Abstract

The neural crest is a population of migrating cells found only in vertebrates. Neural crest cells migrate to the head, heart and trunk regions of the body where they transform into different cell types. The cranial neural crest cells differentiate into chondrocytes and tenocytes, among others. The chondrogenic property of the cranial neural crest has given the vertebrates an advantage during evolution. In this paper, we focus on specific functions of the cranial neural crest and its derivatives in zebrafish *(Danio rerio).* The migration streams of the cranial neural crest follow the antero-posterior axis which is set up by *hox* genes. The development of the neural crest is controlled by a vast gene regulatory network. Here, we focus on the *meis* genes within the craniofacial development of zebrafish. For analysis, we used knock out (KO) mutant lines for each paralog of the *meis* gene *(meis1a, meis1b, meis2a, meis2b)*. Only the *meis1b* KO and double *meis1a1b* KO mutants exhibit malformatins of the cranial cartilages, derivatives of the neural crest. We identified changes during cartilage formation. However, the migration of the neural crest into the pharyngeal arches and subsequent chondrocyte condensation remained unchanged. The formation of the facial part of the skull, so-called viscerocranium, is the result of the interaction of the development of several tissues. One of these tissues are muscles that attach to the cartilage via tendons. Like cartilage, muscle morphology was greatly affected and disorganized in *meis1b* KO. Muscle fibers further influenced the condensation of tendons, other derivatives of the neural crest. Moreover, it has been shown that muscles mechanically stimulate the maturation of chondrocytes within the jaw apparatus. Thus, some aspects of the *meis1b* KO phenotype in the ventral head cartilage resembled changes after disrupting muscle contraction. The innervation of cranial muscles by the V. cranial nerve (trigeminal) and neuromuscular junction were not impaired. Our data showed that the *meis1b* paralog is important for the development of several craniofacial tissues. Comparison with *Meis* mutant mice showed differences in their functions during development of craniofacial structures. We identified *meis* as a factor playing a potential role in determining the midline ventral axis of the first and second pharyngeal arches.

Keywords: neural crest, zebrafish, *meis1b,* craniofacial, pharyngeal arches