Many different factors are known to cause and perpetuate the symptoms of temporomandibular disorders (TMD). However, the roles of parafunctional factors have not been clearly elucidated. We found one of these habits in the clinical setting. This parafunctional habit involves daily light touching of the upper and lower teeth, when the mouth is closed. We named this habit Teeth Contacting Habit (TCH). 

[Objectives] To investigate the following hypotheses: 1) TCH is associated with perpetuation of chronic pain of TMD patients; 2) TCH is associated with other behavioral factors.

[Methods] Two hundred and twenty-nine TMD outpatients with chronic pain were analyzed with multivariate logistic regression models.

[Results] TCH was found in 52.4% of patients. Patients with TCH and pain lasting for more than four months were less likely to experience improvements in pain at the first visit (OR = 1.944, p = 0.043). Other factors associated with TCH were as follows: unilateral chewing (OR = 2.802) and involvement in a precision job (OR = 2.195). [Conclusion] TCH can prolong TMD pain and is associated with other behavioral factors.

Key words: TMJ, temporomandibular joint disorders, contributing factor, teeth contacting habit, parafunction

Introduction

It has long been thought that the etiology and perpetuation of temporomandibular disorders (TMD) are multifactorial. According to the multifactorial concept, it is necessary to recognize and manage these contributing and perpetuating factors in order to improve the symptoms of a TMD patient. We have observed improvements in patient symptoms when these behavioral factors were clinically managed. Of these factors, we noted that some patients constantly touch their upper and lower teeth lightly without clenching forcefully. Almost none of these patients...
were personally aware of this behavioral habit. However, after introducing a self-care program to alter this behavior, some patients either experienced improvement or complete resolution of their pain symptoms. This behavior is referred to as teeth contacting habit (TCH) and is suspected to be a perpetuating factor of TMD. We hypothesized that this habit might increase tension of the masseter and temporal muscles, increasing the load on the temporomandibular joint (TMJ). This continuous tension and loading might result in constant pain in the muscle and/or TMJ. Although there have been no reliable reports on the association of this habit with perpetuation of pain except for diurnal clenching, we consider that control of this habit could be an effective treatment for pain. Gramling et al. reported the efficacy of an oral habit reversal treatment program for TMD pain, although they did not refer to TCH. Thus, we thought that the role of TCH on the perpetuation of pain should be evaluated. The purpose of this study was to investigate the prevalence of this habit and the association of this habit with long-standing or aggravating pain and with other factors in TMD patients using a self-reporting questionnaire. This study had two hypotheses. First, TCH should prolong the duration of pain, and second, TCH is associated with other psychological or behavioral factors.

This investigation was carried out as part of a cross-sectional survey that has been previously described in detail.

**Materials and Methods**

**Subjects**

The subjects of this study were consecutive extractions from TMD patients who visited one of three departments (the Temporomandibular Joint Clinic, and the Clinic of Oral Surgery, Tokyo Medical and Dental University, the Department of Dentistry, Jikei University School of Medicine) for diagnosis and treatment from December 2000 to November 2001. After explaining the survey details and obtaining written informed consent, a battery of questionnaires was administered. A total of 531 outpatients with TMD were recruited. 20 questionnaires could not be collected. Five hundred eleven patients (96.2%) answered the questionnaire and an additional three patients had to be excluded because they did not answer several questions regarding TCH. As a result, 508 patients were eligible for the analysis. Approval was obtained from the ethical committees of both universities prior to commencement of the study.

**Inclusion and exclusion criteria**

Patients who joined this study were those who (1) were diagnosed with RDC/TMD (Axis I), (2) complained of lasting pain for one week or more at the temporomandibular joint (TMJ) and/or the masticatory muscle, and (3) were over 12 years old. Patients with different diagnostic subtypes on either side were classified according to the side with more severe pain. Patients were excluded based on the following criteria: pain resulting from systemic bone or joint disease, age less than 12 years, regular intake of medicines such as analgesics, anti-anxiety drugs, anti-depressants and psychotropics, and having molar teeth deficit and/or recovered removable denture. However, we included one patient with a fixed denture and a deficit of the 2nd molar tooth.

**Questionnaire**

The contents of the questionnaire were as follows:

1. Personal record: name, age, sex
3. Transitional VAS rating of pain intensity evaluated by a patient for each month from development to present time.
4. Hospital Anxiety and Depression Scale (HADS)

The HADS is divided into two subscales: one for anxiety and the other for depression. Each subscale has seven questions, and the patient’s answers are given scores of zero to three. On each subscale, a score of seven or less indicates the absence of anxiety or depression, a score between eight and 10 suggests probable presence of the condition, and a score of 11 or more indicates definite presence of anxiety or depression. This questionnaire is used widely in primary clinics to measure psychological distress in patients with physical illness because it has no items regarding somatic symptoms influenced by psychological illness, and it takes only a short time to complete. All items refer to mood symptoms experienced during the previous week. The validity and usefulness of HADS have been investigated for many types of diseases, including orofacial diseases.

The Japanese version of the HADS is also reported to have well-accepted reliability and validity in studies involving healthy people and people with diseases.


5. Eysenck Personality Questionnaire Short Form (S-EPQ)

The S-EPQ\textsuperscript{27}, which can be answered in about three minutes, is divided into two subscales: one for neuroticism and another for extroversion. Each subscale has six questions, and the patient’s answers are given scores of one to four. Therefore, the minimum score is six and the maximum is 24. The reliability and validity of the Japanese version of the S-EPQ have been evaluated, and the test is considered to be effective for the detection of neuroticism and extroversion.\textsuperscript{28}

6. A total of 25 questions related to behavioral contributing factors and the onset or maintenance of symptoms in daily life. These included seven oral parafunctional factors, 10 usual behavioral factors and eight working environmental factors. The patients were asked to respond with “yes” or “no” to each question. TCH was one of seven oral parafunctional factors examined. In order to detect this habit, we asked each patient “Do you often let your upper- and lower teeth contact continuously during work or at rest?” We did not ask the patients whether she/he clenched forcefully or not.

Statistical analyses

We selected 229 patients in whom pain continued for more than four months from 508 patients for analysis of the first hypothesis.

Next, these patients were divided into two groups according to whether or not their pain improved at the first visit comparing pains at onset and at the first visit. In order to judge the improvement in pain, we made a patient rate her/his pain at the onset of the symptom and at the first visit on a visual analogue scale (VAS) of 100 mm. We then subtracted her/his VAS rating at the first visit from that at the onset of pain, and divided these calculated values into 10 groups. From this distribution, we divided the patients into two groups: improved and not-improved (Fig 1).

And we compared sex, age, duration of pain, HADS score, S-EPQ score and 25 contributing factors between the two groups by univariate statistics. We compared the variables with chi-squared test for percentages, and Mann-Whitney U-tests for numerical values. Thereafter, multiple logistic regression model analysis was performed to examine the first hypothesis. The dependent variable was improvement/no improvement and the independent variables were as follows: sex, age, RDC/TMD subtype, HADS score, S-EPQ score and the binary score of 25 contributing factors. The covariates were entered into the logistic regression model using a stepwise forward technique. The RDC/TMD subtype data were entered into the model as a categorical variable. As S-EPQ scores showed a nonlinear relationship to the logarithm of the dependent variable, these scores were separated into two categories using an appropriate cutoff value (equal to and less than 20/greater than 20) that was determined by plotting the log-odds against the value of the independent variable.

As for the second hypothesis, multiple logistic
regression model analysis was performed for 229 patients. The dependent variable was the presence/absence of TCH, and the independent variables were the above mentioned items, except for the question for TCH.

A p-value of <0.05 (two-tailed) was regarded as statistically significant. The data were analyzed using the SPSS for Windows Ver. 11.0 software (SPSS, JAPAN).

Results

Because of missing values, n varied somewhat from analysis to analysis. No variables had a normal distribution; therefore, central tendency was shown as the median and 25th and 75th percentiles.

Table 1 demonstrates the characteristics of patients whose pain lasted for four or more months. Women accounted for 85.6% of the total patients. The median age was 32 years. The median duration of pain was 6 months. The median scores of anxiety and depression

| Table 1. Characteristics of patients with and without improvement of pain. |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
|                                | Total patients  | Pain            | Not-improved    |                  |
|                                | n=229           | Improved n=96   | Not-improved n=130 | P-value         |
| Sex (%F)                       | 85.6            | 89.6            | 85.1            | NS              |
| Age yr. (median)(25%,75%)      | 32.0 (24, 51.0) | 31.0 (24, 44.0) | 34.0 (23, 52.0) | NS              |
| Duration of pain, mth. (median)(25%, 75%) | 6.0 (6.0, 6.0)   | 6.0 (6.0, 6.0)   | 6.0 (5.0, 6.0)   | NS              |
| HADS anxiety score, (median)(25%,75%) | 7.0 (4.0, 9.0)   | 7.0 (5.0, 9.0)   | 7.0 (4.0,10.0)   | NS              |
| depression score, (median)(25%,75%) | 4.0 (2.5, 6.0)   | 4.0 (2.0, 7.0)   | 4.0 (2.0, 6.0)   | NS              |
| S-EFPQ neuroticism score, (median)(25%,75%) | 15.0 (12.0, 17.0) | 14.0 (12.0, 16.0)| 15.0 (12.0, 18.0)| NS              |
| extroversion score, (median)(25%,75%) | 16.0 (14.0, 18.0) | 16.5 (14.0, 18.0)| 16.0 (14.0,18.0) | NS              |

Selected percentages of contributing factors (%)

Oral parafunctional factors

- Grinding pointed out by family members: 34.2%
- Awareness of teeth contacting habit(TCH): 52.4%
- Gum chewing: 17.0%
- Unilateral chewing: 67.8%
- Nail biting: 6.1%
- Pencil biting: 0.9%
- Jetting the chin forward: 14.0%

Usual behavioral factors

- Shortage of sleep: 47.6%
- Using a high and/or hard pillow: 16.2%
- Reading a book lying on the face: 25.3%
- Prone position during sleep: 10.5%
- Tumbling in bed: 33.9%
- Arm leaning while watching TV: 34.5%
- Cupping of the chin: 44.1%
- Liking for a hard food: 25.3%
- Having poor posture: 62.7%
- Talking for a long time on the phone: 47.6%

Working environmental factors

- Being in a busy job: 56.1%
- Lifting or carrying heavyweights: 19.7%
- Being in a precision job: 25.1%
- Cool air conditioning in the office: 44.7%
- Feeling stress at a meeting or while talking with a customer: 38.5%
- Feeling stress with human relationships: 34.8%
- Talking by telephone with a receiver on the shoulder: 10.7%
- Working on a keyboard: 40.1%

P-values were calculated with the chi-squared test for percentages, and the Mann-Whitney U-tests for numerical values.

* Chi-squared test. NS = not significant.
by HADS were within normal range. The median scores of neuroticism and extroversion by SEPO were 15 and 16, respectively. Contributing factors to which 50% or more of patients answered “yes” were as follows: unilateral chewing (67.8%), poor posture (62.7%), being in a busy job (56.1%) and awareness of teeth contacting habit (52.4%). These patients were divided into two groups based on whether or not they experienced improvement in pain at the first visit. There was no significant difference between the two groups except for the behavioral factor of talking for a long time on the phone (p=0.02).

Table 2 shows the result of multiple logistic regression model analysis for the first hypothesis. TCH (OR = 1.944) and age (OR=1.030) were extracted as significant factors. No other factors were found to be significant.

Table 3 displays the result of multiple logistic regression model analysis for the second hypothesis. Unilateral chewing (OR =2.802) and being in a precision job (OR = 2.195) were extracted as significant factors.

### Discussion

Pain duration of three months was often used as the convenient point of division between acute and chronic pain in nonmalignant pain. Therefore, we excluded patients whose pain lasted for less than four months in order to confirm that TCH would affect pain duration in the analysis of two hypotheses.

There have been reports of many perpetuating factors related to TMD symptoms. Many of these reports indicated a relationship between TMD symptoms and parafunctional oral habits such as nocturnal clenching and grinding. Previous studies in non-symptomatic persons indicated that the percentage of diurnal clenching ranges from six to 29%. On the other hand, the percentage of diurnal clenching in TMD patients was reported to be 52 to 82%. In our study, 50.4% of whole 508 participants responded “Yes” to the question for TCH (data not presented), although those of 229 patients with chronic pain were 49.0% (improved) and 54.6% (not-improved) (Table 1). Because of missing data, three cases had to be excluded. About half of both groups had TCH, even though both data include clenching.

Frequent or prolonged clenching activity was generally thought to be more harmful to muscles and joints than grinding. Furthermore, Rugh reported that any light contact of teeth would increase masseter muscle activity. This report suggested that keeping teeth in contact, no matter how light, could contribute to the development and perpetuation of TMD pain.

There have been a few previous reports of light teeth contact in TMD patients. Schiffman reported that 39% of non-patient population experienced light teeth contact. Our study of TMD patients indicated a higher percentage (50.3%) of TCH than that of Schiffman’s report.

Huang et al. surveyed diurnal clenching as a risk factor for onset of pain in TMD patients involving a light contact. They reported an adjusted odds ratio for clenching of 4.8 for the myofascial group, 1.2 for the arthralgia group and 3.3 for the myofascial with arthralgia group. They indicated a relationship between muscle pain and diurnal clenching. On the other hand, we examined the association of TCH with lasting pain. The analysis also showed this habit as a significant factor as in the study by Huang et al.

Our data included both clenching and light contact. It was impossible to differentiate these two parafunctions as they were obtained by self-report. Therefore, we suspected that the effect of intensity of this habit on the symptom would decrease when compared to data obtained from a patient with only clenching habit. However, the results showed association of this habit with chronic pain. Therefore future questionnaires used to detect this contributing factor should not be limited to the item “diurnal clenching”. Rather, they should also include “light contact”. There were some limitations because this survey relied on self-report. The evaluation of whether or not pain improved reported by a patient was considered to be somewhat vague. However, we could not help depending on patients’ reports, as we could not measure the course of patients’ pain from onset to the first visit. Moreover, in

### Table 2. Hypothesis 1: Results of multiple logistic regression analysis with improvement or lack of improvement in pain as a dependent variable

<table>
<thead>
<tr>
<th>Contributing factors</th>
<th>Odds ratio</th>
<th>95%CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.030</td>
<td>1.006–1.055</td>
<td>0.014</td>
</tr>
<tr>
<td>TCH</td>
<td>1.944</td>
<td>1.020–3.704</td>
<td>0.043</td>
</tr>
</tbody>
</table>

### Table 3. Hypothesis 2: Results of multiple logistic regression analysis with presence or absence of TCH as a dependent variable

<table>
<thead>
<tr>
<th>Contributing factors</th>
<th>Odds ratio</th>
<th>95%CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unilateral chewing</td>
<td>2.802</td>
<td>1.400–5.606</td>
<td>0.004</td>
</tr>
<tr>
<td>Being in a precision job</td>
<td>2.195</td>
<td>1.028–4.688</td>
<td>0.042</td>
</tr>
</tbody>
</table>
the survey for contributing factors, the answer "Yes" might increase with recall although we asked a patient regarding her/his current situation. Although the use of self-report leads to inaccuracies, there is no suitable alternative for it in epidemiological research.\textsuperscript{8,45} Consequently, these results should be carefully compared with those in a non-chronic sample.

In this logistic regression model, age was also found to be a significant factor in prolonging the pain duration. There have been no previous reports of an association between age and duration of pain. The odds ratio of one-point aging was around one, and 5-point incremental odds ratio was also calculated to be 1.16 (data not presented). Therefore, we did not consider aging as an important risk although it was significant.

In the second analysis, unilateral chewing and involvement in precision work were selected as significant factors in the logistic regression model as analyzed with the presence or absence of TCH as dependent variables. Greene\textsuperscript{46} stated that psychological anxiety and tension could lead to clenching or grinding. The selected factors of precision work were considered to be associated with psychological tension. We therefore thought it reasonable that these factors might cause TCH. In this analysis, a HADS anxiety score was not extracted as a factor associated with TCH. This result suggested that the habit of light contact of teeth, distinguished from teeth clenching, might not result from an anxious mood. Many patients with TCH frequently mentioned that they had been lightly contacting their teeth since childhood. From these responses, we consider that these patients have been touching their teeth habitually without relation to anxiety. The habitual light contacting of teeth and teeth clenching and their relationship to anxious mood should be investigated separately in a future study. One hundred and fifty three (68.3%) patients responded affirmatively to unilateral chewing, and this frequency was considerably higher than that (39.2%) of the population sample of Schiffman et al.\textsuperscript{4} This percentage increased in the 118 patients with TCH (95 patients (80.5%)). We consider that this behavioral habit may have a role in TMD symptoms, although we could not find any supporting literature. In the future, the role of this habit on TMD symptoms should be elucidated.

In this study, there were many patients who did not realize that they had TCH until they participated in this study. Some patients stated that they thought it was normal to contact their upper- and lower teeth continuously. We had previously attempted to detect forceful diurnal clenching in clinical settings, however, patients often failed to realize their clenching habit while completing the questionnaire. Therefore, in our questionnaire, we included the question for light touching of the teeth so that we could collect many positive responses. DeLaat\textsuperscript{47} instructed patients not to let a tooth touch at rest as part of general counseling. The results of our study further indicate the risk of TCH. We thought it necessary to make a patient take notice of her/his TCH and to control this habit in order to change their behavioral problem. A methodological procedure to control TCH should be introduced, and the role of controlling TCH in improving pain symptoms should be confirmed in future studies.

**Conclusion**

About half of chronic pain patients with TMD had TCH. TCH may be a factor in the prolongation of TMD pain, and this behavioral habit might be related to other factors, such as unilateral chewing and involvement in precision work.

**References**