Difficulty of Food Intake in Patients with Temporomandibular Disorders

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Purpose: Although patients with temporomandibular disorders (TMD) often report impaired eating, the features of food intake difficulty have rarely been estimated. This study compared subjective difficulty in 4 categories of food intake situations among 3 subgroups of TMD patients. ***Materials and Methods:*** A total of 511 TMD patients (402 women, 109 men, mean age 36.4 ± 15.4, range 12 to 82) participated in this study. Subjects were divided into 3 TMD subgroups: myofascial pain (MFP), disc displacement with/without reduction (DD), and arthralgia or osteoarthritis (Arth). Patients' level of food intake difficulty was assessed using a visual analogue scale (VAS) for 4 categories of food intake situations: difficulty in putting food into mouth (PUT), difficulty in biting off foods (BIT), difficulty in grinding down foods (GRD), and overall difficulty in consuming a meal (OAL). ***Results:*** Nearly all patients (98.6%) exhibited food intake difficulty in at least 1 category. In the category of PUT, the DD group exhibited significantly more difficulty than the MFP and Arth groups ($P < .048$), and the Arth group had a higher VAS score than the MFP group ($P = .030$). With regard to BIT and GRD, there was no significant difference among the TMD subgroups. In OAL, the DD group showed more difficulty than the MFP group ($P = .046$). ***Conclusion:*** TMD patients experienced impaired food intake ability. In particular, the DD group experienced more difficulty than the MFP group. Concerns about types of food and food intake behavior for each TMD subtype should be taken into account in the management of TMD patients. *Int J Prosthodont 2006;19:266–270.*

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In the past decade, the psychologic and physical aspects of quality of life (QOL) of patients with temporomandibular disorders (TMD) have been studied.[1–7] As widely reported in the literature, various psychologic signs and symptoms are comorbid with TMD.[5] However, there are relatively few reports of physical impairment in TMD patients, especially with regard to difficulty of food intake. One such report found that most subjects reported pain while eating that limited their choice of food.[8] Another study found a 4-fold increase in functional problems, such as difficulty with chewing foods, in facial pain patients when compared to a pain-free population.[9] In our own experience, we have often encountered TMD patients who complained of difficulty with chewing; however, their difficulty was not from a simple cause but rather had several explanations. Although there are several aspects of jaw dynamics in masticatory movements, most previous studies were limited to studying the abstract measures of masticatory activities such as eating hard/soft foods or chewing foods. One study determined the impact of myofascial face pain (MFP) on dietary intake of selected nutrients. Reduced intake of dietary fiber was observed more frequently in MFP patients with more severe pain.[10]

Examination of the relationship between the signs and symptoms of TMD and the ability to take in food is important for better understanding of the impairment levels of TMD patients. One study reported that chewing ability worsened significantly with temporomandibular joint (TMJ) pain intensity and limited mouth opening; however, there was no association with TMJ noise or TMJ and muscle tenderness.[11] When comparing the subtypes of TMD, one study showed that the chewing ability of patients with anterior disc displacement with reduction was significantly better than that of other TMD subtypes in the pretreatment period.[12]

While various kinds of disabilities in daily activities of TMD patients have been evaluated,[7,13] previous studies have not considered the possible relationship between food intake disabilities and TMD subtypes.

For all of these reasons, the current study compared subjective difficulty in food intake among 3 TMD subgroups. Furthermore, the intensity of difficulty was measured in 4 different food intake situations. Our null hypothesis was that food intake difficulty levels would not differ between matched TMD subtype patient groups.

Materials and Methods

Subjects

The subjects of this study were consecutively recruited from new patients with TMD who attended 1 of 3 facilities (Temporomandibular Joint Clinic or the Clinic of Oral Surgery, Tokyo Medical and Dental University, and the Department of Dentistry, Jikei University School of Medicine) between December 2000 and November 2001. The ethical committees of both universities gave approval for the survey. All patients provided informed consent for the procedures. Each subject was provided with an explanatory manuscript and full verbal description of the study. Those who elected to enroll signed a university-approved consent form. A total of 531 outpatients with TMD were recruited; however, 20 patients' questionnaires could not be collected because of refusal to answer all questions or return for the second visit. Finally, the remaining 511 patients (96.2%) (402, women, 109 men) answered the questionnaire and were eligible for the analysis. The mean age was 36.4 ± 15.4 (range 12 to 82) years.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows: *(1)* diagnosis with a subtype of TMD based on the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD),[14] *(2)* pain lasting for 1 week or more at the TMJ and/or the masticatory muscle, and *(3)* age greater than 12 years old. Patients with 2 different diagnostic subtypes were classified into a diagnostic group according to the more serious condition.

Exclusion criteria were as follows: *(1)* pain from systemic bone or joint disease; *(2)* age less than 12 years old; *(3)* regular use of medicines such as analgesics, anti anxiety drugs, antidepressants, and psychotropics; and *(4)* molar teeth deficit and/or a removable denture. (Patients with a fixed partial denture replacing a second molar tooth were included.)

Clinical Examination

At the first visit, all enrolled subjects were interviewed, examined clinically for signs and symptoms of TMD, and imaged for panoramic views of their jaws.

According to the RDC/TMD Axis I,[14] subjects were divided into the following 3 TMD subgroups: myofascial pain with/without limited opening (MFP), disc displacement with/without reduction (DD), and arthralgia or osteoarthritis (Arth).

All examination and classification procedures were performed by expert clinicians with more than 3 years of training and clinical experience in TMD treatment practice in each facility. Prior to the clinical examination, all examiners gathered and confirmed the clinical examination specifications and verbal instructions for examiners detailed in the RDC/TMD booklet and its Japanese version. At this meeting, examiners were retrained in digital palpation by using a pressure algometer. Although no formal reliability data were collected, examiners improved their accuracy and reproducibility of 1 and 2 pounds of palpation through the training.

Clinical examinations were conducted on TMD signs and symptoms, including: subjective pain and pain site, range of mandibular movement, pattern of associated pain, TMJ sounds, and palpation tenderness on muscle and TMJ. Palpations were performed to the temporalis and masseter muscles with 2 pounds of digital pressure, with 1 pound of digital pressure to the muscles in the posterior mandibular region and the submandibular region, and with 1 pound of pressure to the lateral poles and posterior attachment of the TMJs. All patients had panoramic radiographs taken for evaluating osteoarthritis.

Table 1 Distribution of Clinical TMD subtypes

TMD subgroup	Frequency	Female	Male
MFP	70 (13.7%)	54	16
DD	306 (59.9%)	256	50
Arth	135 (26.4%)	92	43
Total	511	402	109

Table 2 Mean VAS Scores (SD) of Food Intake Difficulty in MFP, DD, and Arth Patient Groups

	TMD subgroup		
Food intake situation	MFP	DD	Arth
PUT*	35.6 (27.9)	52.8 (27.7)	46.0 (27.6)
BIT	37.4 (29.1)	43.1 (25.7)	45.6 (25.7)
GRD	36.9 (29.7)	38.2 (27.1)	41.4 (27.7)
OAL**	37.6 (26.1)	45.1 (23.7)	44.7 (23.6)

*DD exhibited significantly higher scores than MFP (*P* = .000) and Arth (*P* = .048), and Arth had statistically significanly higher scores than MFP (*P* = .030).
**DD was significantly higher than MFP (*P* = .046).

Questionnaire

Each subject was asked to complete the questionnaire. The questions examined 4 types of food intake difficulty: *(1)* difficulty in putting food into the mouth (PUT), *(2)* difficulty in biting off foods (BIT), *(3)* difficulty in grinding foods (GRD), and *(4)* overall difficulty in consuming a meal (OAL). In each question, the subject assessed their difficulty subjectively on a 100-mm visual analogue scale (VAS), with the endpoints of "not difficult at all" and "impossible to put/bite off/grind/ consume food."

Statistical Analyses

Analysis of variance (ANOVA) was used to compare the differences among the VAS scores of the TMD subgroups. Where significant differences were identified by ANOVA, Tukey tests were performed between all combinations of the 3 subgroups.

Results

The distribution of patients with Axis I diagnoses is shown in Table 1. Patients with DD were most prevalent (59.9%), followed by Arth (26.4%) and MFP (13.7%).

There were several patients who experienced no difficulty with 1 of the 4 types of food intake (VAS = 0): 21 in PUT, 29 in BIT, 37 in GRD, and 12 in OAL. Seven of 511 patients scored no difficulty with any of the 4 types of food intake, while 98.6% of patients experienced difficulty with food intake in certain situations.

The mean VAS scores of each diagnostic group for each type of food intake are presented in Table 2. There was a statistical difference in PUT. The DD group exhibited significantly higher scores than MFP (*P* = .000) and Arth (*P* = .048). Furthermore, the Arth group had statistically higher VAS scores than the MFP group (*P* = .030). With regard to BIT and GRD, there was no significant difference among the TMD subgroups. In OAL, the mean score of the DD group was significantly higher than that of the MFP group (*P* = .046).

Discussion

In our study, 98% of patients experienced difficulty in food intake. Only 7 patients were not aware of any difficulty in any of the 4 kinds of food intake situation. These findings are consistent with previous studies that reported TMD patients' difficulty with chewing foods. Specifically, a study measuring the pain-related disability and psychologic status of TMD patients reported that 77.6% of patients experienced disability in eating hard foods, 75.7% in yawning, and 64.5% in chewing.[6,7] Another study reported that craniofacial pain patients experienced a 4-fold increase in functional problems, such as difficulty with chewing foods, compared to a pain-free population.[8] Furthermore, Irving et al[8] showed that for the majority of TMD patients, these symptoms are likely to affect the choice, intake, and enjoyment of food.

Another major concern in this study was that food intake difficulties were different among TMD subtypes. Difficulty in putting food into the mouth would be affected by the amount of mouth opening. Our results showed that the DD group had a significantly higher VAS score than the MFP and Arth groups. These findings would reflect the symptoms of DD and myogenic disorders. Generally, patients with DD disorders experience painful clicking or limited range of mouth opening. On the other hand, patients with myogenic disorders can achieve maximum mouth opening actively or passively. A study reported that pain complaints of the jaw and TMJ were more highly aggravated by chewing and wide mouth opening in patients with DD than in patients with myogenic TMD.[15] Patients in our study all had pain in the TMJ or masticatory muscles, so patients in the DD group should have pain with clicking or locking leading to limited mouth opening. Furthermore, the Arth group also had pain in the TMJ. Our results showed that when TMD patients take bigger bites of food, the DD and Arth patients experienced more difficulty than the MFP patients. Regarding difficulty of biting off food, no significant difference was found among the TMD subgroups. However, Arth and DD patients scored relatively higher VAS intensities than the MFP group. Biting follows putting food into mouth; thus, it should be more impaired with decreased mouth opening. Therefore, the Arth and DD groups experienced more difficulty biting off food.

In our results, DD and Arth groups scored relatively lower difficulty in GRD than PUT and CUT; however, MFP showed similar levels of difficulty in these food intake situations. In the sequence of mastication, foods are caught, bitten, ground, and then swallowed. The situation of food grinding occurs in the latter part of mastication and is performed repetitively, which could lead to more masticatory muscle fatigue than the PUT and CUT aspects of mastication. Reports showed that muscle in patients with MFP fatigued at a faster rate than muscle in normal patients,[16] and the total time required to reach pain tolerance during sustained clenching was shorter in MFP patients than in controls.[17] Muscle pain after exercise has been reported as a common symptom of patients with fibromyalgia/MFP.[18,19] Interestingly, one study reported that experimental chewing in MFP patients induced opposite reactions of both increased and decreased pain.[20] Nutrient intake in MFP patients during a 4-day period was compared to a sample from a matched common population.[10] The authors found that MFP patients with more severe pain were likely to reduce their intake of dietary fiber. Foods with more dietary fiber such as vegetables and fruits require more grinding than other foods. Although these previous studies did not compare food intake difficulty among TMD subtypes, the difficulty of the MFP patients was unlike that of the DD and Arth patients. It was supposed that the MFP patients would experience difficulty constantly throughout a meal.

With regard to jaw movements during mastication, there were various reports that patterns are changed or not changed by pain or TMD subtypes. Masseter muscle pain experimentally induced by saline infusion brought no significant changes in jaw movements during painful mastication.[21] Another study monitored mandibular movement by tracking mandibular incisor position in which unequal and asymmetric laterotrusive and protrusive movements were frequently observed, but the extent of the mastication envelope was similar to that of the normal controls.[22] In contrast, chewing-pattern analysis in TMD patients demonstrated that the DD group showed a significantly restricted envelope of motion and reduced chewing velocity compared to patients without internal derangement.[23,24] Taking these reports into account, chewing abilities would be more aggravated in DD patients than MFP patients. This finding coincides with our observation that overall food intake difficulty was more impaired in patients with DD than patients with MFP.

One limitation of this investigation is that precise occlusal characteristics were not evaluated, such as overbite, overjet, openbite, crossbite, etc. It is possible that any occlusal feature could affect food intake difficulties; and further, the reported association of occlusal factors in characterizing TMD is weak.[25] Since patients in this study had natural dentition or fixed partial dentures with no missing dental units apart from third molars, our comparison of food intake difficulties between TMD subtypes should not be so affected by this limitation. However, we understand that more specific evaluation of occlusion is needed to corroborate these findings.

Moreover, no data of clinical examination were evaluated with food intake difficulties in this study. It is supposed that clinical features such as mandibular range of motion, severity of pain, the number of pain sites, etc, are different among TMD subtypes and affect food intake aspects. The multivariate analysis of TMD signs and symptoms and food intake features is to be further investigated.

Our data partially rejected the null hypothesis and confirmed that subjective disabilities in certain food intake situations differed among diagnostic subtypes of TMD. Specifically, the DD patients demonstrated worse impairment levels than the MFP patients in putting food into their mouths and overall difficulty in consuming a meal, while the MFP group experienced relatively less difficulty in all food intake situations. Considering all these aspects, concerns about types of food and food intake behavior should be taken into account for each TMD subtype in the management of TMD patients.

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Literature Abstract

Interface reaction at dental implants inserted in condensed bone

The aim of this study was to compare the influence of the osteotome technique on the interface reaction of cylinder implants (SLA, ITI) with the interface reaction of conventional implant insertion in an animal model. A total of 64 implants were placed in the cranial and caudal tibia of 8 Göttinger minipigs. The implant site was prepared either by a conventional technique with drills (control group A) or by the osteotome technique (experimental group B). Bone tissue responses were evaluated by histomorphometry, fluorescence microscopy and scanning electron microscopy (SEM) after 7 and 28 days of osseointegration. The results demonstrated that the average initial (7 days) bone-to-implant contact ratio was not statistically significantly different for the osteotome technique (35.88 ± 2.94%) than for the control group (43.78 ± 3.39%, $P < .095$). After 28 days, the bone-to-implant contact ratio became statistically significantly higher when implants were inserted by conventional preparation (44.81 ± 3.07% (group B), 63.47 ± 4.87% (group A), $P = .003$). Whereas fluorescence and immunhistologic examination revealed new bone formation with osteocalcin deposition directly at the implant surface in both groups, the extent of direct bone/implant contact was enhanced in conventionally prepared implant sites. SEM analysis confirmed an intimate bone-to-implant bond without fibrous tissue formation in places of direct contact at an ultrastructured level. The authors concluded that implant placement in conventionally prepared implantation sites is accompanied by an improved interface formation at an early stage of implantation. The results of this study have clinical relevance with regard to the understanding of osseointegration in condensed bone. The impaired bone-to-implant contact ratio has a negative impact on implant stability. Therefore, early loading protocol cannot be recommended when bone is condensed prior to implant placement.

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