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, intentional or accidental burning. Thus, the potential of odontometry for sample-specific sex diagnosis was investigated.

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 and the root. Four of them, cementum-enamel junction perimeter, mesiodistal, buccolingual 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. Additionally, 10 permanent upper central incisors and 10 permanent lower first molars were experimentally burned at 400°C and 700°C to document heat-induced dimensional changes and serve as comparison with the 900°C sample.

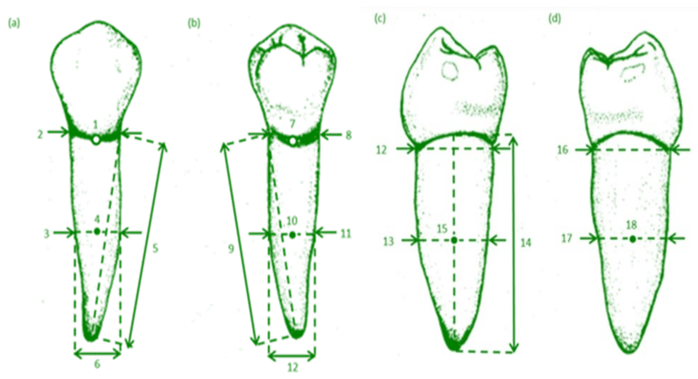

Figura 1. Proposed measures by the present study in a lower second pre-molar in (a) buccal, (b) lingual, (c) mesial and (d) distal views. 1, 7, 12, 16: Buccolingual diameter at CEJ. 2, 8: Mesiodistal at CEJ leval. 3, 11, 15, 18: Mesiodistal diameter at the middle of the root. 4, 10, 13, 17: Buccolingual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

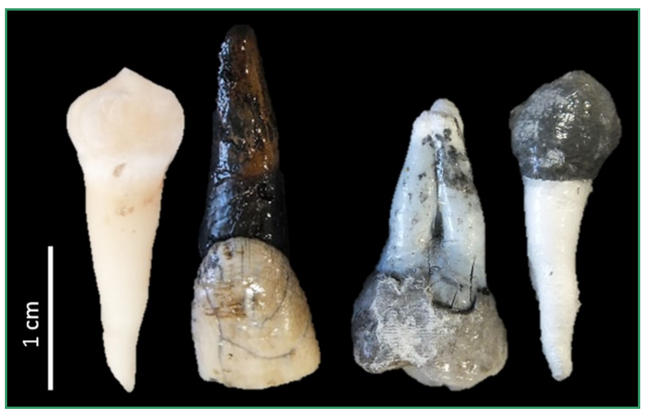

Figura 2. Progressive color changes induced by heat. From left to right: mandibular second premolar unburned; maxillary right central incisor burned to 400°C; maxillary first molar right burned to 700°C and mandibular second premolar right burned to 900°C.

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. Nonetheless, the perimeter at the cementum-enamel junction and the combined measurement of the mesiodistal and buccolingual diameters, at the same level, were quite promising before and after burning, with correct sex classifications above 80%. At 900°C, in average, females were slightly more affected by shrinkage in the perimeter at the cementum-enamel junction than males thus artificially increasing sexual dimorphism after burning.

Discussion

Limitations: (a) to use the values obtained on this sample as cut-off points for sex estimation of unknown individuals , the tooth must be burned up to 900°C; (b) 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 teeth of the same type and have a sex ratio of at least 1:1.5. Also, teeth must have been burned at similar temperatures. Although heat-induced dimensional change may vary between teeth burned at similar temperatures, this apparently did not interfere dramatically with sex estimation based on some stand-ard measurements.

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

Advantages: (a) samples of burned remains, roots measurements, especially those at the level of the CEJ, may provide an alternative to crown measurements; (b) root measurements are not affected by attrition, as frequently happens with the crown; (c) the proposed measures are also aplicable to teeth found outside of the alveoli in archaeological contexts; (d) metric approaches is also more objective and require less experience than morphologic methods; (e) if these approaches are applied to other kind of teeth, for example incisors, they will allow sex estimation of even younger non adults since their time of eruption occurs earlier than the one of lower second pre-molars, as

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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