

**Differences in the regulatory mechanism of blood flow in the orofacial
area mediated by neural and humoral system**

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Abstract

Blood flow is important in the maintenance of orofacial functions and disturbance of blood flow is related to various dysfunctions in the epithelial tissues and muscles. Marked blood flow changes mediated by the autonomic neural and humoral system may be important for orofacial hemodynamics. However, it is still questionable whether differences in the autonomic vasomotor responses mediated by neural (parasympathetic and sympathetic nerves) and humoral (circulating adrenaline) systems exist in the orofacial area. This study thus sought to examine whether there are differences in changes in the hemodynamics and vascular conductance between the masseter muscle (cholinergic) and lower lip (non-cholinergic) mediated by neural and humoral systems in order to elucidate specific regulatory system of blood flow in orofacial tissues in deeply urethane-anesthetized, artificially ventilated rats.

To examine whether there are differences in the effect of trigeminal somatosensory input, vagal visceral inputs, neural sympathetic activity, and circulating adrenaline on the hemodynamics and vascular conductance between masseter muscle and lower lip, the lingual nerve, cervical vagus nerve, cervical sympathetic trunk, and adrenal nerve were electrically stimulated, respectively.

Electrical stimulation of the central cut end of the lingual nerve elicited frequency-dependent blood flow increases in the masseter muscle and lower lip, accompanied by a significant increase in systemic arterial blood pressure, while stimulation of the superior cervical sympathetic trunk consistently decreased blood flow at both sites. The lingual nerve stimulation induced a biphasic change in the vascular conductance in the masseter muscle consisting of an initial decrease and a successive increase. The decrease in vascular conductance in the masseter muscle was positively correlated with changes in

systemic arterial blood pressure and was diminished by pretreatment with guanethidine. Cervical vagus nerve stimulation also induced blood flow increases at both sites; the increases were greater in the masseter muscle than in the lower lip. Activation of the sympathoadrenal system via electrical stimulation of the adrenal nerve and intravenous administration of isoproterenol induced blood flow increases in the masseter muscle but not in the lower lip. These results indicate that the parasympathetic nervous system, mediated by sensory inputs from cranial nerves, is important in the maintenance of the hemodynamics in the orofacial tissues and their functions during complex movements such as mastication, swallowing, and speech. The sympathetic nervous system, including the sympathoadrenal system, may be more involved in the regulation of blood flow in the muscles than in epithelial tissues in the orofacial area.