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Changed Innervation Upon Loss of Mandibular Division of Trigeminal Nerve to Muscles of Mastication

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INTRODUCTION: The gastrulation brain homeobox (Gbx) genes are essential for patterning and maintenance of neurons along the anteroposterior axis of the developing neural tube. Knockout (ko) of Gbx2 results in neonatal lethality associated with neurological and other defects. To understand pathologies, ko studies are not realistic as gene loss usually results in death before birth. Gbx2 neo/neo mutant mice express 6-10% of the wildtype Gbx2 expression levels. They have milder malformations than ko mice but lack the cerebellar vermis and mandibular division of the trigeminal nerve (3rd division of 5th cranial nerve = V3), among other defects. These Gbx2 neo/neo mutant mice die perinatally as they are unable to suckle due to lack of motor innervation via V3 to the muscles of mastication. Muscle cells develop largely without interaction with their motor nerve. However, the final differentiation of myocytes requires interactions with nerve fibers. Unexpectedly, the muscles of mastication appear normal in Gbx2 neo/neo mutant mice, despite the lack of V3.

METHODS: We performed microdissections of neonate wildtype and Gbx2neo/neo mutant mice. Additionally, we embedded mutant and wildtype mouse embryos in paraffin, serial sectioned them (7 µm), stained the sections with Azan staining, and analyzed specimen microscopically.

RESULTS: Current analysis of the data to identify where nerve fibers in the muscles of mastication originate is in process. We favor the origin of these fibers from the facial nerve (7th cranial nerve), which has several overlapping territories with the trigeminal nerve.

CONCLUSIONS: Muscles require innervation for their final differentiation steps. The loss of a nerve can result in the invasion of another nerve into the territory of the lost one, which rescues muscle differentiation but not muscle function.

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