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Comparison of Attrition, Abscessing and Antemortem Tooth Loss between the Mimbres and the Fort Ancient Period Populations

by

Jenna Horvat

A Senior Project in Partial Fulfillment of the Requirements of the Honors Program

ST. CATHERINE UNIVERSITY

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Introduction

Purpose

This project seeks to look at the differences in diet between the Mimbres and the Fort Ancient Period by examining the characteristics of dental wear (attrition), antemortem tooth loss and abscessing. This will be done through the analysis of existing remains at Hamline University and the collecting of data from literary sources on the Fort Ancient Period population with an emphasis on the Hardin Village site.

The intention of this project is to compare the frequency and degree of attrition or dental wear, abscessing and antemortem tooth loss in both the Mimbres and the Fort Ancient Period population samples in order to provide information about their lifestyles and health. Examination of wear patterns, abscessing and antemortem tooth loss can show us how teeth were routinely used and what types of foods were being consumed. Both populations practiced intensive agriculture which consisted of the crops corn, beans, and squash. These crops, known as the Three Sisters, can cause extensive wear and abscessing to the teeth because of the high amount of carbohydrates that these foods possess and the coarse texture of the foods themselves. Not only does this tell us about the dietary practices of these two cultures, but it will help to create more of an understanding of the complexity of the lives these people led and it can give us a window into the health of each society. The methodology included collecting data directly from the Mimbres by observing the dental arcade for the presence and absence of teeth, the degree of dental wear, and the amount of abscessing. Sex and age were estimated in order to give a demographic profile for comparison, to provide a more complete representation of the population samples, and to aid in looking at patterns of sex, age and dental pathologies within
each sample. Data from the Mimbres sample population will then be compared to the data that has been already collected from the Fort Ancient period population through previous research. Given that both populations are primarily agriculturist, the Mimbres and the Fort Ancient Period population samples should have a similar rate of attrition, antemortem tooth loss and abscessing because they ate comparable types of food that would lead to these traits being expressed. The sample of 31 Mimbres individuals and 296 individuals of the Fort Ancient Period population both show a similar rate of antemortem tooth loss. Attrition varies slightly between the two groups, but abscessing rates are vastly different. This suggests that the two populations could have been using their teeth differently and further analysis needs to be done to determine why.

**Sample Populations**

The Mimbres people were a Native American culture that made up one component of the larger Mogollon culture. The Mogollon culture is an American Indian culture that resided in the Southwest region of the United States from 150 to about 450 AD. The Mimbres inhabited the area of what is now southwestern New Mexico, specifically in the Mimbres Valley, Cliff Area on the Gila River, and the east slope of the Black Range. They lived between 200 AD until about 1130 AD. The Mimbres culture is divided into three phases: early Pithouse phase (200 AD-550 AD), Late Pithouse period (550 AD- 1000 AD), and the Classic Period (1000 AD-1130 AD). The styles of pottery are the main way in which the periods are differentiated. The Mimbres sample that is the focus of this research came from the later Classic and Late Pithouse periods. Around 1150 AD, the Mimbres began to disappear from the area and integrate into the other cultures surrounding them. This depopulation may have been due to food shortages or environmental stress. The Mimbres remains that are now at Hamline University were excavated by a University of Minnesota archaeologist, Albert Jenkes, in 1928. (Department of the Interior
He brought back pottery, which is now at the Weisman Art Museum. The human remains were transferred to the Indian Affairs Bureau in 1987 and have been housed at Hamline University since then. (Department of the Interior 2002) There were 31 individuals that data was collected on, but this was not the full collection. The sample in this study is likely about half of the collection that is available at Hamline University.

There is not a lot that is known about the Mimbres culture other than what was gleaned from their pottery and some information from various excavations. From the late 20’s and into the 90’s, there were many amateur archaeologists as well as pot hunters that began excavating and looting Mimbres sites and because of this much of the context of the burials and the site itself was lost. This is why the Mimbres are most known for their pottery. We do know that the Mimbres were mainly agriculturist, but also hunted small and large game. We can also garner information from the geographical area that the Mimbres lived in. The general landscape the Mimbres lived in was comprised mainly a mix of desert, grasslands, various scrub brush lands, dune fields, shallow lake beds and river basins. (DesertUSA 2012) In knowing this information, we can analyze the types of animal and plant life that would have resided here and what this would have meant for the Mimbres diet. For instance, due to the desert type conditions of Southwest New Mexico it was a part of their diet to add in small and large game in the area because the desert conditions made it harder for intensive agriculture. Part of their agricultural practices was to use irrigation systems. (Ancestral Art 2003) Irrigation would have been required to make sure the crops that were being grown could get adequate water.

The people of the Fort Ancient period lived mainly in Southern Ohio and Eastern Kentucky. The development of the Fort Ancient period culture took place over a number of years, but by 950 AD the culture of the Fort Ancient period had emerged. They lived roughly
between 1000 and after 1650 AD. After 1650 AD many of the villages were abandoned and the people migrated from the area because of the pressures that the Iroquois tribes placed on them. There is some speculation on where the Fort Ancient period originates from. Some archaeologists say that it arose out of the Woodland period, while others say that it is Mississippian or a completely unique culture all together. The Fort Ancient peoples are known for being agriculturalists like the Mimbres, but they made a more gradual transition to the lifestyle of horticulture and sedentism. Because of their agriculturalist lifestyle, they lived in permanent villages and supplemented their diet with wild fruits and berries and also large and small game such as elk, deer, bear and wild turkey. Fish and mussels were acquired from the rivers in the area and the mussel shells were often used as tools such as spoons and also as ornaments. Archaeological evidence found at the specific site that is a comparison to the Mimbres reflects the Fort Ancient period culture by the amount of deer and elk remains found as well as mussels and other smaller mammals and birds. (Cassidy 1984:308)

The specific site that this paper will be focusing on in the Fort Ancient period is the Hardin Village Site. This site is in Greenup County, Kentucky and was in existence from 1550 to 1675 AD. This population will be used to compare to the data that was collected on the Mimbres. The main source of the data for the Hardin Village sites is external and is found in Claire Cassidy’s article (1984) in *Paleopathology at the Origins of Agriculture*. At this particular site, there is a sample size of 296 individuals.
Population Demographics

The population demographics were easier to attain for the Mimbres because there was direct access to the collection. The age distribution falls mainly in the middle adult category (35-50 years) for the Mimbres population that was sampled. This could be from the aging techniques that were used. There were a fairly equal amount of children (3-12 years), adolescents (12-20 years) and young adults (20-35 years), but there was only one individual that is in the fetal category (birth-2 years) and there are no individuals in the older adult category (50+ years). This makes sense because, for the Mimbres, there would be a life expectancy of around 50 years of age. Age was determined skeletally. Biological or skeletal age is determined by physical factors whereas chronological or social age is determined by the culture. This differs from culture to culture, but skeletal age is determined by the specific techniques that are used to analyze the skeleton.

The sex distribution of the Mimbres is also equal from the 31 individuals that were studied. There were two individuals where sex could not be determined and this was likely because there were no reliable elements for sex estimation present. The traits for age and sex estimation will be discussed later in this paper.

The article by Claire Cassidy (1984) had limited data about the population demographics. She made statements in her article that can give us some idea of what kinds of age and sex ratios she was seeing. She states that around 1/5 of children died between the ages of 2-4. (Cassidy 1984) This coupled with other information that Cassidy compiled showed that many children and infants died in the weaning years and this was likely due to various nutritional deficiencies in their diet. Cassidy also states that only 1 percent of the population lived past 50 and these 3
individuals were all women. (Cassidy 1984:329) This exhibits the fact that females had a higher life expectancy than males based on dental health, but were more prone to caries or cavities. The age and sex ratios are not explained enough in depth to be able to compare to those of the Mimbres.

**Agriculturalist vs. Hunter Gatherers**

Another aspect that is important to understanding this project is the difference between hunter gatherers and agriculturalists. Hunter gatherers are more nomadic and their diet consists of small and large game animals as well as wild nuts and berries that are gathered from the surrounding environment. Agriculturalists, on the other hand, are sedentary because they need to remain in one place to grow and tend to their crops. Their diet consists mainly of corn, beans and squash and is supplemented by large and small game. For the purpose of this study, we will focus on agriculturalist practices because both the Mimbres and the Fort Ancient period population are believed to be agriculturalists.

**Dental Characteristics**

**Attrition**

Attrition is dental wear that is caused by tooth-on-tooth contact on the occlusal or bite surface of your teeth. (Hillson 1996) “The process of tooth wear is well understood: it commences with loss of occlusal enamel, followed by deposition of secondary dentin serving as a protective zone overlying the pulp chamber.” (Larsen 1997:248) Most of the Mimbres exhibit moderate to severe tooth wear. Attrition is seen mainly on the premolars and molars, but many of the
Mimbres do exhibit moderate to severe wear on their incisors and canines as well. Dental wear is often produced by the dietary practices that a person performs, but other signs of attrition can tell a bioarchaeologist whether the teeth were being used as tools. Image 1 depicts an adult male mandible from the Mimbres population. He exhibits severe attrition that is seen in the Mimbres. All of the teeth have some degree of attrition, even the front incisors and canines.


Abscessing

Abscessing is a bacterial infection that starts with the destruction of the enamel and dentin of the tooth which are seen in dental caries, or cavities, and if severe enough will become an abscess. (Ortner 2003) There are two types: periapical and periodontal. A periapical abscess is based primarily at the apex of the infected tooth. Periodontal abscessing is found in the
periodontal ligaments that surround the tooth and it is normally referred to as an abscess of the gum. Caries are often the cause of an abscess, but they can also originate from severe attrition. “If wear is extreme the abscess is more likely to be due to attrition rather than caries, although it may not always be possible to make this distinction in archeological human remains.” (Ortner 2003:590) Bacteria of the mouth and dietary practices are other factors that can affect the formation of caries. The frequency of caries is lower in hunter-gatherer populations and higher in agriculturalist populations due to the larger amounts of carbohydrates that are consumed. (Ortner 2003) Since both the Mimbres and the Fort Ancient period remains are agriculturalist, it is likely that they will have a high rate of abscessing due to caries or severe attrition. Image 2 illustrates an adult male that exhibits a periapical abscess on his right first premolar.

Antemortem Tooth Loss

Teeth that are lost antemortem are teeth that are lost prior to death. Often, antemortem tooth loss is the result of caries complicated by abscessing. (Ortner 2003) The tooth becomes so infected that it will rot away and the mandible or maxilla will show signs of healing. The alveolar process, or tooth socket, will heal over and there will be no discernible hole for the tooth. Looking for and analyzing whether teeth were lost prior to death can tell us the health of the population. If there are many teeth lost prior to death this is likely to be the result of abscessing, which, in turn, is caused by either caries or extreme dental wear. Image 3 of a Mimbres female exhibits antemortem tooth loss in all molars except the right first molar and, as you can see, the tooth sockets for the molars have almost completely healed over in most parts of the mandible.

Image 3. Individual 15-141. Female. Age: 25-59 (likely older due to a variety of factors)
Health

In the article about the Fort Ancient period written by Claire Monod Cassidy, she mentions that in modern times the dental health of this population would be considered poor. This begs the question about the meaning of what it is to be in good health. Cassidy makes the connection between the modern person and the past populations in order to make a more understandable comparison. Many of us today have a general idea of what it means to be in good health. During the time periods that the Mimbres and the Fort Ancient period were in existence, this idea of health may have been very different. There is not a lot of archaeological evidence from the Mimbres culture, so unfortunately we do not know much about their society. However, we do know that there were not modern dentistry methods at this time, so there is a good chance that there was no consistent practice of oral hygiene within the Mimbres. This was likely true for the Fort Ancient Period as well. Teeth are a very important connection to our overall health and if teeth show signs of stress or disease it is often a good indicator for the general health of a population.

Materials and Methods

The data gathered from examining the Mimbres was collected at Hamline University beginning in August of 2012. Using data sheets, information was collected by observing multiple individuals and recording age, sex, antemortem tooth loss, abscessing and attrition. There were several different techniques used for looking at age and sex. These sources are listed below.

The techniques for assessing antemortem tooth loss, abscessing and attrition varied too. Antemortem tooth loss was scored as the tooth was present (1), absent antemortem (2), or absent
postmortem (0). Abscessing was scored as present (periapical or periodontal) or absent.

Attrition was scored using Holly Smith’s method (1984) for incisors, canines and premolars and Scott’s method (1979) for molars.

Age categories were determined using the methods of pubic symphysis morphology (Brooks and Suchey 1990; Suchey and Katz 1986), auricular surface morphology (Lovejoy et al. 1985), and ectocranial suture closure (Meindl and Lovejoy 1985). Pubic symphysis morphology (Brooks and Suchey 1990; Suchey and Katz 1986) and auricular surface morphology (Lovejoy et al. 1985) are two of the most reliable methods. The ectocranial suture closure technique (Meindl and Lovejoy 1985) is not as reliable, but, in many cases, the skull was the only portion of the remains present. The Mimbres were split into categories based on their age. There were 14 adults, 4 young adults, 2 adolescents and 5 children in total from the Mimbres population that were analyzed. The categories were determined by the skeletal age that was reflected from each individual. There were some individuals on which data was collected that there were no reliable indicators of age present. These individuals were not included in the analysis of age and the three dental pathologies. The categories were divided up differently from the demographic profile for a better statistical comparison. The demographic profile consisted of adults (30-50 years or older), young adults (19-30 years), adolescents (13-18 years), and children (0-12 years). From here, the ranges were narrowed down again to adults (30-50+), young adults (18-30), and children (0-17) for the purpose of statistical analysis.

Sex was divided into three final categories: male, female and indeterminate. The male and female categories initially included probable male and probable female. Probable male and female are indicated if there is a mixture of male and female traits and if there are not enough reliable indicators present to definitively say male and female. The categories were narrowed
down for more accurate results. There were 15 females, 14 males and 2 indeterminate for the Mimbres individuals. The main methods used for sex estimation were the analysis of innominate and cranium. These are some of the most reliable methods for the estimation of sex. The most reliable set of characteristics that was analyzed were the Phenice traits (1969). These are three traits on the pubic bone that indicate male or female. They include the ventral arc, subpubic concavity and the ischiopubic ramus ridge.

The data for the Mimbres was examined using statistical analysis in the Excel program and through calculations made by hand. Chi square models and averages were created for comparing the number of individuals to the pathologies of abscessing, the rate of attrition, and antemortem tooth loss. The data was compiled from data sheets and organized into the categories of analysis for age and abscessing, sex and abscessing, age and antemortem tooth loss, sex and antemortem tooth loss, age and attrition and sex and attrition. Graphs were generated from this data for visuals on the correlations found in these categories.

The data found for the Fort Ancient period was found via scholarly articles and other literary sources. The main source for the Fort Ancient period that was used was written by Claire Cassidy (1984) and had a sample size of 296 individuals from the Hardin Village site. The average amount of abscessing was already calculated in the categories of male and female. This study also included general statements about the amount of attrition and antemortem tooth loss that was seen at the site. She stated that, “[c]aries were the main cause of pulp exposures and abscessing, which occurred even in children, and of antemortem tooth loss, which began in adolescence.” (Cassidy 1984:329) The author then goes on to say that tooth wear was moderate and this pattern of wear is comparable to what is seen in high carbohydrate diets in populations that do not perform methods of effective oral hygiene. (Cassidy 1984: 329)
Results

Mimbres

The remains of 31 Mimbres individuals were analyzed using statistical analysis and looking at the categories of attrition and age, attrition and sex, abscessing and age, abscessing and sex antemortem tooth loss and age, and antemortem tooth loss and sex. The data table (Figure 1) is attached for the raw data that was collected on the Mimbres individuals.

Figure 1.

<table>
<thead>
<tr>
<th>Individual</th>
<th># of Abscesses</th>
<th>Antemortem Tooth Loss</th>
<th>Attrition Assessment</th>
<th>Sex</th>
<th>Age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-317</td>
<td>6</td>
<td>1</td>
<td>Moderate to severe</td>
<td>Ind. Unknown</td>
<td></td>
</tr>
<tr>
<td>1-132</td>
<td>1</td>
<td>0</td>
<td>Severe</td>
<td>M</td>
<td>35-57</td>
</tr>
<tr>
<td>2-85A</td>
<td>2</td>
<td>5</td>
<td>Moderate to severe</td>
<td>F</td>
<td>18-30</td>
</tr>
<tr>
<td>1-49</td>
<td>7</td>
<td>1</td>
<td>Severe</td>
<td>M?</td>
<td>23-76</td>
</tr>
<tr>
<td>2-238</td>
<td>2</td>
<td>5</td>
<td>Moderate to severe</td>
<td>F</td>
<td>18-59</td>
</tr>
<tr>
<td>1-120</td>
<td>0</td>
<td>0</td>
<td>Moderate to severe</td>
<td>F?</td>
<td>2-8 years</td>
</tr>
<tr>
<td>1-111</td>
<td>4</td>
<td>2</td>
<td>Mostly Severe; some moderate</td>
<td>M?</td>
<td>Unknown</td>
</tr>
<tr>
<td>1-68</td>
<td>0</td>
<td>1</td>
<td>Moderate</td>
<td>M?</td>
<td>9-14</td>
</tr>
<tr>
<td>2-155</td>
<td>1</td>
<td>0</td>
<td>Moderate</td>
<td>F?</td>
<td>Unknown</td>
</tr>
<tr>
<td>2-147</td>
<td>0</td>
<td>0</td>
<td>Severe</td>
<td>F</td>
<td>2-11 years</td>
</tr>
<tr>
<td>2-112</td>
<td>2</td>
<td>4</td>
<td>Severe</td>
<td>F?</td>
<td>Unknown</td>
</tr>
<tr>
<td>2-265</td>
<td>1</td>
<td>0</td>
<td>Moderate</td>
<td>F?</td>
<td>24-68</td>
</tr>
<tr>
<td>11-606</td>
<td>2</td>
<td>0</td>
<td>Moderate</td>
<td>F?</td>
<td>18-39</td>
</tr>
<tr>
<td>15-131</td>
<td>4</td>
<td>10</td>
<td>Moderate</td>
<td>M?</td>
<td>35-50</td>
</tr>
<tr>
<td>1-87</td>
<td>9</td>
<td>5</td>
<td>Mostly Severe; some moderate</td>
<td>F?</td>
<td>23-76</td>
</tr>
<tr>
<td>1-101</td>
<td>4</td>
<td>13</td>
<td>Moderate to severe</td>
<td>M?</td>
<td>23-76</td>
</tr>
<tr>
<td>1-44</td>
<td>0</td>
<td>0</td>
<td>Moderate</td>
<td>M</td>
<td>1.5-3.5 years</td>
</tr>
<tr>
<td>15-348</td>
<td>1</td>
<td>0</td>
<td>Moderate</td>
<td>F</td>
<td>2-10</td>
</tr>
<tr>
<td>15-141</td>
<td>10</td>
<td>9</td>
<td>Severe</td>
<td>F</td>
<td>25-59</td>
</tr>
<tr>
<td>1-502</td>
<td>6</td>
<td>2</td>
<td>Moderate</td>
<td>F?</td>
<td>24-68</td>
</tr>
<tr>
<td>1-4</td>
<td>8</td>
<td>2</td>
<td>Moderate to severe</td>
<td>M</td>
<td>23-76</td>
</tr>
</tbody>
</table>
Mimbres Results for Comparison of Sex and all Dental Pathologies.

In all areas of comparison with sex there was no correlation. All of the p values for the chi square models were above 0.05, which indicates that there is no pattern between sex and abscessing, attrition or antemortem tooth loss. If the p value were lower than 0.05 it would suggest that there was a pattern between sex and the dental pathologies that were analyzed. The calculated p value indicates that there was not a difference in sex roles between males and females from within the Mimbres population. While there were younger members of the population included in this addition, removing them did not produce a large difference in the p value. Figures 2-4 illustrate that there is not a large difference between the sexes when looking at the dental pathologies of abscessing, antemortem tooth loss and attrition.
Figure 2.

Sex and Abscessing

![Graph showing the average number of abscesses by sex. Male has a higher average number of abscesses than female.]

Figure 3.

Sex and Antemortem Tooth Loss

![Graph showing the average number of teeth lost antemortem by sex. Male has a higher average number of teeth lost than female.]

Age and Attrition in the Mimbres

The age and attrition model (Figure 5) is a little skewed because there were no young adults with either slight to moderate attrition or severe attrition. Most of the attrition across all age groups was moderate, but there were cases of adults and children with severe attrition. The p value for this group also showed that there was no connection between age and attrition. This would indicate that attrition does not increase with age, but shows that an individual at any age can have slight to severe stages of attrition. It would be expected that children would have less attrition, but this was shown not to be true. This is interesting because there were cases of children with severe attrition in the Mimbres population. Dental wear in the majority of cases was moderate to severe and there were few cases of slight dental wear. Usually, in the Mimbres population, slight dental wear was in the cases of the children or adolescents who had new teeth coming in or were very young. Children and adolescents did have high rates of moderate attrition and in some
cases there was severe attrition

![Age and Attrition Graph](image)

Figure 5.

**Age and Antemortem Tooth Loss in the Mimbres**

The graph in Figure 6 shows what would be the typical progression of antemortem tooth loss. The older you are the more teeth you will have lost.
Age and Abscessing in the Mimbres

The graph in Figure 6 also shows a typical progression that, on average, the occurrence of abscessing will occur more frequently in older ages.

Figure 6.

Figure 7.
Hardin Village Site (Fort Ancient period)

The overall population of Hardin Village showed that there were higher rates of death in childhood. “Among infants, 8.4% died as newborns and 4.7% in the next 11+ months.” (Cassidy, 329) This was due largely to nutritional deficiency that was seen, not only in teeth of the children, but in the rest of their skeleton. Females also showed some measure of nutritional deficiency and would have been passing it onto their children when carrying them and after they were born. Males did tend to have more abscessing than females and this could denote sex differences in the way the teeth were used by males and females. The average age of the population was not over 50 years. “Only 1% of the population (3 females) survived more than 50 years.” (Cassidy 1984:329) Overall she states that, “The pattern of wear and disease is very similar to that seen today in populations that consume highly processed carbohydrate diets and do not practice effective oral hygiene.” (Cassidy 1984:329) She goes on to say that the measure of health that she sees in the Hardin Village site is comparable with that seen in a third world country.

Comparison between the Mimbres and the Hardin Village Site

It is difficult to compare the two populations because the majority of Cassidy’s data is on abscessing and she briefly mentions attrition and antemortem tooth loss. However, she does state that attrition in the Hardin Village site was moderate. Due to the high rates of abscessing and the fact that there are more than a few individuals with moderate to severe or severe wear it would suggest that the Mimbres have a higher rate of attrition than Hardin Village.
The similarities are in the area of antemortem tooth loss. There are similar patterns in the Mimbres and the Hardin Village site. The antemortem tooth loss can be attributed to high amounts of abscessing seen in both populations.

Abscessing was one of the few aspects that there was direct data on from Claire Cassidy’s research. Figure 8 depicts a comparison between the Mimbres and the Hardin Village site in terms of sex and abscessing. As you can see, there is a marked difference between the abscessing rates of both males and females between the two populations. The comparison of males and females within the Hardin Village site shows that there are fewer females with abscessing in contrast to the males, whereas in the Mimbres the two sexes are more equal.

Figure 8.

Comparing age and abscessing also showed that the children of the Mimbres and Hardin Village were relatively the same while the adults have a bit more of a disparity between them.
Conclusion

Overall, the two populations do have some similarities within their dental health. Due to their dietary practices, both samples show signs of what today would be considered poor health. Their diets were based largely on corns, beans and squash and along with this they did not have techniques for maintaining good oral hygiene. Results from both do show that they had mostly moderate dental wear as well as high rates of abscessing. The research that Cassidy (1984) did also went into detail on other aspects of health related skeletal issues that are not just connected to dental. Vertebral arthritis, cribra orbitalia, bone infections, linear enamel hypoplasia, and low cortical thickness all were characteristics found within the Fort Ancient period population at the Hardin Village site. (Cassidy 1984:330) This research did not focus on these health indicators, but from working with the Mimbres for this research and prior to this study it would seem like these types of health conditions would stand out. However, from the general knowledge of the Mimbres it seems that in overall bone health they were healthier. There are some instances of
disease that were shown on their skeletons, but it did not run rampant throughout the population as it seems to do in the case of the Hardin Village site. One of the main indicators of health that the Mimbres have is their teeth and the high rate of abscessing they have in comparison to the population of the Fort Ancient period.

Similarities and differences were seen in the results produced by the comparison of the two populations. The similarity that was noted between the two populations is that antemortem tooth loss was likely caused by abscessing in both the Mimbres and the Hardin Village site. The difference comes in the comparison between the Mimbres average abscessing rates and the rates that the Hardin Village site projects in terms of both age and sex. Differences in the data show that abscessing is much higher in the Mimbres than in the population at the Hardin Village site. Due to the limited knowledge of what we know about the Mimbres diet, this information could give us some insight into the fact that either the Mimbres were eating different foods or higher quantities of carbohydrates than those from Hardin Village or the Mimbres may have been using their teeth differently. Using their teeth differently could be seen in the differences in food preparation, the way that they dealt with tooth decay or the possibility that they used their teeth for tools. Cassidy (1984) writes that the attrition levels in the Hardin Village site were moderate for the majority of individuals. From the results of the data collection on the Mimbres and the brief description that Cassidy (1984) provides, it would suggest that the Mimbres have a higher rate of attrition than that seen at the Hardin Village site. Many individuals were scoring well above a moderate level on the scales that Smith (1984) and Scott (2005) created. Data also shows that there is no correlation between sex and abscessing, sex and attrition and sex and antemortem tooth loss. In Cassidy’s (1984) research it does show that males have higher rates of
abscessing than females. This would indicate that males and females are using their teeth differently and could indicate that there is a differentiation in the roles between the sexes.

Limitations with the research included having a small sample size of the Mimbres population, fragmentary condition of the remains and not having direct access to the comparison collection. One of the main issues that limited this research was that the sample size was much smaller than Claire Cassidy’s (1984) sample. The sample size of the Mimbres population was further reduced due to an ethical issue regarding a student outside of Hamline University and the Bureau of Indian Affairs. This issue put this research essentially on hold from October through January. There would have been more data collected on the Mimbres individuals and this would have led to better results for comparison. There were also more adults in the Mimbres sample which can skew some of the results. Probable males and females are included in the male and female sample. These sex estimations are not definite and this could further add issues to the calculations and statistics. The issue with studying the Mimbres is that most burials were often looted so burial context as well as the burials themselves were most likely disturbed. This and other factors can lead to poor preservation of the remains. In not having direct access to the Hardin Village site population it meant that the majority of the data gathered came from literary sources and from a single article that had information on the skeletal population. This limited some of the results that could be produced.

While doing the comparisons for these two populations, there was an interesting option for further research that came up. This focuses mainly on the dental wear and what that can tell us about how these people were using their teeth. There is some evidence that the Mimbres are using their teeth as tools because if the wear was just from diet we would see little to no attrition on the anterior teeth. However, as exhibited in the pictures provided the majority of these
individuals do exhibit wear on their anterior teeth and it is pretty significant wear at that. Clark Spencer Larsen discusses anterior tooth wear versus posterior tooth wear in his book *Bioarchaeology: Interpreting Behavior from the Human Skeleton*. “In hunter-gatherer, the severity of anterior tooth wear is greater than, or equal to, the severity of wear on the posterior teeth.” (Larsen 1997:256) This would seem to suggest that the Mimbres are closer to the tooth wear that is seen in hunter-gatherer populations, however Larsen also describes they type of wear that differentiates agriculturalists from hunter-gatherers. Agriculturalists have more cupped wear and hunter-gatherers have more rounded wear. (Larsen 1997:256) The Mimbres do have cupped wear and none of the individuals had any rounded wear that was anteriorly located. The anterior wear that is seen in agriculturalist populations is likely due to the mouth compensating for the lack of posterior teeth i.e. molars. However, most of the Mimbres did have molars and there are equal amounts of wear on the anterior and posterior teeth. This could potentially suggest some sort of tool use. “Use of the front teeth as a tool has remained a hallmark of human behavior into recent times in a wide variety of cultures, ranging from Eskimos, who chew hides for clothing and other material culture, to Native Americans, who chew plant material to prepare it for basketry.” (Human Evolution book, Larsen 2011: 369) Because this does not fit the typical situation of an agriculturalist and we do not have a good idea of what the Mimbres were doing with their teeth it would be interesting to use for further research to generate answers on why there are these patterns of wear and what it means that there is no correlation between sex and the dental wear or attrition that is present.
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