By **Souhei Hosokawa[1], Hiroki Hayakawa[1] and Masahiro Furusawa,** Department of Clinical Oral Health Science, Tokyo Dental College

Analysis of the lip-closing force and its relationship to tongue force

In this first half of Dental Asia's user report, we investigate the profound link between lip-closing force and the activities of daily living for lip functions. Analysis methods and use of materials for this study are discussed here.

Dentists come in contact with lips frequently. However, we do not pay a particular attention to it, nor do we value its functions too much. It is known that muscle bundles coming from all directions intersect with each other at the lip in a complex fashion to realise execution of complicated movements, such as ingestion, deglutition and articulation1).

Miura et al. suggest that a close relationship exists between lip-closing force and instrumental ADL (activities of daily living) for higher functions or communication ADL in elderly people who require nursing care2). Also, the ability to perform lip closure is known to influence the dentition and occlusal conditions, and thus can significantly affect the oral environment3)–6). These findings suggest that lip plays important roles and functions that cannot be taken lightly. However, it is difficult to evaluate lip clinically, and not many clinicians are able to perform such evaluations readily under the current situation.

Here, we have focused on the lip-closing force as a possible index for evaluating the lip functions. We have measured the lip-closing force of healthy adults with a simple lip-closing force meter, and evaluated the usefulness of such measurements. We also examined the effect of the size of the measurement adapter of the apparatus on the measurements and analyzed the change in the force obtained by measuring the maximum and minimum lip-closing forces.

Furthermore, while facial muscles are visceral and the lingual muscle is somatic phylogenetically, coordinated action of these two muscle groups is observed during the oral phase of ingestion and deglutition. This suggests a possible linkage between these muscle groups. Thus, we also investigated the relationship between lip-closing force and tongue force.

Materials and Methods

Ten each of adult male and female individuals in their twenties who have never been diagnosed with disorders in eating, swallowing or articulation were selected as the test subjects. Also, a previous report indicated that lip-closing force measurements are affected by the occlusion condition7). Thus, those with significant maxillary or mandibular protrusions were excluded. The average ages of male and female subjects were 26.2 and 26.4 years old, respectively. "Beauty Health Checker" from Patakara Inc. (model number BHC-V01; Figure 1) was used as the simple lip-closing force meter, and we prepared removable 10mm, 17mm and 30mm adaptors so that the height of the measurement adapter can be varied (Figure 2).

Measurements were taken after work in the evening in the order of 10mm, 17mm and 30mm pieces. Measurements were taken three times per subject on different days. Each of the three measurements was taken on a different day to avoid fatigue, which may accumulate upon continuous measurements, from affecting the outcome. Posture during the measurement was set so that the Frankfurt plane and the floor are parallel to each other. The position of the mandible was set so as not to allow occlusion at the mandibular rest position to prevent masticatory muscles from influencing the measurements as much as possible. With the simple lip-closing force meter, measurements were not taken for the initial two seconds during which the subjects were instructed in advance to exert his/her maximum force. Then the subject was asked to maintain the lip closed for the next 10 seconds. The level to which the force came down was taken as the minimum force.

Using the measurements collected as described above, we investigated whether the height of the measurement adapter affected the outcome. We also