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An anthropological and paleopathological analysis of a peculiar skeleton from the Necropolis of Zancle (1st century BCE – 1st century CE): a case report

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Abstract

The work presents the results of the anthropological and paleopathological analysis carried out on human skeletal remains of an individual (T-173) found in a burial from the necropolis "sector 96", Messina, Sicily, dating back to the Roman Empire (1st century BCE – 1st century CE). The study aimed to acquire the information necessary for the reconstruction of the biological profile. In fact, T173 is an adult male which is particularly interesting from a paleopathological point of view, showing skeletal anomalies from the cranial to the post-cranial skeleton probably caused by variations of genetic, neoplastic, articular and dental nature. Furthermore, the analyses have highlighted the possible cause of death, related to two *perimortem* traumatic lesions on parietal bones.

Keywords

physical anthropology; biological profile; paleopathology; Sicily.

Introduction

This work deals with the anthropological and paleopathological analysis of the bone remains belonging to an individual buried in Tomb 173, "sector 96" (Fig. 1), of the Necropolis of Zancle (Messina, Italy), found during the excavation campaign 1998-1999. The necropolis was used for an extended period, from the Hellenistic Period to Late Antiquity (4th century BCE – 5th century CE). Specifically, relining on the material culture recovered in the burial - a *Piriform Unguentarium* -, T173 was archaeologically dated between the 1st century BCE and the 1st century CE. The unguentaria are small ceramic bottles, representing the most common grave offerings of the Hellenistic and early Roman periods, especially in cemeteries of the Mediterranean area (Anderson-Stojanovic, 1987). The pear-shaped body of the *Piriform Unguentarium* is associated with graves of the 1th century BCE and it continues in use for a period of about a hundred years, until the latter part of the 1th century CE (Robinson, 1959; Anderson-Stojanovic, 1987).

The observation of the various skeletal areas highlighted numerous anomalies both in the cranial and post-cranial skeleton, attributable to a pathological spectrum and injuries caused by a violent episode (Messina et al., 2013) in an individual already characterized by a very intense occupational activity in life. Therefore,

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Figure 1. Sector 96 of the necropolis (Messina, Italy). (Tigano, 2017).

we proceeded with an in-depth anthropological analysis of the entire skeleton with the aim of reconstructing the biological profile and investigating the etiology of the numerous and different anomalies found, especially to understand better the activities carried out by the individual.

Historical background

The first consistent settlements in the Messina area date back to the Bronze Age, but it is only with the arrival of the Greeks - in 740 BCE - that the area assumes the maritime role for which it is known. In book IV of "*History of the Peloponnesian War*", Thucydides tells that the first founders of the city were Greek pirates from Cumae (Campania) to whom, later, the inhabitants of Chalcis would be added. Thucydides informs us that the first name of the city – Zancle - is of indigenous origin and it was so named for the sickle shape of the port (the indigenous named the sickle "*zanclon*").

Because of its strategic position in the Strait, the city acquires a new importance within the new communication routes, especially for what concerns shipments. The acquired wealth with the commerce stimulated competition and development and Zancle becomes a crucial Mediterranean hub - not always of peaceful nature - between Greeks, Carthaginians, Phoenicians, Etruscans and Sicilians. Messina became the first Sicilian city in the hands of the Romans during the First Punic War and, at the end of the war, the city obtained the status of *civitas libera et foederata* (free and allied city), unique in Sicily together with *Tauromenium* (Taormina) and *Neaiton* (Noto).

Romans will rule in Sicily for other six centuries, as Sicily was very important for the Empire as a point of supply, for keeping a close watch on Carthage, for the production of grain that supported the Roman armies and – in general - as a central point to oversee the Western Mediterranean (Serrati, 2000; Serrati, 2020).

The necropolis of Zancle

The excavations of the Necropolis of Zancle (in the South/South-Western part of the town of Messina) were directed by *Sovrintendenza dei Beni Culturali di Messina* (Sicilian Heritage Office) from 1991 to 1997. In particular, the interest was placed along via Cesare Battisti, where the sections 83 (I-II sector) and 96 (V-VII compartment) (Fig. 2) brought to light about 400 tombs.

The stratigraphic investigation and the analysis of the material culture found made it possible to isolate three main chronological phases that covered a wide time-span ranging from the early Hellenistic age to the Late Ancient (last quarter IV BCE - V CE) and seem to coincide with the moments of change in the organization of the space intended for burial. From a stratigraphic point of view, these spaces are distinguished by alluvial deposits that seal the tombs of the lower level, thus creating the opportunity for new burials (Tigano, 2017).

Figure 2. Aerophotogrammetry of part of the necropolis, modified from Tigano (2017). The sector 96 is highlighted in grey.

Material and Methods

The anthropological study began with a preliminary analysis of the skeletal districts related to Tomb 173, proceeding with the basic anthropological characterization in order to acquire the necessary information through the use of current anthropological diagnostic methodologies and techniques (Buikstra and Ubelaker, 1994).

For the determination of sex, the dimorphic sexual characteristics of the pelvis and skull were primarily investigated according to the criteria of Acsádi and Nemeskéri (1970). Due to the partial fragmentation of these skeletal areas, it was not possible to observe all the characters reported by the standard, so other qualitative methodologies were applied such as the Phenice (1969) and Bruzek (2002) for the pelvis. As a quantitative method, the Probabilistic Sex Diagnosis (DSP) (Murail et al., 2005; Bruzek et al., 2017) was used. The measurements required by the standard were obtained both physically – by sliding jaw gauge and curved jaw gauge – and digitally through the development of 3D models of the coxal bones through Close Range Photogrammetry (Luhmann et al., 2019).

To estimate the biological age at death were applied methods based on the metamorphosis of certain skeletal areas during aging, such as the auricular surface of the ilium (Lovejoy et al., 1985), the pubic symphysis (Suchey and Brooks, 1990) and the sternal end of the fourth rib (Ïșcan and Loth, 1984).

The formulae of Trotter and Gleser (1952; 1958; 1977) were used to estimate stature.

When possible, the study proceeded with paleopathological assessments, which are fundamental for reconstructing the state of health and lifestyle. In investigating the onset of a disease, it is crucial to identify the nature and distribution of the "anomaly" on the skeleton. Thus, we performed with a preliminary analysis to differentiate the normal development in shape, size, and topography of a healthy skeleton from the ones we observed on T173. Once the "variation" was identified, its description and diagnosis continued with the aid of appropriate manuals (Capasso et al., 1999; Ortner, 2003; Roberts and Manchester, 2010; Grauer, 2011; Waldron, 2020) and from other sources in the scientific literature.

Results

T173 skeleton was found in an excellent state of preservation, despite some of its skeletal elements lacking. The missing skeletal elements are the sternal bones, the whole right upper limb, the left hand (except the first metacarpal), the left foot and phalanges of the right one, the left patella.

Regarding the determination of sex, the application of the Acsádi and Nemeskéri method (1970) gave mixed results. The qualitative analysis of the skull shows marked masculine morphological characters with a sexualization index 0.95. In detail, the characters with a greater degree of relevance – glabella, mastoid process and nuchal plane – have a strong male morphology, while the frontal bossing and the inclination of the frontal bone match with a female morphology. The pelvis' qualitative analysis results in contrasting morphological characters with a sexualization index 0.1. In fact, some of the characters have a male morphology such as the lack of compound arch,

Table 1. Results of the three methods applied for the estimation of biological age at death.

Method	Phase	Range
Pubic symphysis (Suchey & Brooks, 1990)	5	27-66
Auricular surface (Lovejoy *et al.*, 1985)	3	30-34
Sternal end of the fourth rib (Iscan & Loth, 1984)	4	26-32

the body of the ischium, the morphology of the iliac crest and fossa, while others express a female morphology, such as the presence of the preauricular sulcus – albeit minimal –, the shape of ischial incisura, the obturated foramen and the overall shape of the coxal bone.

Because of these conflicting results, the Acsádi and Nemeskéri method (1970) was integrated through the use of other methodologies. The application of Phenice (1969) and Bruzek (2002) methods provide a male assessment of T173, which was further confirmed by the outcome of DSP that gave a male probability of 0.988% (for physical measurements) and 0.96% (for digital measurements).

A preliminary observation of the skeleton has highlighted the belonging to an adult age class, since the epiphyses and the diaphysis of the long bones are welded. Multiple qualitative methodologies were applied as well to be able to obtain an age range of about 10 years (table 1).

The stature estimation was obtained by applying the Trotter and Gleser formulae (1952; 1958; 1977). Femurs and tibiae made it possible to apply the formula showing the lowest margin of error, returning a value of 169.5 +/- 2.99 cm.

Regarding the state of health, on the skeleton of T173 joint, dental, neoplastic and, presumably, congenital anomalies were found.

There are four osteomas on the skull, benign tumors deriving from excessive proliferation of the bone tissue. Furthermore, the skull is characterized by plagiocephaly, accompanied by what appears to be the premature synostosis of the left coronal suture, which could lead to craniosynostosis. A secondary joint of the right mandibular condyle is evident, a phenomenon that has been associated with skeletal dysplasia. Moreover, the skull of T173 manifests two traumatic events on the parietal bones as already described (Messina et al., 2013).

The skull exhibits a series of anatomical variants known as non-metric traits or discontinuous (Ossenberg, 1969) or discrete (Rightmire, 1972) or epigenetic (Berry and Searle, 1963). Usually, these present as a wide range of differences in the morphology and number of foramina, tubercles, ossicles, sutures, and grooves, representing deviations of the normal skeletal development.

The post-cranial skeleton appears afflicted by osteoarthritis, evident in most of the joints, which also show signs of eburnation caused by friction between the joint heads due to the thinning of the articular cartilage. There is evidence of osteophytosis in the vertebrae which also manifest the Schmorl's nodes on the vertebral bodies.

A probable intense physical activity is highlighted by the regions of origin and insertion of some muscles.

Discussion

This work presents the study of an adult skeleton from the necropolis of Zancle (Messina, Italy), that is characterized by a remarkable series of skeletal and pathological markers. In our opinion, it is a paradigmatic example of what could be the level of skeletal impairment in ancient periods.

The anthropological investigation conducted had the purpose of acquiring the information necessary to reconstruct of the biological profile of the individual buried in Tomb 173 of the Necropolis of Zancle – "sector 96" (Messina, Italy).

The first step was determining sex, which was evaluated on the skull and pelvis. The first method used was the combined one of Acsádi & Nemeskéri (1970), which simultaneously evaluates a series of morphological characters of the two skeletal areas mentioned. The results obtained are contrasting, as the skull shows marked masculine morphological characters – sexualization index 0.95 - while the pelvis shows some characters matching with a female morphology and others that are morphologically masculine – sexualization index 0.1 -. When the result of the sexualization index (**Σwx/Σ**) is between the values –0.5 and 0.5 the sex of the element cannot be determined (Acsádi and Nemeskéri, 1970). Therefore, there is a discrepancy using this method on T173 since the skull is morphologically male and the pelvis is undetermined. Due to this uncertainty, others methods have been applied, establishing that T173 was a male.

Similarly, multiple methodologies have been applied to evaluate the biological age at the death, providing further valuable data for an accurate estimation. The results gave a range between 30 and 40 years old.

The estimation of stature is essential to define the physical constitution and body size of skeletal remains. Having previously diagnosed the sex and the biological age and having both right and left femur and tibia available, we obtained an estimate of about 169.5 cm +/- 2.99. However, the Trotter and Gleser formulae (1952; 1958; 1977) are valid for subjects aged between 18 and 30 years, and for older ages it is suggested to subtract 0.06 cm for each year of age (Canci and Minozzi, 2015). As previously mentioned, the age of T173 is estimated in a range between 30-40 years, therefore, the actual estimated stature is about 168.4 cm +/- 2.99.

The paleopathological diagnosis completed the anthropological investigation as an essential step for reconstructing the lifestyle and activities carried out by T173. The beginning of any paleopathological investigation consists in the identification of qualitative and quantitative changes in the bones: the skeleton is a dynamic and flexible structure that adapts to internal and external stresses, therefore when a disease arises the bone tissue reacts and its response may involve in modifications that deviate from the normal skeletal morphology with consequent variations in size, bone strength and formation of accessory facets. So "consistent anatomical alterations" (Grauer, 2011) must be recognized and the single or multifactorial causes of such alterations must be investigated. The anomalies found on the skeleton of T173 are of joint, dental, neoplastic and, probably, congenital type. Furthermore, the individual died for a violent episode (Messina et al., 2013).

Observing the neurocranium a bone deformity was found. Its cause can be attributed to craniosynostosis (Fig. 3), a malformation of the skull's bone structure caused by the premature synostosis of one or more cranial sutures (Kabbani and Raghuveer,

Figure 3. T173 skull, anterior view. Asimmetry of the cranial vault is shown. Scale bar: 5 cm.

2004). This process results in an irregular growth of the neurocranium which expands to the side where it finds no resistance (Sgouros, 2005). The craniosynostosis can arise as a manifestation of a syndrome or as an isolated defect (non-syndromic). There are more than 150 syndromes that can involve craniosynostosis (Zoller et al., 2003). The etiology of the non-syndromic form is not known but is probably caused by various factors commonly of an environmental nature (e.g., the advanced age of the pregnant woman, permanence of the mother at high altitudes, exposure to chemical or physical agents), but presumably linked also to genetic factors such as *de novo* mutations or alterations in gene regulation. Mutations that arise in fibroblast growth factors and their receptors (FGFR) are among the main causes of craniosynostosis (Wilkie, 1997). On T173 skull, it is possible to notice premature synostosis of the left coronal suture, which could have involved a deforming plagiocephaly, modifying the shape of the skull (Fig. 3). This phenomenon could be an explanation of the frontal bone morphology which lacks useful characters for sexual diagnosis, for example the frontal bone inclination and the glabella. The involvement of a single cranial suture allows to hypothesize that the presumed craniosynostosis of T173 is of a non-syndromic form. However, it is not possible to define it precisely due to the still little known etiology and the difficulties in making the appropriate genetic investigations relating to possible factors on skeletal remains.

The craniosynostosis of T173 could also be the cause of the asymmetrical morphology of the mandible, which shows a secondary joint of condylar articulation that can be categorized as skeletal dysplasia (Ortner, 2003). Indeed, the right condyle manifests

Figure 4. Superior view of the mandible, on the right; inferior view of the maxillae, on the left. Scale bar 5 cm.

a double joint resulting in an oval shape with a slight depression in its epicenter and widens in the anterolateral norm, exceeding the size of the condyle (Fig. 4). Several factors may have contributed to the particular morphology of T173's mandible, including arthritis, tumor, trauma suffered during growth, and congenital anomaly (Williams and Polet, 2017). Both arthritis and tumors were excluded as possible causes because the mandible does not show signs of erosion or lipping and inflammatory signs of the periosteal tissue. Among the factors that could cause the formation of a second condylar joint are *postpartum* (Dennison et al., 2008) or adolescent trauma (De Luca et al., 2013). An antenatal obstruction or injury suffered during adolescence can cause a dislocation of the jaw, which, leads to the formation of a second condylar articulation if not treated. This hypothesis was also excluded as a unilateral traumatic phenomenon affecting the mandible is generally accompanied by a very pronounced musculature on the malformed side, affecting the masseter, mylohyoid and pterygoid muscles (Williams and Polet, 2017). The mandible of T173 does not show roughness, exostosis or anomalies in the region of insertion of the aforementioned musculature. The possible presence in T173 of craniosynostosis allows inferring that the malformation of the mandibular condyle is presumably to be traced back to a congenital anomaly, as a collateral results of prenatal craniofacial anomalies (Williams and Polet, 2017). The teeth - already affected by numerous degenerative diseases such as caries, calculus, periodontitis and abscess - do not seem to show an alteration due to the abnormal mandibular morphology, even if the latter could be one of the causes of the marked degree of dental wear, which manifests symmetrically between the hemi arches. Presumably, the dysplasia caused a phenomenon of malocclusion which resulted in constant friction between the teeth of the maxillary and mandibular arches. However, an opposite cause cannot be excluded, namely that it was the phenomenon of malocclusion that caused the formation of a second joint facet of the condyle.

On T173 skull, it is possible to observe four osteomas: two on the frontal bone, one on the occipital squama and one on the right parietal. Osteoma is a benign tumor

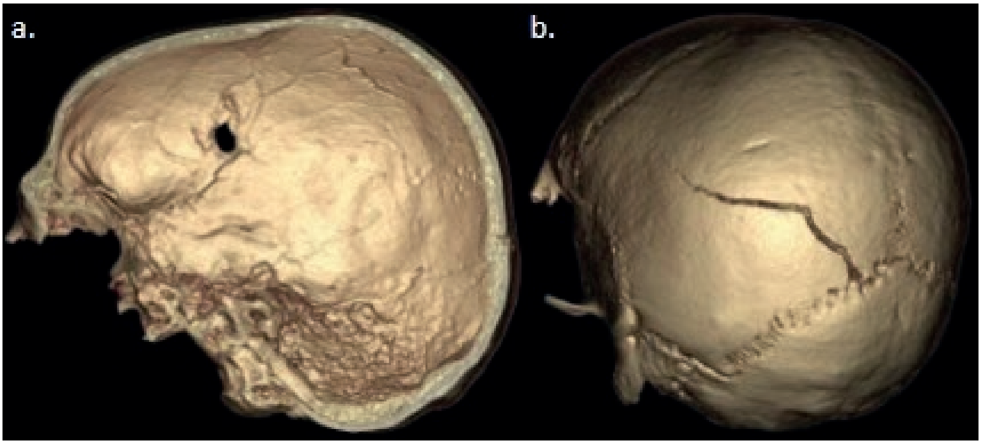

Figure 5. T173 skull computed tomography. a: endocranial, trauma on the right parietal. b: left posterolateral view, fracture lines on the left parietal.

that occurs mainly in the cranial vault and long bones (especially the femur and tibia). This neoplasm presents as a bone formation composed of osteoid and woven bone with a size that rarely exceeds 1.5 cm and is generally asymptomatic (Kransdorf et al., 1991).

The parietal bones of the skull of T173 exhibit two traumatic injuries. Trauma is defined as injury caused by forces or mechanisms extrinsic to the body (Lovell, 1997). Its study is significant since traumatic events testify the physical activities, their degree of intensity and the degree of interpersonal violence. The traumatic injuries found in T173 were investigated by Messina et al. (2013) that wanted to examine these cranial lesions with regard to their possible etiology and to formulate a hypotheses about the events, probably evidence of interpersonal violence. The authors established that the injuries are *perimortem*, i.e. they were inflicted shortly before or at the time of death. Two traumas were found: one involves the right parietal (Fig. 5a) and a secondary one involves the left parietal (Fig. 5b). The outer surface of the right parietal has a trapezoidal perforation located between the coronal suture and the temporal line. It was suggested that the injury was inflicted *perimortem* by a sharp object that hit the bone from left to right and from top to bottom, at an angle of 45°, causing a fracture and perforating the bone.

Through the CT scan analysis, it was found that the perforation also affected the *sulci* of the middle meningeal vessels causing an epidural hematoma, the probable cause of death. This methodology made it possible to detect the presence of a plastic response by the bone, a reaction typically associated with *perimortem* fractures. The hypothesis that the perforation had been inflicted shortly before the individual's death was further validated by the presence of bone splinters attached to the margins of the fracture, evidence that this was inflicted on 'fresh' bone. In addition, the left parietal bone has a lesion in a point near the lambda from which three fracture lines radiate. This injury appears to have been caused by blunt force trauma, possibly associated with a blow or fall. The hypothesis is that T173 was first hit by a sharp object that injured the left parietal bone, creating a tear in the blood vessels resulting in an accumulation of blood between the intracranial surface and the *dura mater.* That caused an epidural hematoma. Due to this event, losing consciousness, the individual fell on a hard surface which caused the fracture on the left parietal bone (Messina et al., 2013).

Finally, the skull exhibits non-metric traits such as left supraorbital foramen, symmetrical parietal foramina and the lack of the jugular foramen septum.

The study of the skeletal material belonging to T173 also focused on dental analysis and the pathologies found. The teeth of the mandibular arch are all present, except the first and third molars of the left hemiarch, which were lost *postmortem* (Fig. 5). In contrast, the maxillary arch is almost devoid of teeth. Several and often interrelated factors can cause tooth loss in the lifetime. When a pathology affects one or more teeth, there is a reaction of the alveolar tissue that responds with remodeling, resorption and obliteration processes (Canci and Minozzi, 2015). The high number of *antemortem* tooth loss in T173 (Table 2) could find an explanation in the variety of dental pathologies that have been found. The presence of caries, abscess, periodontitis and *antemortem* loss of the teeth is indicative of a diet with high consumption of carbohydrates; however, the role played by poor oral hygiene should not be forgotten. Furthermore, the finding of a strong degree of dental wear on the occlusal plane could be related to the consumption of solid foods with a strong fibrous component that generally requires vigorous chewing. This factor could be one of the causes that led to such a degree of wear, which could also be caused by the friction deriving from the contact between the teeth of the upper arch and the teeth of the lower arch, from the use of the mouth as a third hand, from the friction by exogenous material on the tooth surface and the chemical dissolution resulting from the consumption of acidic food (Kaifu et al., 2003).

Regarding the post-cranial skeleton, T173 is affected by osteoarthritis, a degenerative change with a chronic course that affects the articular cartilage whose progressive thinning - being a non-vascularized tissue and therefore not subject to remodeling - involves a direct contact between the articular heads. Their friction causes the eburnation that represent the shiny appearance of the articular surfaces that's also furrowed by striae in the direction of movement and by porosity. Osteoarthritis is generally related to biomechanical stresses affecting the joints, genetic factors, health factors (e.g., obesity) and tends to increase with age (Gardner, 1983). The alterations caused by arthropathy are clearly visible in T173.

Arthrosis also affects the entire spine of T173. In fact, the vertebrae present tissue erosion, marginal lipping, osteophytosis and osteophytic spicules. It is hypothesized that the etiology of arthrosis in T173 is due to the intense activity practiced in life and it seems to be evidenced by other markers of occupational stress found, such as Schmorl's

Table 2. Teeth in situ; antemortem and postmortem tooth loss.

	In situ	Antemortem	Postmortem
Maxillary arch	L: I2 - C – P3 R: C - M2	L: I1 - P4 - M1 R: I1 - I2 - P3 - M3	--- R: P4 - M1
Mandibular arch	L: I1 - I2 - C – P3 - P4 - M2 R: I1 - I2 - C – P3 - P4 - M1 - M2 - M3	---	L: M1 - M3

Figure 6. Left upper limb: humerus, ulna, radius. Scale bar 5 cm. A: ulnar proximal end. B: radial proximal end.

nodes, accessory facets and squatting facets. Schmorl's nodes affect the spinal column and represent the degeneration of the intervertebral discs. The degeneration of the vertebral body bone tissue produces cavitation, and a bony "barrier" is created at the margin to prevent the progression of the herniation of the nucleus pulposus in the vertebral body (Schmorl and Junghanns, 1971). Schmorl's nodes can result from congenital defects of the vertebral column, traumatic events or senescent processes (Resnick and Niwayama, 1978; Capasso et al., 1999; Dar et al., 2009). In particular, on T173 the cause could be traced to a traumatic event affecting the thoracic and lumbar vertebrae, causing the deformation and rupture of the intervertebral disc. This hypothesis is supported by the presence of other skeletal alterations related to stress events found in T173.

The skeletal system of T173 is remarkably robust, therefore it is possible to hypothesize that the musculature was equally powerful. Most of the muscular insertions on the upper appendicular bones have a very rough and irregular surface (Fig 6). The clavicles show a region of depression at the insertion site of the conoid ligament and roughness in the sites of origin of the *M. pectoralis major* and *deltoideus*. The humerus shows a depressed and osteophytic region at the insertion site of the *M. deltoideus,* osteophytosis and porosity in the insertion regions of the *M. latissimus dorsi* and *teres major*. The origin site of the *M. brachioradialis* (lateral supracondylar ridge of humerus) shows bone growth while the insertion site (proximal to the styloid process of radius) is eroded. The radial tuberosity is depressed with protruding margins. The ulna presents bone growth and roughness at the insertion sites of *M. brachialis*, *pronator* and *supinator.*

The stresses affecting these muscles - involved in the movements of adduction, abduction, flexion, external and internal rotation, extension of the arm and forearm - and osteoarthritis affecting the sternoclavicular, acromion-clavicular, glenohumeral and elbow suggest that the individual carried out activities requiring constant use of the upper limbs, with frequent movements of flexion, extension, rotation and elevation of the arms, requiring the effort of the entire shoulder girdle and arm and forearm. Furthermore, Schmorl's nodes in the thoracic and lumbar vertebrae, the stresses on the elbow joint and the alterations in insertion areas of *M. deltoideus*, *M. brachialis* and *M. pectoralis major* suggest the transport of heavy objects on the vertebral column and the arms.

Moreover, the left radial head and the distal end of the right first metacarpal show signs of eburnation. Radial eburnation can be related to alternation movements of supination/pronation, while the first metacarpal eburnation (Fig. 7) can be connected to rotational movements.

Agriculture and maritime activities such as fishing or working with fishing nets may be an explanation to the movements involving radium and thumb (Parks, 2002). However, this remains a hypothesis because the lack of the right upper limb prevents more accurate inferences.

Similarly, the bones of the lower limbs (Fig. 8) also show areas of osteophytosis, bone tissue apposition, porosity, bridges and marginal lipping.

The evidence of stress affecting the insertions of the main abductor, adductor, rotator and extensor muscles of the lower limbs are supplemented by other alterations of the skeleton, such as the enlargement of the lunate facies whose lower region extends into the region of the acetabulum margin, up to the region of insertion of the transverse ligament. There is a groove for *M. obturatorius externus* and a bridge in the acetabulum, the latter is formed due to the extension of the facies. The causes of the enlargement of the lunate facies are due to abduction and flexion of the hip joint and the stress on the margin and transverse ligament can cause osteoblastic activity (Capasso et al., 1999). The accessory facets of the sacrum appear at the level of the first and second posterior foramen of the sacrum, probably caused by stress on the vertebral column, which flexes and compresses during the transport of heavy objects. A depression is observed in the medial condyle of the femur, usually in the posterior side, which is generally caused by contact with the tibial condyle following repeated flexor movements; this phenomenon is called tibial imprint (Capasso et al., 1999). The patella has an incisura on the supero-lateral surface, probably for a presumed constant contraction of *M.vastus lateralis* following flexion and squatting movements. The tibia has a lesion on the tubercle presumably related to the partial avulsion of the insertion of the patellar ligament caused by the movements of the quadriceps (Capasso et al., 1999). Squatting facets in the tibia and talar are evident. This joint morphology occurs on the anterior surface of the distal tibia and on the lateral-superior surface of the talus, and it is caused by the habitual dorsiflexion of the foot in which

Figure 7. Left first metacarpal, scale bar 5 cm. Posterior view (left) and superiore view (right).

Figure 8. Anterior view of left femur (up, distal end) and left tibia (down, proximal end). Posterior view of the patella. Scale bar 5 cm.

the elongation of the ligaments creates further contact surfaces between the tibia and talus (Capasso et al., 1999).

The evidence of anomalies described is part of a pattern of movements attributable to squatting movements that represent a bending movement on the legs that is

Figure 9. Plantar view of left and right calcaneus. Calcanear spur is shown. A: lateral view of the right calcaneus. Scale bar 5 cm.

carried out with the simultaneous flexion of the hip, knee and ankle. The manifestation of sacral accessory facets, knee osteoarthritis and changes in the muscular insertions of the femur and tibia lead to the hypothesis of carrying heavy loads.

It's possible to observe osteophytosis on tibiae, especially on the posterior insertion of *M. soleus*. However, there are stress markers at the level of the tibial tuberosity and on the anterior intercondylar region (the insertion site of the cruciate ligament), with the diffuse presence of marginal lipping both in the proximal and distal epiphysis. The variations in the muscle insertion regions of the femur and tibia, and the arthritic degeneration of the knee are presumably caused by the transport of heavy loads on the vertebral column. Furthermore, the morphological changes observable in the talus and calcaneus seem to confirm this hypothesis. In fact, osteophytosis and osteoarthritis affecting the Achilles tendon in the calcaneus, the modification of the trochlear surface, and the presence of squatting facets in the talus suggest movements on rough terrain, probably during long walks. Both calcaneus present plantar spurs (Fig. 9), a bony outgrowth of the calcaneal tuberosity that occurs in higher proportions in the elderly, the overweight, plantar fasciitis, and arthritis, which is also connected to abnormal foot biomechanics (Kirkpatrick et al., 2017). Due to the pervasive presence of biomechanical stress markers recorded on T173, it can be assumed that the plantar spurs may be an adaptative response to repetitive, vertically orientated forces (Kumai and Benjamin, 2002; Li and Muehleman, 2007; Menz et al. 2008) which could arise from a transmission of weight on the toes to maintain a balanced position, for example on steep terrain or wet terrain.

Conclusion

The anthropological investigation aimed to acquire the information necessary for the reconstruction of the biological profile, the state of health and lifestyle of the individual found in a burial of the necropolis of Messina (Sicily). The results obtained made it possible to establish that the skeleton buried in the Tomb 173 belongs to a male individual, whose biological age at death was probably within a range of 30-40 years and with an estimated stature of about 168.4 cm. The paleopathological investigation allowed the evaluation of skeletal alterations presumably of a genetic, neoplastic, dental, joint and violent nature. Finally, the study of arthropathies and alterations related to occupational stress made it possible to hypothesize the activities that the individual carried out in life. The alterations affecting the bones of the shoulder girdle, the pelvic girdle and the upper and lower appendicular skeleton highlight a constant use of these elements and intense stress on the mobile joints. Furthermore, the alterations found in the vertebral column and the femoral, tibial and tarsal bones lead to activities carried out on rough and/or unbalanced terrain with a hefty load on the vertebral column.

At the moment, the study is limited to T173, but certainly expanding the studies on coeval skeletal remains could provide interesting data about the lifestyle and state of health during Roman Imperial period.

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