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# Pathologies And Cultural Dynamics

## Dental Anthropology In The Medieval Sample From Ferento (VT)

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**Abstract**
*The methods and principles of Dental anthropology was used to inquire into population of Ferento, demonstrating that Ferento as a important core for anthropology. Ferento is inserted among Early Middle Ages sites as a town where we can see commune dental pathologies and disorder (decay, calculus, enamel hypoplasia, malocclusion and malposition).*

**Keywords:** Ferento; Dental anthropology; State of dental health; Dental pathologies; Traits of teeth;

### Introduction

Dental anthropology is defined as study of proofs provided by observation of morphometric traits and pathologies of teeth of a skeletal populations (Hillson, 1996). The importance of teeth for the study of ancient populations have to characteristics of tooth itself, it keeps better than others rests.
The aspects we can analyse in dental anthropology include genetic variables (dimensions and morphology of dental crown); biological and intentional dental wear; pathologies of enamel and dentin.

### History of Study

First approach to study of teeth dates back to classical time. The *Corpus Hippocraticum* (5th century B.C.) mention anatomy and growth of teeth and several dental disorders.
Aelius Galenus was first to describes human bones from an archeological context (see Peyer, 1968; Hillson, 2005).
J. Hunter (1865) laid down basics of dental science, with introduction, in addition, of scientific words.
In the second half of 19th century anthropologists and odontologists showed some morphological variation: P. Mantegazza (1877) and E. Magitot (1880) addressed about variation of molar cusps; while G. von Carabelli (1842) described an accessorial mesio-lingual cusp of maxillary molars. Important contributions came with J. H. Mummery (1870) and P. Broca (1879) who studied respectively the dental morphometry and dental wear.
In most recent times, the studies of Dental anthropology focused on dental variables with economic and cultural aspects with T. D. Campbell (1925), J. C. Middleton Shaw (1931) and R. W. Leigh (1925).
Significative methodological developments came since 1950 with A. A. Dahlberg (1950) and T. Murphy (1959) concerning dental morphology and wear (Scott, 1996).
With D. R. Brothwell (1963) a considerable fillip came in Dental anthropology.
Since second half of 20th century two important events typified this discipline: the birth of Dental Anthropology Association (1986) and circulation of numerous scientific publications.

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**Dental Traits**

The morphology of tooth is genetically determined (Buikstra and Ubelaker, 1994) since it don't changes during the life. Teeth are made up by two principal elements: crown and root. The crown, covered by a translucent enamel, protrudes in the mouth; while the root, covered by a yellowish cement, is forced in the maxillary bones.
Dental body is almost composed by dentin, hard and mineral (65%) compound, and by enamel, a material with nature most mineralized (96%).
The formation of dental elements is called *odontogenesis*, that starts after a month of embryonal life. The dental eruption follows three principal stages distinguishable in: alveolar emergence, that may be seen only in skeletal remains; gum emergence and emergence of dental crown.
The eruption of deciduous teeth follows: first incisors (i1), second incisors (i2), first molars (m1), canines (c) and second molars (m2) (Tab.1). The permanent teeth eruption follows: first down molars ($M_1$), first incisors (I1), second incisors (I2), first upper molars ($M^1$), upper canines (C'), first (P1) and second premolars (P2), second molars (M2) and third molar (M3) (Tab. 2).
Principal morphological characteristic of each typological teeth are: a) incisors teeth, chisel-form crown, sharp occlusal border and lingual tuberculum; b) canines teeth, pyramidal-form crown, conical root; c) premolars teeth, bicuspidal crown with conical root; d) molars teeth, quadrangular crown and multiple root.

**Archeological context of the human remains: Ferento**

Ferento site is located north-east of Viterbo, it is clinging on a tufaceous plateau. We have some evidences about Etruscan installation (4th century B.C.). With the roman conquest of this zone (310 B.C.) Ferento entered under the influence of Rome. First reliable information go to *Liber Coloniarum* (123 B.C.) where is reported that Ferento became a *municipium* and was recorded in the Stellatina tribe. The built-up area develop in *strigas* (3th century B.C.) whit block of houses of 35 meters to 35 meters. During Julio-Claudian dynasty were built numerous structures like a Theatre, *Thermae* and *Forum*. In the first years of 7th century Ferento was reduced to fortification of Tuscania territory. From 9th to 10th century was mentioned as *civitas*, appearing in the *diploma* of Louis the Pious.
The presence of tombs in Early Middle Ages suggests the hypothesis of an urban fabric with large net, where housing was alternated to free spaces utilized like cave or burial ground.
Cores of monolithic basin tombs or caisson tombs are recognizable, from 6th to 8th century, inside theatre and outside the city-walls. During 11th century Ferento lives a progressive reoccupation of the abandoned areas. Ferento was destructed by Viterbo from 1170 to 1172.
The research are led by University of Tuscia (Viterbo) from 1994. The principal findings are a sculpture of a young man (*Herakliskos*, second half of 2th century) and ceramic materials dated from 11th to 12th century (Romagnoli, 2001, 3:273-300).

**Materials and Methods**

The persons highlights in the archaeological assays II (AS II) are 198 where 43 invidiuals keep dental elements.
Individuals are subdivisible in age-at-death including: 12 persons from 0 to 6 age-at-death; 8 individuals from 7 to 14 age-at-death; 1 young from 15 to 20 years; 6 young adults from 21 to 40 year-to-death and 16 adult person with an age-at-death from 40 to 60. Dental materials belong to 10 males, 7 females, 5 undefinable and 21 immatures.
Teeth, as survey instrument, are connected to aid of methodology that concern metric and non-metric variability and the study of dental pathologies.

**Metric Variations**

The dimensions of teeth present an high genetic transmissibility showing variation that we can pronounce with differences in genetic pool. Measures utilised encompass width, length and height of dental crown.
The study of pathologies is remarkable importance to reconstruct type of life of a population. Teeth, being in direct contact with outer environment, present a definite marks.
Pathologies or anomalies noted in this work concern: decay, calculus, periodontal disease, hypoplasia and dental wear.
Decay is a degenerative process of hard tissue by organic acid produced from bacterial fermentation (Mays, 1998; Larsen, 1999; White and Folkens, 2005). The influence of decay may be due to consumption of cariogenic food and the reduction of occlusal space.
For every single tooth is specified if the decay is present on occlusal, interproximal, buccal or lingual surface, on

the root or if the decay is a destructive decay.
Calculus represents dental plaque mineralized. In calculus etiology the salivary pH has an important role. In the presence of alkaline pH crystallites collect on plaque. There are two types of dental plaque: supra-gingival and sub-gingival plaque. The calculus deposit is recorded according to amount (Brothwell, 1981).
The periodontal diseases are linked to accretion of plaque. The inflammation break out in four phases: early lesion, primary lesion, full-blown lesion and advanced lesion.
In the skeletal remains we can observe a rough surface with the exposure of nutrient canals that expand its, the distance between alveolar edge and cement-enamel junction raises (Hillson, 1996; Larsen, 1999; Canci e Minozzi, 2005).
Enamel hypoplasia presents in the shape of transversal lines or low areas of enamel at ends of dental crown (Mays, 1998). The causes can be local, with periapical traumas or infections and curbed a single tooth; or general reasons that involve group of symmetric teeth. Among this factors, the principal are vitaminic deficiencies, endocrine disorders and infectious diseases. Hypoplasia appears only during the childhood, in a time period between born to 6-7 years old. By measuring hypoplastic lines with digital calliper, is possible calculate the age of formation of blemish, by Goodman and Rose's equations of regression (1990).
In dental chewing wear we must distinguish between the two phases of consumption: the slice and preparation of food (front teeth) and food reduction (back teeth). According to dental wear is possible estimate the age-at-death of the person, using various methods, among: Miles' (1998), it is based on molars eruption; Molnar's (1971) it considers angulation and direction of wear too; and Lovejoy's (1985) with the observation of single tooth.
Among dental not-food wear remember: interproximal grooves, occlusal grooves, oblique wear facets, cutmarks and deliberate alterations.

**Non-metric Variations**
Particular teeth traits show a considerable variability not quantifiable by measuring. Morphological variations was studied by Gregory (1922), T. D. Campbell (1925), J. C. Middleton Shaw (1931) and, most important, by Turner *et al.* (1991), authors of reading system of morphological variations of Arizona State University (ASU).
Non-metric traits most observed for single tooth are the "shovel-shape", labial incisor groove, additional canine distal ridge, occlusal additional cusps of premolars, molars grooves ("Y-groove", "+-groove" and "X-groove") and Carabelli's tuberculum.

**Instruments and Developments of Work**
To observation of metrical, morphological and pathological traits of teeth I used four form-model: a) "Dental Anthropology general Form-model", where are underline every single tooth discovered during the excavation and reporting presence or lack of pathologies; b) "Enamel Hypoplasia Form-model", where are reported datas of measuring with digital calliper and calculating the age-at-death using Goodman and Rose's method (1990); c) "Metrical Tooth Form-model", where are inserted the surveys of mesio-distal and buccal-lingual diameters; d) "Age-at-death Form-model", that is composed by Lovejoy's wear table.

**Results and Discussions**
The study about sample of 630 persons buried in the Ferento necropolis concerns on the analysis of metrical traits as occlusal area and on the survey of incidence of particular pathologies, as decay, calculus, hypoplasia, alveolar retraction, periodontal diseases, loss at death and dental wear.
Out of 10 upper first deciduous molars it surfaces that the average of occlusal wear is 63,89 $mm^2$, with a light wear. Similar case finds in lower first deciduous molars with an average occlusal wear 58,92 $mm^2$ (Tab. 3).
For permanent molars we can observe a considerable decrease of occlusal surface, in particular in first molars, is due to time of eruption of molars, we have in fact a average of 99,29 $mm^2$ for thirty-six first upper molars, with a average loss of 9,74% of occlusal space.
In the first lower molar the average occlusal surface of Ferento sample of thirty-nine teeth is 87,13 $mm^2$ with a occlusal loss of 12,64%.
For the second molars we have different progress with a wear loss equal to 1,59% for second lower molars.
The study of pathologies was conducted dividing persons into two macro-groups: sex and age-at-death.
For the first group was spotted four subgroups: males, females, indefinite sex and immatures. The second macro-group was spotted in five subgroups: 0-6 years old, 7-14, 15-20, 21-40, 40-60, 60+.

The percentage of suffering teeth from decay is equal to 7,1%, while the total of persons affected compared to total observed individuals are 37,2%.
Teeth most affected are posterior those ones with an incidence of 5,7% on 630. From datas obtained we can see a light predominance of decay in female persons (52,9% of affected teeth on total of 34 teeth). The physiological causes that explain the difference between males and females in developments of decay is traceable in the hormonal peaks of oestrogens and in the less production of saliva of women (Tab. 4).
The presence of calculus is attested in the percentage of persons affected, this data is about 95,35% on 43 individuals (Tab. 5). Both males and female present a rating of affected teeth (≈ 98,00%).
Teeth with hypoplasia are 12,7%. Almost half of individuals shows metabolic stress mark (48,84%). Women are those most affected (38,8%) (Tab. 6).
The phenomenon of alveolar retraction concern 67,44% of persons. Even in the alveolar retraction was observed a greater increase in women than in men.

**Anomalies of Noteworthy Importance**
The teeth of Ferento's sample report particular cases of anomalies or serious pathologies. We can observe teeth with strong destructed decay or interproximal decay. In particular, in Tomb 3 (T3) we see serious calcification or a remarkable alveolar resorption. There are cases of malposition of right lower canine, rolled in lingual way or a malocclusion of third upper left molar (Tomb 17, T17) (Fig. 1). Another malposition case is findable in central upper left incisor that come out on top of maxillary bones (Tomb 93, T93) (Fig. 2).

**State of Dental Health among Ferento and others Early Middle Ages Necropolis**
Others necropolis considered are Necropolis of Saint Stephen in Cividale del Friuli (Friuli-Venezia-Giulia, Italy), Saint Laurence Necropolis in Quingentole (Lombardy, Italy), Centallo Necropolis (Piedmont, Italy), Poggio Imperiale Necropolis (Tuscany, Italy), Vicenne Necropolis in Campochiaro (Molise, Italy) and Venosa Necropolis (Basilicata, Italy) (Tab. 7).
Sites that have a higher incidence of dental diseases are Ferento and Poggio Imperiale, in fact, both skeletal sets studied shows diseases such as hypoplasia, periodontal diseases, decay and calculus. In Ferento the incidence of this pathologies compared to Poggio Imperiale is highest (63,25%).

**Conclusions**
The state of dental health of Ferento is similar to coeval necropolis.
Dental wear provides informations about use of teeth. In this populations we don't have a remarkable extra-masticatory use, concluding that the wear is linked with food factors, with food with middle-high hardness. Whereas the age of eruption and age-at-death, the degree of food hardness the tooth has not been worn in a short period of time.
Compared to pathologies, the decay is linked to diet; Cariogenic foods accessible to the population of Ferento include: chestnuts, pears, cherries and apples (Romagnoli, 2001). If the fructose have a low input to decay can contribute to it.

| **Maxillary deciduous teeth** | | | | |
|---|---|---|---|---|
| **$i^1$** | **$i^2$** | **c** | **$m^1$** | **$m^2$** |
| 8 – 10 months | 9 – 11 months | 16 – 19 months | 10 – 15 months | 2 years |
| **Mandibular deciduous teeth** | | | | |
| **$i_1$** | **$i_2$** | **c** | **$m_1$** | **$m_2$** |
| 6 – 8 months | 10 – 13 months | 17 – 20 months | 10 – 15 months | 2 years |

**Table 1.** *Dental deciduous eruption. i1, central incisor, i2, lateral incisor, c, canine; m1, first molar; m2, second molar. The position of the superscript or subscript numbers indicate, respectively, maxillary tooth or mandibular tooth.*

| **Maxillary permanent teeth** | | | | | | |
|---|---|---|---|---|---|---|
| **$I^1$** | **$I^2$** | **C** | **$PM^1$** | **$PM^2$** | **$M^1$** | **$M^2$** |
| 7 – 8 anni | 8 – 9 anni | 11 – 12 anni | 10 – 11 anni | 12 – 14 anni | 9 – 10 anni | 14 – 16 anni |
| **Maxillary permanent teeth** | | | | | | |
| **$I_1$** | **$I_2$** | **C** | **$PM_1$** | **$PM_2$** | **$M_1$** | **$M_2$** |
| 6 – 7 anni | 7 – 8 anni | 9 – 10 anni | 10 -12 anni | 13 – 14 anni | 9 -10 anni | 14 -15 anni |

**Table 2.** *Dental permanen eruption. I1, central incisor, I2, lateral incisor, C, canine; M1, first molar; M2, second molar. The position of the superscript or subscript numbers indicate, respectively, maxillary tooth or mandibular tooth.*

**Fig. 1:** T17. Malposition of lower right canine rolled in lingual way.

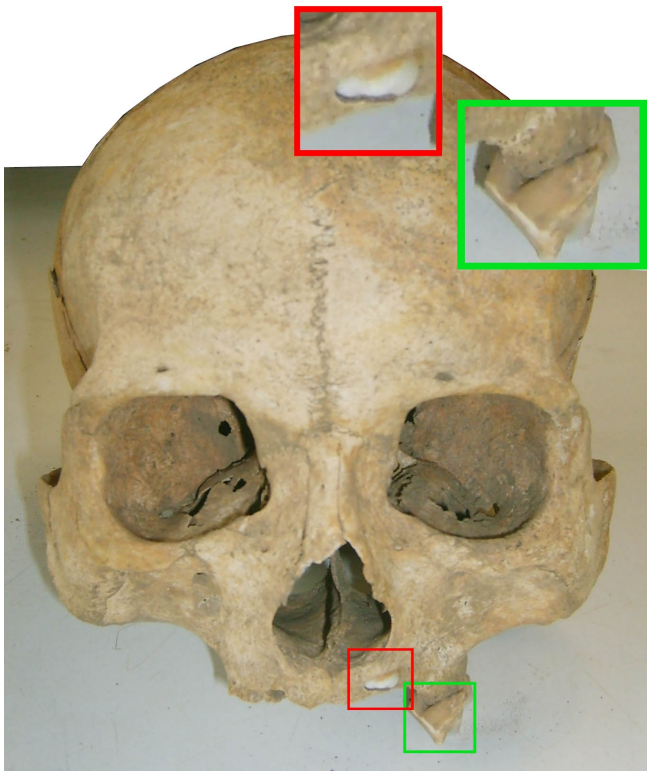
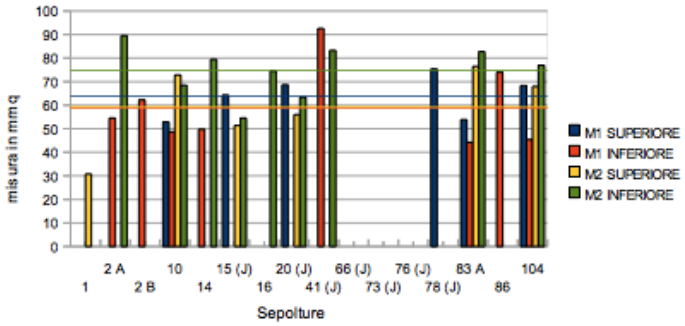
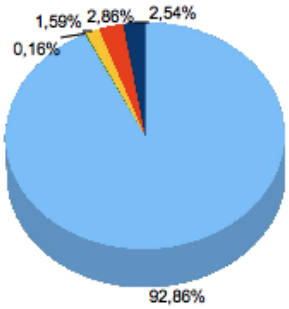


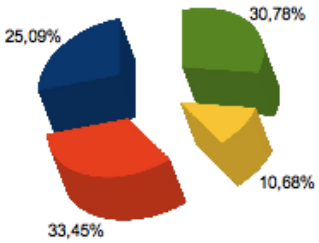
**Fig. 2:** *Skull of T93, Malposition of first upper left incisor (red square) and malposition of upper left molar (green square).*



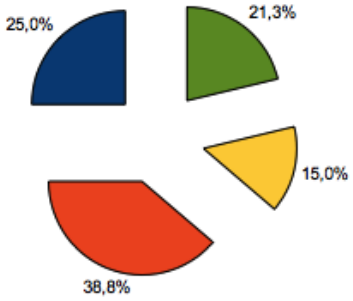

**Tab. 3** *Occlusal area of deciduous molars with indication of the average value. The average value is indicated by the horizontal line on the basis of color matching.*



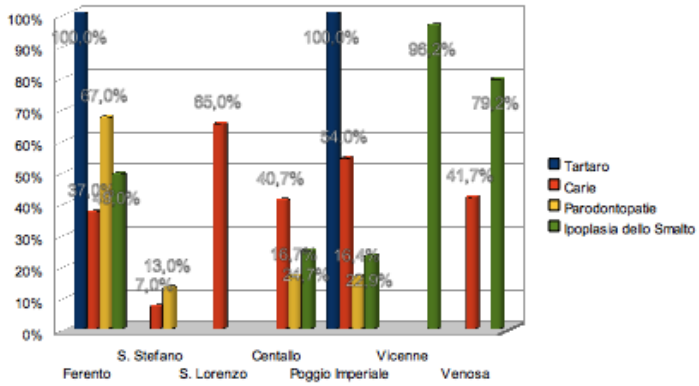

**Tab. 4** *Incidence of caries for each tooth, with distinction of sex. Label: male (dark blue), female (orange), indefinable (yellow), immatures (green), not-affected (light blue).*




**Tab. 5** *Incidence of calculus for each tooth, with distinction of sex. Label: male (dark blue), female (orange), indefinable (yellow), immatures (green)*




**Tab. 6** *Percentage of teeth which hypoplastic lines are observed in relation to sex. Label: male (dark blue), female (orange), indefinible (yellow), immatures (green).*




**Tab. 7** *Incidence of dental diseases in Ferento skeletal and other contemporary series.*

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