Anterior segment dysgenesis (ASD) is a developmental abnormality in which the anterior segment of the eye is affected, in particular the cornea, iris, lens, and structures of the iridocorneal angle. Approximately 50% of ASD patients are at risk for developing glaucoma, a leading cause of vision loss nationwide. Proper development of anterior segment tissues is crucial in maintaining the healthy, normal-functioning eye as these tissues serve important functions ranging from visual acuity, and light transmission and refraction, to maintaining an optimal intraocular pressure (IOP). Differentiation and specification of the neural crest-derived mesenchymal progenitor cells into their prospective anterior segment tissues mark one aspect of proper development of the anterior segment of the eye.

Neural crest cells (NCC) are multipotent, migratory stem cells that emerge from the dorsal neural tube and serve critical functions in embryonic development. They migrate to different regions of the body and form diverse cell lineages and structures, including the peripheral nervous system, craniofacial skeleton, as well as numerous ocular and periorcular structures. Improper development of the neural crest can cause craniofacial and ocular defects such as Axenfeld-Rieger syndrome (ARS). ARS is a disorder that affects anterior segment structures derived from the periorcular mesenchyme (POM) and has been found to cause glaucoma in up to 75% of patients after early childhood diagnosis. NCC, with respect to ocular development, are generally derived from the forebrain (prosencephalon) and midbrain (mesencephalon). They give rise to corneal endothelium and stroma, iris stroma, ciliary body stroma, and trabecular meshwork, all of which are important anterior structures of a normal, healthy eye. Many clinical entities of ASD exist with distinct manifestations, contributing to the complexity of the disorder. This paper aims to focus on differentiation and specification of NCC in relation to the onset of ASD, an area that necessitates further research.

ASD GENES

PITX2 and FOXC1

There are two ASD genes, PITX2 and FOXC1, that have been extensively researched in the past decade. Numerous studies have demonstrated their close relation to the embryonic development of the anterior segment of the eye and their extensive role in...