Chapter Number

3D-µCT Cephalometric Measurements in Mice

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1. Introduction

The skull of all vertebrates is a structure made up of the neurocranium, which surrounds and protects the encephalon, and the viscerocranium, which protects the initial segment of the digestive and respiratory systems. The separate bones that form the skull are articulated among them forming sutures and synchondroses in the adjacent margins of the membrane bones of the calvaria and of the bones of the skull base, respectively (see for a detailed review and references Wilkie and Morriss-Kay, 2001; Morriss-Kay and Wilkie, 2005).

Advances in molecular genetics over the past two decades have revealed some of the key genes for skull vault development (Verdyck et al., 2006). Then, the genetic engineering has been used to construct mice that lack these genes resulting in abnormal craniofacial development, equivalent to those of some human conditions. Therefore, the murine model has been chosen as a surrogate for studying the biologic behavior of human cranial bones and joints-sutures. For example, we have recently analyzed the cranial, mandible and tooth defects of a mouse strain which mimics a human progeroid syndrome (De Carlos et al., 2008). These mouse models are basics for understanding the developmental mechanisms leading to skull malformations, and may eventually help in the development of new therapeutic strategies.

The image technique modalities used to quantitatively asses the changes in size and shape in the skull in these animal varies from simple radiology to three-dimensional (3D) micro-computed tomography (µCT; Figure 1; see for a review Tobita et al., 2010). Nevertheless, 3D-µCT is becoming more and more a common technique for the anatomical analyses of these mice models (Paulus et al., 2001; Song et al., 2001; Recinos et al., 2004; Schambach et al., 2010), especially in the field of the skeletal development and growth (Guldberg et al., 2004). For example, 3D µCT quantitative evaluations have been made in mouse to study different functional skull changes (Enomoto et al., 2010; Saito et al., 2011a,b), or several kinds of developmental or genetic skull malformations (Perlyn et al., 2006; De Carlos et al., 2008;

Coleman et al., 2010; Purushothaman et al., 2011), or the distribution of some genetic characters in different strains of mice (Nishimura et al., 2003).