Patterns of Degenerative Joint Disease Among Males and Females at Windover (8BR246) and Their Relationship to Grave Goods

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Introduction

In 1982, during the construction of a housing project in east central Florida, a backhoe operator removing earth from the rim of a pond noticed a pale object in the spoil heap. That object was the first of 168 well-preserved individuals that were later excavated over three field seasons from the site now known as Windover (8BR246), an Archaic mortuary pond used for the interment of the dead. Dated to over 7,000 BP (Doran and Dickel 1988), the remains from Windover have afforded genetic, isotopic, paleobotanical, mortuary, and bioarchaeological analyses that have shed light on life and health during Florida's Archaic period (Doran et al. 1986; Smith et al. 2002; Wentz et al. 2006; Tuross et al. 1994; Dickel 2002; Wentz 2006). The exceptional preservation also provided for a large assortment of grave goods, one of the largest and most ancient assemblages of textiles in North America (Andrews et al. 2002), and preserved human brain matter from 91 crania.

In 2006, a doctoral dissertation completed by the author applied the Western Hemisphere Health Index (Steckel and Rose 2002) to the Windover population to assess levels of pathology in a hunter/gatherer population. During the course of that research, data on occurrences of degenerative joint disease (DJD) revealed variation in patterns of involvement between adult males and females. An earlier analysis of mortuary patterns based on grave goods (Hamlin 2001) assessed the role of gender and task division among the Windover population. The patterns of DJD were then compared and contrasted with task division based on mortuary analysis in order to interpret behavior within this ancient population.

Materials and Methods

The role of gender among hunter/gatherer populations has been the subject of numerous anthropological studies (Grauer and Stuart-Macadam 1998; Arnold and Wicker 2001; Rosenberg 1980; Larsen 1997). Task division, differential access to resources, and variation in levels of pathology/biological stress can provide information about social structure of early Native American populations. The corroboration of skeletal and material culture analyses can further enhance this information.

In 2001, Arnold and Wicker edited *Gender and the Archaeology of Death*, exploring gender issues through archaeological analyses. Hamlin's chapter, entitled *Sharing the Load: Gender and Task Division at the Windover Site* (p. 119-135) examined the role of gender among the people from Windover based on grave good type and distribution. The grave goods, which included lithics, bone and antler tools, ornamental shell, and atlatl components (Figure 1) were divided into five functional categories based on the work of Penders (1997). The categories include domestic, fabricating and processing, hunting-related/weaponry, ornamental, and unmodified material. Hamlin attempted to identify gender roles based on the type of artifacts found with each sex. She examined 145 individuals (the sample included subadults). Of the adults, 23 females had associated grave goods, 17 did not. Of the males, 29 had associated grave goods, 17 did not. There were 30 "sex unknown" individuals with grave goods and 29 without (these groups primarily comprised subadults). A breakdown in the type and number of grave goods associated with the adults is provided in Table 1.

Hamlin found a nonrandom distribution of artifacts based on sex. Among the burials of adult males, grave goods consisted primarily of fabricating and processing and hunting-related/weaponry items. These included lithic projectile points, atlatl components, antler perforators/punches, awls and drills. Found in association with adult females were bone tubes, turtle-shell containers, shark-tooth scrapers, shell necklaces, and a textile bag/container. Antler projectile points were associated with burials of both sexes. She concluded that males appear to have been primarily responsible for hunting larger game, the processing of faunal materials for the fabrication of tools, as well as the procurement of non-vegetative foodstuffs; females probably also hunted but on a smaller scale. Males also appear to be responsible for the manufacturing of fishing nets, based on the presence of hollow-point awls. It appears women may have been responsible for hunting small game, fishing, gathering, and preparing foodstuffs. Based on the containers associated with females, they may also have been responsible for the preparation of medicines, since there were over 31 potential food or medicinal plants recovered through archaeobotanical analysis at Windover (Tuross et al. 1994). Tools associated with the production of textiles were found with both sexes. Thus, it appears the manufacture of textiles was a non-gendered task, although the type of textile produced may have differed by sex (Hamlin 2001:132).

Hamlin concluded that the Windover population lacked rigidly defined divisions of labor and that tasks were probably

Figure 1. Examples of artifacts recovered from the Windover site. (Photo courtesy of G.H. Doran).

Table 1. Grave good type and distribution by sex (Hamlin 2001:131).

Females (type/number of artifacts)	Males (type/number of artifacts)
barbed antler projectile point (2)	antler perforator/punch (2)
bird-bone tube (4)	atlatl components (10)
butchered faunal bone (unk quantity)	bone needle (1)
Opurtia (prickly pear) pad (1)	deer ulna gouge/burnishing tool (2)
shark-tooth graver/scraper (1)	hollow-point awl (6)
shell necklace (2)	lithic projectile point (2)
textile bag/container (1)	mammal canine graver/burnisher (3)
turtle-shell container (4)	miscellaneous modified antler (1)
	shark-tooth drill (2)

often shared, as opposed to being gender-specific. Although there were male-only and female-only items, the artifact assemblage appears to suggest that the tasks were not gender-coded but that the items used to complete such tasks may have been, what Hamlin labels gender ideology rather than gender roles (Hamlin 2001:133). Based on mortuary analysis, the males and females at Windover were performing many of the same tasks. This "sharing the load" implies equal distribution of type and amount of work load, which should be reflected in similar patterns of degenerative joint disease on the body.

Degenerative joint disease is a condition that commonly results from mechanical wear and tear on the joints of the skeleton due to physical activity (Hough and Sokoloff 1993). It produces bony deposits around the periphery of joint surfaces in the form of osteophytes and may lead to complete loss of mobility of the joint in severe cases where bony fusion of the joint takes place. The rate and severity of skeletal lesions associated with degenerative joint disease have been tracked through time in an attempt to compare mechanical stress loads on the skeleton in relation to varying subsistence practices (Larsen and Ruff 1991; Bridges 1991; Cohen 1989; Larsen et al. 1992). More physically demanding lifestyles typically result in greater incidences and levels of severity of degenerative bony changes. However, average life span can affect rates of degenerative joint disease within skeletal populations since the older the individual, the greater likelihood that he or she will display these bony changes over time.

The Western Hemisphere Health Index (Steckel and Rose 2002) was developed to evaluate health over broad geographic areas and temporal periods. The project was organized in the late 1980s and brought together physical anthropologists, demographers, and economic and medical historians for a multidisciplinary approach to evaluating the history of health in the Western Hemisphere using data from human skeletal remains from archaeological contexts. Over 12,000 skeletons from archaeological sites in North, Central, and South America make up the data set. The remains consist primarily of Native Americans but also include Euro- and African – Americans from sites spanning the last 7,000 years of human history in the Western Hemisphere.

The health index utilizes two components: length and quality of life. Because estimating length of life from skeletal populations can be problematic, quality of life is emphasized and gauged based on the assessment of seven skeletal indicators of health. These include infection/periosteal reaction, trauma, linear enamel hypoplasia, cribra orbitalia, stature and robusticity, dental health, and degenerative joint disease. Individuals are scored for each category, with scores ranging from zero to 100 based on presence, absence or degree of pathology. For example, an individual with no signs of trauma would receive a score of 100 for that category (see Steckel and Rose 2002, for complete scoring protocol). For the purpose of the present research, only adult individuals reliably sexed were included: 35 females and 43 males. Co-mingled and juvenile remains were excluded. The age distribution is provided in Figure 2.

Degenerative joint disease among the Windover population was assessed using protocol set forth in the Western Hemisphere Health Index. There are eight fields of analysis for DJD; the most severely affected joint/element from each field is recorded and given a numerical value between zero and five (scoring values differ depending on joint/element

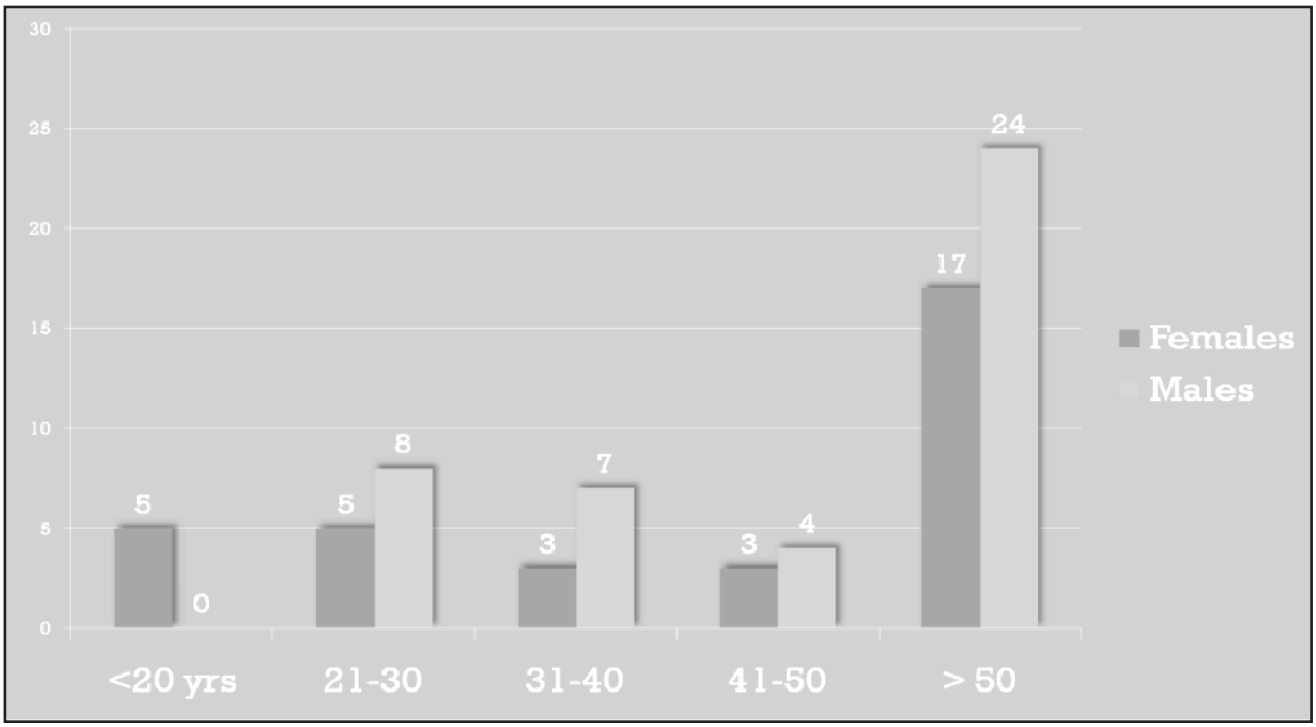

Figure 2. Age distribution of Windover study population.

being scored). The areas surveyed include shoulder/elbow, hip/knee, vertebrae (cervical, thoracic, and lumbar each scored separately), temporomandibular joint, wrist, and hand. For example, shoulder and elbow scoring values are provided below:

Shoulder and Elbow

0 = Joints not available for observation
1 = Joints show no sign of degenerative disease
2 = Initial osteophyte or deterioration of the joint surfaces
3 = Major osteophyte formation and/or destruction of the joint surface, such as eburnation
4 =Immobilization of the joint due only to degenerative disease
5 = Systemic degenerative disease (e.g. rheumatoid arthritis)

Scoring criteria for the hip/knee follow the same numerical values. Scoring criteria for the vertebrae require the presence of four or more thoracic and two or more cervical and lumbar for each category to be assessed. Scoring for the temporomandibular joint, wrist and hand are scored as not observable (0), no degenerative joint disease (1), or degenerative joint disease present (2). Only two individuals had DJD of the wrist and one of these individuals also had involvement of the hand (both females aged 51 and 64 years of age). Table 2 shows the number of observations per category.

Table 2. Number of observations per element/joint scored.

	Females (n=32)	Males (n= 43)
Shoulder/Elbow	**30**	**41**
Hip/knee	**26**	**40**
Cervical	**23**	**35**
Thoracic	**20**	**29**
Lumbar	**18**	**22**

Results

Rates of degenerative joint disease among Windover males and females were low compared to the rest of the populations within the WHHI database (Windover males 85.5, females 90.3; total dataset mean score of 79.00; total dataset median score of 79.85), as reflected in higher scores among Windover adults compared to scores for other populations within the dataset. Males had a slightly lower score than females, which could be indicative of greater activity levels, as reflected in trauma scores as well (males trauma scores were 69.7 versus 73.8 for females). The percentage of individuals affected with DJD is provided below in Figure 3.

The highest percentage of females had DJD of the shoulder/elbow joints (40%). The highest percentage of males had involvement of the lumbar vertebrae (44%). The second most frequent area of involvement was cervical vertebrae for females and thoracic vertebrae for males. The lack of DJD affecting the wrists and hands among females was surprising considering the elevated rates involving shoulders/elbows, although females did have higher rates of traumatic injury to the hands compared to males (15% of females versus 6% in males). Men had much higher rates of DJD of the hip/knee than females. Males had a greater number of cases of major osteophyte formation, with 11 males versus 6 females exhibiting significant levels of DJD on one or more joint/element.

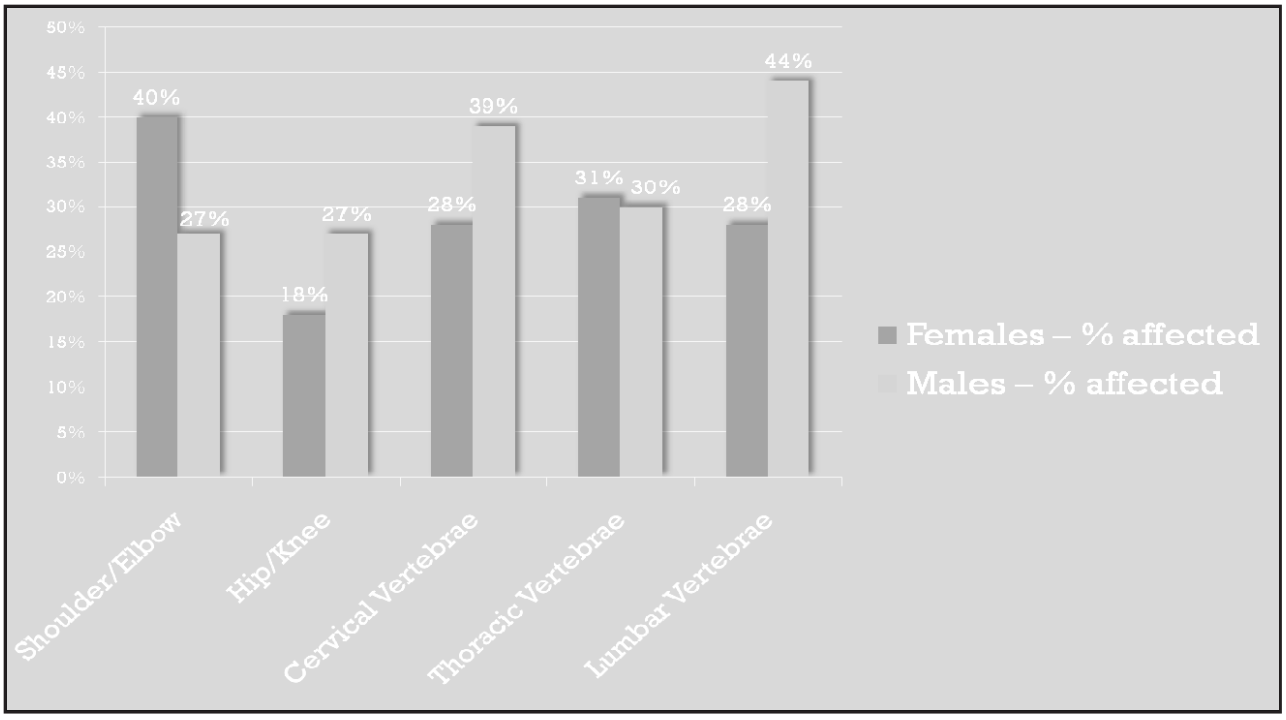

Figure 3. Percentage of males and females with degenerative joint disease.

Discussion

The higher rates of DJD affecting shoulders and elbows among the females could be related to the repeated stress associated with food processing. The processing of palm fibers for textiles could also have contributed to the elevated rates of involvement of the shoulders/elbows among females, since this involves working the palm leaves (through rubbing or rolling) in order to break down the fibers. The higher rates of lumbar involvement among males could be caused from carrying heavy loads, for instance during hunting of larger game (deer) or the seasonal relocation of settlements (seasonality of site based on archaeobotanical analyses [Tuross et al., 1994]). It could also be caused by the repetitive motions of processing hides, as reflected in the recovery of fabricating/processing tools with males.

Although canoes have not been found in association with the people from Windover, they have been recovered from sites dating to 5,120 BP in Florida (Newsom and Purdy 1990). The use of canoes to traverse central Florida's extensive waterways may have been a factor in degenerative joint disease among this population, if canoes were present during the Archaic period. Lai and Lovell (1992) found increased rates of vertebral osteophytosis and osteoarthritis as well as osteoarthritis of the shoulder and elbow joints associated with carrying, lifting, and paddling of canoes among Canadian fur traders. It is possible that transportation via canoes (with males responsible for carrying the canoes and females charged with paddling) accounts for the higher rates of vertebral involvement in males and higher rates of shoulder/elbow joints in females.

Conclusions

The purpose of this research was to bring together two forms of analyses in order to gain a clearer understanding of life among Florida's Archaic peoples. The analysis of grave goods revealed a population in which everyday tasks were shared among males and females, with all members working together to insure group survival. Males hunted larger game, fabricated tools and fishing nets, and procured non-vegetative food stuffs. Females hunted small game, gathered and prepared foodstuffs, and possibly prepared medicines. Both sexes were associated with the production of textiles.

Although these tasks were shared and all members played important roles (based on grave good analyses), patterns of degenerative joint disease reveal variation in types and levels of activities. Males had higher rates of DJD of the lumbar vertebrae; females had higher rates of the shoulder/elbow. Males also had higher rates of DJD of the hip/knee than females. Males had higher numbers of joints/elements exhibiting major osteophyte formation. Although there were a larger number of males in the >50 age category (24 versus 17 females), the number of observations in each of the most involved categories (lumbar vertebrae for males; shoulder/elbows for females) were comparable (see Table 2). In fact, there were a smaller number of observations in the shoulder/elbow category among the females than there were among males (30 versus 41), yet females still had a greater number of individuals exhibiting DJD within this category.

By comparing the analysis of grave goods to patterns of degenerative joint disease among the adults from Windover, we have observed how different lines of analysis produce variations in our interpretation of culture. Although the people of Windover were probably working together to accomplish everyday tasks, their skeletal remains exhibit variation in the levels and patterns of wear and tear. Whether this was due to males and females performing tasks that were not apparent in the distribution of grave goods or they were performing similar tasks but to varying degrees are unknown. What we do know is that the activities performed in life among this hunter/gatherer population affected the sexes in different ways. They may have been "sharing the load", but that load was distributed in differing ways between the sexes.

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