Relationship between Visual Acuity and Labial Closure Force in Japanese Elementary School Children

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Abstract: Labial closure force, reflecting the function of the orbicularis oris muscles, is related to oral function. The orbicularis oculi muscles, which might regulate visual acuity, are mechanically connected with the orbicularis oris muscles. The orbicularis oculi muscles and orbicularis oris muscles are innervated by the facial nerve. We hypothesized that labial closure force might relate to visual acuity. A total of 396 children aged 7–12 years participated in this cross-sectional study. The children, except sixteen children with malocclusion, were divided into two groups: high (≥20/20) and low (<20/20) visual acuity groups. The high and low visual acuity groups consisted of 264 and 116 children, respectively. The high visual acuity group had significantly higher labial closure force (p=0.024), a higher proportion of males (p=0.045), lower age (p=0.001) and lower Hellman’s dental stage (p=0.002) than the low visual acuity group. Logistic regression analysis showed that labial closure force was significantly associated with visual acuity after adjusting for gender, age and Hellman’s dental stage (OR 1.65, 95% CI 1.04–2.64, p=0.004). This study suggested an association between visual acuity and labial closure force in elementary school children.

Key words: Visual acuity, Myopia, Labial closure force, Elementary school children, Japan

Introduction

Labial closure force1) is defined predominantly by the orbicularis oris muscle, which provides sphincteric function and oral competence2). Labial closure force has attracted the attention of health care professionals because it can measure the function of oral muscles such as the orbicularis oris muscle3). For example, a close relationship has been shown between lip closure force and swallowing capacity in stroke patients4). Training of muscles around the mouth improves lip force and swallowing capacity. In Japanese children, there is a positive correlation between labial closure force and chewing ability5). Labial closure force of children with an open bite and maxillary protrusion is lower than that of children with other dental occlusions6).

The visual acuity of Japanese children has been decreasing for over 20 years7). Since maintaining normal vision is important to the lives of individuals and to society at large3), the decreased visual acuity of Japanese children is a nationwide health concern. The major cause of pediatric myopia is axial myopia, which is attributed to an increase in the eye’s axial length8). The orbicularis oculi is a muscle that closes the eyelids. This