H. Koga, Y. Usuda, M. Matsuno, Y. Ogura, H. Ishii, J. Solis, A. Takanishi, A. Katsumata. Development of oral-rehabilitation robot. Gerontechnology 2008; 7(2):142. It is well known that the massage therapy is useful for the rehabilitation of various diseases. Although various apparatus have been developed for the massage of the torso and limbs, a machine to perform precise massage therapy to maxillofacial region is not developed yet. Therefore, we developed a robot system that provides massage therapy to the maxillofacial region. The name of our newly developed robot was WAO-1. WAO-1 has been designed to perform appropriate massage to the patients with dry mouth. **System description** The mechanism of WAO-1 consists of two main parts: robot arms and the plunger device. The robot arms consist of two 6-DOF (degrees of freedom) manipulators used to control the movement of the plunger device attached to the end-effector of each manipulator (*Figure 1*). The plunger device is the only part of the robot having direct contact with the patient face. In order to control the motion of the plungers attached at each arm of WAO-1, a position control system is implemented. The control system of WAO-1 is composed by a Massage Pattern Generator and Virtual Compliance Control[1]. **Method** An evaluation experiment of WAO-1 is performed. In this experiment, WAO-1 provides the massage to 6 healthy volunteers (without any maxillofacial disorders). Each subject is provided the massage to its parotid gland for 2 minutes. In order to confirm the effectiveness of the massage provide by WAO-1, the production of saliva was considered as a performance index. This index is measured by using the Saxon test[2]; which is a standard method to confirm the effectiveness of the massage therapy. **Results and discussion** The average production of saliva was increased by 0.63 g after providing the massage. By analyzing the collected data with a t-test, we found a significant difference ($p < 0.05$). Thus the effectiveness of the massage to the parotid gland by WAO-1 is confirmed. On the other hand, when the doctor gives the massage to the parotid gland of the people, production of saliva increases 1.4 g (average of 6 people). Therefore, the effect of WAO-1's massage is less than that of doctor's massage. We developed a robot system (WAO-1) which can massage the face. We think clinical trial is necessary to collect the data to certify the effectiveness of robotic massage. The goal of this study is to establish robot massage therapy as physiotherapy.

References

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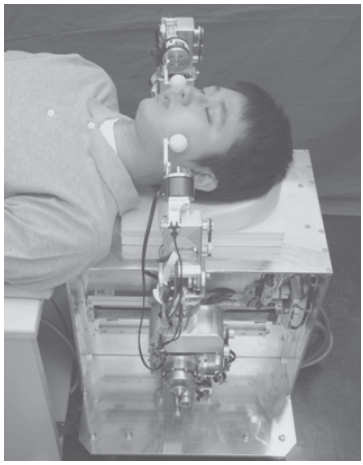

Figure 1 Screenshot of WAO-1 while providing massage therapy