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Zebrafish (Danio rerio) as a model to understand the cleft lip and palate development

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Background:

Cleft lip and/or cleft palate (CLP) are common birth defects that occur as a result of a failure in proper growth and fusion of the facial processes. Maternal alcohol consumption has been suggested to increase the risk of development of CLP Studies on zebrafish (*Danio rerio*) provide many advantages toward morphogenetic analysis of craniofacial development, including palatal development.

Objective:

The objectives of the present study are to identify the role of ectodermal epithelia in zebrafish palatal bone morphogenesis and to identify the effect of alcohol exposure on the development of the CLP.

Methods:

Wild type zebrafish embryos were used. Bone and cartilage staining, and serial histological sectioning were performed to detect the dynamic epithelial cell activity during zebrafish palate development. Zebrafish embryos were exposed to different alcohol concentrations (0.5% - 3%) and the resulting gene expression changes and craniofacial skeletal phenotypes were compared with the untreated samples.

Results:

Growth series analysis showed the normal development of upper lip and palatal bones (ethmoid bones, paired trabeculae and parasphenoid bone). Development of the above structures is completed at 72 hours post fertilization (hpf). The peridermal epithelial cells make the continuous outline of the upper lip and the palatal bone margins. This is a flat single epithelial layer and the left and right peridermal cell layer fuse with each other. In situ hybridization shows the expression pattern of key signaling molecules in the developing palatal roof. The expression begins from 36hpf and continues up to 96hpf. The overall expression of the above molecules found to be altered after the alcohol exposure. The different alcohol concentrations do not show any significant changes in the expression levels.

Conclusion:

This study provides the novel insight of ectodermal cell activity of zebrafish palate development and advance our understanding of fetal alcohol syndrome associated CLP development.