



## Hide and seek: Impacted maxillary and mandibular canines from the Roman period Croatia



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### ARTICLE INFO

#### Keywords:

Multiple impaction  
Canine  
Roman Mursa

### ABSTRACT

**Objective:** The aim of this paper was to analyse the dental remains of an adult male with three impacted canines from the Roman period cemetery in Osijek, Croatia.

**Materials:** The dental remains of an adult male aged 35–45 years at the time of death were analysed.

**Methods:** Macroscopic analysis of dental remains was accompanied by radiographic examination.

**Results:** The individual also had additional dental pathologies (carious lesion, antemortem tooth loss). A total of 21 permanent teeth were present in maxillae and mandible. Eighteen of them were normal fully erupted dentition, while three were impacted: left maxillary canine and both mandibular canines. The left maxillary and mandibular canines were mesially inclined, and the right mandibular canine was relatively horizontally positioned.

**Conclusion:** A case of non-syndrome impaction in which the lack of eruptive force in combination with the unfavorable position of the tooth bud might have resulted in multiple impacted teeth is presented.

**Significance:** Current clinical knowledge reports low frequency of this anomaly, with maxillary impaction occurring more often than mandibular. Furthermore, canine impaction is even more rarely reported in the archaeological material. The presented case is the only one from the archaeological setting with impaction present both in maxillae and mandible.

**Limitations:** In modern populations multiple impactions are often associated with various syndromes. Since the majority of syndromes affect soft tissue, their association with impaction cannot be confirmed in archaeological populations.

### 1. Introduction

During their lifetime, humans have two sets of teeth - deciduous and permanent. One of the crucial stages in tooth development is dental eruption, an event in which the tooth erupts from the jaw and become visible. Tooth eruption is a complex process influenced by different factors (Hillson, 2014). Even though the eruption time for deciduous and permanent teeth is relatively consistent, individual variability is common, with significant deviations from established norms occurring occasionally. One such case is dental impaction, an anomaly in which fully formed teeth are retained in the jaw a long time after their normal eruption age (Üçüncü et al., 2011).

While this process can affect all types of both deciduous and permanent teeth, the most frequently impacted permanent teeth are third molars, followed by maxillary canines, premolars, maxillary incisors,

mandibular canines, mandibular incisors, first molars and finally, second molars (Bourzgui et al., 2012). While impaction of canines is a relatively common condition in the maxilla, mandibular teeth are rarely affected. Among the modern populations, frequency of maxillary canine impaction ranges from 0.8 to 2.8% (Aydin et al., 2004). Mandibular impaction frequency is difficult to estimate due to its rare occurrence. Some authors estimated mandibular impaction to be even 20 times lower than maxillary. A sampling of several living populations found that the frequency ranges from as low as 0.07 and 0.44% to high as 1.29% (Aydin et al., 2004; Yavuz et al., 2007). Impaction of maxillary canines is twice as frequent in females, while only 8% of cases are bilateral (Işık Aslan and Üçüncü, 2015). The frequency of concurrent impaction in maxilla and mandible in clinical literature is very scarce (Aydin et al., 2004; Fardi et al., 2011; Mustafa and Abuaffan, 2014). One case of triple canine impaction was found in the studied

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<https://doi.org/10.1016/j.ijpp.2018.10.004>

Received 10 January 2018; Received in revised form 3 October 2018; Accepted 3 October 2018

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populations (Aydin et al., 2004; Fardi et al., 2011; Mustafa and Abuaffan, 2014).

The aetiology of canine impaction is still unclear, but the condition appears to be associated with localized, systemic and/or genetic factors (Işık Aslan and Üçüncü, 2015; San Román et al., 2002). Some of these factors include: long developmental pathways, available space in dental arch, germ rotation, prolonged retention of deciduous teeth, early loss of deciduous canine, distal tip of nearby lateral incisor, incisor trauma, palate cleft, cyst, neoplastic lesions, root dilacerations, supernumerary teeth, odontoma, genetic disorders and endocrine deficiencies (Bourzgui et al., 2012; Üçüncü et al., 2011). Currently, there are two common theories that explain maxillary canine impaction: guidance theory and genetic theory (Richardson and Russell, 2000). According to the guidance theory, the impaction is a result of a local cause. Based on this theory, canines erupt along the roots of the lateral incisors, which serve as guides. Any malformation, trauma or absence of lateral incisors will influence canine eruption (Bourzgui et al., 2012). Additionally, maxillary canines due to their high position in the maxilla are the last teeth that develop and have the longest path into occlusion. This long path potentiates future disturbances (Richardson and Russell, 2000). The genetic theory focuses on genetic factors as a primary origin of impacted maxillary canines and includes other associated anomalies such as tooth size, shape and number (Richardson and Russell, 2000).

In the case of impacted mandibular canines, sometimes there can be obvious local factors such as supernumerary teeth, odontomes or enlarged dental follicles that are associated with the condition (Becker, 2012; Panda et al., 2011). Unfortunately, in the majority of the cases, there is no obvious local cause. The most probable cause is hereditary primary tooth germ displacement, leading to abnormal angulation of the tooth's long axis and consequently to the impaction (Becker, 2012).

In most cases, impactions remain asymptomatic, especially in regard to mandibular canines (Becker, 2012). When they occur, the usual symptoms are mobility or migration of adjacent teeth, bone expansion or perhaps pain and/or discharge (Becker, 2012). In modern dentistry, there are several options available for treatment of impacted canines such as surgical removal, exposure, and orthodontic alignment (Becker, 2012; Manne et al., 2012; Üçüncü et al., 2011).

Even though the canine impaction has been described relatively frequently in modern populations, to date only several cases from archaeological populations have been published (Fujita, 2005; Hooton, 1925; Iseri and Uzel, 1993; Mockers et al., 2004; Rajić et al., 1996). In the majority of the cases, the impaction is present in maxillary teeth. Among the Guanches, ancient inhabitants of Tenerife, impacted maxillary canines were present in five males and two females, with the frequency around 2% in both sexes (Hooton, 1925). An ancient skull from the Turkish site of Çayönü site exhibited the impaction of both maxillary canines (Iseri and Uzel, 1993). At the prehistoric site of Vučedol (28th - 25th century BC), a 35 to 45 years old female had an impacted left maxillary canine. The affected tooth was slightly mesially inclined (Rajić et al., 1996). A case from Edo period in Japan (17th -19th century) exhibited symmetrically impacted canines in a female aged 20 to 40 years. Since the axes of both teeth were inclined mesially, the impaction was almost symmetrical (Fujita, 2005). According to the authors, the observed anomaly was the result of the malposition of dental germ during eruption (Fujita, 2005). To the best of our knowledge, the only reported archeological case of mandibular impaction dates from Copper Age France. Two individuals from the site of Roaix exhibited single canine impactions (Mockers et al., 2004). The authors state the reason for the observed anomalies was a small-sized jaw not large enough to accommodate normally sized teeth (Mockers et al., 2004).

In this paper, an unusual case of canine impaction of a male from the Roman period cemetery in Osijek, Croatia, is described. The presence of three impacted canines, unilateral in the maxilla and bilateral in the mandible, is discussed based on the current clinical knowledge of this anomaly.



Fig. 1. Map of Croatia with the location of Osijek.

## 2. Material and methods

The city of Osijek, in continental Croatia (Fig. 1), has a long history. In the period of the Roman Empire, Osijek, Roman Mursa, was established as a military camp. By the end of the 1<sup>st</sup> century BC, a civilian settlement emerged in the close proximity to the fortress (Leleković, 2011). The city continued to develop during the 2<sup>nd</sup> century and was given the status of colony by the Emperor Hadrian. The prosperity of Mursa ended in the mid 3<sup>rd</sup> century with the barbarian invasions and extensive disease epidemics (Leleković, 2011).

A cemetery at the site of 120 Divalentova Street in Osijek was discovered in 2009. Archaeological rescue excavation revealed 77 burials (60 inhumations in wooden coffins, and 17 cremations) (Leleković, 2011). Based on grave goods, the cemetery was dated to the 3<sup>rd</sup> and 4<sup>th</sup> century, with the majority of the burials belonging to the first half of the 3<sup>rd</sup> century (Vukmanić and Hršak, 2010). The location of the cemetery and high density of the graves suggest that the discovered graves were part of the larger, southern Mursan cemetery (Leleković, 2011), used for burials of civilians over several generations (Vukmanić and Hršak, 2010).

The individual described in this paper was found in Grave 68, located in the southeast corner of the excavated area. Skeletal remains were found in a rectangular grave oriented west-east. The deceased was in the supine position, with the head toward the west. Only the superior part of the skeleton was excavated, as the inferior part was left in an area inaccessible for excavation. The recovered part of the skeleton was well preserved with the majority of the bones present. Morphological characteristics of the cranium and pelvic bones (Buikstra and Ubelaker, 1994) suggested that the skeletal remains belong to 35–45 years old male. During the analysis, a healed fracture between the middle and distal third of the right humerus was observed.

Macroscopic analysis of the dental remains was accompanied by radiographic examination. A panoramic image (Orthopantomograph OP 300, Instrumentarium ; 70 kV, 13 mA, exposure time 160) was used to localize impacted canines. Accurate position of the impacted teeth was obtained by Cone beam computed tomography (CBCT) (T3DAccuitomo XZY Slice View Tomograph; 90.0 kV; 3,5 mA; exposure time 0 ms; radiation dose 6,2 mGy). The Fédération Dentaire Internationale two digit numerical system (Keiser-Nielsen, 1971) was used to inventory the dental remains.

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