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Mini Review

Oral cavity and feeding

Hiroshi Uematsu

Department of Geriatric Dentistry, Tokyo Medical and Dental University

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1. Introduction

The loss in the ability of full mastication means a restriction in what one can eat, and an inability to eat the foods one desires. Not only that, but there is also the danger it will lead to a lack of or imbalance in nutrition—the whole point of eating food.

Furthermore, when the mouth, such as the lips and tongue, is impaired, a person develops problems eating, they spill their food, and assistance becomes necessary. During feeding, bolus formation also becomes difficult. Wrongful swallowing due to impairment in the ability to transport food can even threaten life. The chewing and eating of food means stimulation to the mouth and surrounding sense organs of taste, smell, and touch, and experiencing the joy of food. It is therefore important to maintain the ability to chew from this aspect also.

In most stroke patients, the body is paralyzed on one side of the body, and it is widely known that the muscles atrophy and lose their strength in the paralyzed side. Does this one-sided paralysis affect circumoral function that plays a significant role in feeding?

Function of the lips

The lips take food into the mouth, and close together during mastication so food does not fall out.

Address correspondence to: Hiroshi Uematsu
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When the lips are weak, food spills from the mouth and the patient slobbers. Furthermore, the lips are not only involved in the function of eating, but they are also involved in pronunciation and many other functions. For the stroke patient, the pronunciation of "pa, pi, pu, pe, po" and "ma, mi, mu, me, mo" sounds becomes difficult, and whistling is almost impossible. Water is spilt and gargling can no longer be performed (Fig. 1).

We thought that perhaps there was a way to evaluate the severity of disorders by not simply observing these events, but by understanding the disabilities which are the bases of these events. We quantitatively assessed and examined lip function by the following two parameters in stroke patients with one-sided paralysis (stroke group) and healthy subjects (healthy group) of approximately the same ages.

1. Lip strength

Having strength to close the lips together means food does not fall out of the mouth. We placed a round button in the anterior floor of the mouth (space between the lips and teeth), and pulled on a string looped through a hole in the middle of it to measure a person's strength to keep hold of the button. As the string is pulled tighter, the ability to keep hold of the button is lost and it is pulled out of the mouth. We measured the strength demonstrated by a person to keep hold of the button. Results showed that the strength to keep the button in the mouth was weaker in the stroke group than in the healthy group (Fig. 2).

Mouth pressure was also measured. Subjects were made to blow into one end of a U-shaped tube, and mouth pressure was measured by water pressure. When the lips do not close well, air escapes from the mouth and mouth pressure fails to increase. Results of testing showed there was lower mouth pressure

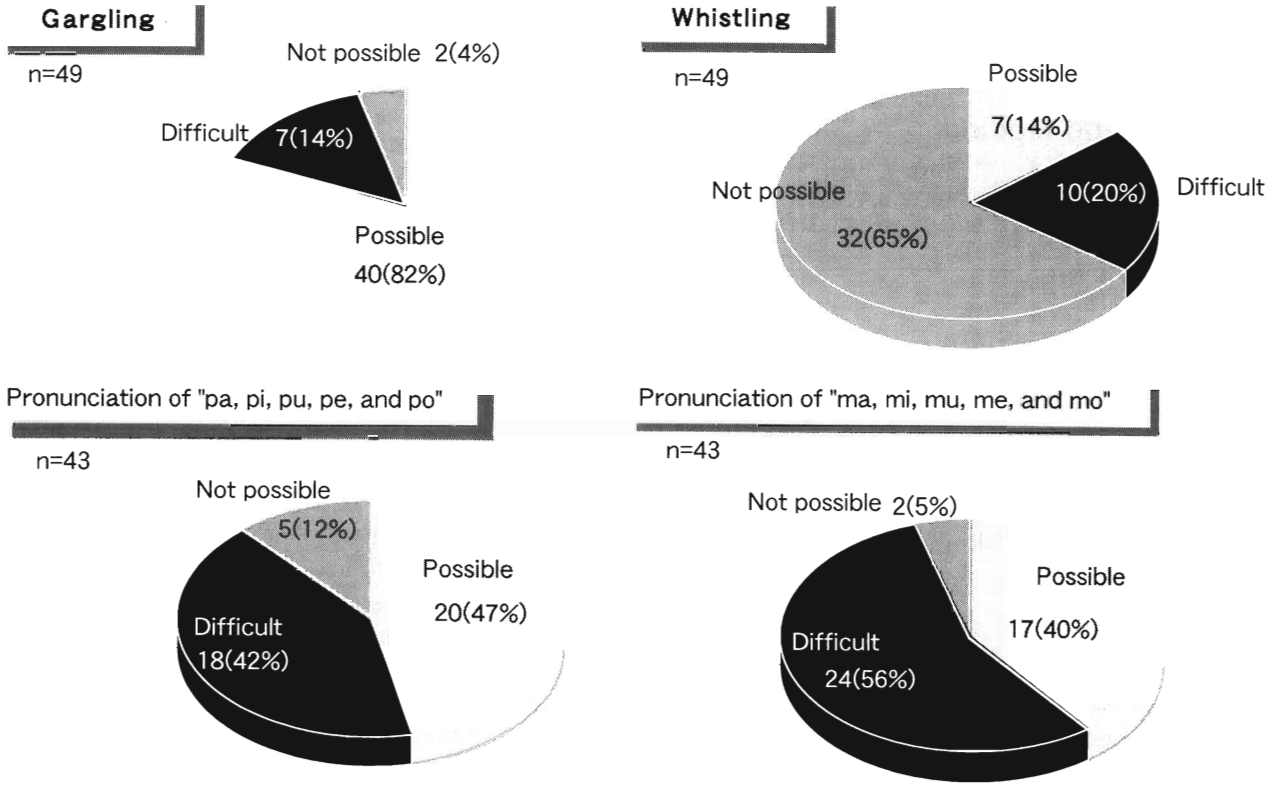

Fig 1. Lip function and related matters.

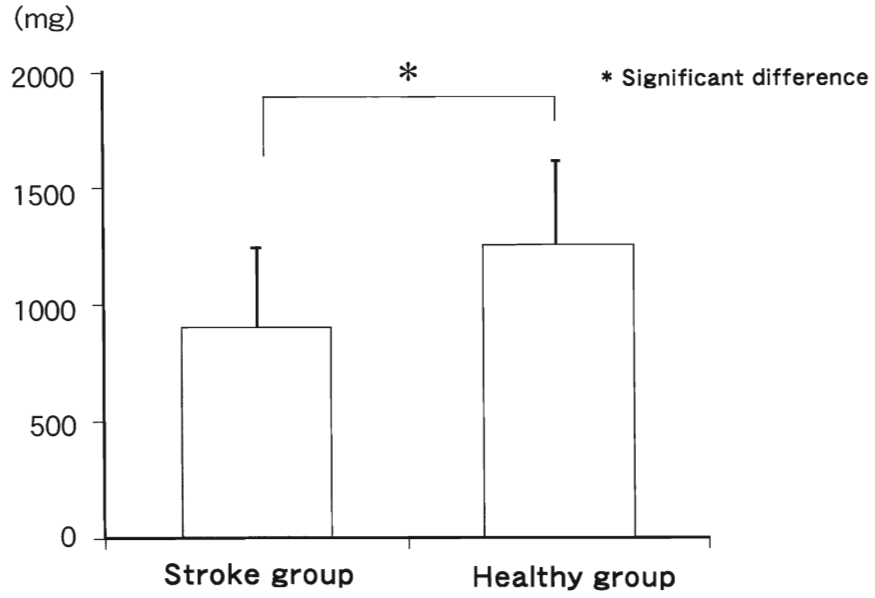

Fig 2. Lip strength: Strength to keep hold of a button in the mounth.

among the stroke group than in the healthy group (Fig. 3). Here, lip closing function can be said to be poor.

2. Lip movement

During chewing, food is pushed out to the sides of the teeth. The food is pushed against the chewing side of the teeth by mainly the lips and cheeks from the outside, and the tongue from the inside. Further chewing breaks up the food into finer pieces. As this is repeated, saliva is added, a bolus is formed, and the food is pre-

pared for swallowing. The following test was conducted in order to examine one part of the movement of the lips. Firstly, the distance between both corners of the mouth (a) was measured, and the distance (b) when the corners of the mouth on the left and right were pulled fully apart was measured by calipers. The following formula was applied, and the change rates examined. Lip movement: (b - a) x 100

a

Results revealed that movement was slightly worse in the stroke group compared to the healthy group, but no statistical differences were seen (Fig. 4). This means it cannot be indiscriminately stated that lip function declined in the stroke group. If anything, it can be said that lip function was well maintained even when a stroke had occurred. There was also no difference with the healthy group among mild cases of facial nerve palsy. Incidentally, there was also no relation between these functions of the lips and patient age and period of time since onset.

Chewing force

The chewing and eating of food means stimulation to the mouth and surrounding sense organs of taste, smell, and touch, and experiencing the joy of food. It is therefore important to maintain the ability to chew from this aspect also.

Even when a patient has been confined to bed for a

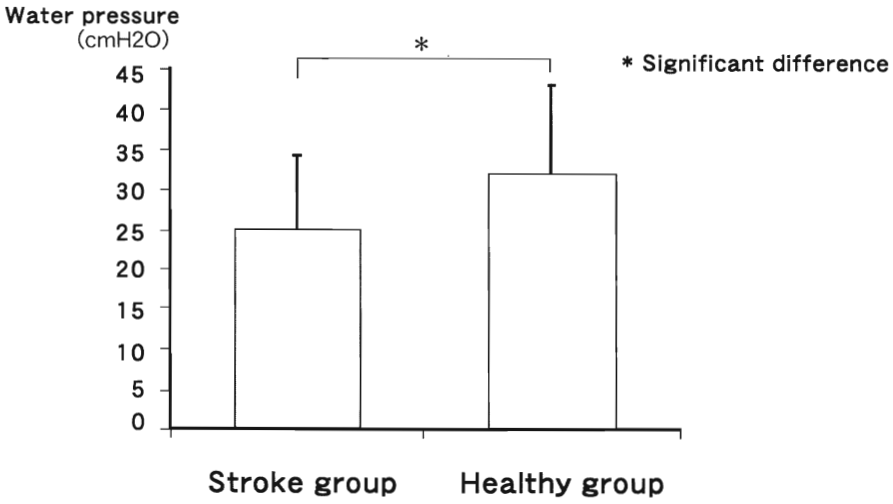

Fig 3. Comparison of mouth pressure.

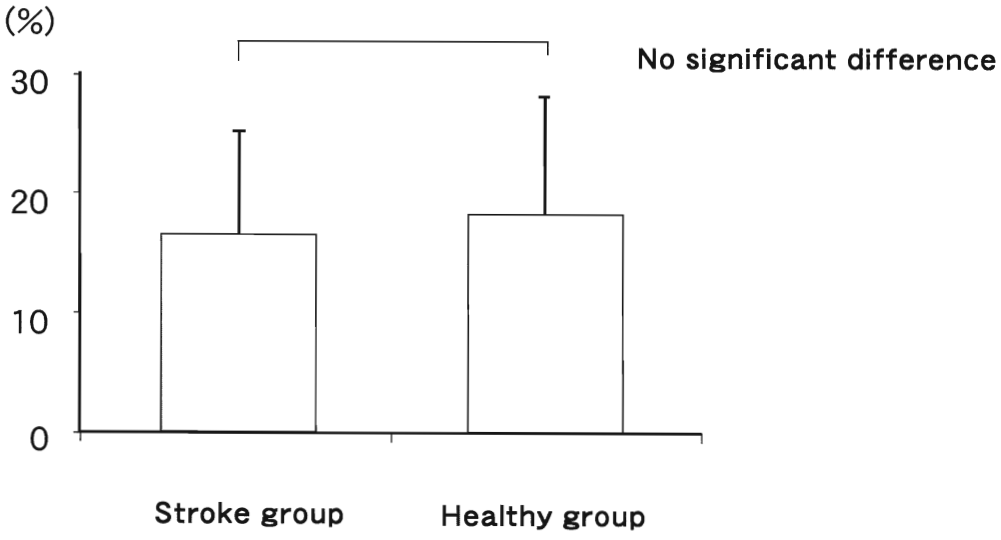

Fig 4. Lateral movement of the lips.

short period, the thickness of the arms and legs is reduced; that is, the muscles atrophy and muscle strength decreases. Now, can changes be seen in the chewing muscles of the paralyzed side in stroke patients? According to one theory, the oral cavity is an important organ provided for preserving life, so a weakening of this is surprisingly unknown even in very old age.

We took CTs of the stroke group and measured the cross-section areas of the muscles of mastication that close the mouth, the masseter and medial pterygoid muscles that play significant roles during chewing. We then compared these results with the healthy group (Fig. 5). Results failed to reveal any significant differences in the cross-section areas of the masseter and medial pterygoid muscles between the paralyzed side and healthy side. Similarly, there was also no difference between the left and right muscle cross-section areas among the healthy group. It was therefore thought that no central acting muscle atrophy of the muscles of mastication accompanied one-sided paralysis.

However, a comparison of hemiplegia stroke patients and healthy subjects revealed lower cross section areas in both the masseter and medial pterygoid muscles in the former. This is presumed due to a lack of chewing movement as a result of an inappropriate diet and untreated odontopathy, which led to disuse atrophy in both the paralyzed and healthy sides. In other words, these stroke patients who are paralyzed in one side are given liquid diets during the period of onset, and are continually supplied food which they can easily chew and swallow even once they have advanced to the chronic stage. This lack of chewing motion is believed to be the cause of disuse atrophy not only in the side of paralysis but also in the healthy side of the stroke patient. In order to restore chewing force, it is logical to properly supply food that cannot be eaten unless it is chewed.

Physiological function

1. Salivation

Aside from containing enzymes to promote digestion, saliva is indispensable for mixing with food that has been chewed and crushed to form a bolus. It is frequently said that salivary secretion decreases with age. In reality, however, adverse reactions to drugs cannot be overlooked when the reduction in the secretion of saliva is considered. Drugs that are used very frequently, such as antihistamines, antihypertensive agents, and psychomimetics, suppress salivation. The effects are marked particularly when a number of these drugs are administered. When we studied the excretory rates of saliva stimulated by the parotid gland (citric acid stimulation) in the stroke group, we did not see any difference between the stroke group and the healthy group (Fig. 6). Just because a person has had a stroke does not mean saliva secretion is reduced.

2. Taste

Without taste, food would surely be dreary.

It is not an exaggeration to say that of most of the senses, tasting is what food is all about. The sense of taste is perceived by the tongue (front 2/3 by the chorda tympani nerve region, and back 1/3 by the glossopharyngeal nerve) and further by the gums (greater pet-

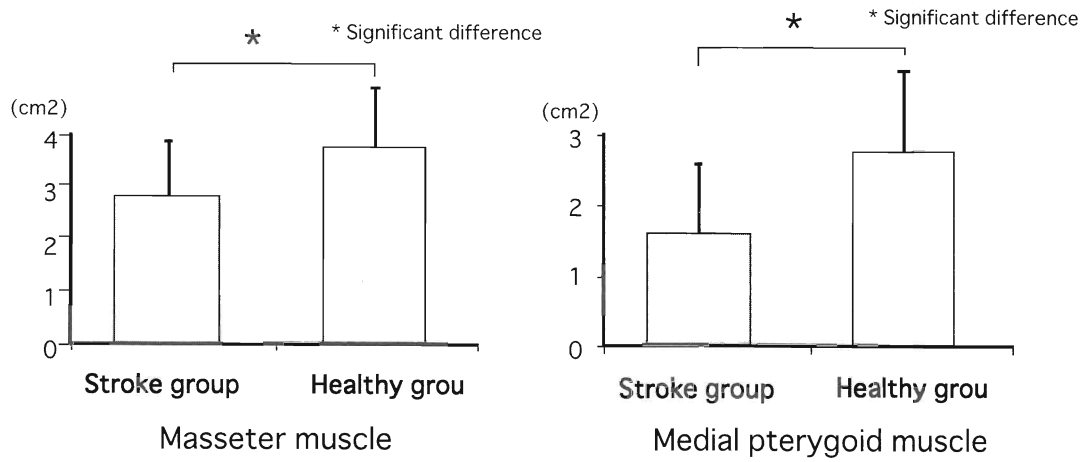

Fig 5. Comparison of cross section areas of muscles of mastication as seen on CT.

rosal nerve region). It is also said that taste wanes with age, and the mechanism for this was ascribed to a reduction in taste accumulation or degeneration.

According to recent research, however, taste hardly changes. If it must be said, it appears that the sense of saltiness appears to weaken with age. It is difficult to say in a word how the sense of taste changes in stroke patients paralyzed on one side, but if pressed one would say that salty and bitter tastes are dull on the healthy side (side of the lesion). However, sweet and sour tastes have also become less sensitive in part of the nerve region (Fig.7).

When dentures are fitted, they cover the mucosa, thereby reducing the sense of taste. However, when people with both upper and lower dentures were asked whether or not their food preferences had changed since when they did have teeth, about 80% answered that their food preferences had not changed. Approximately 70% of subjects responded that they could taste food well with their dentures.

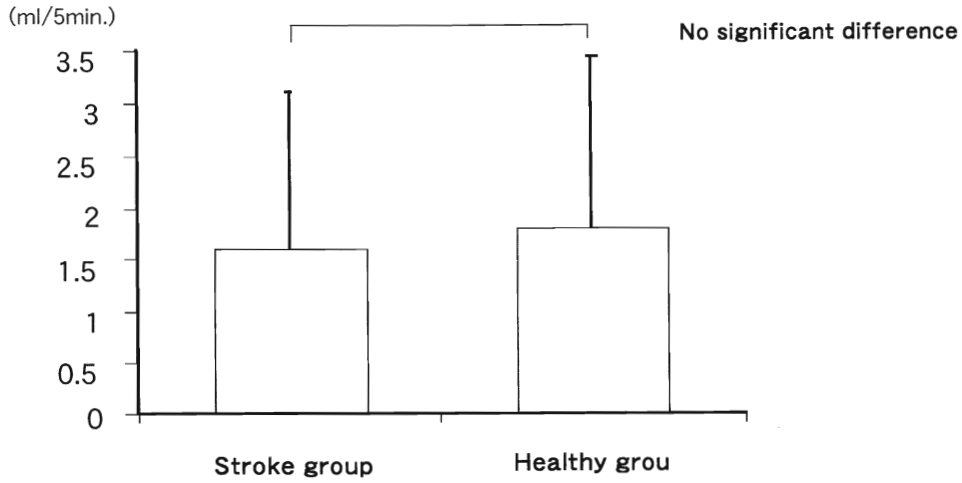

Fig 6. Comparison of salivation rates—parotid gland saliva by citric acid stimulation—

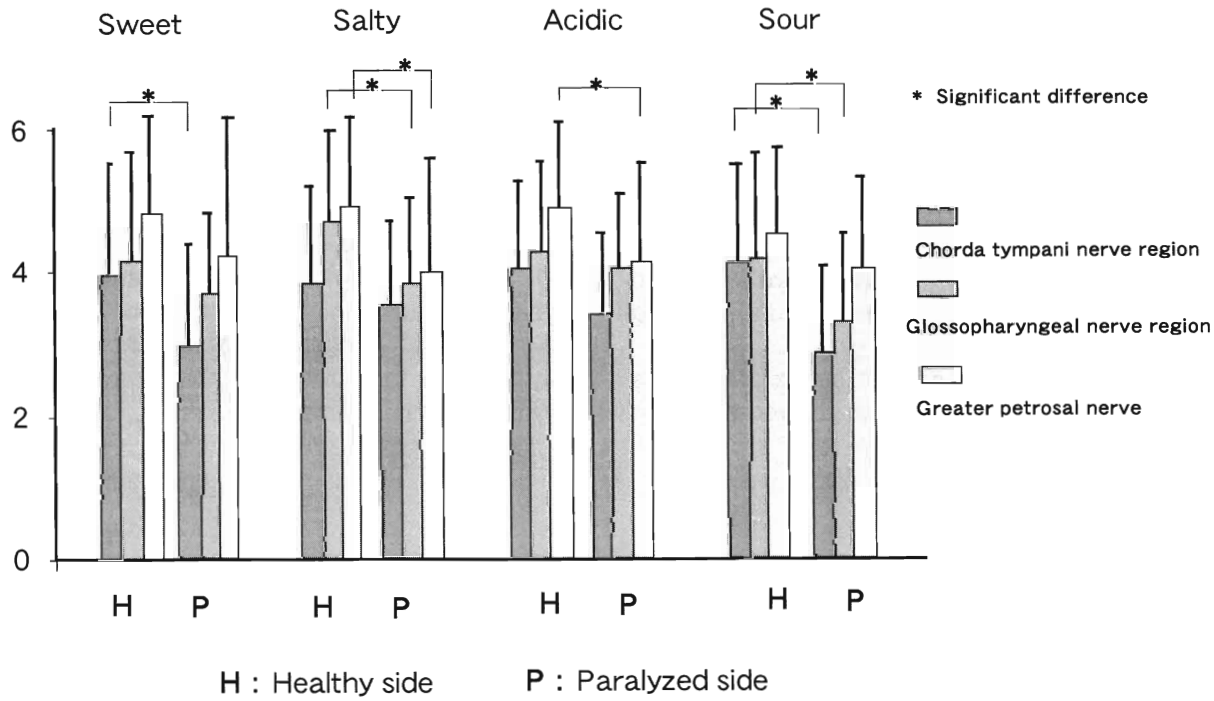

Fig 7. Comparison of healthy side and paralyzed side taste thresholds.

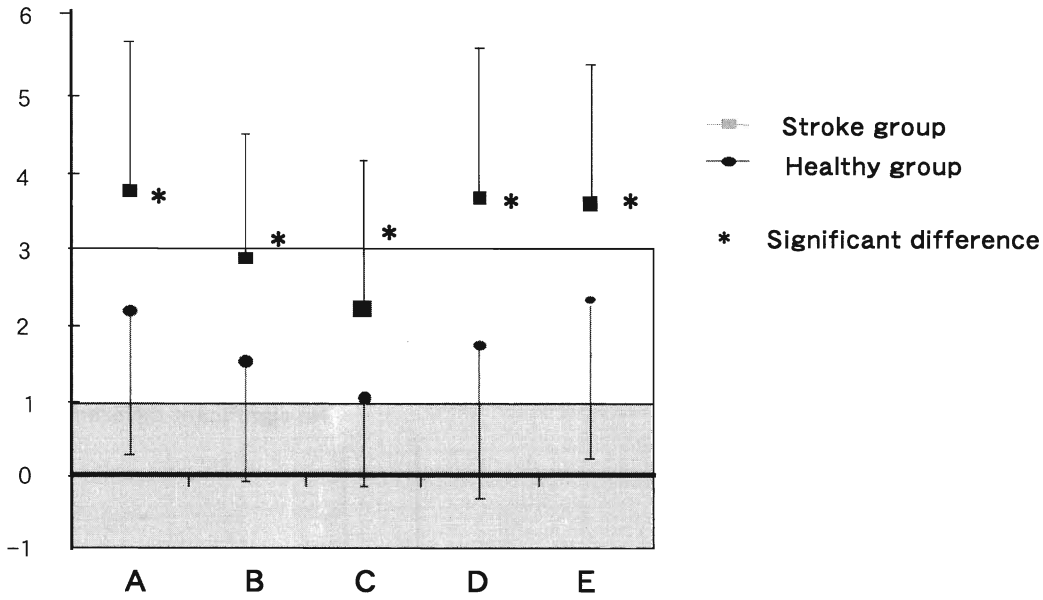

Fig 8. Comparison of olfactory ability—Cognitive detection of 5 different types of standard odors—

There are surprisingly few cases in which food likes and taste sensations are affected by missing teeth. There are surprisingly few cases of reduction in the sensation of taste with age, and more attention needs to be paid to the flavoring of the food by the needed caregiver.

3. Sense of smell

Smell also cannot be ignored. Before food is placed in the mouth, the aromas whet the appetite. Once food is placed in the mouth, the aromas from ingredients in the food flow from the back of the soft palate to the olfactory bulb in the back of the nasal cavity and the sense of smell experienced. This goes hand in hand with the sense of taste and is experienced as flavor. It is unthinkable to have a meal without any flavor, and it would' nt give you an appetite. Spices have even been added to food for patients with eating and swallowing disorders.

We studied whether or not the sense of smell is dulled in the stroke group. Results showed that both detection threshold and cognitive threshold were higher in the stroke group than in the healthy group. There were differences depending on the types of smells, and sensitivity was worse for flower scents.

On the other hand, the most keenly sensed were foul odors (Fig. 8).

Isn't it good to know, for example, that even if central nerves are damaged our human defense instincts will function to distinguish between good and bad things placed in the mouth before a nice smell will calm the nerves.

Food is pleasurable for anybody. For people with dysfunctions due to the after-effects of various diseases, and the elderly whose bodily functions have deteriorated and who need assistance, the pleasure obtained from food is probably hard to replace. Reduction in circumoral function, and particularly physiological function is surprisingly not recognized in stroke patients. Maintaining oral hygiene and enjoying tasty food are the sources of an active lifestyle, and daily oral care is advisable.