



Human palaeontology and prehistory

Talonid crests expression at the enamel–dentine junction of hominin lower permanent and deciduous molars



Expression des crêtes du talonide à la limite émail–dentine de molaires inférieures permanentes et caduques chez les Homininés

María Martinón-Torres^{a,*}, Marina Martínez de Pinillos^a,
Matthew M. Skinner^{b,c}, Laura Martín-Francés^a, Ana Gracia-Téllez^{d,e},
Ignacio Martínez^{d,e}, Juan Luis Arsuaga^e, José María Bermúdez de Castro^a

^a National Research Center on Human Evolution (CENIEH), Paseo Sierra de Atapuerca s/n, 09002, Burgos, Spain

^b Department of Anthropology, University College London, 14, Taviston Street, London, WC1H 0BW, United Kingdom

^c Department of Human Evolution, Max Planck Institute for Evolutionary Anthropology, Deutscher Platz 6, 04103, Germany

^d Centro Mixto UCM-ISCIII de Evolución y Comportamiento Humanos, Avd. Monforte de Lemos 5, Pabellón 14, 28029, Madrid, Spain

^e Área de Paleontología, Departamento de Geología, Universidad de Alcalá de Henares, 28871, Alcalá de Henares, Spain

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ABSTRACT

The application of microtomography (mCT) to dental morphological studies has unveiled a new source of palaeobiological information, particularly in the analysis of the internal structures of teeth. In this study, we assess the expression of talonid crests at the enamel and dentine surfaces in lower permanent and second deciduous molars (M_2 and dm_2) of *H. sapiens*, *H. neanderthalensis* and Atapuerca-Sima de los Huesos (SH) hominins. In modern humans, talonid crests are described exclusively in the deciduous teeth (Korenhof, 1982) and interpreted as a primitive mammalian remnant of the talonid attachment to the trigonid. Here we report for the first time the expression of talonid crests of deciduous and permanent molars in *H. sapiens*, *H. neanderthalensis* and Middle Pleistocene hominins. We discuss possible evolutionary interpretations and suggest the importance of recording this feature in future studies.

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R É S U M É

L'application de la microtomographie (mCT) aux études de morphologie dentaire a dévoilé une nouvelle source d'information paléobiologique, particulièrement dans l'analyse des structures internes des dents. Dans cette étude, nous évaluons l'expression des crêtes du talonide à la surface de l'émail et de la dentine de molaires inférieures et caduques (M_2 et dm_2) de *H. sapiens*, *H. neanderthalensis* et d'Homininés d'Atapuerca-Sima de los Huesos (SH). Chez les humains modernes, les crêtes du talonide sont exclusivement décrites dans le cas des dents caduques (Korenhof, 1982) et interprétées comme un vestige mammalien primitif de l'attache du talonide au trigonide. Ici, nous présentons pour la première fois l'expression de crêtes du talonide de molaires temporaires et permanentes chez *H. sapiens*, *H. neanderthalensis* et chez des Homininés du Pléistocène moyen. Nous discutons les interprétations évolutionnistes possibles et proposons de prendre en compte cet élément dans les futures études.

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* Corresponding author.

E-mail address: maria.martinon.torres@gmail.com (M. Martinón-Torres).

1. Introduction

The frequency and degree of expression of many dental discrete traits expressed on the outer enamel surface (OES) is strongly heritable. Thus, these features have become a valuable source of information to infer evolutionary relatedness among modern humans (e.g. Pilbrow, 2006; Scott and Turner, 1997), fossil hominins (e.g. Bailey, 2002a, 2004; Bermúdez de Castro et al., 2003; Irish and Guatelli-Steinberg, 2003; Gómez-Robles et al., 2008, 2012; Guatelli-Steinberg and Irish, 2005; Irish and Guatelli-Steinberg, 2003; Martín-Torres et al., 2006, 2007b, 2012; Wood and Abbott, 1983), and other hominoids (e.g. Pilbrow, 2006), as well as to investigate the evolutionary scenario in which these species evolved (e.g. Bermúdez de Castro and Martín-Torres, 2013; Martín-Torres et al., 2007b, 2011).

The morphology of the enamel–dentine junction (EDJ) has been also studied in the past in an attempt to relate the dentine core topography with OES features (e.g. Corruccini, 1987a, 1987b; Korenhof, 1960, 1961, 1978, 1982; Nager, 1960; Saki et al., 1969). It is now widely accepted that the EDJ is predominantly responsible for the external morphology of a tooth, although the precise level of concordance between both surfaces is still under study (Bailey et al., 2011; Macchiarelli et al., 2006; Martínez de Pinillos et al., 2014; Nager, 1960; Schwartz et al., 1998; Skinner et al., 2008a, 2009a, 2009b). In the past, in order to access the EDJ surface, it was necessary to apply destructive techniques or that the teeth were broken or incomplete (Korenhof, 1982; Nager, 1960; Saki et al., 1969). Using microtomography (mCT) it is now possible to virtually “segment” or separate the different tissues, and produce a 3D reconstruction of each surface in a non-destructive manner (e.g. Macchiarelli et al., 2006; Olejniczak et al., 2007).

Dental mCT studies have provided a new source of palaeobiological information, revealing a number of crests, ridges and tubercles that seem to be of evolutionary significance, but were inaccessible or did not receive systematic attention (Bailey et al., 2011; Skinner et al., 2008a). In this context, the trigonid crest pattern of variation in human species has been extensively analyzed at the OES (e.g. Bailey, 2002b; Bailey et al., 2011; Irish, 1998; Martín-Torres et al., 2007a, 2012; Scott and Turner, 1997; Turner et al., 1991). Following the pioneer work of Korenhof during the last century (Korenhof, 1978, 1982), trigonid crests have been recently studied at the EDJ by means of mCT (Bailey et al., 2011; Martínez de Pinillos et al., 2014; Skinner et al., 2008a, Zanolli and Mazurier, 2013). These studies have added new and interesting observations about the morphological variability and origin of the trigonid crests.

In contrast, the expression of a distinct crest extending from the distal trigonid crest to the talonid, also referred as “talonid crest” (Korenhof, 1982) (Fig. 1) has not been systematically studied in human populations. One reason for this lack of assessment may be the difficulty in accessing the EDJ surface non-destructively (prior to the use of mCT). Furthermore, this crest was defined as an anatomical feature only present in human deciduous lower molars and, historically, the deciduous dentition has received significantly less attention than the permanent dentition.

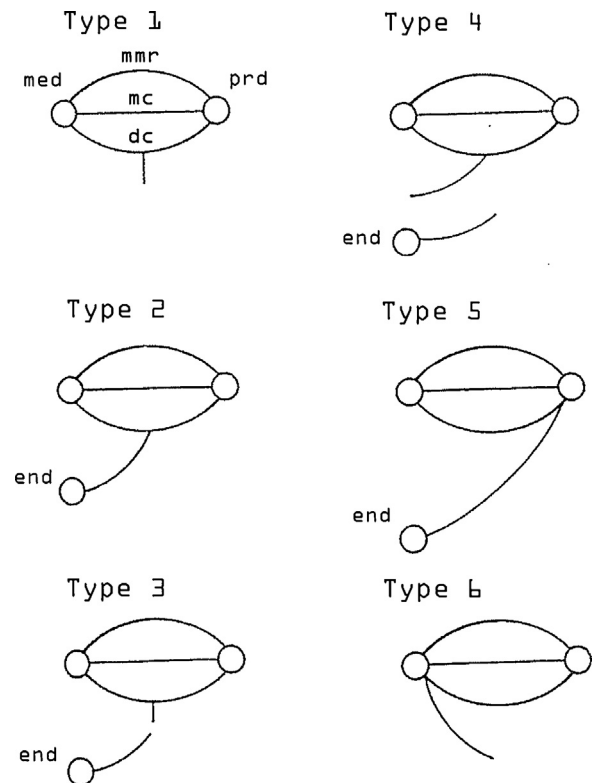


Fig. 1. Korenhof's types of talonid crest (modified from Korenhof, 1982; Fig. 24.8). Type 1. From the middle of the distal trigonid crest a small crest runs for some length in distal direction, but is not connected to any other distinct landmark. Type 2. From the middle of the distal trigonid crest an uninterrupted crest runs to the tip of the entoconid. Type 3. From the middle of the distal trigonid crest an interrupted crest runs to the tip of the entoconid. Type 4. From the middle of the distal trigonid crest a small crest runs to the lingual side, which is reached slightly mesially from the tip of the entoconid. Type 5. From the tip of the protoconid a crest runs to the tip of the entoconid. Type 6. From the tip of the metaconid a crest runs for some distance in a distobuccal direction. Prd: protoconid, med: metaconid, end: entoconid, mmr: mesial marginal ridge, mc: middle trigonid crest, dc: distal trigonid crest.

Fig. 1. Types de crête du talonide de Korenhof (modifié d'après Korenhof, 1982, Fig. 24.8). Type 1. À partir du milieu de la crête du trigonide distale, une petite crête se développe sur une certaine longueur dans la direction distale, mais n'est pas connectée à quelque point que ce soit. Type 2. À partir du milieu de la crête du trigonide distale, une crête ininterrompue se développe jusqu'à l'extrémité de l'entoconide. Type 3. À partir du milieu de la crête du trigonide distale, une crête interrompue se développe jusqu'à l'extrémité de l'entoconide. Type 4. À partir du milieu de la crête du trigonide distale, une petite crête se développe du côté lingual qui est atteint à peu près mésialement par rapport à l'extrémité de l'entoconide. Type 5. À partir de l'extrémité du protoconide, une crête se développe jusqu'à l'extrémité de l'entoconide. Type 6. À partir de l'extrémité du métaconide, une crête se développe sur une certaine distance, dans une direction disto-buccale. Prd : protoconide ; med : métaconide ; end : entoconide ; mmr : arête marginale mésiale ; mc : crête du trigonide moyenne ; dc : crête du trigonide distale.

Korenhof (1982) suggested that the talonid crest resembled the original attachment of the primitive talonid to the more derived trigonid in mammals, and that its expression in human deciduous molars (but not in permanent teeth) was a proof that temporary dentitions were morphologically more conservative.

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