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Differences of stimulated and unstimulated salivary flow rates in patients with dry mouth

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ABSTRACT

Purpose: The purpose of this study was to clarify the usefulness of noninvasive examination items such as sialometry and Visual Analog Scale (VAS) in distinguishing Sjögren's syndrome (SS) in dry mouth patients from neurogenic/neuropsychiatric disorders and drugs (DND).
Patients and methods: The study cohort comprised 50 patients with SS and 28 patients with DND. The gum test and Saxon test for stimulated salivary flow rate (SSFR), the spitting test for unstimulated salivary flow rate (USFR) and VAS were performed in all the patients with dry mouth.
Results: In SS patients, the SSFR (mean: gum test, 6.34 mL/10 min; Saxon test, 1.19 g/2 min) and USFR (0.61 mL/15 min) were decreased. In DND patients, the SSFR (gum test, 16.35 mL/10 min; Saxon test, 3.58 g/2 min) was within the normal range, but the USFR (0.90 mL/15 min) was decreased. In VAS, SS patients scored significantly higher in the items of "water-drinking at meals", "difficulty in swallowing", and "taste abnormality", while significantly lower in the item of "oral pain".
Conclusion: These results suggest that the SSFR, USFR and VAS could be useful in distinguishing DND from SS.

1. Introduction

The number of patients complaining of dry mouth has increased recently, because of raised awareness of oral health [1–4]. Xerostomia is defined as a subjective complaint of dry mouth, and is caused by the evaporation and/or hyposalivation of saliva. Evaporation of saliva is mainly caused by mouth opening or mouth breathing, which often occurs during the night without an apparent decrease in the salivary flow. Hyposalivation occurs due to various causes, including radiation therapy to the head and neck, the use of medications, and certain systemic conditions and diseases such as diarrhea, dehydration, hyperthyroidism, diabetes mellitus, kidney malfunction, anemia, and Sjögren's syndrome [5–10]. Hyposalivation can be divided into two groups according to the mechanism of disorder: a destruction of the secretary cells of the salivary glands and a dysfunction of the autonomic nervous system which stimulates saliva secretion. One of the causes of the former disorder is Sjögren's syndrome (SS), and the latter is caused by anxiety, depression, and medications such as antidepressant, antiemetic, antihistamine, and antihypertensive. The term "dry mouth associated with neurogenic/neuropsychiatric disorders and drugs (DND)" is proposed for the latter disorder by the Japanese Society of Oral Medicine in 2008 [11]. SS and DND compose a majority of the patients with dry mouth.

SS is diagnosed based on the diagnostic criteria including the 1999 revised diagnostic criteria of the Ministry of Health, Labor and Welfare (MHLW) and those of the American-European Consensus Group, which are generally used in Japan [12–14]. However, a limitation of the criteria is that many patients go untested and do not receive a confirmed diagnosis. The reasons for this may include the large number of tests required to fulfill the diagnostic criteria, the fact that some tests are invasive (especially lip biopsy and sialography), and the fact that some patients do not want to be tested. On the other hand, there are no diagnostic criteria for DND. Thus, it is

☆ AsianAOMS: Asian Association of Oral and Maxillofacial Surgeons; ASOMP: Asian Society of Oral and Maxillofacial Pathology; JSOP: Japanese Society of Oral Pathology; JSOMS: Japanese Society of Oral and Maxillofacial Surgeons; JSOM: Japanese Society of Oral Medicine; JAMI: Japanese Academy of Maxillofacial Implants.

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necessary to ascertain how best to carry out the tests for diagnosis of SS and DND without imposing an excessive burden on patients. In this context, the purpose of this study was to clarify the usefulness of noninvasive examination items such as sialometry and Visual Analog Scale (VAS) in distinguishing DND from SS. Differences of stimulated and unstimulated salivary flow rates and score of the VAS were compared between the patients with SS and DND.

2. Patients and methods

2.1. Patients

Fifty patients with SS (48 women and 2 men; mean age, 62.6 ± 10.5 years) and 30 patients with DND (25 women and 5 men; mean age, 53.9 ± 8.8 years) referred to the Department of Oral and Maxillofacial Surgery, Kyushu University Hospital from 2009 to 2013 were included in the study. All the patients presented with subjective complaint of dry mouth and decreased USFR flow rate (<1.5 mL/15 min) or SWS flow rate (<2.00 g/2 min). SS was diagnosed according to both the Research Committee on SS of the MHLW of the Japanese Government (1999) [12] and the American–European Consensus Group criteria for SS [14]. None of the patients had other autoimmune diseases and were treated with steroids or any other immunodepressants. DND was diagnosed according to the following criteria: (1) fail to fulfill each of the above-mentioned diagnostic criteria for SS and (2) taking drug or diagnosed with depression in Department of Psychosomatic Medicine. The patients with DND were taking antidepressant drug ($n = 8$), sleeping-inducing drug ($n = 8$), antihypertension drug ($n = 6$), and other oral medicines with side effect of dry mouth ($n = 10$). In contrast, three patients with DND were diagnosed with depression by the physicians in our hospital but were not taking any drugs. Informed consent, which was approved by the Ethics Committee of Kyushu University, Japan, was obtained from all the patients, and healthy controls were included in the study (IRB serial number: 25-287).

2.2. Measurements of salivary flow rates

The gum test was carried out by asking the subjects to chew gum for 10 min. The saliva secreted during that time was collected in a cap and its volume measured. If the volume of the saliva was <10 mL, the subject was classified as "decreased" [12–14]. The Saxon test was undertaken by having the subjects chew Surgeon® Type IV Gauze Sponge (Hakuzo Medical Corporation, Osaka, Japan) once a second for 2 min and measuring the weight of the gauze. If the increase in weight of the gauze was <2 g, the subject was classified as "decreased" [12–14]. The spitting test was carried out by asking subjects to spit saliva into a cup for 15 min. The amount of saliva in the unstimulated condition (sitting on a chair and not moving) was measured. If the volume of saliva was <1.5 mL, the subject was classified as "decreased" [13,14].

2.3. Subjective symptoms of dry mouth

The subjective symptoms and major complaints of dry mouth were ascertained from the medical interview. Additionally, a VAS was used for quantifying the subjective symptoms of dry mouth. The scale was from 0 mm to 100 mm. A reading of 0 mm was designated as "do not feel any symptoms" and that of 100 mm as "feel significant symptoms". Patients were asked to mark their subjective feeling between these two points arbitrarily, and the distance from 0 mm to their mark was measured. With this VAS method, six items of the symptoms of dry mouth (xerostomia, feeling hyposalivation, oral pain, water-drinking at meals, difficulty in swallowing, and taste abnormality) were assessed [13,14].

2.4. Statistical analyses

The Mann–Whitney *U*-test, chi-square test, and Pearson's product–moment correlation coefficient were used for statistical assessments. $p < 0.05$ was considered significant.

3. Results

3.1. Differences in subjective symptoms between SS patients and DND patients

In terms of major complaints, SS patients complained of "dryness of eyes" significantly more often than DND patients, whereas DND patients complained of "feeling oral pain" significantly more often than SS patients (Table 1). According to the comparisons between patients with SS and DND in the VAS, SS patients scored significantly higher in the items of "water-drinking at meals", "difficulty in swallowing", and "taste abnormality", while significantly lower in the item of "oral pain". There was no significant difference in the items of "xerostomia" and "feeling hyposalivation" between SS and DND patients (Fig. 1).

3.2. Salivary flow rates of patients with dry mouth

The SSFR of SS patients (mean: gum test, 6.34 mL/10 min; Saxon test, 1.19 g/2 min) was decreased significantly compared

Table 1
Frequency of major complaints with dry mouth patients.

	SS ($n = 50$)	DND ($n = 26$)
Xerostomia (%)	84	100
Hyposalivation	42	58
Dryness of eyes	60*	27
Feeling oral pain	18	65**
Drinking excess water at meals	52	77
Difficulty in swallowing	44	38
Abnormality of tasting	60	62
No complaint	12	0

χ^2 test.
SS, Sjögren's syndrome; DND, dry mouth associated with neurogenic/neuropsychiatric disorders and drugs.
* $p < 0.05$
** $p < 0.01$.

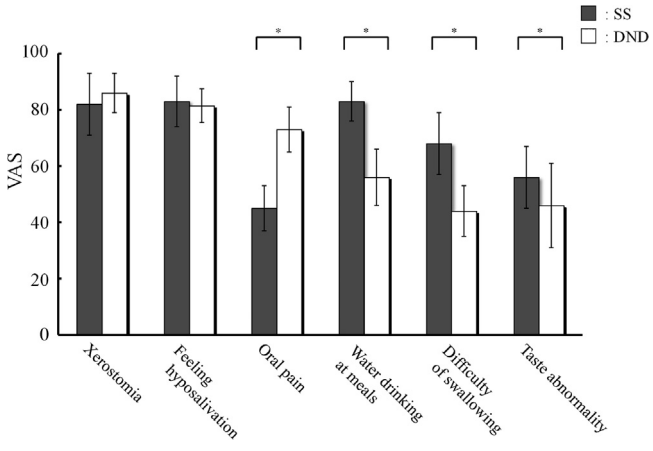

Fig. 1. Visual analog scale value of patients with dry mouth. Results of the visual analog scale (VAS) values of patients with Sjögren's syndrome (SS) and dry mouth associated with neurogenic/neuropsychiatric disorders and drugs (DND). The patients of both groups complained strongly in the items of xerostomia, feeling hyposalivation and oral pain. Additionally, the VAS values of water-drinking at meals difficulty in swallowing, and taste abnormality of DND patients were lower than those of SS patients (Mann–Whitney *U*-test, *$p < 0.05$).