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IMPLICATIONS OF THE CULTURAL AND BIOLOGICAL DEFORMATIONS OF AN IRON AGE INDIVIDUAL

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ABSTRACT

The skeleton of an adult male, dating to the Early Iron Age of the Assyrian Period (B.C. 8th- 7th cc), recovered in South Eastern Turkey was analyzed. It reveals significant biological and cultural deformations. This so-called Zeviya Tivilki individual represents the first known record of circular-type double bandage artificial cranial deformation from the Iron Age in Anatolia. The presence of cranial pathology *temporomandibular joint disorder* (TMJD) on the left side of the mandible, most probably caused by a trauma, was identified and negatively affected dental function and health. In particular, the occlusal surface of the left upper teeth covered by dental plaque indicates that the individual was not able to use this side of his jaw. Signs of the postcranial pathology *diffuse idiopathic skeletal hyperostosis* (DISH) reveal that the individual's physical behaviors were effected (limited). Deformations due to physical and physiological stresses on the postcranial and cranial parts indicate the individual severely suffered during his lifetime.

KEYWORDS: Anatolia, Iron Age, cranial deformation, DISH, TMJD

1. INTRODUCTION

Statistics based archeological research is limited when working with a low number of skeletons. Increasing the collection size is generally a matter of time. This is the dilemma of rescue sites—time is running out. While many excavation sites are accessible across decades, the duration of rescue archeology projects in Turkey, especially in areas where national dam construction projects are underway, is limited to just a few excavation seasons. Skeletons from this type of site are few in number, sometimes only one, and further discoveries cannot be projected. However, these remains can be enough to offer some valuable information on the biological and cultural life of an individual. This study was conducted on such a unique skeleton.

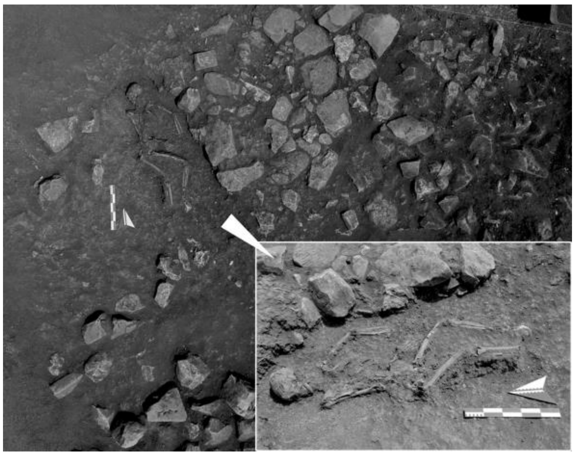

Figure 1. Skeleton, M 9/001/İ, recovered in the bulding structure.

The studied skeleton from the Early Iron Age at Zeviya Tivilki (hereafter refered to as ZT) is an important example of biological and cultural deformations. Marks found on bones and signs of specific cranial deformation tell about illnesses undergone by the indiviudal during his life time and about the artifical cranial deformation practise that dates back to the origins of humanity in the Pleistocene period (Droessler, 1981; Ozbek, 1974; 1982; 2001; Meiklejohn et al., 1992; Gerszten et al., 1995; Anton and Weinstein, 1999; Durband 2008; O'Brien and Stanley, 2013). This so called ZT individual is also important as it represents the first artifical cranial deformation dated to the Early Iron Age in Southeastern Anatolia.

2. MATERIAL AND METHOD

The material in this study was found in 2009 in the 'Zeviya Tivilki' (meaning “The Field of Doves” in Kurdish) settlement in the Ilısu village, which belongs to Mardins' Dargeçit district, in eastern Turkey. The excavation project, led by Prof. Dr. Tuba Okse, was sponsored by 'Studies Aimed at Preserving and Documenting the Cultural Property in the HES (Hydroelectiric Centrals) Project Intertaction Sites'. According to ceramic shard and iron findings, the ZT has been dated to the Early Iron Age and the New Assyrian period (8th-7th century BC) (Ökse et al., 2010). During the excavation a construction complex belonging to a top soil agricultural settlement was found. In this construction complex from different sites, three individual skeletons with no evidence of funeral practice were found. The skeletons do not seem to have had a normal burial and are believed to have lost their lives during an accident when the buildings collapsed on them (Figure 1). This statement is supported by the lack of burial artifacts juxtaposed with the skeletons (Ökse et al., 2014). The three skeletons were damaged by rubble, but skeleton number M 9/001/İ, as it is the material of this study was in better condition. Carefully collected skeletal remains were curated and reconstructed before the study.

Parameters such as: the changing phases of rib end connections with the sternum (Loth and İşcan, 1989), the degree of closure of cranial sutures (Masset, 1989), and the degree of symphsis pubis deformation due to old age (Meindl and Lovejoy, 1989) were used. Determinations of sex and cranium deformation were measured in accordance with Buikstra and Ubelaker (1994). Dental pathology and other pathologic evidence were also recorded according to Buikstra and Ubelaker (1994).

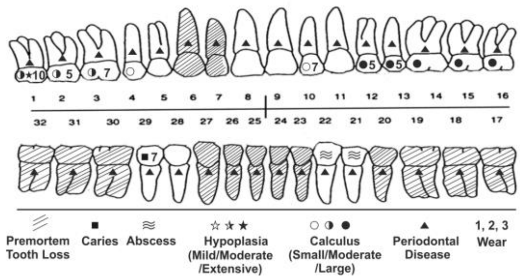

Figure 2. Teeth pathologies observed on the upper and lower jaws

3. RESULTS

3.1 Age and Sex

The determination of sex was possible due to the individual’s age and the presence of a relatively well-preserved cranium and long bones. Nonmetric features like size, mass, and muscle attachment spots on bones were the main parameters for determining sex. Pronounced superciliary arch and prominent nuchal muscle attachment lines and crests on the occipital bone were observed. Additionally, the shape and size of the mastoid process, the supraorbital margin, and the supraorbital ridge were useful in identifying the individual as a male (White, 2011).

The edge of the menton, most prominent point of the chin, on the badly preserved mandible was pronounced. Other bones besides the cranium retained a moderate level of mass. When all the evidence was considered, the skeleton was attributed to a male individual. For determining age of the specimen morphological change phases of the sternal ribs (Loth and Işcan, 1989; Hartnett, 2010a), closure of cranial sutures (Masset, 1989), and the degree of symphysis pubis deformation (Brooks and Suchey, 1990; Hartnett, 2010b) examined. Phase calculation of the sternal surface of the fourth rib according to Hartnett (2010a) was phase 5 (range: 45-59; mean: 52.05) and according to Loth and Işcan (1989) was phase 6 (range: 32-71; mean: 50). Deformation phase of the pubic symphysial face was phase 5 based on the Brooks and Suchey (1990) (range: 27-66; mean: 45.6), and it was phase 5 (range: 37-72; mean: 54) based on the Hartnett (2010b). In conclusion, the skeleton was determinate to be a male at approximately 45-54 years old at time of death.

3.2 Biological Deformation

The individual was exposed to a variety of biological deformations from birth to death. It shows very interesting pathologic lesions in the cranial and postcranial elements.

3.2.1 Teeth

Observed pathologies in the lower and upper jaws of the ZT specimen are shown in Figure 2. A high rate of tooth wear in the upper jaw was observed. Left upper molar teeth were completely covered with dental calculus and so the wear status of these teeth could not be examined, however a high rate of tooth wear was expected for those teeth (Figure 3a and b).

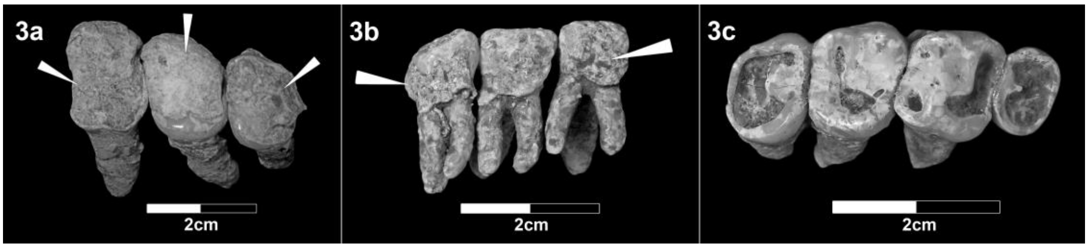

Figure 3. a) Occlusial view of the left upper molars show exessive calculus on the occlusial surface. b) Buccal view of the left upper molars show exessive calculus on the buccal surface. c) Occlusial view of the right upper molars show high tooth wear and no calculus.

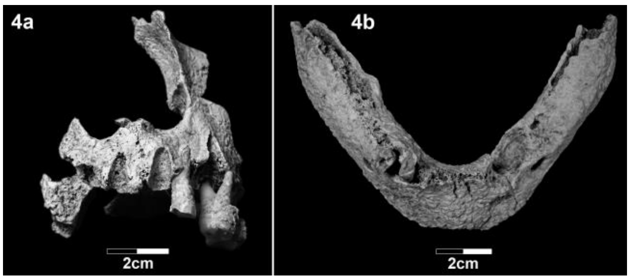

Figure 4. a) Anterior view of the maxilla revealing periodontal disease. b) Superior view of the mandibula found periodontal disease and alveolar bone lost.

Tooth cavities and abscess were not observed on the existing teeth. Due to wear and calculus, examining the hypoplasia on teeth was not possible. Calculus levels, on the right second premolar were weak and at a medium level on the molars (Figure 3c). Labial, lingual, and occlusal surfaces of the premolar and molar teeth on the left side were completely covered by dental calculus (Figure 3b). This situation shows that the individual did not use his left side actively. On the upper jaw, there is an alveolar loss, which shows serious periodontal disease (Figure 3a).

Only the right first premolar remained on the lower jaw (Figure 4b). There is intense wear and a cavity on the distal side of the neck of the tooth. Hypoplasia was not observed due to high wear status on this premolar and there was no dental calculus development. Due to abscess tooth sockets of the left canine and first molar were widened and there was alveolar loss. On the left side of the jaw premortem alveolar loss observed with well-developed periodontal disease (Figure 4b).

3.2.2 Cranial

The ZT individual shows TMJD in the left temporomandibular joints (Figure 5, 6b). There was erosion, flattening/ irregularities and deformations on the surface of the left mandibular condyle. Additionally, a reduction of joint space and shortening of the area where the mandibular condyle attach was observed. The area between the coronoid process and the mandibular notch was shattered, possibly due to condyle movement. Just below the mandibular notch on the anterior side there was an unexpected irregular tuber-like deformation. Most probably this affect was caused by a trauma or high tension, and the spheno-mandibular ligament in that area formed a secondary ossification due to calcification of the ligament. The rounded hole at the head of the joint and the expansion of the mandibular notch towards the edge of the coronoid point also depict that this secondary ossification of the spheno-mandibular ligament formed to heal or support the weakened area at the joint. It has known that vertebral ligament ossification or calcification is very common, such as DISH. The mandibular fossa was fully destroyed and lost its previous position. Eburnation, which is the definite indicator of the osteoarthritis on the joint surfaces, was not seen, possibly, due to postmortem wear of the bone surface. However, at least it proves two of the Rogers and Waldrons' (1995) morphological change phases caused by osteoarthritis: 1. Alteration of the joint contour occurs when the normal contours of the joint are altered through active remodeling of the joint and as a result it can become flattened, enlarged or reduced. 2. Marginal osteophytes are bony developments forming along the margins of a joint. They may develop on three types of tissues: insertions of ligaments; fibrocartilage at the rim of a joint; or in the periosteum of the bone.

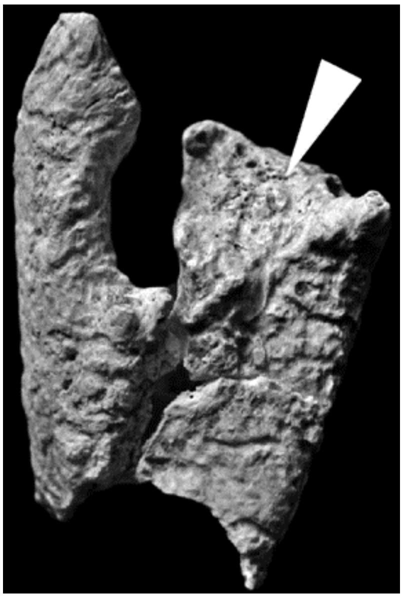

Figure 5. Tempora-mandibular joint disease in the left ramus of the mandibula.

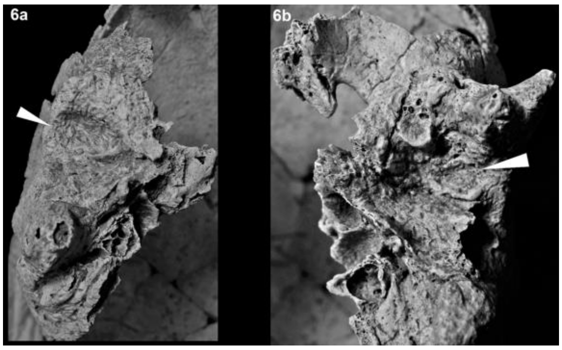

Figure 6. Inferior view of the skull. TMJD is marked on the mandibular fossa of the temporal bone in the left side (6b).

This proliferation of new bone changes in form can include a thin rim or florid fringe of bone along the joint margin. In this specific case the spheno-mandibular ligament ossification can be grouped in the phase 2 as a marginal osteophyte.

3.2.3 Post-cranial

Candle dripping like pathologic lesions on the anterior part of the two lumbar vertebrae attributed to DISH (Figure 7a and b). DISH, an illness that seriously inhibits one's movement, has three radiologic diagnos criteria: 1) calcified bone bridge in the anterolateral of at least two sequential vertebrae, 2) a normal or slightly reduced intervertebral disc space between the segments, and 3) the interapofizyal joints not having any ankylosis (Resnick et al., 1975; Burkus, 1988; Cammisa et al., 1998; Aufderheide and Rodriguez-Martin, 1998;). The typical properties of the illness are: bridge is formed on consecutive vertebrae due to the formation of a new bone without complimentary disc degeneration (Cammisa et al., 1998; Aufderheide and Rodriquez-Martin, 1998; Mann and Hunt, 2005; Diederichs et al., 2011). Ultsinger (1985) suggests that when a case of DISH is prescribed, there are also symmetric enthesopaties on top of the patella and the olecranon. Since the skeleton was poorly preserved, only two DISH indicators were found. DISH was commonly observed in vertebrae, , however where the tendon and ligament meet bone, which called entheses, some irregular secondary ossification or calcification, enthesopathies, can occur in the iliac crest, ischium, big and little trochanters, throhanteric fossa, patella and calcaneus (Ortner, 2003). Possible enthesopathies were examined in the ZT individual as well, but mentioned skeletal elements where enthesopathies can occur were missing in the collection. However, in the ischium part of the pelvic bone enthesopathic deformations were noted.

Generally the arcus parts of the vertebra were preserved well and some degenerative patterns observed in the disc side of the first cervical vertebra in those well-preserved ones. DJD (degenerative join disease) was observed on the apophyseal (superior articular facet) joints and inferior articular facets on the arcus parts of the vertebra. Additionally, on the apophyseal joint of the thoracic vertebra DJD was observed. Furthermore, there were osteopytic formations on the parts of the two vertebrae corpus.

On the right glenoid fossa and right acetabulum of the scapula, as Ubelaker (1999) notes, there were small deposits of articular margins on the bone and a small pit.

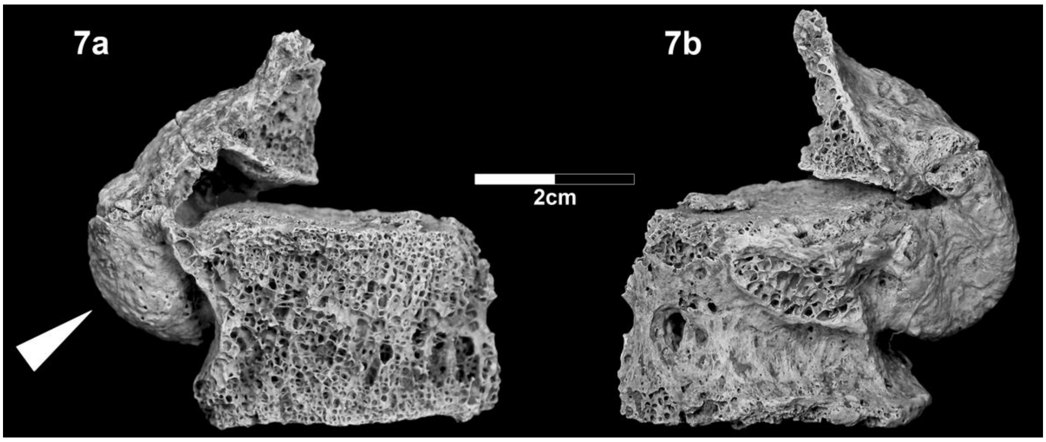

Figure 7. a) Anterior view and b) posterior view of the lumbar vertebrae shows DISH on the antero-lateral of the vertebrae.

3.3 Cultural Deformation

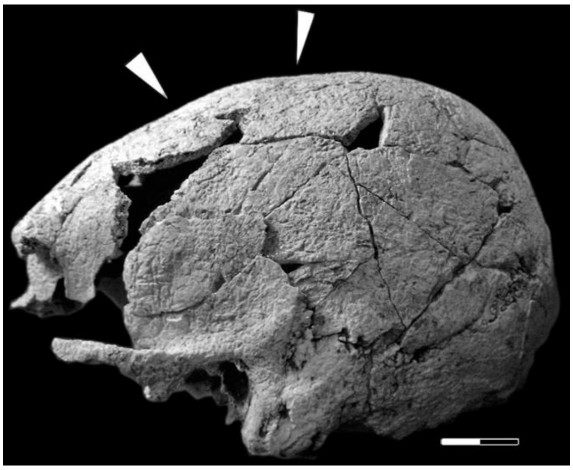

Figure 8. Lateral view of the skull. White arrows point the caving of circular-type double bandage practice of artificial cranial deformation (Scale bar is 2cm).

Artificial cranial deformation was practiced by a number of cultures in different times and regions. This cultural practice has revealed itself in two ways: circular and tabular (Ozbek 2001). The deformation type of the ZT skeleton can be defined as circular (Figure 8). Circular flattening of the cranium and a structural change due to a pressure on the frontal bone was observed, strongly depicting the characteristics of circular deformation. When we look at the cranium from the side there is a clear caving most probably related to a tight bandage use. This band around the cranium goes through the frontal bone's prebregmatic area and continues from the parietals, and finally surround the bottom part of the occipital bone. Additionally there is strong evidence of second (dual) bandage use on the cranium of the ZT skeleton. The second, postbregmatic band, goes around from the coronal suture. Prebregmatic flatenning was more pronounced than the postbregmatic, and between the first prebregmatic band and the second postbregmatic band a clear torus formation was notable.

4. DISCUSSION AND CONCLUSION

4.1Biological Deformation

4.1.1 Teeth

The teeth and jaw are good records of the feeding, hygiene habits, and general life quality of individuals. Teeth are one of the most important study materials in biological anthropology as they reflect the changes in cultural habits and subsistence strategies throughout time. Notably, the tooth and jaw pathologies vary depending on time and place (Costa, 1982; Lucaks, 1992; Kaifu et al., 2003; Molnar, 2008; Lightfoot et al., 2012). Furthermore, tooth pathologies provide crucial information about the geographic or environmental factors as well (***Lieverse*** et al., 2007). Illnesses such as carries, periodontal disease, abscesses, ante mortem tooth decay, and the type of malocclusion are used to explain diet preferences and cultural differences (Scott and Turner, 1988; Lucaks, 1992; Hubbe et al., 2012)

A carious lesion on the neck (cervix) of the lower first premolar of the specimen was observed and the pulp chamber was revealed. If the individual had lived a little longer he probably would have lost the tooth before death. Most of the ZT individual's teeth, on his lower jaw, were lost before death. However, we do not know if the teeth were lost due to carries, wear or periodontal disease. High rate of tooth wear was notable on the upper jaw teeth, but the degree of the wear was not high enough to reach pulp chamber and cause infection. Therefore, tooth caries are a probable cause of the serious damage to the tooth or even cause its loss especially as a result of caries located on the cervix causing the breaking of the tooth's crown (Larsen, 1997; Nelson et al., 1999; Molnar, 2008; Lieverse et al., 2007). The most probable reason for the loss of most of the lower jaw teeth could be dental caries and periodontal diseases. According to Larsen (1997), in the archeological context, the antemortem loss of the cheek teeth of the lower jaw is mostly caused by periodontal disease.

Periodontal disease is the destruction and infection of the gum tissue, periodontal ligaments, root cement and alveolar bone through the agency of a variety of pathogenic infections in the dental plaque (Winkelhoff and Slots, 1999). Bacterial infection can be caused by the micro-trauma of the soft tissues that are attached to the bone (Hilson, 1996). According to Lieverse et al. (2007), caries, too, can cause periostitis on the alveol bone. There is also a reasonable connection between periodontal illnesses and periosteal lesions (Hilson, 1996; DeWitte and Berkvelac, 2011; Hubbe et al., 2012). Periostitis is an infectious disease causing the loss of the alveol bone (DeWitte and Bekvelac, 2011; Lieverse et al., 2007). Lieverse et al. (2007) state that there is a notable relation between the increase of periostitis and tooth loss before death with aging. Additionally, the factors that cause tooth loss may vary due to feeding habits of an individual. Eating hard food causes attrition and wear mainly on the occlusal surface, while refined food causes caries and periodontal diseases (Larsen, 1997). For the ZT individual who has both advanced periodontal disease and alveolar loss, the most possible reasons for the tooth loss were his diet preferences including abrasive foods causing tooth wear and increased caries with aging.

The advanced level of calculus is one of the most wide-spread illnesses among dental pathologies after periodontal diseases (Hilson, 1996). Calculus, which is a mineralized plaque forms on the surface of the tooth (Hilson, 1996; Lieverse et al., 2007), causes periodontitis and the reduction of alveolar bone (Hillson, 1996). According to Lieverse et al. (2007), increased degree of tooth wear with aging causes increased sedimantation of dental plaque and calculus, creating high risk for periodontal disease to develop. The ZT individual was quite aged according to life expectancy rates of the period his remains dated. It is quite expected to observe high rate of tooth wear, caries, and periodontal diseases on the material. In addition to this, the most important factor triggering dental calculus in this individual was the dysfunction of the mandibular joint on the left side due to advanced TMJD. The teeth on the left side of the upper jaw were completely covered with dental calculus, including occlusal surface. Besides, high levels of tooth wear on the rest of the teeth were remarkable.

The degree of wear caused by the chewing time and the duration of its effects on the interproximal surfaces as teeth meet each other. It changes depending on the content of the diet and food preparation techniques (Scott and Turner, 1988; Larsen, 1997; Hillson, 1996). Tooth wear frequency was higher in the past among hunter-gatherers than in agricultural populations (Lieverse et al., 2007; Molnar et al., 1989). Also, wear depends on localized behavioral traits, differences in cultural practice, age, sex and types of nutrition (Larsen, 1997; Lieverse et al., 2007). As seen in the ZT individual (Figure 1, 2c), tooth wear was one of the most widespread and destructive of pathologies in ancient communities, promoting other problems including periodontitis, antemortem tooth loss, alveolar defects and caries (Aufderhide and Rodriquez-Martin, 1998).

In conclusion it is safe the comment that general dental conditions and mouth hygiene of the ZT individual was not healthy, but let him survive little more than the life expectancy of his time (Early Iron Age). The actual factor that worsened his mouth health was the osteoarthritis on his left tempora-mandibular joint. Combination of all these diseases and factors negatively affected his oral health.

4.1.2 Cranial

TMJD shows a distribution of 4% to 28% today (Manzione et al., 1984), and it is rarely seen in children unless the child has a development problem or a trauma (Lobbezoo et al., 2004). When examined radiographically, TMJ OA (Osteoarthritis), for example, progressively increases with age (Widmalm et al., 1994). Rando and Waldron (2012) showed that the general prevalence of osteoarthritis prevalence falls in line with the patterns observed in their epidemiological data. As prevalence increases with older age there is a slight tendency for females to be affected to a higher degree than males. This illness is not rare as it is observed frequently in young adults (Pullinger and Seligman, 1987), However, in clinical studies elderly people tend to be less likely to report pain (pain degreases with age) or seek treatment. Younger patients have more muscle pain and they often seek treatment (Schmitter et al., 2005).

The tempora-mandibular joint is different from other joints structurally as its surface is surrounded more by fibrocartilage than hyaline (articular) cartilage (Levangie and Norkin, 2001; Hylander, 2006). As a result, fibrocatilage does not ossify and secondary cartilage joints tend to be preserved even in the old age (Scheuer et al., 2000). Due to this, osteoarthritis starts from the lower layers of the fibro cartilage on the tempora mandibular joint and ends with the deformation of the bone (Hodges, 1991). What could be the reason for high level of osteoarthritihic deformation on the ZT specimen, who is particularly old for the time he lived in?

A few factors are responsible for the formation of TMJD. One of the reasons is intensive tooth wear

(Richards, 1990). Studies made on populations such as Australian Aborjines (Richards 1990), the English (Hodges, 1991) and Eskimo Inuits (Merbes, 1983), have shown the connection between TMJD and intensive tooth wear. According to Roberts and Manchester (2007), besides wear, structural anomalies to the anatomy and the physiology of the joint are the causes of joint illness in the jaw. The ZT had teeth on both sides of the upper jaw. However, teeth on the left side, especially the upper first molar, had more wear than on the right side. As the teeth on the left side are fully covered with calculus, both on the buccal and the occlusal sides, it indicates that the left side was not used. At first glance, it may seem that the reason for the left side not being used is caused by ante mortem tooth loss. However, as there is similar tooth loss on the right side and as the right side was used, this possibility is discredited. As a result, it is clear that the left side could not be used due to TMJD.

Hylander (1975) suggested a hypothesis that the mandibula and temporal bones interact during chewing. According to this Lever-action model, TMJ forces on the balanced side are higher than on the functioning side where the biting pressure occurs. Individuals who have abscess and caries on one side of their mouth tend to eat on the healthy side. The mastication forces with the help of the healthy teeth pass to the condyle of the ill side. However, if there is an illness that is on the TMJ and not on the teeth mastication forces will be passed by the teeth to the ill side and by condyle onto the healthy side. These two adaptations help to decrease pain during chewing. However, this adaptation causes asymmetric stress on the TMJ and can result in joint degeneration in the end. In addition to the right/left asymmetry, molar tooth loss is observed to promote TMJ degeneration in the living populations (Sheridan et al., 1991). Sheridan et al. (1991) has stated that after posterior teeth loss and the closing of the jaw sockets TMJ pressure increases with the use of the front teeth and this is the main factor for the TMD formation. Also, in the same study, a reasonable relation was not found to tooth wear, an indicator for right/left asymmetry. Studies on TMJ have found a relation between the forward shift of the joint disc and osteoarthritis (Katzberg et al., 1983).

This Early Iron Age individual did not have a particularly healthy life style, when we look at his teeth and skeleton. Especially, the jaw joint illnesses show, that the individual had serious difficulties in his nutrition. The upper left side teeth that are covered with calculus until occlusal indicates these difficulties. The left jaw of the ZT human was completely useless because of the illness supposedly caused by a trauma together with and the other many factors listed above.

4.1.3 Postcranial

The ZT skeleton's vertebrae could not be fully examined since it had many missing parts. However, the two existing parts of the vertebrae had osteophytic formations. Disc degeneration causes vertebrae to come closer together. The irritation of the vertebra from contact with the vertebra edges starts new bone noduls, meaning the formation of osteophytes. When bone growth in such areas connects with bone growth on the neighbouring bone ankylosis occurs. Also, on the body of the vertebra, porozite and pitting are frequent (Aufderheide and Rodriguez-Martin, 1998). These changes, rare at the age of 30, reach 80-90 % by the age of 75 and above (Aufderheide and Rodriguez-Martin, 1998). The osteophytic formations and DJD lesions seen on the ZT individuals' vertebrae seem to be at a reasonable level considering his age. However, on the individuals' vertebrae DISH was observed which causes intense pain and limited movement (Cammisa et al., 1998; Roberts and Manchester, 2007)

DISH, which was found on the Neanderthal human found in 'Shanidar I' going back 50 thousand years (Crubezy and Trinkaus, 1992), is an ossification illness that causes bone union of the vertebrae due to ligament ossification without causing any intervertebral disc problems (Quintelier et al., 2014). This illness, which is mostly observed in the elderly and has no known cause, (Belanger and Rowe, 2001) is rarely observed before 40 years of age (Aufderheide and Rodriguez-Martin, 1998). Vertebral evidence was first defined by Forestier and Rotes-Querol (1950) as 'senile vertebrae anquilosante hyperostosis'. Later on Resnick et al. (1975) broadened the definition of DISH to include extra-spinal signs. The prevalence of DISH changes from 4% to 35% among different study groups and diagnostic measures (Diederichs et al., 2011). The spinal indicators of DISH are the paravertebral and paradiscal bone formations settling in as craniocaudal and the osteophytic formations of the anterior longitudinal ligaments. The ossification of the spine can be extreme and can cause esophageal stenosis or neurological illnesses (Roberts and Manchester, 2007; Diederichs et al., 2011). DISH, which has an ambiguous etiology and the pathology is in the studies, laid on few factors. 1. Trauma and professional stress, 2. acromegaly, hiperparatroidism, sugar, endocrine anomalies including growth hormone, 3. flosis, ancylosan spondilitis, spondilitic variations, 4. infectious diseases, 5.neuroarthrophaty and 6.Hipervitaminosis (Weinfeld et al., 1997; Mader and Lavi, 2009).

Table 1. The tradition of deformation in Anatolian and Near East populations

Near East Populations		
Jericho (Palestine)	Ferembach, 1985	Neolithic
Khirokitia (Cyprus)	Angel, 1936	Neolithic
Shanidar Cave (Iraq)	Meiklejohn et al. 1992	Proto-Neolithic
Tepe Ghenil (Iran)	Meiklejohn et al. 1992	Neolithic
Bouqras (Syria)	Meiklejohn et al. 1992	Neolithic
Ganj Dareh Tepe (Iran)	Lambert, 1979; Meiklejohn et al. 1992	Neolithic

Anatolian Populations	Researcher	Period of Time
Salat Camii	See. Miyake, 2010	Neolithic (pottery)
Hakemi Use	Erdal, 2011	Neolithic (pottery)
Şeyh Höyük	Şenyürek and Tunakan, 1951	Chalcolithic
Kurban Höyük	Alpagut, 1986	Chalcolithic
Değirmentepe	Ozbek, 2001	Chalcolithic
Karataş	Angel, 1976	Early Bronze Age
Hayaz Höyük	Ozbek, 1984	Early Bronze Age
Resuloğlu	Duyar and Atamtürk, 2010	Early Bronze Age
Zeviya Tivilki	Current study	Early Iron Age
Gordion / Ankara	See. Ozbek, 2001	Phrygia

There is not enough data about DISH to offer a prescription. Its prevalence increases later in life and affects men more than women (Rogers and Waldron, 2001; Roberts and Manchester, 2007; Quintelier et al., 2014). In his skeleton series Quintelier et al. (2014) found that only older men had this illness. Weinfeld et al. (1997), found among the 2300 patients they investigated that 25 % of the men over 50 and 15 % of the women had this illness. The research reveals that this illness was found less frequently among African Americans (22%), American Indians (16 %) and Asian Populations (20%) over 70 years of age (Weinfeld et al., 1997). This disease was observed 10 % among Koreans (Kim et al., 2004). Verlaan et al. (2007), conducted a study among 51 archeological individuals, 17 individuals (40.4 %) with an average age of 49.5, had DISH. Compared to this high percentage, Rogers and Waldron (2001) in a medieval skeleton series found only an 11.5 % presence of DISH.

4.2 Cultural Deformation

Traditionally, the forms of the cranium have changed, depending on the culture of different populations. Around the world there are around 16 main types and countless subtypes of cranium deformation (Droessler, 1981). However, old populations mainly changed the cranium in two ways: tabular and annular (O'Brien and Stanley 2013). It is known that the cranium is deformed in different ways. There are the aesthetic concerns of the mother or midwife shaping the baby's head with their hands (Gerszten et al., 1995); tying the head to a wooden panel, giving a conic or cylindrical look to the head (Droessler, 1981; Ozbek, 1982; Gerszten et al., 1995; O'Brien and Stanley 2013), laying the baby on a wooden surface and setting heavy stones, one on the top and two at the sides of the head (Ozbek, 1982; Gerszten et al., 1995); and the cradle practice (Gerszten et al., 1995). This operation, which starts right after birth (Droessler, 1981; Gerszten et al., 1995; O'Brien and Stanley 2013;) causes frontal flattening and anterio-posterior extension which becomes pronounced after some time, especially when the baby is 2-2,5 years old (Ozbek, 1982). Generally in Anatolia, the annular shape is given to the cranium by wrapping the head with a bandage (Ozbek, 2001; Şenyürek and Tunakan, 1951; Alpagut, 1986; Erdal, 2011; Angel 1976).

Practices involving wrapping the head go back to the Pleistocene period (Anton and Weinstein, 1999; Durband, 2008). Today, examples of this practice, which became widespread in the Near East during the Neolithic period (Ferembach, 1985; Lambert, 1979; Meiklejohn et al., 1992; Angel, 1936), can still be observed in the Yazidi people and Turkmen living in Iraq (Ozbek, 2001).

Among the Değirmentepe skeletons observed by Ozbek (2001), 13 out of 14 individuals had deformation. 5 in 13 individuals had a deformation through the use of double bandages. In the double strapping observed on the ZT skeleton the caving caused by the first band is more pronounced than one the caving in caused by the second. The second band goes around from the coronal suture. Between the first prebregmatic band and the second postbregmatic band we can see a clear torus formation. The same practice was found in the Şeyh Höyük (Şenyürek and Tunakan, 1951), Byblos (Ozbek, 1982). In the Değirmentepe population, Ozbek (2001) found deformation only on skeletons from the Chalcolithic period and he did not find any deformation on skeletons from the Iron Age and the Middle Ages. As in Table 1, there has been deformation in different periods in Anatolia: starting from the Neolithic period (Miyake, 2010; Erdal, 2011) to the Chalcolithic (Şenyürek and Tunakan, 1951), the Early Bronze Age (Angel, 1976; Duyar and Atamtürk, 2010) and the Phrygian period (see. Ozbek, 2001). The ZT skeleton is the first to have a deformation dating from the Iron Age.

In some areas of the world, there has been a correlation between deformation and sex (MacCurdy, 1923; Şenyürek and Tunakan, 1951; Ossenberg, 1970; White, 1996; Ozbek, 2001). However, the significance of this relation is not clear yet. In Değirmentepe, since the skeleton series were composed of children, the sex of the skeletons and its relation to cranium deformation could not be predicted. However, a 9-10 years old individual with male characteristics offered no evidence of this practice so, it is thought that it was practiced only on female babies. Similarly, on the skeletons from Şeyh Höyük (Şenyürek and Tunakan, 1951) and Byblos (Ozbek, 1982), it was found that this deformation was only found among women. Even though in many sites, sexual differences (MacCurdy, 1923; Ossenberg, 1970) are observed in the practice of deformation, White (1996) has stated that in the Lamanai settlement there were no sexual differences concerning the Maya cranium deformation. In Maya, ethno-historic study offers insights into how the cranium deformation was made. In Ganj Dareh Hill (Lambert, 1979) and Cyprus Khirokitia cranium deformation in terms of sexual difference was not observed, but among the Byblos people during the Chalcolitic period, cranium deformation was practiced only on women (Ozbek, 1974). In Illinois there were no findings on class differences and the women to men ratio of the cranium deformation was 2:1 (Ossenberg, 1970). On the other hand, in Mexico and Chile, there was a big difference between the sexes (Gerszten, 1993). In Borneo Malanauda, it was accepted as a sign of beauty, starts deformed and was found more often on women than men (Gerszten et al., 1995). Droessler (1981), who studies cranium deformation among American Indians he could not, except for one series, find a significant sexual difference. In that one series, he found that frontal and occipital flattening was more obvious among females. Among the ZT skeletons, represented by three skeletons, only two have a cranium. The other cranium, belonging to a 13-14 years old adolescent, showed a deformation of an annular type and the mark of a single band. Among the Karataş (Angel, 1976) and the Resuloglu (Duyar and Atamtürk, 2010) remains this type of deformation was prevalent, which reflects a change that starts from the post-vertex area of the cranium and includes the occipital bone. With the ZT can the deformation differences with single and double bands, be a result of the individual's sex? Since the ZT skeletons, had only two craniums and it was not possible to determine the sex of the second skeleton, it is hard to answer this question. Also, it was not possible to reach a conclusion on this subject because I was unable to evaluate the ZT skeletons on the basis of population density. Tritsaroli (2011), in the Byzantine Site, found a deformation showing a double band mark on a female individual making one think that the annular type double wrapping is not a difference of form concerning sex.

Cranial deformations used as a tool to demonstrate social status in some societies (Droessler, 1981). In Egypt, Queen Nefertiti and her female children had elongated heads. This practice observed in the individuals from the royal family line (Vlahos, 1079). Additionally, it is known that religious leaders and elites had deformed craniums in Maya civilization (Gerszten et al., 1995).

As a result, in the rural settlement complex found in ZT it is believed that at least there were 8 nuclear families and a population of 50 people all together. Compared to a settlement that is constantly inhabited, there are very few houses. It is believed that this was a seasonal settlement (Ökse et al., 2014). Skeleton number M9/001/İ, which is one of the three skeletons found in the ZT settlement, dating back to the Early Iron Age, is not representative of the ZT society. However, it reveals important clues about the time of the Early Iron Age. It is also offers significant in terms of biological deformation patterns undergone throughout a lifespan. With the help of new excavations in South East Anatolia it is hoped that we can get more useful information about the people and their culture belonging to the same period.

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