An Unidentified Skeletal Assemblage from a Post-1755 Mass Grave of Lisbon: Dental Morphology and Population Affinity

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Abstract

Dental morphology is treated differently by different researchers. Some authors consider tooth size alone, whereas others take the shape of the tooth into account. We distinguish size from morphology because the methods of study, as well as the underlying principles for each one are distinct. Although

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morphology and shape have more in common than morphology and size, shape also shows noteworthy differences. Methods developed for ascertaining "tooth shape" for dental anthropological and forensic purposes have not been adopted widely, partly because they are difficult to replicate, which diminishes their utility in comparative studies. In this investigation, we focus on what forensic experts refer to as dental morphology; that is, distinct features or traits of the crowns and roots that are present or absent and, when present, exhibit variable degrees of expression. Common examples include shovel-shaped incisors, upper and lower molar cusp number, Carabelli's cusp and three-rooted lower first molars. This study comprises 1210 disarticulated teeth, 179 jaws and 65 skulls from a skeletal assemblage of commingled remains belonging to victims of the 1755 Lisbon earthquake. These remains were excavated in 2004 at the Lisbon Academy of Sciences and were analysed according to dental morphology parameters utilised by the Arizona State University Dental Anthropology System to ascertain population affinity.

Introduction

Dental morphology is treated differently by various researchers (1,2). Some authors consider only tooth size, whereas others take into account the shape (2,3,4). We distinguish size from morphology because of the methods of study and the general underlying principles for each one are distinct (5,6). Although morphology and shape have more in common than morphology and size, shape also shows noteworthy differences (7). Methods developed for ascertaining "tooth shape" for dental anthropological and forensic purposes have not been adopted widely, partly because they are difficult to replicate, diminishing their utility in comparative studies (7,8). In this investigation report, we focus on what most forensic experts refer to as dental morphology; that is, distinct features or traits of the crowns and roots that are present or absent and, when present, exhibit variable degrees of expression (9, 10). This study was a part of a broader project which analysed 1210 disarticulated teeth, 179 jaws and 65 skulls from a skeletal assemblage of commingled remains belonging to the 1755 Lisbon earthquake victims (5), excavated in 2004 by the Lisbon Academy of Sciences (Figure 1). One of the main goals of this broader project was to ascertain the population affinity affected by the catastrophe using dental parameters and to characterize the Lisbon population from the XVIII century by dental morphology.

Materials and methods

To achieve our aim, the isolated teeth and teeth from the alveolar sockets from the upper and lower jaws were examined to assess dental morphology. This was undertaken in accordance with observational methods utilised at the Museum of the Academy of Sciences which are in turn in

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accordance with the Arizona State University Dental Anthropology System or ASUDAS (9). During laboratory investigations some problems were encountered and subsequently addressed. These included questions such as: How many traits should be defined and examined? Should casts or skulls be used? Should the permanent or deciduous dentition be examined? - These types of question were the background to improve the collection of dental morphology data from the museum and provided additional guidelines for future projects of human dental morphology, in addition to the primary results from the original project- the paleodemographic characterization of a mass disaster population from 1755 (8).

The collection of data on crown and root morphology began with operational definitions of trait expression. These definitions focus primarily on the precise location of the trait and its range of variation in size and form.

The intraobserver error was also analysed. This assessment was performed on 20% of the sample for each trait one month after the initial assessment.

Results

The main dental traits from the sample are addressed below:

Maxillary Incisors – Shovelling

Shovelling can be described as lingual marginal ridging of the central and lateral incisors. There are specifics plaques for each type of tooth, central and lateral. According to the distribution by Scott, grade 3 is the normal for Americans Indians.

Out of the total sample, 75% had an absence of this trait, grade 0, only 1 incisor (a lateral incisor from Skull TAS 40) had grade 3 (Figure 2). This dental morphology is compatible with a presence of a Native American at the commingled skeletal remains from this mass disaster population.

Maxillary Incisors and Canines – Tuberculum dentale

Tuberculum projections on the basal eminence of the two upper incisors and canines have traditionally been referred to as tuberculum dentale. This trait is relatively common in European and European derived populations, making it one of the few positively expressed traits found in this geographic group.

For this anthropological sample, 85% of the sample had presence of this trait; the average was the grade 3 (Figure 3). This is compatible with a Caucasian Population.

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Maxillary Incisors – Interruption grooves

Along the lingual marginal borders or basal eminences of lateral and central uppers incisors, we can find developmental furrows that some call corono-radicular grooves because they involve both the crown and the root. Only 12% of the sample exhibited this trait (Figure 4). This dental find is a very uncommon and unspecific morphology for determining population affinity.

Maxillary premolars – upper first premolar root number

Upper premolars can express one, two, or three independent roots. This variation is, however, limited for the most part to upper first premolar. A high level of first premolar, 87% of the sample, exhibit two independent roots – grade 2 (Figure 5). This dental find is a very common and unspecific morphology for determining population affinity.

Maxillary premolars and molars – enamel extensions

This feature is exhibited by upper premolars and molars. The cervical enamel line of the molars typically runs a straight or horizontal course from the mesial to the distal margins of the upper molars. In some instances, however, the enamel line deflects toward the root in the area separating the mesial and distal roots. These extensions range from slight to pronounced deflections. Only one tooth from the sample study exhibited this trait, tooth 17 – skull TAS 37, grade 2 (Figure 6). This dental find is a very uncommon and unspecific morphology for determining population affinity.

Maxillary molars - hypocone

The hypocone was an additional cusp that originates from the distolingual cingulum on the upper molars (Figure 7). The study showed 18.52 % of the sample exhibited a hypocone – grade 5 (Skull TAS 1). This dental morphology is typically associated with human evolution and is compatible with modern humans

Maxillary molars – Carabelli's trait

This tuberculum projection is a cingular derivate on the mesiolingual cusp of the upper molars. A total of 80% of the sample exhibited Carabelli's trait – grade 3. Only one molar from the Skull TAS 1 exhibited grade 6 (Figure 8). This is a dental trait compatible with Caucasoid affinity.

Maxillary molars – cusp 5

This accessory cusp is located on the distal marginal ridge of the upper molars between the metacone and the hypocone. It is also referred as metaconule. A total of 2.70% upper molars exhibit this trait. The Skull TAS 41 exhibited a single molar with maximum value, grade 3 (Figure 9). This dental find is

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a very uncommon and unspecific morphology for determining population affinity.

Mandible canines – root number

Of the anterior teeth only the lower canine may exhibit multiple roots in polymorphic frequencies. This trait is one of the few that is found most commonly in Europeans, and it may be scored even when the teeth are missing. The arrows from the Figure 10 point to the lower socket of 3 canines which show the presence of two distinct root for each canine. Only 2,44% of the lower jaw canines exhibited this trait. This dental find is a very uncommon and unspecific morphology for determining population affinity.

Mandible premolars – lingual cusp number

Only 2 teeth, the lower second premolars of jaw 86 TAS exhibited this trait: 3 lingual cusps, with maximum value, grade 9 (Figure 11). This feature is well represented in the African population. This dental morphology is compatible with a presence of an African at the commingled skeletal remains from this mass disaster population. Results obtained with the anthropological study of the skulls from this broader project confirm a presence of an African black woman (Skull TAS 18).

Mandible molars- deflecting wrinkle

The essential ridge of the metaconid usually runs a straight course from the cusp tip to the central occlusal pit. However, in some cases, this ridge begins with a more mesial orientation before changing course toward the center of the tooth, hence the name deflecting wrinkle. Only 19,75 % of lower first molars exhibited this trait. The lower jaw 154 TAS, tooth 36 had grade 3 (Figure 12). This dental find is a very uncommon and unspecific morphology for determining population affinity.

Mandible molars- hypoconulid or cusp 5

Lower molars have five major cusps: 1) protoconid, 2) metaconid, 3) hypoconid, 4) entoconid, and 5) hypoconulid (Figure 13). When there is variation in cusp number, it involves the hypoconulid. Over the course of hominid evolution, the fifth cusp was often lost, especially on the second molar. A total of 46,77 % of lower molars from this anthropological sample exhibited this trait. The lower jaw 84 TAS, tooth 38 has scored with grade 5 (Figure 13). This dental find is a very common and unspecific morphology for determining population affinity.

Mandible molars- entoconulid or cusp 6

The modal number of cusps in the lower molars is five. However, a relatively common supernumerary cusp is positioned between the cusp 4 and the cusp 5 referred to as cusp 6 (respectively numbers 4, 5

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and 6 from the Figure 14). Only 2,91% of lower molars exhibited this trait. The lower jaw 76 TAS, tooth 38 scored with grade 5 (Figure 14). This dental find is a very uncommon and unspecific morphology for determining population affinity.

Mandible molars- metaconulid or cusp 7

A second supernumerary cusp of the lower molars is cusp 7 (number 7 from the Figure 15), positioned between cusps 2 and 4 (numbers 2 and 4 from the Figure 15). Only 3 lower molars exhibited this trait. One of them the tooth 36 from the lower jaw 46 TAS scored with grade 2 (Figure 15). This dental find is a very uncommon and unspecific morphology for determining population affinity.

Mandible molars- protostylid

This cingular derivateis often associated with the buccal groove located on the mesiobuccal cusp of the lower molars. It is frequent in American Indian populations. Only 2 lower molars, teeth 38 and 48, exhibited this trait which both belonged to the same mandible, lower jaw 217 TAS,where tooth 38 was scored with a grade 6 (Figure 16). This dental find is compatible with an American Indian.

Discussion

In the eighteenth century, the number of foreigners in the capital of Lisbon was considerable, and so it is not strange that we should have found many different populations represented in this assemblage (5,6). Some of the analyzed traits of tooth morphology allowed this investigation to conclude that population affinity comprised:

• European population,

• American Indian population,

• African population.

This information is supported by death certificate lists from the local councils of Santa Catarina (5,6).

Conclusions

There are a lot of interesting historical and processual issues to address by using crown and root variation. The use of tooth morphology in elucidating the population affinity of forensic remains is a fertile ground for expansion with the introduction of new traits not present on the Arizona scale for an actual miscegenation population. However, concerning this population, it was useful to determine 3 different populations of people in the society of eighteenth century Lisbon.

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Acknowledgements

References

1.   Brothwell DR: Dental anthropology. London, 1963: Pergamon Press.

2.   Pereira C: Commingled Assemblage from Earthquake 1755 of Lisbon: Forensic Anthropology Study. In: Forensic Science. Hauppauge, Nova Publishers. 2011.

3.   Brothwell DR: Some Problems and objectives related to the study of dental variation in human populations. J Dent Res 1967; 46(5): 938-941.

4.   Hillson S: Dental Anthropology. Cambridge University Press, 1996.

5.   Pereira C: Contribuição para a Identificação Demográfica de uma População Catastrófica por Parâmetros Dentários – População não Identificada relacionada com o Terramoto de Lisboa de 1755.Tese de doutoramento. 2010. Faculdade de Medicina: Universidade de Lisboa.

6.   Pereira C, Antunes MT: Vítimas do Terramoto de 1755 no Convento de Jesus (Academia das Ciências de Lisboa) – Identificação demográfica por parâmetros dentários. In: Memórias da Academia das Ciências de Lisboa – Classe de Ciências. Tomo XLIII, Volume II, Lisboa: Imprensa Nacional Casa da moeda. 2011. pp. 389-421.

7.   Scott GR: Dental morphology. In: Biological Anthropology of the Human Skeleton. Edited by Katzenberg MA, Saunders SR. 2008, John Wiley & Sons, Inc. 2nd, pp. 265-298.

8.   Pereira C, Mendonça MC, Costa Santos J, Antunes MT: An unidentified skeletal assemblage from a post-1755 mass grave: Paleodemography and palaeopathology identification by dental parameters – Part I. Inter J Dental Anthropol 2010; 17:1-17.

9.   Turner CG II, Nichol CR, Scott GR: Scoring Procedures for key morphological traits of the permanent dentition: The Arizona State University Dental Anthropology System. In: Advances in Dental Anthropology, Wiley-Liss, Inc., 1991, pp 13-31.

10. Turner CG II: Notes and Comments: Dental morphology and the population history of the Pacific Rim and Basin: commentary on Hirofumi Matsumura and Mark J. Hudson. American Journal of Physical Anthropology 2006; 130:455-61.

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Figure 1 Skulls and lower jaws from the earthquake 1755 of Lisbon
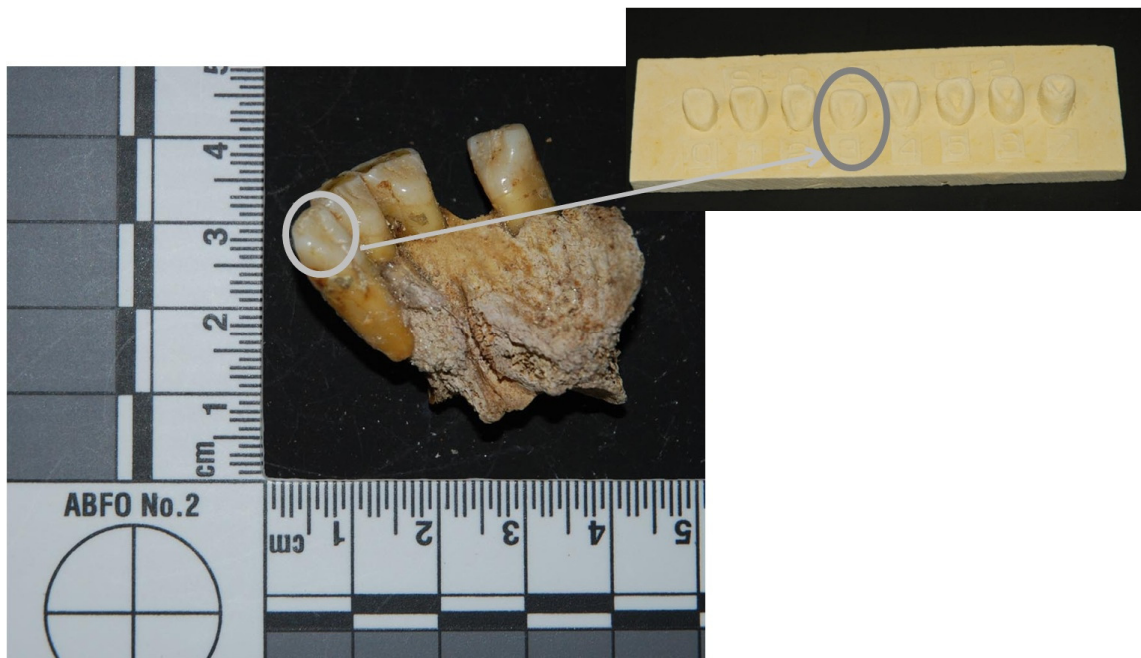
Figure 2 Lateral incisor from Skull TAS 40 scored the trait shoveling with grade 3

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Figure 3 Tuberculum dentale scored grade 3 in the lingual surface from the central incisor and canine

Figure 4 Interruption groove in the lingual surface from the uppers incisors: distolingual location D UI2

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Figure 5 Upper first premolar root number grade 2: two independent roots

Figure 6 Tooth 17 from the skull TAS37 with enamel extension grade 2

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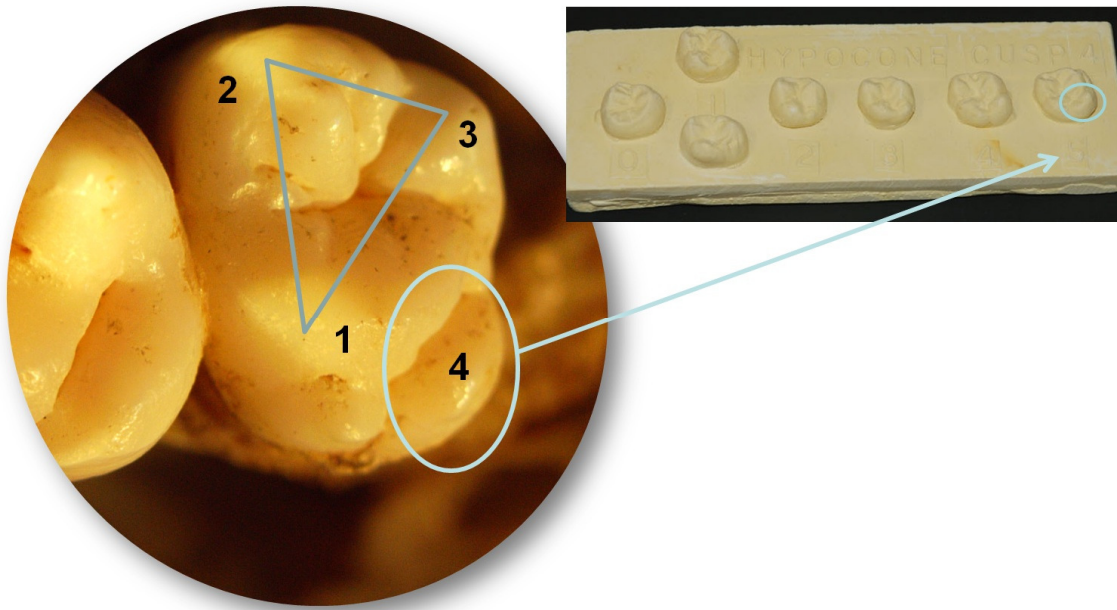
Figure 7 Skull TAS1 with the upper molar with:1 PROTOCONE; 2 PARACONE; 3 METACONE; 4 HYPOCONE The lines drawn between the first three cusps illustrate the primate origin The hypocone was an additional cusp that originates from the distolingual cingulum

Figure 8 The only molar that exhibited grade 6 for Carabelli trait

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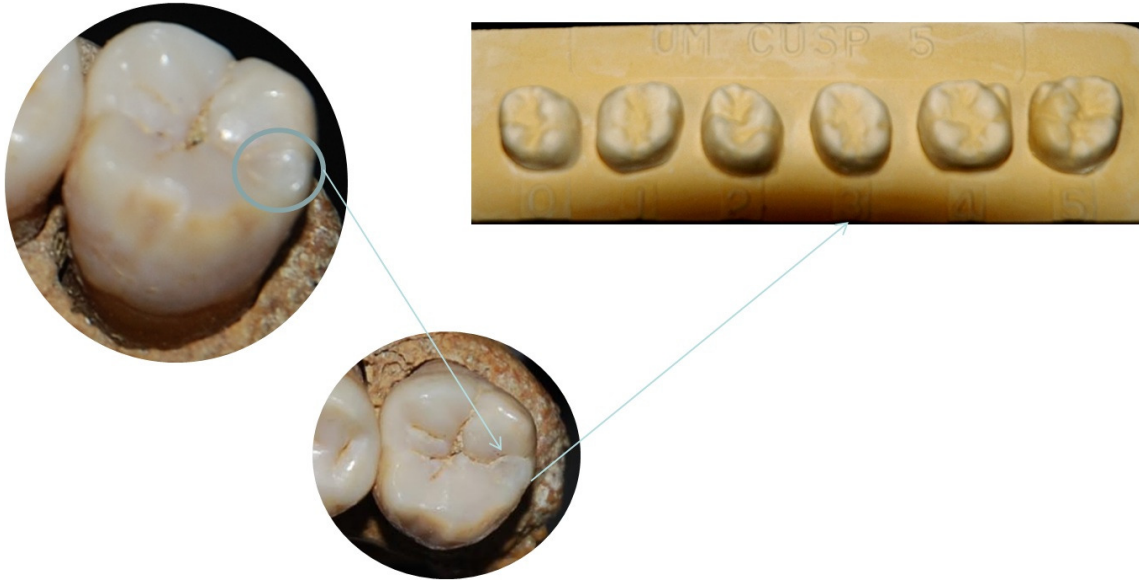
Figure 9 The Skull TAS 41 exhibited a molar with maximum value, grade 3 for cusp 5
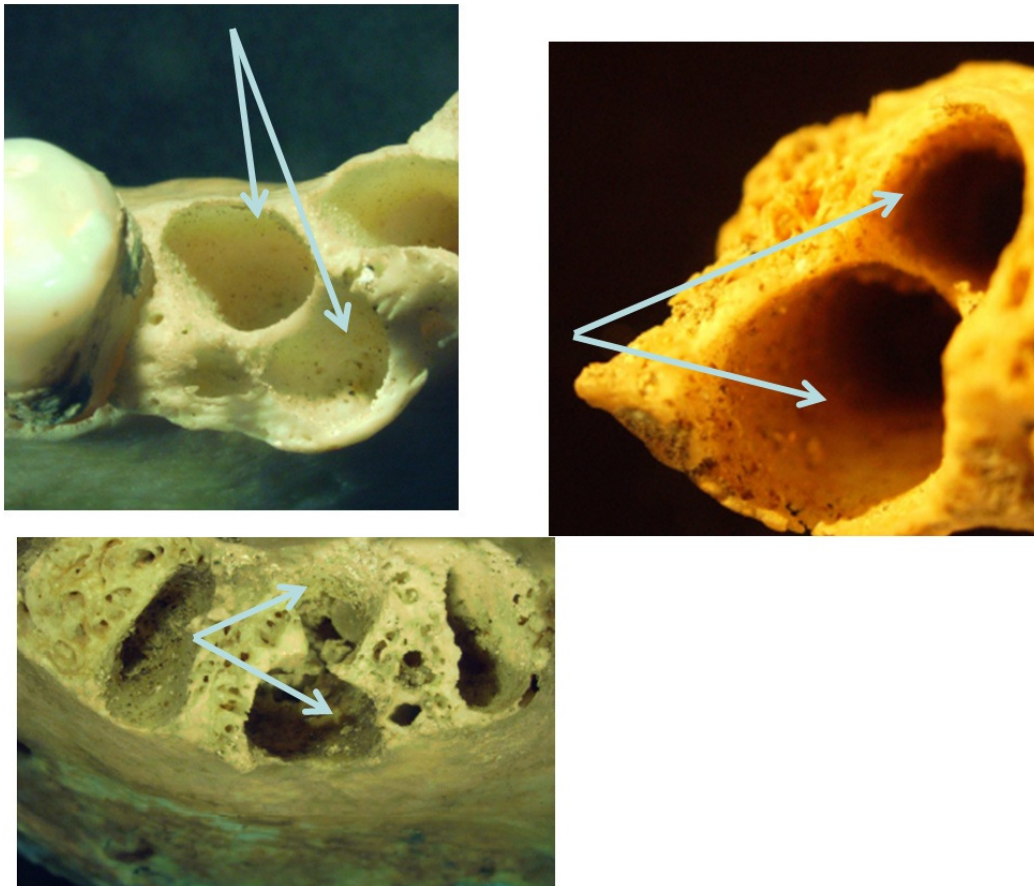
Figure 10 Three sockets of 3 canines that show the presence of two distinct root for each canine
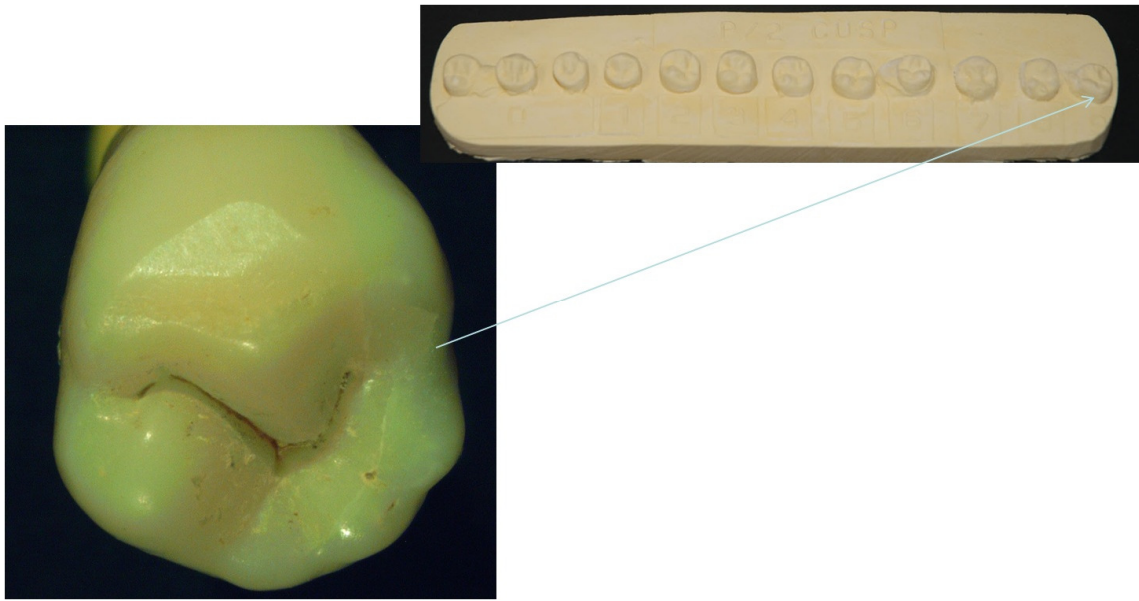
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Figure 11 Mandible premolar with 3 lingual cusp grade 9
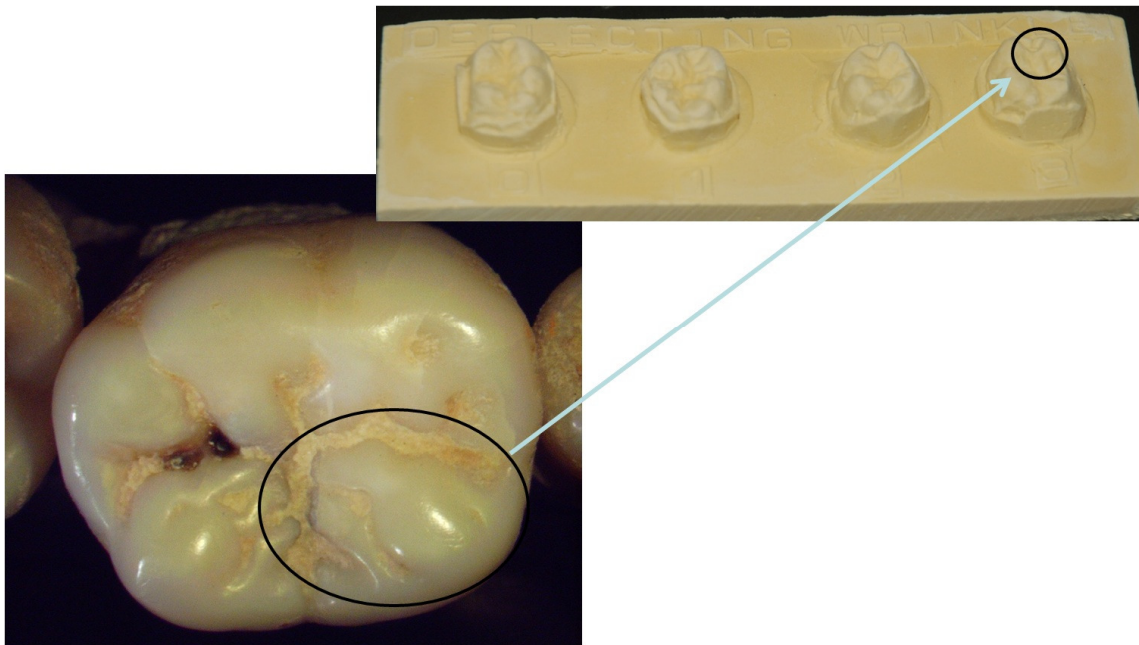
Figure 12 The lower jaw 154 TAS with tooth 36 had grade 3 for deflecting wrinkle in the occlusal surface

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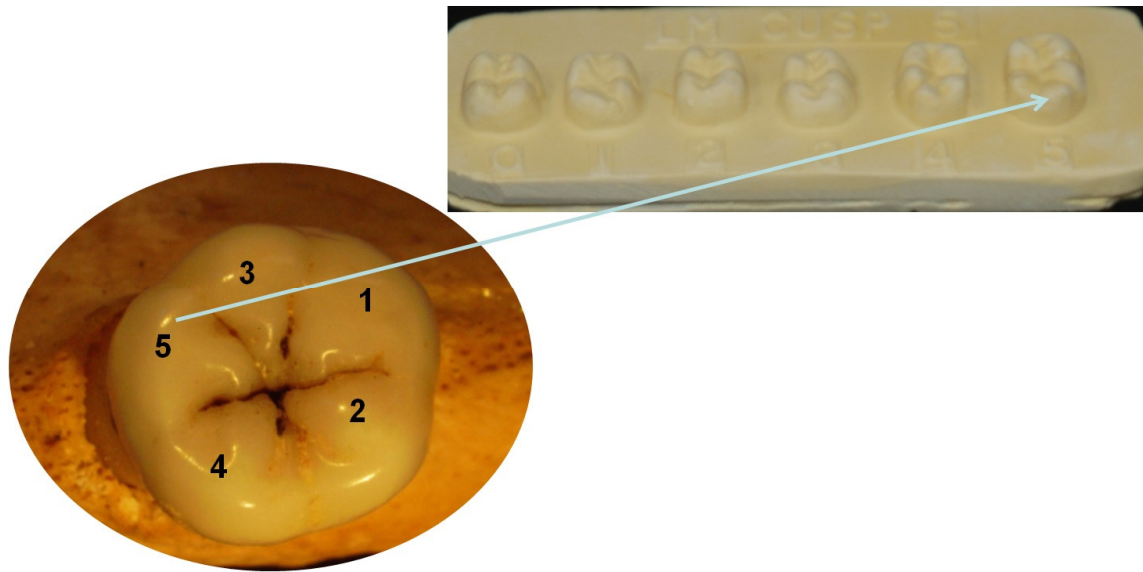
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Figure 13 The lower jaw 84 TAS with tooth 38 scored with grade 5 for cusp 5 (5)
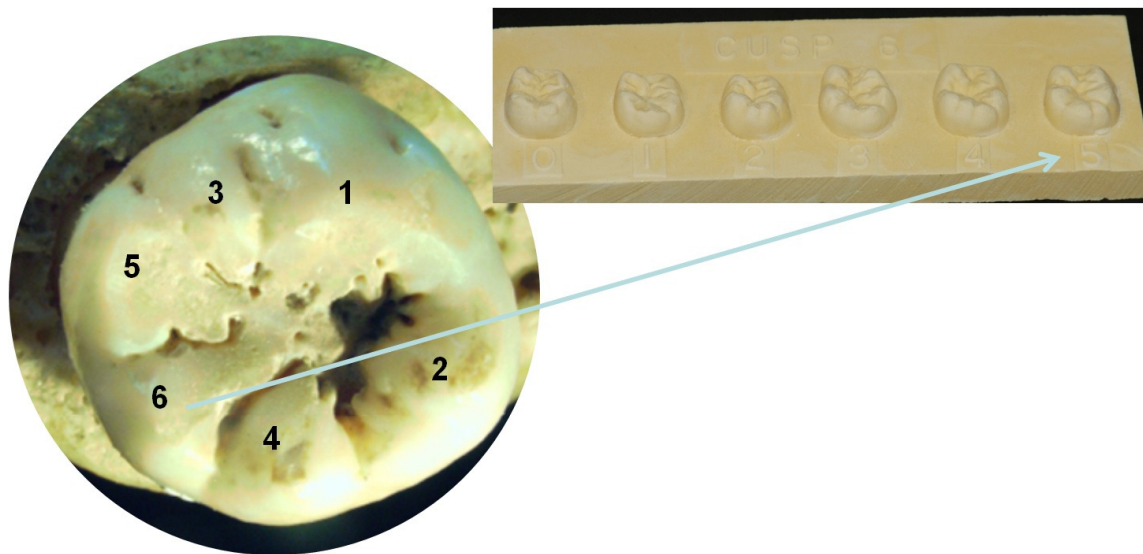
Figure 14 Tooth 38 from the jaw 76TAS scored with grade 5 for the cusp 6 (6)

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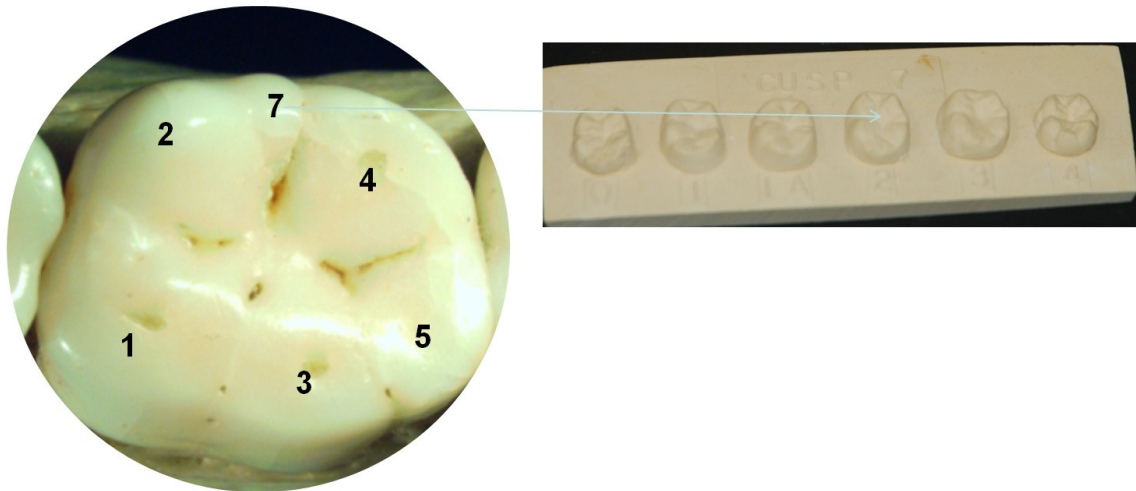
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Figure 15 Tooth 36 from the lower jaw 46 TAS scored with grade 2 for the cusp 7 (7)

Figure 16 Tooth 38 from the lower jaw 217 TAS with a protostylid scored grade 6

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