A Computerized Approach to Reconstruction of Growth Patterns in Hominid Molar Teeth

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INTRODUCTION

Recent attempts to reconstruct life histories of fossil hominids have focused on the dentition as a reliable source of information on developmental rates. This as it is assumed that dental maturation is highly synchronized with general body development (Dean et al., 1986; Smith, 1991). Most of the research carried out on dental development in fossil hominids has focused on studies of the later stages of crown and root development, estimated from enamel apposition rates (Beynon, 1992; Beynon and Dean, 1987; Beynon and Wood 1987; Ramirrez-Rozzi, 1993) or crown and root development estimated from radiographs or single C-t scans (Conroy and Vannier, 1987; Faerman et al., 1994; Mann et al., 1990; Skinner and Sperber, 1982). However it is also possible to study earlier stages of the ontogeny of these fossil teeth, since the dentine-enamel junction (DEJ) provides a permanent record of the balance achieved between cell growth and differentiation at an early stage of development. Moreover, this can be compared to the final shape of the crown seen at the outer enamel surface (OES), so providing information on two successive phases of growth within a single tooth.

The potential value of the DEJ for studying ontogeny and phylogeny has long been realized (Butler, 1968; Korenhof, 1960; Kraus, 1952, Kraus and Jordan, 1965), but its application to fossils has been limited until now by the difficulty of visualizing the DEJ without destroying either dentine or enamel. The development of three dimensional imaging systems has removed this obstacle, and Smith et al., (1997) used serial C-t scans to develop a three dimensional model for comparison of selected locations at the DEJ and OES of modern and fossil teeth.

In this paper we describe a new computerized three dimensional model derived from serial C-t scans, that can be viewed from any angle or superimposed on any other tooth for direct comparison. The model is extremely flexible and was designed to obtain information on global size and shape change in teeth. It has been applied here to analysis of growth in the first permanent (M1) and second deciduous (DM2) molars. We propose that the shape and size changes observed reflect growth trajectories within the teeth and can be used to reconstruct the ontogeny of tooth development in both living and fossil hominids. The rationale for using C-t scans and the accuracy of the method has been discussed in detail in Smith et al., (1997). The great advantage of the method is that it is non-invasive, can be applied to both recent and fossil teeth and provides excellent

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