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A Bioarchaeological Insight into Etruscan Female Activity at Civita, Tarquinia

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Abstract: This research investigates sex roles and labor in ancient Etruscan society, comparing and contrasting the bioarchaeological profile of human remains of five females and two males from the sacred area of the 'monumental complex' (Civita, Tarquinia). Despite the small sample size, analyses of entheseal changes, spinal and appendicular osteoarthrosis, Schmorl's nodes, and dental wear reveal much higher frequencies of biomechanical stress markers compared to other coeval Etruscan sites as well as pre-Roman and Roman data. Both males and females exhibited evidence of repeated strenuous physical activity, but the degree of biomechanical stress in females was particularly striking, suggesting involvement in physically intensive tasks. The study also draws comparisons with Roman populations, highlighting the higher biomechanical stress among women living in the Etruscan society compared to Roman females. These findings challenge the assumption of strict sex divisions of labor in ancient societies, indicating that Etruscan women at Civita may have shared in physically demanding activities typically associated with men, such as agricultural labor, sports, or domestic production. While the sample is limited and precludes definitive conclusions, this study represents a rare bioarchaeological contribution to the study of Etruscan society, offering insight into their lived experiences. Moreover, it underscores the importance of valorizing this skeletal material to enrich our understanding of sex roles and labor in one of antiquity's most enigmatic civilizations.

Keywords: bioarchaeology; biomechanical stress; physical activity; entheseal changes; Etruria; Etruscans; Tarquinia

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1. Introduction

Between the 9th and 6th centuries BCE, the Italian peninsula was a dynamic landscape composed of diverse peoples and cultures, each with distinct linguistic, social, and cultural characteristics. This period witnessed the emergence and interaction of various groups, from the Italic tribes to the Greeks and Phoenicians. Among the most prominent and influential of these cultures were the Etruscans, a civilization that flourished in areas corresponding to the modern regions of Tuscany, western Umbria, northern Latium Emilia-Romagna, Lombardy, and Campania, since the end of the 10th century BCE [1].

Etruscan society was notable for its high degree of sophistication, urbanization, and integration with other Mediterranean cultures, particularly the Greeks, with whom they traded extensively [2]. Despite the cultural closeness with the Greeks, the Etruscans

distinguished themselves in several ways, particularly in their treatment of women. In contrast to the restricted roles and limited public visibility of women in contemporary Greek society, Etruscan women, especially those of the elite, enjoyed a relatively elevated status [3]. Archaeological and epigraphic evidence reveals that Etruscan women were literate, as indicated by inscriptions bearing their names, and participated actively in social and public life [4–6]. Unlike their Greek counterparts, Etruscan women attended banquets alongside men, engaged in religious rituals, and had access to luxury goods [7]. These aspects of their lives are vividly illustrated in Etruscan art, tomb paintings, and grave goods, where women are depicted as powerful figures within their households and communities (see the tomb of "Iscrizioni Graffite" in Cerveteri) [4–6]. Moreover, the funerary practices of the elite suggest a degree of gender parity, with women receiving burials that reflect their high social standing. In fact, Etruscan women are frequently represented in tombs with symbols of status and wealth, though they were more commonly cremated than their male counterparts [4–6]. The archaeological record thus paints a picture of a society in which women could attain significant social and political visibility, embodying roles that extended beyond the domestic sphere and garnering public recognition of their status.

Human remains provide an invaluable, often underutilized, perspective in archaeological and historical studies, offering a direct connection to the individuals who lived in the past [8]. Through bioarchaeological analysis, it becomes possible to reconstruct aspects of their lives that are not recorded in historical texts. In addition to estimating biological traits such as biological sex, age-at-death, population affinity, and stature, bioarchaeology allows for deeper insights into health, lifestyle, and activity patterns [8,9]. Paleopathological and traumatological examinations, for example, can reveal the presence of diseases, injuries, or stressors that impacted an individual's life [10]. Stress markers in the skeleton, which develop as a response to various stressors, serve as reliable proxies for understanding the mechanical and physiological stressors individuals experienced [8]. Mechanical stress markers can inform on repeated physical activity, while non-mechanical markers can reflect on stress during growth [8]. In this way, the skeleton functions as a biological archive, adapting and recording responses to a range of environmental, ecological, cultural, and social factors [8].

The objective of this research is to challenge current knowledge on Etruscan women through bioarchaeological analysis with a particular focus on biomechanical stress in comparison to men. Although the sample size (five females and two males) is too limited for population-level generalizations, it represents a rare and invaluable opportunity to examine individuals selected for burial in a sacred area rather than in a necropolis. The Etruscan archaeological site of the 'monumental complex' (Civita, Tarquinia) is a sacred area of immense cultural significance, spanning the emergence of Etruscan civilization to the Roman Imperial period. The site has yielded an exceptional assemblage of human remains, including six females (one represented by a single bone and therefore excluded from this study), two males, one non-determinable individual, and ten juveniles.

This osteobiographical analysis of the seven individuals provides a critical first step in understanding the lives, labor patterns, and physical stresses of females interred at this sacred site. While the findings must be interpreted with caution due to the small sample size, they offer a unique lens into the roles and experiences of Etruscan females and males at Civita. The scarcity of bioarchaeological research on Etruscan skeletal remains [11–14] and the limited preservation of their material culture further underscores the importance of such research. By examining these individuals, this study valorizes the cultural and biological heritage of this ancient population and contributes to a deeper understanding of sex roles in this enigmatic civilization, paving the way for future research on the complexities of Etruscan society.

2. Materials and Methods

Tarquinia was one of the most prominent coastal cities of Etruria on the Tyrrenic versant, alongside Cerveteri to the south and Vulci to the north (Figure 1). Since 1982, the "Tarquinia Project" has conducted extensive excavations on the Civita plateau (an elevated area about 10 km from the coast), which hosts two archaeological sites dated to the Estruscan period: the 'monumental complex' and the *Ara della Regina* sanctuary, both with a religious and ritual vocation [15]. The *Ara della Regina* is the sanctuary area, inside which a temple dedicated to Tarconte and dated to the 6th century BCE has been discovered [16]. The sample is from the area of the 'monumental complex', which traced the origins of Tarquinia back to the Bronze Age (early 10th century BCE) and prompted the urbanisation of the area. Central to this early phase was a natural cavity, referred to as the *mundus*, whose connection with the chthonic sphere transformed the area into a sacred and institutional hub, highlighting Tarquinia's pivotal role in Etruscan religious life. The sanctity of the area is further emphasized by the burial (in the *area alpha*) near the cavity of an eight-year-old child (Individual 1) with signs of encephalopathy and epilepsy, dating to the 10–9th century BCE, whose resemblance to the mythological figure *Tagetes* has been the subject of study [17]. The area was monumentalized beginning in the Orientalizing period (early 7th to early 6th century BCE), with the construction of an altar-temple measuring 6.5 by 11 m (*edificio beta*), incorporating distinct Near Eastern architectural influences, and dedicated by a priest-king to the most important goddess of the Etruscan pantheon, *Uni*. By the 6th century BCE, the 'monumental complex' had become a prominent site for communal gatherings and remembrance, maintaining its ritual significance. During the early 5th century BCE, the complex was redesigned with a new North–South pathway, incorporating an underground tunnel (*cuniculus*) covered with stone slabs. Recent discoveries, now being published, are shedding light on the Hellenistic period and continuity of ritual practises. Later phases, including a hypogeum built in the Augustan period and reused for burials in the 8th century CE, remain under study. However, these later developments lie beyond the primary focus of this research.



Figure 1. Map showing the location of the site.

A total of 19 individuals were excavated from the sacred area of Civita (Tarquinia) (Figure 2) and preserved at the LABANOF (Laboratory of Forensic Anthropology and Odontology—*Laboratorio di Antropologia e Odontologia Forense*, University of Milan) [15]. Of these, eight skeletons were selected for this study, which focused solely on adult individuals whose biological sex could be reliably estimated (individuals 7, 8, 10, 11, 12, 13, 14, and 19). As individual 13 was only represented by a single innominate bone, it was excluded from the analysis. The remaining individuals comprised immature skeletons or were too fragmentary for a reliable estimation of sex.



Figure 2. General plan of the 'monumental complex', including the discussed depositions. The depositions are indicated in pink.

Biological sex estimation was performed using standard morphological methods to assess sexually dimorphic traits of the cranium and pelvis [18–20]. This was complemented by metric analysis of post-cranial bones to ensure accuracy [21]. Age-at-death estimation considering physiological changes in the pubic symphysis, acetabulum, and auricular surface [22–24]. Additionally, a paleopathological and trauma assessment for each individual was conducted using standards in the literature [25–27]. Special attention was devoted to markers of biomechanical stress, which provide insights into the physical activities and workloads endured by these individuals. The markers examined included

- **Entheseal changes (EC)**: These changes refer to the development at tendon and ligament attachment sites (entheses) and can indicate repetitive or strenuous physical activity. The system proposed by Mariotti et al. [28] was used to categorize EC into five stages (1a, 1b, 1c, 2, or 3), with only degrees 2 and 3 classified as enthesopathies for this study, as per the original recommendation. Osteolysis and osteoproliferation were not recorded; only entheseal robustness was considered.
- Osteoarthrosis (OA): This degenerative condition of the joints [29] was analyzed both in the spine (**spinal OA**) and in the appendicular skeleton (**appendicular OA**) for consideration of location, pattern, and mechanical interpretation of movements. Skeletal signs include pitting, eburnation, marginal osteophytes, new bone formation on the articular surface, and alteration of bone shape at the margins [30,31].

- **Schmorl's nodes (SN)**: These impressions, caused by the herniation of the nucleus pulposus into the vertebral body, are often used as indicators of mechanical stress on the spine. The presence of SN suggests that the individuals likely engaged in activities that involved significant spinal loading [32].
- **Dental wear:** Dental wear, the mechanical abrasion of tooth enamel, was also assessed. In severe cases, this resulted in the exposure of dentin. Following the standard proposed by Buikstra and Ubelaker [9], the interpretation of this lesion is considered compatible with both masticatory and non-masticatory activities.

The small sample size of the study prevented the execution of meaningful statistical analysis. Instead, findings were discussed qualitatively and using basic descriptive statistics to present the distribution of markers by sex.

After collection of data, individual osteobiographies were constructed for each skeleton. These biographical sketches focused on reconstructing the biomechanical load each individual experienced during their lifetime, offering valuable insights into their physical activities and overall health.

3. Results

A description of the individuals present in this study will be provided one by one. Table 1 presents the details of the markers of mechanical stress observed for each skeleton. Figure 3 illustrates the lesions observed, whereas Figure 4 shows the state of preservation of the skeletons studied as well as the location and type of the lesions reported.

Table 1. Mechanical stress markers per skeleton.

Skeleton	Sex	Age	Spinal OA	SN	Appendicular OA	EC	Dental Wear
7	F	45–55	C5 to C7, thoracic, lumbar vertebrae	Inferior body of T5, T6, T11; superior body of T12 to L2	Olecranon of both ulnae	Absent	Severe wear (stage 5/6) on 42, 43, and 34 to 37. Absence of maxillary bone
8	F	40–55	L2 and L4	Absent	Absent	Right femur (*vastus medialis m.*, stage 2); right humerus (*brachioradialis m.*, stage 2); hand phalanges	Severe wear (stage 7/8) on 11 to 16, 21 to 26, 32 to 35, 37, and 41 to 45; Groove from para-masticatory activity on 41–42
11	F	55–75	C1 and C3 to C5, thoracic/lumbar vertebrae	Thoracic/lumbar vertebra fragment	Femoral head, glenoid fossa of both scapulae, epicondyle of the right humerus	Hands, left clavicle (*conoid* and *trapezoid lig.*, score 2), right clavicle (*pectoralis major m.*, score 2), right humerus (*deltoideus m.*, score 2), both humeri (*brachioradialis m.*, score 2), left patella (*quadriceps tendon*, score 2)	Wear (stage 5/6) on 31 to 37 and 41 to 46
12	F	25–35	T4	Superior body of T8, T10, and L1 to L3; inferior body of T4 to L2	Left 2nd metacarpal, 5th proximal phalanx	Right scapula (*triceps brachii m.*, score 2)	Wear (stage 4/5) on 11 to 16, 21 to 26, 32 to 37, and 41 to 45
14	F	30–45	Absent	Superior body of T11, and L1 to L3; inferior body of T11 to L3	Absent	Right clavicle (*costocavicular lig.*, score 2), right femur (*gluteus maximus m.*, score 3), left femur (*gluteus maximus m.*, score 2), right tibia (*soleus m.*, score 2)	Absent

Table 1. *Cont.*

Skeleton	Sex	Age	Spinal OA	SN	Appendicular OA	EC	Dental Wear
10	M	35–55	Not observable	Not observable	Right trapezoid bone, left 3rd metatarsal (MT3), left cuneiform	Right humerus (*deltoideus m.*, *brachioradialis m.*, score 2/3), left humerus (*deltoideus m.*, score 2), femora (*vastus medialis m.*, score 2/3 *gluteus maximus m.*, score 2/3), left calcaneus (*Achilles tendon*)	Severe wear (stage 5/6) on 14, 23 to 26, 31 to 35, 37, 41 to 46, and 48
19	M	60–85	8 thoracic vertebrae	Intermediate thoracic vertebra	Femoral head and condyles, tibial condyles, glenoid fossa of the scapulae	MC and phalanges, scapulae (*triceps brachii m.*, score 2), humeri (*pectoralis major m.*, *deltoideus m.*, score 2), right humerus (*brachioradialis m.*, score 3), left radius (*biceps brachii m.*, score 2), femora (*gluteus maximus m.*, score 3), right femur (*vastus medialis m.*, score 2), tibiae (*quadriceps tendon*, score 2/3), calcanei (*Achilles tendon*, score 2)	Wear (stage 5/6) on 12 to 16, 21, 22, 24, 25, 31 to 33, 41, and 43



Figure 3. Photographic images of the biomechanical stress markers observed in this study (indicated by the arrows and asterisks). From left to right: marked entheseal changes at the insertion of the *brachioradialis* muscle of the right humerus (skeleton 8), Schmorl's node on a vertebral body (skeleton 12), knee osteoarthrosis on the left distal femur (skeleton 19), and mandibular dental wear (skeleton 12).

3.1. Skeleton 7

The remains correspond to a female individual, aged about 45–55 years, with most of the skeleton preserved but heavily fragmented (Figure 4).

The spinal lesions (Table 1) are likely to be related to aging rather than physical activity, particularly in the case of cervical OA, which is clinically associated with the physiological degradation of hyaline cartilage [33]. In fact, marginal osteophytes could result from either mechanical loading of the spine or the physiological degradation of the intervertebral disc [34]. However, given the age-at-death of the individual and the mild severity of the lesion, the latter etiological factor appears more probable [35,36]. The distribution of SN along the intermediate and lower thoracic vertebrae, as well as the lumbar vertebrae (Table 1), could be associated with heavy weight-bearing activities [37]. Regardless of the cause, all spinal lesions could have led to joint stiffness, rigidity, pain, and limited mobility [38]. A similar interpretation could be suggested for the ulnar lesions (Table 1), although in this case, a correlation with physical activity rather than aging is more plausible, as it is the only articulation displaying appendicular osteoarthrosis [39].

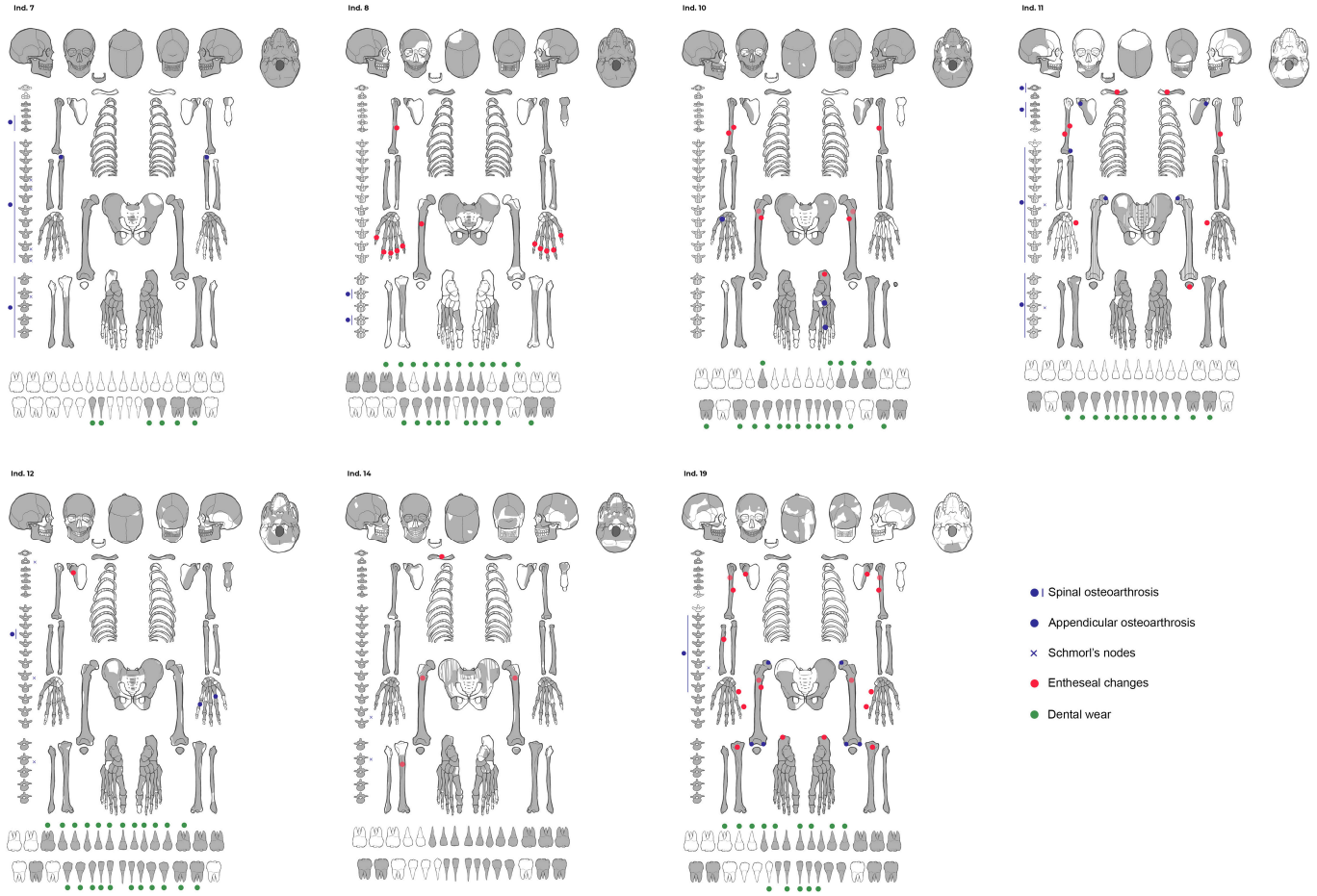


Figure 4. State of preservation of the skeletal remains (grey-colored bones were present) and location of the lesions observed. Credits: Figure by Lucrezia Rodella.

3.2. Skeleton 8

Anthropological analysis revealed a female aged 40–55 years, whose skeleton was well-preserved qualitatively and quantitatively, while the integrity of the bones was low (Figure 4).

Temporomandibular joint (TMJ) OA (Table 1), clinically associated with age, hormonal factors, systemic illnesses, and mechanical stress, may be attributed to masticatory or para-masticatory demands [40]. Symptoms are categorized by the severity of the lesions; in this case, joint and muscle pain could occur, accompanied by crepitus and malocclusion [41,42]. The EC observed in the lower limbs (Table 1) could be related to daily activities rather than to specific occupational tasks [43,44]. In contrast, the distribution of EC along the upper limbs (Figure 3) may provide insights into the individual's lifestyle. The involvement of the brachioradialis muscle, which is active in forearm extension and elbow flexion [43], suggests repetitive movements. Additionally, the presence of EC on the phalanges may indicate frequent use of the hand for activities such as sewing or spinning [45]. Despite the absence of SN, the presence of spinal OA could be related to mechanical loading [36], as the lesions were identified in the lumbar region (Table 1). Indeed, this area acts as a focal point for force transmission from the top (cervical) to the bottom (lumbar) of the spine [38].

3.3. Skeleton 11

The skeleton of Individual 11 was highly fragmented and poorly preserved; in fact, most of the vertebral column, ribs, splanchnocranium, and lower limbs were missing, the bones of the pelvis were severely fragmented, and the remaining bones were incomplete

(Figure 4). Age-at-death was estimated between 55 and 75 years. Genetic analysis suggested a female individual, whereas morphometric analysis suggested a male profile, albeit with female features [15]. This evidence may be associated with the "masculinization" of female cranial morphology with advancing age, potentially attributable to hormonal variations related to menopause [46]. Individual 11 clusters with populations from Scandinavia, the Baltic Sea, and north Atlantic regions in Europe, with genetic affinities to populations from further north in Europe than has previously been demonstrated in any Iron Age Italian individual [15].

Spinal OA seems to have been distributed along the vertebral column (Table 1), causing joint pain and rigidity [38]. A distinct involvement of the cervical vertebrae was noted, which may be related to head rotation along both the vertical and horizontal axes [33]. Given the advanced age of the individual, it is possible that these lesions resulted from normal physiological degradation of cartilage [35,36]; however, a correlation with physical activity cannot be entirely ruled out. The same cautious approach should be applied when interpreting appendicular osteoarthrosis, which was observed symmetrically in both the upper and lower limbs [39]. EC were more pronounced on the left side than on the right (Table 1), indicating an asymmetry likely associated with occupational activities. Both humeri were therefore likely involved in repeated extension of the forearm and flexion of the elbow [43], although the right humerus also showed frequent involvement in rotational and abduction movements of the shoulder [44]. Additionally, the right upper limb shows signs of recurrent throwing movements, involving adduction and rotation of the arm across the front of the chest [43,47], while the left side was more engaged in the upward rotation of the glenoid fossa and elevation of the scapula [48]. Probably frequent thigh flexion in the right lower limb was indicated by the EC found in the patella (Table 1) [43]. TMJ OA, similar to that observed in Skeleton 8, could be associated with joint and muscle pain, as well as malocclusion.

3.4. Skeleton 12

Individual 12 was estimated to be a 25 to 35 years old female. The skeleton was almost complete, apart from a few elements of the hands and feet, but the bones were rather fragmented (Figure 4).

The distribution of SN (Table 1) aligns with clinical studies, showing a higher frequency of lesions on the inferior surface [37]. The number of lesions (n = 16) suggests that the individual may have suffered from back pain, particularly in the mid-thoracic area, where a co-occurrence with osteophytes was observed [38] (Figure 3). This distribution suggests daily stress on the spine, likely related to lifting and carrying of heavy loads [32,37]. The young woman thus likely experienced joint pain due to her physical activities; however, this hypothesis assumes that SN are symptomatic [49–52], though conflicting evidence exists in the literature [53,54]. The individual displays signs of biomechanical stress (EC and hand OA—Table 1) compatible with occupational tasks involving the continuous use of the hands and upper limbs. Specifically, EC found on the right scapula could be related to movements involving extension of the forearm at the elbow joint, as well as extension and adduction of the arm at the shoulder joint [43,44]. The asymmetry of this lesion suggests a connection to physical activities, particularly considering the lateralization. Similarly, left hand OA may be related to manual activities [55]. Given the young age of the individual, both OA and EC can be interpreted as resulting from mechanical stress rather than age-related skeletal changes. Joint stiffness, rigidity, and pain resulting from OA [56] could have represented a significant impediment to daily activities and productivity, particularly in ancient societies.

3.5. Skeleton 14

Individual 14 was an adult female between 30 and 45 years old. The skeleton was almost complete apart from a few bones of the face, hands, and feet, but the scapulae, innominate bones, and most of the long bones were fragmented (Figure 4).

SN can lead to back pain and joint rigidity, thereby limiting movement. The frequency and distribution of the lesions (Table 1) may have been caused by recurrent mechanical stress along the spine, such as heavy load [32,37]. EC were more frequently distributed in the lower limbs (Table 1), which could be interpreted as resulting from both specific and non-specific activities with a significant biomechanical component [57–59]. In fact, the EC on the femur suggests recurrent movements such as extension, external rotation, abduction, and adduction of the thigh, while the involvement the soleus muscle as seen on the right tibia indicates foot extension [60]. These movements appear more consistent with everyday activities rather than specific occupational tasks. The lateralization of EC in the upper limbs, predominantly on the right side, could indicate a greater involvement of shoulder movements [43,60].

3.6. Skeleton 10

Anthropological analysis revealed a male of about 35–55 years. The skeletal remains were rather well-preserved, though the vertebral column, some ribs, and bones of the extremities were absent (Figure 4).

TMJ degenerative disorders (Table 1) could have caused joint and muscle pain, in addition to malocclusion [40]. Their etiology may be linked to aging as well as other factors unrelated to mechanical activity. Indeed, the pattern and severity of dental wear, combined with dental crowding, are more likely associated with masticatory rather than para-masticatory activities [40]. Furthermore, the pronounced robustness of the masseter muscle impressions could result from an imbalance of the hemimandible. This muscle, along with the medial pterygoid muscle, are involved in the elevation and occlusion of the mandible and play a role in teeth grinding conditions, such as clenching and bruxism [61]. EC in the upper limbs (Table 1) could be related to repeated abduction and rotation of the shoulder, extension of the forearm, and flexion of the elbow [43,44] on both the right and left sides. These movements appear to be associated with symmetrical activity of the upper limbs. Additionally, the signs observed on the left hand (EC and OA—Table 1) suggest recurrent manual labor involving the hands [55].

3.7. Skeleton 19

The individual was estimated to be male between 60 and 85 years. The skeleton was almost complete, but the bones were heavily fragmented (Figure 4).

The appendicular OA observed in both the lower and upper limbs (Table 1) could be associated with physiological degradation of hyaline cartilage, given the advanced age of the individual [35,36]. The lesions would have been accompanied by joint pain and rigidity, particularly in the knee joint, which exhibited signs of severe mechanical alteration. The lesions on the patellae and femora (Figure 3) (such as eburnation) indicate extensive use of the joint even after cartilage degradation, despite the associated pain. Additionally, spinal OA, also potentially related to aging, would have caused stiffness and pain [38]. EC were numerous (Table 1) and, considering the individual's age-at-death and physical activity, were evenly distributed across both upper and lower limbs. Both upper limbs appeared to have been involved in a variety of recurrent movements, including extension of the forearm at the elbow joint, extension and adduction of the arm at the shoulder joint, throwing or pitching motions, adduction and rotation of the arm forward and backward, drawing the arm across the front of the chest, and abducting and rotating the shoulder [43,44,47]. The

right side showed EC consistent with repeated forearm extension, while the left side was associated with straightening and bending the elbow as well as supination of the forearm and flexion of the elbow [43,48]. Furthermore, these changes appear to align with activities involving the lifting of heavy loads with bent arms and carrying loads [62,63]. The lower limbs were similarly involved in frequent extension, external rotation, abduction, and adduction of the thigh, as well as extension of the knee and flexion of the foot towards the thigh [64]. However, these EC could be related to everyday movements rather than specific activities [57]. It is noteworthy that a very similar pattern of EC distribution was found on a skeleton from Populonia [11].

Table 2 summarizes the distribution of mechanical stress markers among the selected adults from Civita, Tarquinia, showing that all females and both males exhibited evidence of biomechanical stress. Notably, while individuals of advanced age may have developed these markers due to normal physiological degeneration, all individuals—and most importantly, all females—displayed biomechanical indicators consistent with repetitive physical activity.

Table 2. Summary of the presence of markers biomechanical stress in the adult individuals of Tarquinia (X = present) and likely cause of the mechanical stress as age and/or occupation (understood here as a repeated physical activity).

Skeleton	Sex	Age	Spinal OA	SN	Appendicular OA	EC	Dental Wear	Likely Cause
7	F	45–55	X		X		X	Age and Occupation
8	F	40–55	X			X	X	Occupation
11	F	55–75	X	X	X	X	X	Age and Occupation
12	F	25–35	X	X	X	X	X	Occupation
14	F	30–45		X		X		Occupation
10	M	35–55			X	X	X	Age and Occupation
19	M	60–85	X	X	X	X	X	Age and Occupation

4. Discussion

The results of the study showed that all females manifested biomechanical stress markers (Tables 1 and 2), indicating repeated physical effort from specific activities or occupation, although in two cases (Individuals 7 and 11), age may have been a significant contributing factor. Indeed, advanced age is a well-documented risk factor for OA, with a typical onset in the late 40s to mid-50s [35,36]. Similarly, the development of EC is strongly influenced by the age, with increased robusticity in older individuals [65]. Additionally, advanced age is a strong predisposing factor for the formation of Schmorl's nodes [37]. In this study, both males and two females (Individuals 7 and 11) had an advanced age-at-death, supporting the key role of age in the observed biomechanical markers. In contrast, the biomechanical markers observed in younger females (Individuals 12 and 14) are more likely to reflect occupational stress as a primary factor. Individual 8 had an estimated age of 40–55, consistent with the physiological changes with age; however, only spinal OA, heavy dental wear, and marked EC were noted. The absence of appendicular OA and Schmorl's nodes, which are typically expected in age-related degeneration, suggests that occupational factors may have also played a significant role. While age likely contributed to the observed markers, these findings emphasize the potential interplay between aging and occupation. Strontium stable isotope analyses indicate that individuals 8 and 11 were likely non-local to Tarquinia, suggesting mobility and possibly growth and/or life in a different area prior to their death at Civita, Tarquinia [15].

Spinal OA was found in four females (n = 4/5, 80%) and one male (n = 1/2, 50%) (Tables 1 and 2, Figures 3 and 4). Lesions were predominantly clustered in specific segments

of the vertebral column. For instance, Skeleton 7 exhibited lesions primarily in the cervical segment, Skeletons 12 and 19 in the thoracic segment, and Skeleton 8 in the lumbar segment. The greater involvement of specific segments may be attributed to the mechanics of weight distribution along the spine, reflecting areas of increasing stress. In the case of the thoracic segment, this may be related to tasks involving the carrying or lifting of heavy objects [38]. This segmented pattern was not observed in Skeleton 11, who displayed lesions distributed across the cervical, thoracic, and lumbar regions. This disseminated pattern may be related to the advanced age of the individual, a significant factor in the development of OA. A comparable segmented pattern of thoracic involvement has been observed at Spina (6th–3rd century BCE), where the cervical vertebrae were similarly affected, as seen in the Civita sample 13. While population-based statistical analysis cannot be conducted due to the sample size, the frequency of spinal OA at other Etruscan sites provides some context: Published data indicate spinal OA frequencies of 22.5% at Spina (6th–3rd century BCE), 50.9% at Pontecagnano (7th–5th century BCE), and 65.4% [13,14]. When compared to other Etruscan sites, the Civita sample shows a notably higher frequency of spinal OA. This may reflect differences in lifestyle, occupation, or cultural practices between these sites. The similarity with Spina in terms of cervical involvement could point to shared occupational tasks or stresses across these Etruscan settlements, although further research with larger samples is needed to clarify these patterns.

Appendicular OA was reported in both males (n = 2/2, 100%) and three females (n = 3/5, 60%) (Tables 1 and 2, Figures 3 and 4). Both males and females exhibited a similar distribution of the degenerative condition, with a greater involvement of the upper limbs compared to the lower limbs in both sexes. Notably, the hands were particularly affected in both males (e.g., Skeleton 10) and females (e.g., Skeleton 12), with a preference for the left side in females. This is an interesting finding, as Waldron's macro-study on the distribution of OA in the past identifies the hands as a relatively uncommon site, occurring in only 4.3% of cases. This suggests that manual activities may have played a significant role in the daily life of the individuals buried at Tarquinia. However, caution is warranted, as attributing specific activities to degenerative joint changes remains problematic [34,66]. Appendicular OA was also observed in 21.2% of the individuals of the Etruscan site of Spina (6th–3rd century BCE) [13,14], where a significant difference in frequency distribution between sexes was attributed to lifestyle [13].

SN were found in four females (n = 4/5, 80%) and one male (n = 1/2, 50%) (Tables 1 and 2, Figures 3 and 4), contrasting with findings in Roman populations [67,68] and contemporary epidemiological data [69]. This result highlights the uniqueness of the sample, indicating that the observed differences may be related to the individuals' lifestyle [37]. Moreover, the distribution of SN also diverges from frequencies recorded at other Etruscan sites, such as Pontecagnano (63.6% total, with 70% in males and 44.4% in females) and Spina (11.3% total, with 16.4% in males and 8.9% in females) [13,14]. However, it is important to recognize that SN can be associated with various factors beyond physical activity, including osteoporosis, traumatic injuries, congenital defects, and metabolic and neoplastic disorders [70]. The lesions observed were distributed along the vertebral column with a particular concentration on the lower thoracic and lumbar segments. This is consistent with principles of human anatomy, where mechanical pressure tends to concentrate in the lower thoracic and lumbar regions, making these areas more susceptible to intervertebral disc herniation [71].

Marked EC were noted in both males (n = 2/2, 100%) and four females (n = 4/5, 80%) (Tables 1 and 2, Figures 3 and 4), a result consistent with current epidemiological data [65]. The females examined exhibited greater involvement of the upper limbs (Skeletons 8 and 12) compared to the lower limbs (Skeleton 14) and showed a preference for the right side

(Skeletons 8, 12, and 14); for males, this differentiation was less pronounced. Only Individual 11 had more involvement of the upper than lower limbs, with no significant lateral dominance. A similar prevalence of EC among males and females was recorded in the Cenomani Gauls (Veneto, 3rd–1st century BCE), where significance was found mainly among younger individuals, suggesting a connection to occupational activities [72]. Laffranchi also noted greater heterogeneity of EC among females compared to males, which contrasts with the results of this study, where the opposite trend was observed. Research has often associated upper limb enthesopathies in males, particularly involving the *biceps brachii* muscle, with agricultural activities, as documented in both archaeological [57] and contemporary data [73]. While a structured interpretation is not possible here because of the limited sample size, it is noteworthy that one male (Skeleton 19) exhibited such EC, and that agricultural fieldwork is well-documented in Italy, historically and archaeologically. The distribution of EC among females could suggest activities related to spinning, weaving, grain preparation, or ceramic production, as supported by iconographic and archaeological evidence [74,75]. However, it is important to emphasize the hypothetical nature of these interpretations, as the etiology of EC is complex, influenced by age, body mass, hormonal, and pathological factors, and therefore a potential source of bias [76–78].

Dental wear was seen in both males (n = 2/2, 100%) and four females (n = 4/5, 80%) (Tables 1 and 2, Figures 3 and 4), which is consistent with findings from Spina (4th–3rd century BCE) [12]. Nonetheless, individuals from the Spina necropolis showed no evidence for para-masticatory activity [12], contrary to the skeletons from Civita. In particular, the pronounced dental wear observed among females may be attributed to the habit of preparing grains [74]. The overall frequency in coeval Etruscan sites ranged from 30% to 50% (e.g., Chiusi, Monte Bibele, and Pontecagnano).

A diachronic comparison with the Roman population (1st–5th century CE) from Milan reveals marked differences in biomechanical stress with the seven individuals from Civita, Tarquinia. First, EC were more marked at Tarquinia than Milan. Following a previous study [79], three indices per individual were calculated, including the mean individual score averaging the scores for all 23 entheseal sites, using left-side scores and substituting with right-side scores when unavailable, and mean upper/lower limbs scores, averaging the scores of the upper or lower limbs. As a result, Civita females evidenced higher mean individual, upper, and lower scores than Milanese females (1.12, 1.30, and 1.11 vs. 1.09, 1.12, and 1.09, respectively), as did the Civita males (1.41, 1.79, and 1.21 vs. 1.20, 1.28, and 1.16). Another distinctive feature is the distribution of OA, SN, and marked dental wear. Comparing males and females from the 'monumental complex' with Roman Milan [67,68] shows higher frequencies among Civita males (OA: 100%, SN: 50%, wear: 100%) compared to Milanese males (OA: 59%, SN: 66%, wear: 64%), and notably higher frequencies for Civita females (OA: 80%, SN: 80%, wear: 80%) compared to Milanese females (OA: 24%, SN: 33%, wear: 48%). Again, it should be noted that this comparison is based on a limited sample of only seven Etruscan individuals, further restricted when divided by sex with only five females and two males. In spite of this limitation, this comparison evidences a stark contrast in frequencies of signs of biomechanical stress among the two populations, indicating that Etruscans buried at the 'monumental complex' may have been exposed to more physically strenuous activities and/or occupation with respect to Roman Milan. Interestingly, this is even more true for the females of the site, for whom these biomarkers are particularly marked. The presence of these skeletal markers of mechanical stress in women might reflect culturally specific sex roles, where women participated in labor-intensive domestic or agricultural work.

It is important to note that the skeletal remains from the 'monumental complex' (Civita, Tarquinia) were found in a sacred area and may not represent the broader Etruscan

population (Figure 2). However, bioarchaeological evidence offers a new lens through which to understand the lifestyles of ancient Etruscans, in particular, those committed to a sacred area. The pronounced biomechanical stress markers observed in female skeletons from Civita indicate involvement in repetitive, physically demanding activities, shedding light on their potential occupations.

In particular, notable bioarchaeological findings among the females of the 'monumental complex' included appendicular OA in the upper limbs, such as the elbow joint (Individual 7) and hands (Individual 12), as well as marked EC in the upper limbs (Individuals 8, 11, 12, and 14) and hands (Individual 8) (Table 2). Additionally, Civita females presented higher frequencies of OA, SN, dental wear, and EC than their Milanese Roman counterparts and showed more elevated rates of spinal and appendicular OA than in other pre-Roman sites. These findings suggest a complex and physically active role for females buried in the sacred area of Civita.

Knowledge of female physical activity and occupations in ancient Etruria is limited, as evidence is restricted to archaeological, iconographic, epigraphic, and indirect historical sources. Etruscan women engaged in spinning, weaving, food preparation, and ceramic production for household use [74,75], all of which would have required strenuous use of the upper limb musculature, elbow joint, and hands. This is supported by the frequent finding of spindles, spindle whorls, distaffs, bobbins, loom weights, and pottery among archaeological artefacts [75] Etruscan women's socioeconomic roles may have differed significantly from those of their Greek and Roman counterparts [75]. Evidence suggests that Etruscan women played an active role in managing domestic production, particularly in textile manufacturing, where they held varying degrees of responsibility, even if they belonged to aristocratic social classes. This is exemplified by a bronze *Tintinnabulo* from Bologna (*Necropoli dell'Arsenale Militare*, tomb 5), which depicts women overseeing textile work. Additionally, women were involved in pottery production, workshop mastery [80], and were even entrusted with crafting fishing nets. [75,81]. The presence of parade shields and iron rods with nodules, interpreted as distaffs or scepters, in female burials indicates their elevated social status [82]. Furthermore, women held religious power and participated in both initiatory and ceremonial duties [6,83–85]. For instance, evidence from Tarquinia suggests that a woman, equal to the *rex-sacerdos* (priest-king), was involved in dedicating the 'monumental complex' to Uni, the primary Etruscan goddess [5].

Physical activity was also prominent in Etruscan society and included games similar to those in Greece, such as wrestling, long jump, discus and javelin throwing, chariot racing, horseback riding, and foot races [75]. Scenes of pugilism appear in Etruscan art as early as the 7th century BCE [75]. Evidence also suggests the professionalization of athletes and the integration of sports into public performances [75]. Armed dances, often associated with sporting competitions like the *Phersu* game, were also a theatrical performance [75]. Notably, tomb paintings in Tarquinia and Chiusi from the late 6th and early 5th centuries BCE depict a female dancer balancing a candelabrum on her head while a young man attempts to throw rings at her [76]. Such depictions indicate women's participation in sports, though the extent, professionalization, and specific activities in their involvement remain unclear. Theopompus (apud Ath. XII, 14) even described Etruscan women engaging in sport exercises, providing further evidence of their participation in sports. While it is impossible to determine whether the individuals analyzed in this study participated in sports, the biomechanical stress markers observed are consistent with repetitive and strenuous activities, such as those involved in athletic practices. However, attributing specific activities to biomechanical markers remains speculative, as such reconstructions are inherently limited and rely on broad interpretations rather than direct evidence.

5. Conclusions

Reconstruction of the lifestyle, history, and social structure of the Etruscan people relies primarily on archaeological evidence, particularly funerary practices. However, bioarchaeological analysis of human remains offers valuable insights into individual and population health, daily habits, lifestyle, experiences of violence, and physical activities in the past. In this study, we focused on markers of biomechanical stress to better understand the daily lives and physical activities of the individuals interred at the 'monumental complex' (Civita, Tarquinia).

Although the sample size was not sufficient for a population-level study, the findings revealed that the males and females in this sacred area exhibited numerous signs of biomechanical stress markers. This suggests that the skeletal remains gathered in this site engaged in repeated and strenuous physical activities. Particularly striking was the pronounced presence of biomechanical stress markers among the females, which was not only higher than in other sites but also indicative of significant involvement in physically demanding tasks. These findings align with and even exceed evidence of women's involvement in textile production, ceramic manufacturing, and performative spheres as documented in the data available today, suggesting a level of physical engagement comparable to that of their male counterparts in a broader scope of activities. Despite the limited sample size, this study provides insights into sex roles, labor patterns, and overall physical activity in a sacred Etruscan environment.

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