>6) Have you felt that your breath has been stale?</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>