

# THE USE OF COMPUTERIZED AXIAL TOMOGRAPHY SCAN IN THE STUDY OF A MANDIBULAR CYST OF A MEDIEVAL CHILD

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**RESUMEN** La aplicación de la Tomografía Axial Computarizada (TAC) se ha convertido en una herramienta de gran importancia en el estudio de restos óseos y dentales de yacimientos arqueológicos. Se trata de una técnica no destructiva que nos proporciona imágenes de secciones de los objetos a analizar, con las que podemos reconstruir en 3D el propio objeto e inspeccionar las estructuras internas del mismo. Por ello es muy importante su uso en la realización del diagnóstico paleopatológico.

En el caso que presentamos a continuación se ha realizado el TAC de una mandíbula de un individuo de aproximadamente 7 años, procedente del yacimiento medieval de Santa Eulalia de Abamia (Asturias). Este individuo presenta un quiste periapical en la zona del canino temporal y el primer molar temporal izquierdos. Gracias al tratamiento de las imágenes obtenidas a través del TAC podemos observar el recrecimiento óseo que tiene lugar en la zona afectada. Además, podemos analizar las caries que sufre este individuo, las cuales a pesar de su pequeño tamaño, llegan a afectar a la pulpa del diente.

A la vista de estos rasgos y el desgaste que presentan los molares, es muy probable que este niño sufriese una caries en el primer molar temporal, lo que supuso una vía de entrada para las bacterias y dio lugar al desarrollo de un quiste, como vía de drenaje para la salida del pus proveniente de la infección.

**PALABRAS CLAVE** Paleopatología, caries, Edad Media, TAC, abscesos

**ABSTRACT** The use of computerized axial tomography scan (CAT scan) has become an important tool for the study of bones and teeth of archaeological sites. It is a no destructive technique which provides us images of slices from the objects we want to analyze, that images are used to restore the object in 3D and to examine the interior structures of it. Because of that, is very important the use of CAT scan to make a more accurate diagnosis in paleopathology.

We present in this paper the CAT scan of a 7 years old child's mandible, coming from the medieval site of Santa Eulalia de Abamia (Asturias). This individual shows a periapical cyst in relation to left deciduous canine and left first deciduous molar. Thanks to the images obtained through CAT scan, we can observe the bone growth that is taking place around the affected area. In addition, we can analyze the decay suffered by this child, which despite its small size affected the pulp of the tooth.

In view of these features and wear presenting the molars, it is very likely that this child suffer a decay in the first deciduous molar, which meant an entry for bacteria and resulted in the development of a cyst, as a way drain output pus from infection.

**KEYWORDS** Paleopathology, decay, Middle Ages, CAT scan, abscesses

## INTRODUCTION

A cyst is a pathological condition in response to an infection of the apical tissue. That infection is a result of exposure of the pulp to oral bacteria through caries, attrition or trauma (Dias y Tyles, 1997). We can divide cysts into two main groups, depending on the aetiology of this condition. On the one hand, we find non-odontogenic cysts, in which the origin of the cavity is because of a source other than tooth-forming organ (Dias *et al.*, 2007). On the other hand, there are odontogenic cysts which include development and inflammatory cysts (Dias *et al.*, 2007). Traditionally the studies of cysts in paleopathology have been done macroscopically or by radiographic images.

In this case, Computerized Axial Tomography scan (CAT scan) was used to do the study of a child's cyst. CAT scan makes use of computer-processed combinations of many X-ray images taken from different angles to produce cross-sectional (tomographic) images of specific areas of a scanned object. The images obtained through CAT scan allow us to describe and make a more accurate diagnosis of this pathology. This can be possible because CAT scan eliminates the superimposition of images, shows us differences between densities of tissues, displays views from different planes (axial, sagittal and coronal) and also, shows the inside of the object without cutting.



1. Right side of the mandible. Scale bar 3 cm. (Debe ir en Material/Methods).



2. Left side of the mandible, showing a periapical cyst. Scale bar 3 cm. (Debe ir en Material/Methods).

## MATERIAL/METHODS

The study focuses on a mandible of a seven years old child from Santa Eulalia de Abamia, a medieval church situated in Asturias (Spain). The teeth present are both first permanent molars. The left second permanent molar, fourth premolar and permanent canine are unerupted. On the right side of the mandible, second permanent molar, third premolar and permanent canine are also unerupted.

First, a generally study of oral health was done. To do that, the presence/absence of the teeth and its general status have been recorder primary. Then the presence and severity of caries, dental calculus, periodontal disease, abscesses and dental wear was registered. Dental caries were macroscopically evaluated in all teeth. Four different surface cohorts were established: oc-

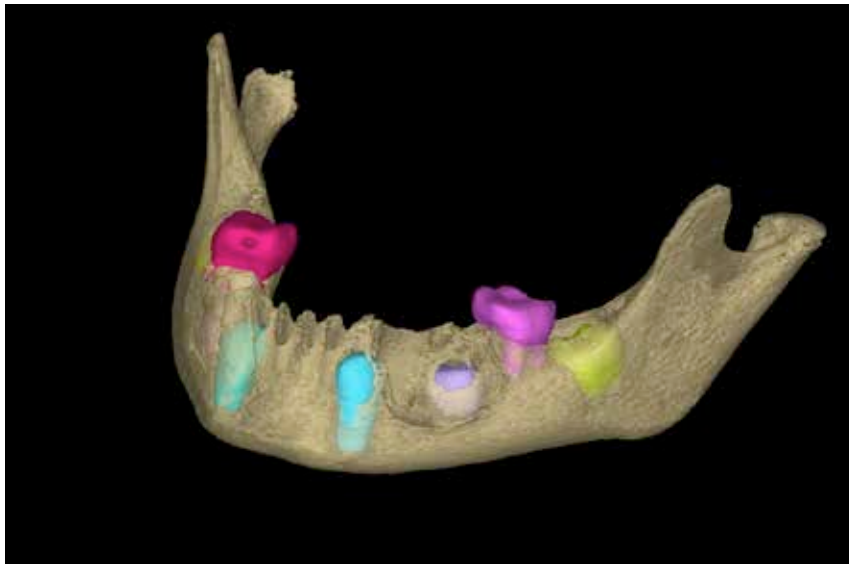
clusal, coronal, cement-enamel junction (CEJ) or root (Hillson, 2001). Also, three different degrees were recognized to identify the severity of the decay.

Teeth were examined for calculus deposits and for abscesses. Different degrees of alveolar reabsorption were given according to the exposure section of the tooth, considering like the highest degree when the exposure root exceed 6 mm (Chimenos-Küstner, 2003). Dental wear was also recorded by different degrees depending on the affected surface (Dawson y Brown, 2013).

For a better understanding of the pathologies presented before, we used non-medical (industrial) CAT scan with a 170kV of voltage and 3,75mA of current. The ROI was 199,87mm. The distance between slice was 0,20mm and the pixel size was 0,14638916mm. We obtained a 1024x1024 image dimension. This slice images were processed using Mimics© to create a 3D figure.



3. 3D image of right first permanent molar. Caries in red. (Debe ir en Results/Discussion).



4. The mandible 3D virtually reconstructed. (Debe ir en Results/Discussion).

## RESULTS/DISCUSSION

Only both first permanent molars could be studied macroscopically. Both molars present dental calculus remains and medium wear rates. The right M<sub>1</sub> has a serious decay, which involves the pulp, as we can see thanks to the CAT scan images. The lower jaw shows a large hollow bony lesion 16mm high and 19mm wide in relation to the first deciduous molar, which is lost post-mortem. The interior bony wall of the cavity is well demarcated and smooth. Via CAT scan we can see the bone growth that is taking place around the cyst, which could indicate a slow-growing lesion. Also, we can observe the unerupted tooth and realize that left fourth premolar is rotated.

Dental abscesses were a serious health problem for medieval populations (Boldsen, 1998). Traditionally, cysts were associated to dental attrition (Boldsen, 1998), because of the exposition of the pulp. In this case, we have a caries lesion in the right first permanent molar. If we suppose that this child could have inclination to suffer decay, maybe the cyst could have a decay origin instead of an exposed pulp by attrition.

## CONCLUSIONS

The analysis of the 3D allows us to analyze the coronal caries of the first right permanent molar, and we see how the lesion affects pulp chamber. The gravity of this disease could mean an infection and eventually develop another cyst.

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