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MORPHOLOGY AND FUNCTION: ASPECTS OF MANDIBULAR DEVELOPMENT AND GROWTH AT DIFFERENT STAGES ACROSS THE LIFESPAN

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ABSTRACT

During development and growth, the mandible adapts to accommodate increased biomechanical loading associated with the development and growth of the tongue and the dentition. Biomechanical loads play a vital role in the modelling and remodelling of bone, with site-specific effects on bone density. In the functional transition from the prenatal to the postnatal period, biomechanical loading appears to be intensified and may affect the morphology of the mandible. The aim of this study was to analyze the growth and development of the human mandible during the functionally complex perinatal period of growth in order to investigate biomechanical effects. As edentulism modifies the biomechanical landscape of mastication, the effects of tooth loss on the morphology of the adult mandible were also investigated. Seven hundred and seventeen mandibles were sourced from cadaveric and skeletonized remains forming part of the Paediatric Collection, Raymond A. Dart Collection of Human Skeletons and Johannesburg Forensic Paediatric Collection, University of the Witwatersrand. The morphometric growth relationships between the mandible and tongue were initially investigated. A strong correlation between changes in the dimensions of the mandible and tongue was observed between 20 gestational weeks and 2 years. It was hypothesized, that mandibular growth was directed by the growth of the tongue. This would result in areas of increased bone modelling and remodelling, directly associated with the attachment of the tongue to the mandible and would manifest in areas of lower density bone. Subsequently, variations in bone mineral density of the body of the mandible were assessed. The lingual surface had significantly higher bone density values when compared to the external surface across the period of 30 gestational weeks to 5 years. Variations in the bone density across the external surface of the mandible followed the patterns of postnatal dental development. Thus, the effects of edentulism on the morphology of the adult mandible were also considered. The edentulous mandible had a shorter alveolar height and mandibular body length as well as more obtuse gonial and mental angles, when compared to the dentate mandible. Thus, changes in the morphology of the mandible over time appear to be indicative of an altered mandibular morphology prompted by a changing biomechanical landscape.