A Bronze Age Grave Discovered at Tepe Foroudgah, Iran: An Anthropological and Palaeopathological Study

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Abstract

The first aim to study skeletal remains is to recognize and answer the human differences, sex, stature and demography. The next, and important reason, is skeletal palaeopathology. It examines remained bones and teeth to show dead reasons and find out the environmental diseases in ancient times. The result of this study illustrates re-establishment of ancient society and gives the main key for discussion and conclusion. This article focuses on remained bones, found from the first season of excavation, on Tepe Foroudgah, Khorramabad-Iran, in September 2014. This site is located among three prehistoric sites with almost 3 to 4 kilometers away from each other. No reports from those archaeological excavations have been issued on human skeletal remains so far. Tepe Foroudgah yielded human skeletal remains for the first time amongst them and from this point of view, the study of the found bones was put in the first job of excavation reports to answers many questions such as the reason of finding human skeleton, its identity, the reason of death, sex and age. Hence, this article tries to give a new light on Iranian ancient population in Western parts. Further, this article will focus on age and sex determination, human discrepancies and it will describe these main questions as well. General views and analysis on palaeopathologies show the stresses and lesions of individual. Therefore, the reason of individual death is discussed here. The methodology applied is based on current and standard studies methods in Physical Anthropology.

Keywords: *Palaeoanthropology, Human skeletal remains, Tepe Foroudgah, Khorramabad, Iran.*

1. Introduction

The Bronze cultures in Lorestan and Tepe Foroudgah mark the development of agriculture and making bronze objects in South West Iran.

Tepe Foroudgah is located among three Bronze Age ancient sites; Tepe Masur, Tepe Jaldan and Tepe Gilvaran. The distance of this site with others is almost 3 to 4 kilometers. No reports from bioarchaeological excavations have been issued on human skeletal remains so far. Among those sites, only Tepe Foroudgah yielded human skeletal remains for the first time. The reason for naming the site as "Tepe Foroudgah" is due to its location which is near Khorramabad Airport ("Foroudgah" is a Persian word and stands for Airport).

Hole (1985: 34) beleives that geography is a determiner for the natural environment of West Iran's ancient sites. In his opinion, there were four sections in West part of Iran during pastoralism: 1) Low Plains, 2) Azarbaijan area, 3) The central Zagros Valleys, 4) Plains valley of South Zagros in Fars area (Ibid). The third one is the same area which discussed in this article. Hole writes that a large part of the West Iran is mountainous and agricultural plains, which is relatively small and discontinuous are among the high mountains (Ibid:59). Talaei (Sajjadi, 2014: 5) has divided Iranian Plateau into seven zones in explaining Iran in Bronz Age. Among seven regional zones one and two and three can be placed in the area of the Zagros Mountains. First zone, North West, second zone, Central Zagros and third one is considered South West Zagros (Hole, 1970:286-292). The second division is in full compliance with the study area in this paper. According to him, the Central Zagros because of its proximity to the major centers of civilization in ancient Mesopotamia and Elam and there are also rich mineral resources and the overall natural and geographical context, particular importance in the study of archeology in Iran (Sajjadi, 2014: 64; Medveskaya, 1982).

The alluvial valley with remarkable streams, fountains and water resources originated from three rivers named as Khorramabad River (Gelal), Kargaaneh River and Blarody River.

Khorramabad valley is a part of the Zagros Mountain, which due to its suitable ecosystem and favorable conditions is considered as one of the world's oldest habitats. It was a good place of human habitation in different periods.

Tepe Foroudgah is located at the southern edge of the Khorramabad Valley. Khorramabad River is the main water resources of the valley with the northwest-southeast direction, passes from the northern edge of the hill (to a distance of 200 meters from the site) (Fig.1). Height of the hill at the highest point of the surrounding ground level is about 5 meters. The site has a circular base with a base diameter of 80 meters, and is a gentle slope on the edge (Ibid:71). This hill was taken as a site for installation of airport but later it subjected to destruction and therefore became a priority in the excavations program.

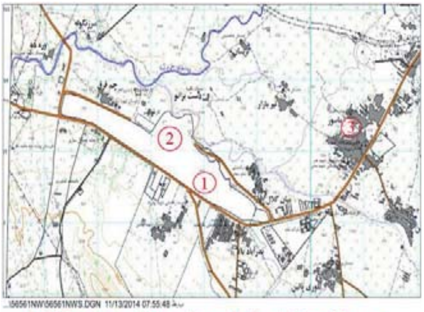

Figure 1. Location of Khorramabad Air port and Tepe Foroudgah. (adopted from:www. google map).

The site was subjected to large scale horizontal excavations by Department of Cultural Heritage, Khorramabad, during months of June and September 2014. The three months excavation work has brought up results of many interesting features of this ancient site.

Although it is an extensive archaeological settlement, much of the upper deposit (about 1-1.5 m) has been destroyed because of intensive construction works of airport.

The site reveals a single cultural habitation and the occupation can be dated on the basis of the earthenware and bronze objects, means between 2700 to 2400 B.C. People practiced subsistence agriculture and animal husbandry combined with hunting and fishing.

With the discovery of a grave beneath the floor (house), it seems that the dead bodies have been buried inside the residential area. The present study is an attempt to study the biological adaptations of such individual.

2. Material and Methods

The excavations at Tepe Foroudgah yielded a human burial. This burial was found in the excavated trench No. T.M.8, Loc.902, F.9002, in the depth of about 115cm (Fig.2). From the cultural deposit it appears that this individual belonged to Bronze Age. The appearance of these bones shows that they are related to a body which was buried in semi-embryonic state. Unfortunately, the complete decay of most parts of the skeleton caused at least fifty percent of the bones became as same as powder while exposing. Skull with a few cervical vertebrae, parts of humerus, ulna, radius, femur, tibia, fibula, fingers, ankle, toe, and a few small parts of pelvis could be collected. Other parts could not be collected and studied because of fracturing and decay.

Figure 2. Burial, *in situ.* (Photo by M.Gravand).

Most of the damage that has happened to the facial region is post-mortem loss during the excavation process. The post-cranial skeleton is not well preserved. The dentition, however, is not well represented and many teeth are missing or damaged.

Descriptive and comparative analysis of this individual is the objective of the present research. The methods which adopted in this study are outlined in this chapter. The next chapter focuses on the preservation and morphometry of the skeletal remains. General comments, discussion of the biological adaptation and comparative analysis are presented in the last section.

Age and sex of the sample is determined by the standardized criteria described in Browthwell (1981), Olivier (1969), Stewart (1979) and Bass (1981).

Craniometric and osteometric methods used in this study follow Martin and Saller (1957). Additional mandibular measurements are attampted as suggested by Kamali (1975-76). The measurements/indices are classified according to the source quoted. Stature estimation from almost intact long bone follows the method of Kamali (1975-76).

The dental elements are poorly preserved which exhibit either incomplete calcification or moderate to severe attrition. For permanent teeth, we followed the method of Hellman (1928).

Pathological interpretations are based on Brothwell (1981), Orthner and Putshar (1981), Tavassoli (1999), Goodman et al. (1984), Wells (1964), Moseley (1963), El-Najjar (1976), Rathbun (1980) and Zivanovic (1982). Diagnosis and interpretation of skeletal and dental pathologies are given at appropriate place in the last chapter.

3. Analysis

This section gives an elaborate bio-anthropological account of the human skeletal remains revealed from Tepe Foroudgah.

The burial is associated with single cultural phase, Bronze culture. The explanations of the burial with its archaeological placement as well as a note on the orientation of the skeleton have done within the burial pit. The relevant morphological observations and metric data are given under the head "description", for cranium, dentition and post-cranial elements, in the given order. Description of the X-Ray pathological lesions is given. Comment on the estimation of age at time of death is made. Gender could be determined for the specimen.

Burial Description: The burial was located in the eastern-north of the site, Loc. No.902, depth 115 cm., layer II (Sajjadi, 2014:313). The orientation of the skeleton was north-south, the head towards north, slightly turned towards west, and the legs towards south, while both legs turned towards east. The burial was devoid of any funerary goods. Condition of preservation is fairly good, except the clavicle, scapula, thorax, manus, pelvis and left foot were completely damaged. Some bones such as sacrum and lumbars were damaged during the excavation process.

Preservation and skeletal inventory: Osseous remains of this individual are fairly good preserved while some bones are ground and lost and exhibit of chemical interactions of soil and land. Detailed account of the preserved elements is given below.

Norma frontalis: Preservation of the frontal bone is excellent in general. The supra orbital margin is excellent. The nasal bones are lost post-mortem. Both malars are damaged. The upper jaw is damaged during the excavation process and incisors and canines in both upper and lower jaws are lost post-mortem.

Norma lateralis (Right): The temporal bone is damaged during the excavation process. The squamosal suture is almost closed. A small fragment of temporal across the coronal suture is there. The petrous portion is lost. The mastoid process of the temporal is complete and undamaged. The zygomatic process is damaged during the excavation process, but due to the loss of malar bones the zygomatic arch is incomplete. The occipital bone is complete except for a few cracks and damaged in the foramen magnum.

Norma lateralis (Left): The skull is almost damaged in this perspective especially for the temporal and zygomatic bones. The coronal suture is incomplete closed.

Norma verticalis: The region posterior to the coronal suture is slightly remained opened. The parietal bones are well preserved. The frontal bone and methopic suture is completely closed.

Norma occipitalis: Only damaged in this perspective is for the foramen magnum.

Norma basalaris: The palatine bones and process of maxilla are damaged. Post-mortem loss of dentition leaves the tooth sockets empty. The womer and the sphenoid are missing. The styloid process is missing, while the mastoid process in left side is damaged. Foramen magnum is damaged during the excavation process as mentioned above.

Mandible: The mandible is fairly complete and well preserved except the breakage of left coronoid process and right condyle. The teeth retained are 18, including 1 canine and 17 Molars and Pre-molars, while the number of crypts in both upper and lower jaws are 24.

The post-cranial skeleton is fairly good. The bones of the thoracic cage and 2/3 of vertebrae completely damaged during the excavation process. The pelvis is completely damaged during the excavation process except for some small pieces, slight amount of weathering is evident in illium and pubis. The pectoral girdle is missing except a small piece of left clavicle. The bones of the upper extremities are damaged except a small piece of humerus, means left diaphyseal, the broken bones of ulna and radius, radial head and the distal end of ulna from both sides. The manus are missing.

Both the heads femora are missing, while the other parts are well preserved. A patella remained in well preservation. Left tibia and both the fibula bones are fairly well preserved.

Tarsals, metatarsals and phalanges of the left lower are completely preserved.

Description of Cranial Bones: The skull, in general, is long-headed in appearance and still many processes are well developed. The face appearance narrow and orbits slightly large enough. The parietal tubera exhibits slight bossing. The coronal and sagittal suture are fairly opened. The temporal bones have fairly well developed mastoid processes. The occipital bone is oval in shape and occipital suture is well closed. Foramen magnum is of medium size and rather circle in shape. The palate is small and U shaped. The zygomatic arch is damaged in both sides.

The mandible is fairly fragile in appearance. The chain is pointed. The gonial angle is rather fine (narrow) (92°). The right side M3, C and Inc. (1and 2), and the left side only Inc. (1and 2) from upper jaw are lost post-mortem. From mandible, P1, C and Inc. (1and 2), from both side, are lost post-mortem.

Description of Dental Elements: Dentition is fairly well preserved. Eighteen out of thirty two of teeth are in maxilla and mandible of this individual. They include RM_2, RM_1, RP_2, RP_1, LM_3, LM_2, LM_1, LP_2, LP_1, LC in upper jaw, RM_3, RM_2, RM_1, RP_2, LM_3, LM_2, LM_1, LP_2 in lower jaw. The dentine was not damaged in any tooth. The wear pattern on molar teeth appears "normal". The crypts completely opened and exhibit post-mortem teeth.

Other pathology evident on the upper jaw and mandible is alveolar resorption, while no any decay is in retained teeth. The alveolar bone may reduce or resorb for a variety of different reasons including pyorrhea (inflamation of the gums). The odontometric data are presented in table 1.

Table 1. Dental crown dimensions and indices.

Tooth	Side	Crown Dimensions		Crown Indices		
		MD	BL	CA	CI	CM
Maxilla						
C	L	7.5	7.4	55.50	101.35	7.45
Pm_3	R	6.3	8.5	53.55	74.12	7.40
	L	6.4	8.4	53.77	76.19	7.40
Pm_2	R	5.3	8.5	45.05	62.35	6.90
	L	5.5	8.4	46.26	65.48	6.95
M_1	R	8-9	9.9	88.11	89.90	9.40
	L	9.0	9.9	89.10	90.91	9.45
M_2	R	8.9	9.6	85.44	92.71	9.25
	L	9.0	9.6	86.40	97.75	9.30
M_3	L	9.5	9.0	85.50	105.56	9.25
Mandible						
Pm_4	R	5.9	7.3	43.07	80.82	6.60
	L	5.9	7.4	43.66	79.73	6.65
M_1	R	10.5	9.8	102.90	107.14	10.15
	L	10.4	10.0	104.00	104.00	10.20
M_2	R	9.5	9.7	92.15	97.94	9.60
	L	9.5	9.9	94.05	95.96	9.70
M_3	L	9.5	9.1	86.45	104.40	9.30

Description of Post-Cranial Bones: In general, the post-cranial elements of this individual exhibit gracility. Only cervical vertebrae (7 pieces) are well preserved, while others are completely destroyed and exhibit weathering.

Humerus bones are rather robustly built with prominent deltoid tuberocity. Radius and ulna exhibit styloid processes of tuberocity. Radius and ulna exhibit styloid processes of moderate size.

The pelvis is disarticulated and damaged; however, it preserves the portions of siatic notch providing valuable clue for the sex determination. Symphisis pubis and pubis tubercle shape exhibit feminine features. The obturator foramen is trigonous in shape which logically related to female. Linea aspera on the femora and popliteal line on the tibia are moderately pronounced. The upper end of the left femur is porosity. The metric data on post-cranial elements preserved are presented in table 2.

Table 2. Vertebral measurements and osteometric data on Foroudgah Specimen.

Measurements/Index	Cervical				
	1	2	3	4	5*
Ventral vertical diameter of vertebral body (anterior heigth)	12	35	11	12	11
Dorsal vertical diameter of vertebral body (posterior heigth)	8	26	12	11	10
Middle vertical diameter of vertebral body (middle heigth)	__	__	9	9	9
Cranial sagittal diameter of vertebral body (anterior diam.)	6	10	11	14	14
Caudal sagittal diameter of vertebral body (posterior diam.)	4	14	14	17	15
Middle sagittal diameter of vertebral body	__	14	13	15	15
Cranial transverse diameter of vertebral body (anterior transverse diameter)	__	10	__	23	__
Caudal transverse diameter of vertebral body (posterior transverse diameter)	__	16	__	20	19
Middle transverse diameter of vertebral body	__	__	15	19	18
Sagittal diameter of vertebral foramen	24	18	15	13	13
Transverse diameter of vertebral foramen	28	22	21	24	22
Index					
Anterior-posterior vertebral body index	__	74.29	109.09	91.67	90.91
Sagittal vertical vertebral body index	__	__	69.23	60.00	64.29
Transverse vertical vertebral body index	__	__	73.33	63.16	61.11
Transverse sagittal vertebral body index	__	__	86.67	78.95	77.78
Transverse sagittal index of vertebral foramen	85.71	81.82	71.43	54.17	59.09
Radius	**Right**		**Left**		
Maximun length	___		228		
Physiological length	___		216		
Least girth of shaft	___		34		
Transverse diameter of shaft	___		13.5		
Sagittal diameter of shaft	___		10		
Caliber index, robusticity index	___		15.8		
Cross section index of shaft	___		74.1		
Radio-humeral index	___		77.3		
Ulna*					
Femur					
Maximum length	___		425		
Physiological length	___		(4.20)		
Maximum trochanter length, trochaner-condylar length	___		407		
Physiological trochanter length	___		400		
Diaphyseal length	___		345		
Sagittal diameter at mid-shaft	___		28		
Transverse diameter at mid-shaft	___		24		
Girth at mid-shaft	___		82		
Upper transverse diameter of shaft, transverse diameter at subtrochanterion	___		30		
Upper sagittal diameter of shaft, anterior-posterior diameter at subtrochanterion	__		22		
Least lower sagittal diameter of shaft	___		25		
Lower transverse diameter of shaft	___		29		
Vertical diameter of neck, breadth or depth of neck	___		23		
Girth of neck	___		21		
Collo-diaphyseal angle, neck-shaft angle	___		74		
Length-thickness index	___		128°		
Robusticity index	___		19.5		
Cross-section index of neck	___		91.3		
Tibia					
Total length of tibia, lateral condylar malleolar length	___		357		
Maximum length of tibia, spino-malleolar length	___		362		
Physiological length	___		340		
Maximum proximal epiphyseal breadth, upper breadth	___		66		
Maximum sagittal diameter of tibia at the level of tuberosity	_		41		
Maximum transverse diameter of tibia at the level of tub.	_		35		
Maximum anterio-posterior diameter at mid-shaft	___		28		
Transverse diameter at mid-shaft	___		18		
Maximum distal epiphyseal breadth, lower breadth	___		47		
Sagittal diameter of lower epiphysis	___		31		
Girth of shaft	___		81		
Minimum girth of shaft	___		74		

Length-thickness index	___	20.7
Tibio-femoral index	___	84.0
Fibula		
Maximum length of fibula	340	___
Maximum diameter in middle	12	___
Minimum diameter in middle	7	___
Girth in middle	32	___
Minimum girth of bone	28	___
Transverse diameter at mid-shaft	9	___
Sagittal diameter at mid-shaft	7	___
Upper epiphyseal breadth	20	___
Lower epiphyseal breadth	17	___
Cross-section index in middle	63.6	___
Caliber index	8.9	___
Cross-section index at mid-shaft	128.6	___
Tarsals		
Talus height	___	53
Talus breadth	___	(40)
Breadth-height index for talus	___	75.5
Calcaneus length	___	70
Cuneiform 1 length	___	35
Cuneiform 1 breadth	___	25
Breadth-length index for Cuneiform 1	___	71.4
Cuneiform 2 length	___	18
Cuneiform 2 breadth	___	15
Breadth-length index for Cuneiform 2	___	83.3
Cuneiform 3 length	___	(19)
Cuneiform 3 breadth	___	18
Breadth-length index for Cuneiform 3	___	94.7
Cuboid length	___	33
Cuboind breadth	___	26
Breadth –length index for Cuboid	___	78.8
Navicular length	___	36
Navicular breadth	___	24
Breadth-length index for Navicular	___	66-7
Metatarsals		
Length metatarsal 1	___	60
Length metatarsal 2	___	73
Length metatarsal 3	___	67
Length metatarsal 4	___	64
Length metatarsal 5	___	64
Phalanges		
First (proximal) row		
Phalanx 1 length	___	30
Phalanx 2 length	___	29
Phalanx 3 length	___	26
Phalanx 4 length	___	23
Phalanx 5 length	___	21
Second (middle) row		?
Phalanx 1 length	___	24
Phalanx 2 length	___	15
Phalanx 3 length	___	10
Phalanx 4 length	___	8
Phalanx 5 length	___	4
Third (distal) row		?
Phalanx 1 length	___	9
Phalanx 2 length	___	7
Phalanx 3 length	___	5
Phalanx 4 length	___	4
Phalanx 5 length	___	2

* Unestimable, only small pieces of ulna preserved and could not be measured.

Note: All measurements are recorded in millimeter. Estimates are bracketed.

4. Results

4.1 Age Determination

The neurocranial vault is filled with matrix as a result, so the state of suture closure cannot be observed endocranially. Coronal suture closure may be taken as half-way complete in the bregmatic region. The sagittal suture is almost closed in the obelica region. The data suggest as age of more than 30 years at time of death. The wear pattern of the dentition suggests as age over 35 years.

4.2 Sex Determination

The specimen exhibites a variety of female characteristics. On the basis of cranial features alone, the specimen may be classified as female. The vault is fairly robust with small mastoid and styloid processes. The mandible features, however, suggests a female. The prominent chin and fairly broad mandibular angle suggests female sex. The pelvis features suggests female sex when exposed: a widing sciatic notch, tringular shape of obtorator, the raised region of sacro-illiac articulation. It may be concluded that the specimen is of female sex.

4.3 Stature

Unestimable, although according Kamali (1975-76) who suggests the stature can be estimated by measuring physiological length multiple 4, the stature of the specimen is 161.00cm. (Table 3).

Table 3. Stature estimation for selected female ancient Iranian skeletal populations (range variation/ Martin-Saller 1957).

Site	Sample size	Stature (cm)
Hasanlu III-V	19	158
Dinkha Tepe II-III	10	154
Foroudgah II	1	161*

*Range variation-Kamali 1975-76.

4.4 Pathology

Awareness, acquisition of knowledge and description of dry bone pathological lesions in anthropological or palaeontological specimens date back to at least two hundred years. Pathological lesions are now been considered as responses of the individual (and, of the population, in general) to environmental factors like ecology, demography and nutrition. New techniques and methodologies now involve a host of young investigators researching into new areas of palaeopathology.

The main focus of research on population health is to illustrate a balance between past populations, disease parasites and environmental stressors. The science of pathology studies the effects of diseases and various other afflictions. Palaeopathology focuses on surviving features of the archaeological remains: dry bones, mummies, and even corprolites. Shortage of food and starvations, disease, occupational trauma and congenital / genetic anomalies often leads to marks on teeth and bones. When preserved in the prehistoric archaeological record, these specimens provide crucial evidence for the reconstruction of ancient life styles. They provide insights into the subsistence practice, environmental stressors, general health of the population, sexual division of labour, and knowledge of medical treatment and techniques. It may be noted that many diseases or epidemics leave no evidence on the dry bone. Nevertheless close scrutiny of observable pathologies and their analysis in relation to other archaeological evidence often provide clue of major trauma undergone by the population. In other words, palaeopathological data when carefully analyzed, yield insights into the bio-cultural responses of individuals and populations to their environment (Tavassoli, 1999:102-103; Walimbe and Gambhir, 1994).

4.4.1 Infection/Episodic stress (specific/non-specific) diseases:

4.4.1.1 Cribra Orbitalia

Porotic hyperostosis (lesions of the frontal, parietal, and occipital bones of the cranium) and cribra orbitalia (lesions on the superior border of the orbits) are manifested as a widening of the spongy diploe with a corresponding thinning of the outer dense cortical bone resulting in the appearance of surface porosity (Goodman et al., 1984).

In cribra orbitalia, tiny pits develop in the roof of the eye-socket. It is most frequent in children's skulls and has been thought to be the result of an unidentified deficiency disease. Another theory attributes it to a generalized infection of the eye leading to blindness (Wells, 1964). The pathology is also related to thalassemia, hereditary anemias and sickle - cell anemia, and iron deficiency anemia (Moseley, 1963). The alternation in skeletal tissue from these anemias are caused by the increase in red blood cell production which takes place in the marrow cavities of long bones and the diploe of flat bones. Because the cranial bones are so thin, they are often affected. As the diploe expands, the outer layer of bone becomes very thin and the inner trabecular bone is exposed. The thickened and porous bone has a sieve-like appearance (Goodman et al., 1984).

Among the various other etiologies cited, the most important is iron deficiency, acting synergestically with infectious and parasitic diseases (Hegen, 1971, Quoted Goodman et al., 1984). El-Najjar (1976) has stated that porotic hyperostosis (cribra orbitalia) is a non- specific pathology that reflects an anemic condition. However, high frequencies of infectious diseases, a diet low in iron or one that inhibits iron absorption, and cultural factors such as weanling, all increase the potential of this lesion (Goodman at al., 1984). It is thus a valuable marker for indicating nutritional stress in skeletal populations.

Few sites in Iran have yield skeletal remains with this lesion during Chalcolithic. Rathbun (1980) writes that the Chalcolithic site, Seh Gabi, shows a 28% rate of orbital lesions. In the metal age groups of the Iranian Plateau and the Mesopotamian Valley, an average of 23% of the individuals exhibit orbital lesions (Rathbun, 1980).

Comparating with those sites, Tepe Foroudgah individual shows a rather severe cribra orbitalia (Fig.3). The iron deficiency in daily diet has caused porotic upper part of the eyes of the Foroudgah individual. This lesion also affected the diploe.

Figure 3. Cribra orbitalia. (Photo by M.Gravand)

4.4.1.2 Osteoporosis

Skeletal materials from archaeological sites have often exhibited signs of a disease known as osteoporosis. Such bones are relatively lighter and very fragile and have noticeably larger cavities in their spongy tissue (Zivanovic, 1982). This lesion represents a condition of significantly diminished bone mass due to long - standing imbalance between bone resorption and bone formation. With increasing age, bone formation lags more and more behind bone resorption thus diminishing the entire bone mass. This leads imperceptibly into osteoporosis. It usually does not manifest itself before the fifth decade and is more frequent and more serve in the female than in the male (Ortner and Putschar, 1981). Sometimes the cause of this lesion may be due to some disorder of the metabolism created by a lack of vitamin C (scurvy), or some disorder of the endocrine glands (Zivanovic, 1982). This lesion does not affect the entire skeleton evenly. The bones of thrunk, long bones and skull are more liable to the disease (Ortner and Putschar, 1981).

An example of this lesion is found among the Iranian skeletel populations at Seh Gabi. The postnatal infants at Seh Gabi and 3 % of the metal age samples also show such lesions (Rathbun, 1984).

The Foroudgah individual has shown more osteoporosis in long bones as it is seen in other Iranian skeletal populations from different sites from pre-Neolithic to Metal Ages.

4.4.2 Degenerative Conditions

4.4.2.1 Osteoarthritic Changes

Degenerative arthritis is the most common type of all articular diseases. As the term "degenerative" indicates, it is not an inflammatory disease but develops on the basis of aging changes and degeneration of articular cartilage as an effect of physiological wear and tear. There is no sharp border line between aging phenomena and incipient degenerative arthritis. The condition is slowly progressive, and demonstrable bone changes are preceded by many years of alterations of the articular cartilage alone. Thus, degenerative arthritis becomes in part, the end-stage of various inflammatory, traumatic, metabolic, and congenital or acquired joint diseases, provided that joint function continuous under altered conditions for a long time (Ortner and Putschar, 1981).

The joint most often involved is the knee. In the knee joint, the articular changes begin in the patellar cartilage followed by lesions on the patellar facet of the femur, on the tibial condyles, on the anterior portion of the medial condyle and, lastly, on the anterior portion of the lateral condyle and posterior condylar portions of the femur. This pattern follows the locations of maximal pressure and friction, stressing the mechanical factors in the causation of degenerative arthritis. Significant bone changes usually develope many years after the initiation of degenerative and proliferative cartilage changes. These begin at the margin of the articular cartilage and manifest themselves as marginal lipping and exostoses. Severe and irregular marginal lipping definitely represents a manifestation of the degenerative joint disease.

It may be noted that the arthritic lesions occur in increasing frequency in pre-agriculture societies, relatively less common in agricultural populations. Since this pathology is attributed to physical stress (and to age), the trend of decreasing frequency can be related to changes in economic activities associated with settled life (Cohen and

Armelagos, 1984).

An example to this lesion is noticed in the preagricultural Hotu sample. All the indviduals (3 specimen) collected from Hotu reflect stress, especially of the lower back and hands (Angel, 1952). At the Neolithic Hajji Firuz, this lesion is the most common pathology present and afflicts 63% of the adults. For the Chalcolithic sites no degenerative joint disease has been reported so far, but in the metal age samples (Hasanlu), the lesion appears to be common where all adults over 25 years old exhibit degenerative joint diseases (Rathbun, 1984).

It should be remember that the average age at death for all of these samples was low.

The Bronze Age sample of Foroudgah exhibits this lesion as Rathbun (1984) has reported for Hasanlu samples (Table 4).

Table 4. Rathbun studies on ancient Iranian human skeletal remains (modified from Tavassoli 1999).

Site	Dates B.C.	Individuals	Demo-graphy	Pathology	Cranio-metry	Post-cranial	Height	Dentition	Source
Chalcolithic & Bronze Age									
Hasanlu VII-IX	5000-3000	7	Yes	Yes	Yes	Yes	Yes	Yes	Rathbun 1972
Dinkha Tepe IV	1900-1600	13	Yes	Yes	Yes	Yes	Yes	Yes	Rathbun 1983
Dinkha Tepe II-III	1350-800	24	Yes	Yes	Yes	Yes	Yes	Yes	Rathbun 1983
Hasanlu III-V	1350-800	141	Yes	Yes	Yes	Yes	Yes	Yes	Rathbun 1972

Note: Dates given in this table are for the layes from where human skeletal evidence is recovered.

5. Discussion and Conclusion

The Bronze Age culture site of Foroudgah provides a weak evidence of ceremonial human burial. Osseous remains did not survive in good condition for detailed laboratory analysis. The archaeological evidence of one human burial has been recovered from the site. This burial pit contains of osseous remains of human skeletal, but it preserved in bad condition.

The present study is an attempt to understand the bio-anthropological characteristics of this human skeletal antiquity.

The description of the biological characteristics has to be based on a very small sample size; one individual. Therefore, cranial and mandibular metric data of this individual is compared with three selected prehistoric female skeletal collections of Western part of Iran (Table 5). Comparative homogeneity occurs in cranial and facial features of Bronze Age populations in West Iran, the most obvious reason being the close geographical, temporal and cultural proximity among these sites, as Rathbun states in his works. The crania are long with weak musculature and gracile appearance. Slope forehead, with faintly developed glabello-superciliary region, medium to low upper fascial height, moderate cheek bones, and alveolar prognathism, are important facial features. These characteristics conform to the phenotype which is conventionally called as a branch of Mediterranean class.

Table 5. Comparative craniometric data for selected some Iranian Chacolithic and Bronze Age female populations.

Measurements	Hasanlu V	Hasanlu IV	Hasanlu III	Tepe Foroudgah III
Sample size	(5)	(18)	(3)	(1)
MCL (1)	185.55	181.42	180.67	189.00
MCB (8)	135.50	134.18	137.00	132.00
MFB (9)	95.00	93.64	93.00	104.00
BBH (17)	_	129.16	125.60	129.00
FAr (26)	122.00	126.89	126.00	122.25
PAr (27)	_	127.75	127.00	128.00
OAr (28)	_	115.00	_	116.00
LAr (25)	_	368.83	_	(356.00)
BZB (45)	_	118.92	120.00	_
UFH (48)	67.33	67.75	65.50	64.05
NB (54)	27.25	24.06	26.00	_
NH (55)	47.67	50.56	47.00	_
BGB (66)	125.00	93.52	84.80	84.13
CI (I 1)	74.45	74.12	74.10	68.25
VI (I 2)	_	71.38	68.77	68.20
SM (137)	_	147.11	147.22	127.43
TVI (13)	_	98.58	94.38	102.32
TFI (138)	_	95.38	93.33	(100.00)
UFI (139)	_	56.99	52.92	67.04
OI (I 42)	74.77	83.40	79.60	_
NI (I 48)	56.00	47.71	55.44	_
TCI (I 71)	67.91	69.83	74.38	86.48

The dental data is too insufficient to draw any meaningful conclusions. The form of teeth size in this individual is interpreted as a biological adaptation to rather coarse dietary items, basic food preparation methods and a mixed economy that included pastoralism and less agriculture. The Zagross Mountains were full of wild oak trees, much thicker than today, and people consume oak fruits by making bread from the oak flour. This diet was rich in fiber.

In early farming, the relationship of population density and disease is noted at several Zagross sites, as Rathbun reported for Hasanlu and Dinkh Tepe. The skeletal elements preserved over years have the potential to provide primary evidence of nutritional stress. The Bronze Age site of Foroudgah provides some evidences to pathological data in support of this theory (Table 6).

Table 6. Common pathologies observed in Iranian skeletal remains (modified from Tavassoli 1999).

Diseases	chalcolithic and Bronze Age	
	Site	Percent
Harris lines	Dinkha Tepe/Hasanlu	92%
Hypoplasia	Dinkha Tepe/Hasanlu	14%
Preiodontal diseases	Dinkha Tepe/Hasanlu	37%
Attrition	Hasanlu	Medium-marked
Cribra orbitalia	Dinkha Tepe/Hasanlu	23%
Osteoporosis	Dinkha Tepe/Hasanlu	3%
Infections	Dinkha Tepe/Hasanlu	3%
Truma/Fracture	Dinkha Tepe/Hasanlu	15%
Osteoarthritic changes	Dinkha Tepe/Hasanlu	35%
Spondylitis	——	
Bone Inflamation	Hasanlu	?
Metabolic diseases	Hasanlu	?

Though the pathological characteristics and physiological stresses have observed in Foroudgah, it is difficult to give an accurate answer as the size of the sample is limited to one individual only.

Robousticity observed in this female specimen is related to her life style as farming and pastoral activities. Overall, the reduced body size may be due to less demanding life style in comparison to hunting and gathering populations. The shift in economy and associated life-style resulted in reduction in functional demand placed on the post cranial skeleton.

Age factor at the time of death stands as the most important indicator of stress. The Foroudgah specimen shows infectious diseases. Many of the chronic infectious diseases produce morphologically overlapping responses in skeletal tissue making specific infectious diseases in prehistoric skeletal remains are of non-specific nature. The lesions are caused by various kinds of micro-organisms, but their exact etiology remains unknown, since the pathological characteristics necessary to make specific diagnosis are not available.

According to X-Ray from skeletal remained elements, three kinds of pathologies have been observed on the Foroudgah skeletal remains. Iron deficiency is symptom of poor diet. Osteoporosis reactions are of the major pathologies observed in this specimen. It is interesting to note that this lesion is more frequent and more serves in the female than in the male. The other reason is due to some disorder of the metabolism created by a lack of vitamin C, or may be due to some disorder of the endocrine glands. In Rathbun reports, this lesion affected 3% of both Hasanlu and Dinkha Tepe Bronze Age populations (see table 6). The third one is osteoarthritic changes. This lesion is frequent observed on skeletal remains from West Iranian Bronze Age sites especially Hasanlu and Dinkha Tepe as reported Rathbun (see tables 4 and 6). Table 6, shows 35% of individuals were affected this lesion. It observed on Foroudgah sample. As it is mentioned here before, it is due to stressing the mechanical factors in the causation of degenerative arthritis.

Dental health of the specimen is completely good. Therefore, no observation has seen in lesion. It is due to adequate fluoride and sodium in drinking water (in nature), which is available in region's water sources at present.

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