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General Summary

Clinical studies of temporomandibular disorders
We continued our studies of screening questionnaires and the evaluation of quality of life in patients with temporomandibular disorders (TMDs). We also studied clinical questions for drafting guidelines for TMDs.

Clinical and basic studies of obstructive sleep apnea hypopnea syndrome
Our clinical study using X-ray cephalometry analysis indicated a correlation between the e- s- (ES) angle and the apnea-hypopnea index (AHI). Our goal is to establish a screening evaluation using the measurement of facial morphology. In an animal study, fat was deposited, particularly in the tongue muscles, by a high-fat diet.

Basic studies of oral mucosal keratinocytes
We examined the expression of T-cell-specific adapter protein (TSAd) messenger RNA and protein in both human and murine oral mucosal epithelium and human primary oral keratinocyte cell cultures. The function of TSAd in keratinocytes was also studied by proliferation and migration assays with TSAd-/- mice keratinocytes.

Research Activities

Clinical studies of TMDs
1. Questionnaire survey about the relation between patients with TMDs and working contents in general dental clinics in Tokyo
Purpose: To study relationships between working contents and patients with TMDs.
Methods: A questionnaire that included 4 TMD screening items (J Jpn Soc TMJ 19(2), 2007) and 8 working contents items (time of personal computer [PC] use, commuting, sleeping, meeting, driving, handwork, heavy-duty lifting, and relaxation before going to bed) was administered to 253 patients who had consulted general dental clinics in Tokyo because of dental problems. Subjects included employed persons, unemployed persons, full-time homemakers, self-employed persons, and students, but this information was not recorded. The Mann-Whitney U-test and logistic regression analysis were performed. As a dependent variable, the results of the TMD screening questionnaire (TMD and non-TMD) were analyzed.
Results: A total 244 patients (120 male and 124 female) completed the questionnaire and were eligible for the analysis. There was no significance difference in mean age between the sexes. The TMD screening questionnaire showed that 35 patients (14.3%) had TMD and 209 patients did not. There was no significant difference in the operation contents

between TMD patients and non-TMD patients. When we assumed that unemployed persons had a commuting time of 0 and compared the operation contents of employed and unemployed persons, we found that employed persons had significantly less PC time, relaxation time before going to bed, and meeting time and that unemployed persons were significantly older. Logistic regression analysis showed a significant odds ratio for PC time (1.84) in women.
Conclusions: In women, the risk of TMD increases with PC time.
2. An evaluation of improvement of symptoms after treatment in elderly patients with TMDs: Comparison between patients 65 years or older and those 39 years or younger
To assess the efficacy of our treatment of elderly patients, we performed a retrospective clinical study of 77 patients with TMDs who were 65 years or older and 82 patients 39 years or younger. The results showed that in the older patients, the treatment was effective in 53 joints (68.8%) and that in the patients in whom TMDs were cured, the signs and symptoms had improved within 1 month in 60.4%. In the younger patients, treatment was effective in 59 joints (72.2%), and in patients in whom TMDs were cured, the signs and symptoms had improved within 1 month in 67.8%. According to the classification of the Japanese Society for Temporomandibular Joint, in the older patients the improvement rate of patients with type I disease was highest (92.9%), followed by that of patients with type III-a disease (80.0%) and patients with type II disease (72.2%). The lowest improvement rate was in patients with type III-b disease (45.0%). In the younger patients, the improvement rate of patients with type I disease was highest (100.0%), followed by that of patients with type II disease (77.1%) and patients with type III-a disease (76.9%). The lowest improvement rate was for patients with type III-b disease (43.6%). There was no significant difference between the older and younger patients in the improvement rate of any of the TMD types. The results suggest that conservative treatment, mainly guidance on diet and daily life, is as effective for elderly patients as for younger patients.
3. Questionnaire analysis of clinical questions for treating TMDs collected from dental care providers: A preliminary investigation of participants of the 20th annual meeting of the Japanese Society for Temporomandibular Joint
The committee drafting guidelines for the primary care of TMDs of the Japanese Society for Temporomandibular Joint performed a questionnaire survey of participants of its 20th annual meeting held on July 14 and 15, 2007. Its purpose was to consider strategies for collecting clinical questions from dental care providers. The questionnaire included the position in the society and the social stage, how long the respondent had treated TMDs, the format for clinical questions, and free opinions about the guidelines. An advertising effort was thought to be necessary for the next investigation because we were able to collect only 61 answers. Of the respondents, 54 (89%) were society members and 24 (39%) were authorized specialists. Thirty-one dentists (51%) had treated TMDs for more than 11 years. In the symptoms described in the clinical questions format, pain was the most frequent and was followed by joint noise and limited mouth-opening. The most frequently described treatment was splint therapy, which was followed by mouth-opening exercises and pharmacotherapy. Several answers given by respondents suggested they did not recognize the format style for clinical questions. These results

suggest that we must consider more detailed methods for collecting clinical questions.

Clinical and basic studies of obstructive sleep apnea hypopnea syndrome

1. Cross-validity assessment of the ES angle for the severity of obstructive sleep apnea hypopnea syndrome

Higurashi introduced the ES angle as a method to estimate the severity of obstructive sleep apnea hypopnea syndrome (OSAHS) and reported that its sensitivity and specificity for OSAHS with an AHI of 20 or more are 0.66 and 0.80, respectively. We examined the cross-validity of the ES angle to see whether similar results are obtained even if the subject is changed. The study involved 26 healthy subjects (AHI $<$ 5) described by Higurashi and 51 patients with OSAHS (AHI$<$5) who consulted our department from 2003 through 2009. The subjects underwent lateral cephalometric radiography and overnight polygraphy. We followed the method of Higrashi and measured the ES angle with cephalometric radiography. We examined the validity of the ES angle for the severity screening of sleep apnea syndrome. The median value showed a significant difference between the control group (121.5°; quartile deviation, 113.3–125.0) and the OSAHS group (129.0°; quartile deviation, 119.0–135.0; $p<0.001$). The criterion-related validity of the ES angle was 0.522. The sensitivity and specificity of an ES angle$>$127° for an AHI greater than 20 were 0.63 and 0.69, respectively. The ES angle significantly correlated with AHI, and the cross-validity of the ES angle and AHI was confirmed.

2. Study of adipogenic changes of the lingual muscles in obese rats

Objectives: To study the effects of obesity on the function and morphology of the lingual and masseter muscles related to obstructive sleep apnea, adipogenic changes, and the fiber type composition of the lingual and masseter muscles were examined in rats fed a fatty diet.

Methods: Twelve 8-week-old male Wistar rats were divided into 2 groups. For 10 weeks the obesity group was fed a fatty diet, and the normal group was fed a regular diet. The lingual (genioglossus and geniohyoid) and masseter muscles were removed. The adipogenic change of each muscle was analyzed with Oil O red staining. Expression levels of myosin heavy chain (MHC IIb, IId, IIa, I) messenger (m) RNAs were evaluated quantitatively with real-time reverse transcriptase-polymerase chain reaction.

Results: The body weight was significantly higher in the obesity group (492.7$\pm$35.0 g) than in the normal group (326.5$\pm$35.1 g, $P<0.05$). The area of oil droplets was significantly greater in the genioglossus and genihyoid muscles of the obesity group (8.2%$\pm$3.7%, 7.4%$\pm$2.2%) than in those of the normal group (2.3%$\pm$1.4%, 3.0%$\pm$1.2%, $p<0.05$). The oil droplet accumulation was observed in the myofibers of the genioglossus and geniohyoid muscles but not in those of the masseter muscle. The distribution of MHC I mRNA expression differed among the 3 muscles in the control group but not in the obesity group. The distribution of mRNA levels of MHC IId differed among the 3 muscles in the obesity group but not in the control group.

Conclusion: With a fatty diet, adipose accumulated, particularly in the genioglossus and geniohyoid muscles, and may influence the fiber type composition.

Basic studies of oral mucosal keratinocytes

1. Expression of the TSAd protein in oral epithelium

The multifunctional TSAd was originally described in T cells but is also expressed in epithelial cells from the respiratory tract and in endothelium. In this study, we found expression of TSAd mRNA and protein in both human and murine oral mucosal epithelium and in human primary oral keratinocyte cell cultures. In TSAd-/- mice, the mucosa and skin appeared macroscopically normal, but severe disturbances were observed in the fine structures of the basal membrane and intercellular epithelial spaces upon analysis with transmission electron microscopy. Oral epithelial cells from TSAd-/- mice displayed decreased migration compared with cells from wild-type mice, whereas overexpression of TSAd in a human epithelial cell line resulted in impaired proliferation. To our knowledge, this study is the first to show that TSAd is expressed in normal oral mucosa, is important for the normal ultrastructural morphology of the epithelium and basal membrane, and is involved in the migration and proliferation of oral keratinocytes.

Publications

Ikai A, Tamai K, Sugisaki M. An evaluation of improvement of symptoms after the treatment in geriatric patients with temporomandibular disorders: comparison between 65 or older year-age group and 39 or younger year-age group (in Japanese). *Nihon Gakukansetsu Gakkai Zasshi (J Jpn Soc TMJ)* 2009; **21:** 11–7.

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