NORMAL AND ABNORMAL LOWER JAW DEVELOPMENT

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Functioning of the masticatory and breathing apparatus and harmony of the face are significantly influenced by the size and shape of the lower jaw. Absent or deficient lower jaw growth may lead to life threatening condition because of obstruction in the airway. Prevention and treatment of congenital and acquired mandibular anomalies necessitate understanding of mandibular morphogenesis at the cellular and molecular level.

Mandibular development is complex and peculiar, since it involves three different and essential elements: Meckel’s cartilage, intramembraneous bony component and cartilaginous condylar blastema. Meckel’s cartilage is thought to be the supportive element of the first branchial arch, however, it may have a crucial role as an inductor for the intramembranous bone formation of the mandible on its lateral surface. Thus, defect in the neural crest originating Meckel’s cartilage may adversely affect jaw morphogenesis. A more serious defect has been documented following FGF8 gene inactivation: the first branchial arch does not develop properly and mandible remains rudimentary.

Genetic experiments in mice have begun to address the role of epithelial-mesenchymal interactions by targeting genes expressed in one tissue layer. It has been shown that Tgfβ, Pitx1, Tbx1, Sox9, and Runx2 are necessary for normal lower jaw growth and development. Condylar cartilaginous blastema appears later in the development than primary cartilages. Ihh seems to be very important for the development of the secondary cartilage and the TMJ. During development the anteriorly expanding cartilaginous blastema fuses with the posteriorly growing bony part, however, process of fusion and defects in this are poorly understood. CTs of patients with hemifacial microsomia have revealed a small bony structure on the buccal side of the mandible not being attached to the ramus. This structure could be condylar blastema, which did not fuse to the mandibular ramus.

During postnatal growth condylar cartilage has a central role in the mandibular growth. Recent studies have increased our understanding on the endochondral bone formation cascade in the condylar cartilage. Large variation in the growth quantity and direction of condylar growth leads to large individual variation in the mandibular shape and also to difference in response to treatment. A recent association study has shown that the variation may be partly due to single nucleotide polymorphism in the growth hormone receptor gene.

Holistic view of the factors associated with pre- and postnatal mandibular growth is poorly understood and the future challenge is to disclose these factors to prevent and treat individuals with lower jaw growth disturbances.

REFERENCES:  