

Sex diagnosis of the human dentition after heat exposure: the potential of cementum-enamel junction and root dimensions

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Introduction

Teeth are often the only elements preserved from human skeletons after cremations and intentional or accidental burning. Thus, the aim of this study was to investigate the potential of odontometry for sample-specific sex diagnosis.

Material and Methods

A sample of permanent lower second pre-molars, donated by 40 patients (20 males and 20 women) after extraction in dental medicine clinics were experimentally burned at 900°C to assess heat-induced changes in seven dimensions of the cementum-enamel junction (CEJ) and the root. Four of them, CEJ perimeter, mesiodistal (MD), buccolingual (BL) and perimeter at the mid-root level, were investigated for the first time. Also, five measurements combining some of the isolated standard measurements were investigated (Fig. 1).

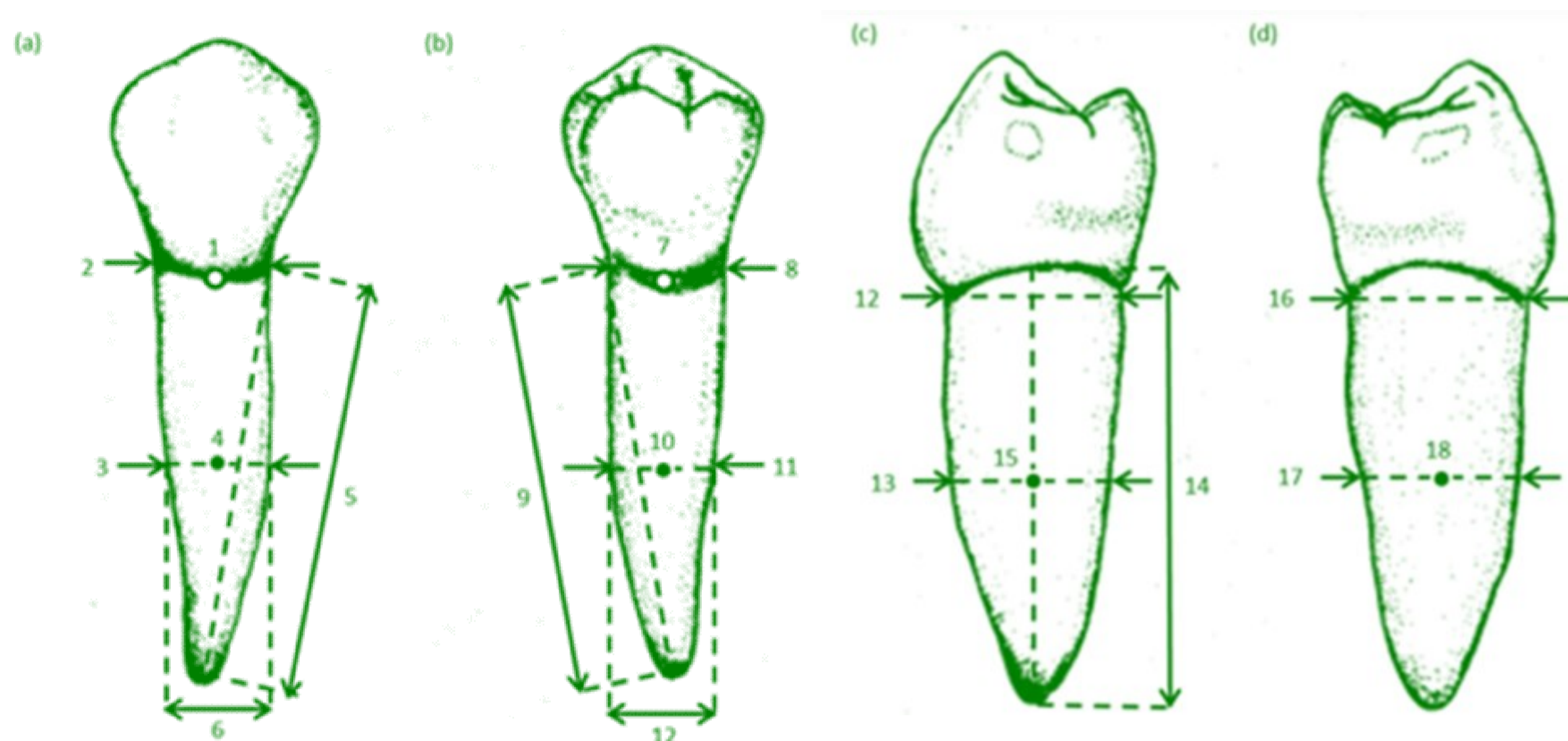


Figure 1. Proposed measures by the present study in a lower second pre-molar in (a) buccal, (b) lingual, (c) mesial and (d) distal views. Buccolingual diameter at CEJ: 1, 7, 12, 16; Mesiodistal at CEJ level: 2, 8; Mesiodistal diameter at the middle of the root: 3, 11, 15, 18; Buccolingual diameter at the middle of the root: 4, 10, 13, 17; Maximum height of the root (measured on the mesial side): 5, 9, 14; Perimeter at the middle of the root: 6, 12; CEJ perimeter: 12, 16 (adapted from Fuller et al., 2001: 132).

Results

Results showed that most of the standard measurements, although presenting significant sex differences, were not reliable enough to allow for correct sex classifications above 80% both before and after the burning (Fig. 2). Nonetheless, the perimeter at CEJ and the combined measurement of the MD and BL diameters, at the same level, were quite promising before and after burning, with correct sex classifications above 80%. On average, females were slightly more affected by shrinkage at the CEJ perimeter than males thus artificially increasing sexual dimorphism after burning.



Figure 2. Example of a LPM2 burned at 900°C.

Discussion

Application: Results suggest that sample-specific sex estimation (Albanese et al., 2005; Cardoso, 2008) can be carried out based on some standard measurements (CEJ perimeter; MD + BL diameters).

Advantages: (a) Roots measurements, especially those at the level of the CEJ, may provide an alternative to crown measurements because they are not as affected by attrition or heat-induced damage; (b) the proposed measures are also applicable to loose teeth; (c) metric approaches are more objective and require less experience than morphological methods; (d) Other kinds of teeth, for example incisors, may allow sex estimation of even younger non adults since their time of eruption occurs earlier as shown by Cardoso (2008).

Limitations: (a) to calculate sample-specific cut-off points for sex estimation, samples must follow the assumptions recommended by Albanese et al. (2005) – be composed of more than 40 specimens and have a sex ratio of at least 1:1.5. Teeth should ideally have been burned at similar temperatures. However, heat-induced dimensional change may vary between teeth burned at similar temperatures and this apparently did not interfere dramatically with sex estimation based on some standard measurements.

Conclusion

Although additional research is needed, these measures apparently have good potential for sample-specific sex diagnosis in individuals recovered from archaeological and forensic contexts.

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