FORENSIC DENTISTRY:
DENTAL INDICATORS FOR IDENTIFICATION

A Thesis

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by
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ABSTRACT

The use of dentition for identification has been well established in the field of forensics. However, dental analysis has been employed primarily for positive personal identification. The purpose of this thesis research is to explore the possibility of using dental characteristics for general profiling of the decedent. Dental characteristics, including caries and dental restorations, were examined in the dentition of 41 modern forensic cases in the LSU FACES Collection. Twenty-one of these cases are positively identified individuals whose remains were donated to the university. The other 20 cases are active forensic cases which have not been identified. The general profiling information, including sex, age, race, and socioeconomic status, was compared with the dental characteristics to determine any correlations between the categories. In the 20 unidentified cases, socioeconomic status was not known and, therefore, these cases were not analyzed for socioeconomic status correlations. Many significant relationships exist between the dental characteristics and the identifiers, sex, race, age, and socioeconomic status. Socioeconomic status has the least number of correlations. Age and race have the most.
CHAPTER 1: INTRODUCTION

When human remains are found, the first priority of investigators is to identify who the individual was in life. To attain this goal, investigators and researchers use methods from many fields of science. In cases where the remains are completely or mostly skeletonized or in which decomposition or deformation of soft tissues has negated the ability to perform an autopsy or collect fingerprints, identification is determined by utilizing physical anthropology and odontology.

Anthropologists, especially those trained in forensics, perform an analysis, whether skeletal remains are complete or incomplete. Many different techniques are used to gain different types of information. These techniques vary depending upon the part of the skeleton being examined. For example, age can be estimated from dentition, suture or epiphyseal closure, changes in the pubic symphysis, changes in the auricular surface of the ilium, and changes in the sternal end of ribs. (These techniques involve the cranium, long bones, pelvis, and ribs.) Using these methods in conjunction with each other allows the anthropologist to reach a more accurate estimation of age, but the completeness of the skeleton may limit the techniques that can be utilized. (Anthropological analysis provides an estimation of age, race, and sex. Analysis can also include conclusions about antemortem, perimortem, and postmortem trauma.)

Most dentists, or odontologists, have the basic knowledge and skills to perform forensic dental analysis. Analysis of dentition generally includes examination of position and shape of fillings, presence or absence of teeth, and shape of molar roots. Usually, this information is gained through the use of radiographs. Forensic odontologists also do comparative analysis between postmortem information of an unknown individual and
antemortem information of a missing person. By comparing these data, an identification of the unknown individual may be reached.

The process of identification has three types or stages. The first is a general identification which an anthropologist usually provides when the remains are completely or mostly skeletonized. This type is a general description of the individual, what the person’s sex, age, race, and stature were at the time of death. Anthropologists can also estimate the postmortem interval (PMI), or time since death. The information provided by anthropologists can lead police investigators to possible identities for the unknown individual. Comparisons between possible identities and the unknown individual can direct investigators to a presumptive or positive identification. Presumptive identification may also be made based on tattoos, circumstantial evidence, personal effects, or facial reconstruction. This type of identification is not scientifically confirmed, but can be accepted as final when foul play is not suspected and no other reason for doubt exists.

Positive identification is scientifically proven, usually through dental comparison, DNA matching, or fingerprinting. A corpus identification, in which a relative or close friend identifies the individual by viewing the body, is also accepted as positive identification. However, corpus identification is not beyond human error and is not possible when the body is in advanced stages of decomposition or severely damaged by trauma such as fire or mutilation.

This thesis studies the possible use of dentition for determining general profiling information. Many dental traits that have been used for this purpose in the past, such as crown size, tooth eruption, incisor shape, and Carabelli’s cusp, are not included in this research. Instead, dental features that have only been utilized previously for positive
identification, such as filling shape, are examined in this study for correlations to sex, race, age, and socioeconomic status.
CHAPTER 2: LITERATURE REVIEW

This thesis research focuses on analysis of dentition in forensic cases, utilizing many aspects from the field of dental anthropology. In this chapter, the potential of dental anthropology is examined, the morphology of teeth is explained, and past research in the field is discussed.

A medical examiner or forensic pathologist should be well aware of the value and application of forensic dentistry. Although forensic dentistry does not apply to all cases, the field is extremely important in those cases to which it does apply. Forensic dentistry is most commonly used for purposes of identification, but is also useful in the evaluation of bitemark evidence (the latter use will not be addressed in this thesis). The significance of forensic dentistry was officially recognized in 1969 with the establishment of the American Society of Forensic Odontology and in 1970 with the formation of an Odontology Section within the American Academy of Forensic Sciences (Sopher 1976).

Next to fingerprints, teeth are the most useful tool in determining positive identification of human remains. Teeth are the most durable portion of the body and have the ability to resist erosion, deterioration, and fire long after death. Teeth must be exposed to a temperature of over 500°C (932°F) to be reduced to ash. Teeth demonstrate a variety of form and varied conditions of wear, trauma, disease, and professional manipulation. Approximate age and useful indications of probable sex, race, occupation, personal habits, medical history, and environment can often be revealed by analysis of only teeth (Rogers 1986; 1987; 1988).
**Tooth Development and Structure**

Tooth development begins during the sixth week of embryonic life with the formation of the primordial tooth buds. Tooth development is slightly, but significantly, more advanced in girls than in boys, even before puberty (Miles 1963). The deciduous dentition begins eruption between six to nine months of age, starting with the anterior teeth and progressing posteriorly. These twenty “baby” teeth are usually completely erupted by two to two and a half years of age. The permanent dentition begins emerging at six years of age with the four first molars. Between the ages of six and twelve, the permanent anterior teeth emerge. Around age twelve, the second molars erupt. The final four permanent teeth to emerge, out of the total 32, are the third molars, also called “wisdom” teeth. These teeth are the most unstable. Typically, they erupt around age eighteen to early twenties. Sometimes these teeth are congenitally absent or are unusual in appearance (e.g., they may appear as peg teeth).

The completed definitive tooth is naturally divided into two regions: a root and a crown. “The transition from crown to root takes place at the cervix or neck of the tooth in a sinuous outline, and is called the cementoenamel junction or the cervical line” (Türp and Alt 1998: 71-72). Human teeth are composed of four tissues (Figure 2.1): the soft tissue of the pulp and three calcified tissues called dentin, enamel, and cementum. The crown consists of an outer layer of enamel and an inner layer of dentin. Dental enamel is the hardest tissue in the human body. Enamel functions as a resistant outer structure, allowing the tooth to withstand the abrasive force of mastication (chewing). Dentin is slightly harder than bone but considerably softer than enamel. Once the enamel is destroyed, dentin is rapidly penetrated by dental decay. Cementum covers the root and
provides a place of attachment for connective tissue fibers which secure the root to the surrounding bony socket, known as the alveolus. Dental pulp is a connective tissue located in the pulp cavity of a tooth. There are two types of dental pulp: coronal pulp in the central pulp chamber of the crown and radicular pulp in the pulp canals of the root.

![Figure 2.1: Tooth Structure in Cross-Section](Adapted from Bass (1995))

**Tooth Identification**

Four types of teeth comprise human permanent dentition: incisors (I), canines (C), premolars (PM), and molars (M) (Figure 2.2). If a person’s mouth were divided into four quadrants, upper from lower and left from right (Figure 2.3), two incisors, one canine, two premolars, and three molars should be present in each quadrant. A typical adult should have eight incisors, four canines, eight premolars, and twelve molars. Deciduous dentition contains eight incisors, four canines, and eight molars. Incisors and canines are considered anterior teeth and premolars and molars are considered posterior teeth.
Each type of tooth has its own function and shape. Incisors are the most anterior teeth in the maxilla and mandible. They are the “biting” teeth and are flat and bladelike in appearance with a single root. These teeth are generally the most affected by wear, particularly that caused by personal habits such as cigarette or pipe smoking or occupational habits such as holding pins or nails in the mouth. Canines, otherwise known as “eye” teeth, are conical and tusklike. They are used for tearing and biting. Canines
also have a single root, but this root tends to be longer than that of an incisor. Premolars, also called bicuspids, are usually single rooted. Premolars are used for chewing and are generally shorter in crown height and root length than a canine. Molars are used for chewing too. They have two or three roots and four or five cusps. Many subtle differences exist between individual teeth of the same type. These differences allow for determining a tooth’s exact position in the dental arch. (These differences will not be discussed in this thesis. For further information see Bass 1995 and White 2000.)

Dental professionals use several different methods for abbreviating tooth identification. This variation can lead to difficulties in forensic cases if the examiner is not familiar with the system being used on an individual’s dental chart. The following is a brief description of three systems that are common (Table 2.1).

Table 2.1: Symbol Systems for Permanent Dentition
(a) Upper and lower right quadrants, (b) Upper and lower left quadrants. Adapted from Rogers (1987)

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<tr>
<th></th>
<th>M3</th>
<th>M2</th>
<th>M1</th>
<th>PM2</th>
<th>PM1</th>
<th>C</th>
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<td>15</td>
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<td>American System</td>
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a.

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b.
The Two Digit System or the FDI system (named for the conference where it was first introduced, the Federation Dentaire Internationale) divides the dental arcade into four quadrants: upper right, upper left, lower left, and lower right. Prefix numbers are assigned to each quadrant: 1, 2, 3, and 4 in permanent dentition and 5, 6, 7, and 8 in deciduous dentition, respectively. Added to this prefix is a number, 1 through 8 for permanent dentition and 1 through 5 for deciduous for the specific tooth. Each central incisor is assigned 1 and counting each tooth, moving posteriorly, each third molar is assigned 8 (Roger 1987). Therefore, in this system, the upper right canine would be designated as 13.

The American System also separates dentition into four quadrants and numbers the teeth in each quadrant 1 through 8. The quadrants are not numbered in this system though. Instead, a written symbol is required for upper right, upper left, lower right, and lower left. In the Zsigmondy system, a variant of the American system, a right angle is added to the number. This right angle suggests the quadrant in which the tooth is located (Rogers 1987).

In the Universal System, dentition is not divided into quadrants. Each tooth has a unique number. The upper right third molar is designated as number 1, the upper left third molar as number 16, with the appropriate number assigned to each maxillary tooth. The lower left third molar is designated as number 17 and the lower right third molar as number 32, with each mandibular tooth numbered accordingly. This system is the one utilized in this thesis.

For further accuracy in dental charts, especially when noting dental disease and restoration, each surface of a tooth should be identifiable. The crown of the tooth
presents five surfaces for visual examination (Figure 2.4). The occlusal surface (O) of the posterior teeth contacts the opposite tooth when the jaws are closed. For example, the occlusal surface of the upper right second molar contacts the occlusal surface of the lower right second molar. The occlusal surface can be regarded as the masticating or chewing surface of the tooth. On anterior teeth this surface is termed the incisal (I) surface or edge. For the purpose of this thesis the term occlusal is used for both posterior and anterior teeth.

The mesial (M) and distal (D) surfaces are in constant direct contact with adjacent teeth. The mesial surface is directed toward the midline of the dental arch, or anteriorly. The distal surface is directed away from the midline, or posteriorly. Returning to the previous example, the mesial surface of the second molar contacts the distal surface of the first molar; the distal surface of the second molar contacts the mesial surface of the third molar. This pattern is true for all dentition except the four central incisors. The two upper central incisors meet mesial surface to mesial surface. The same occurs between
the two lower central incisors. The junction between central incisors represents the midline in the dental arch.

The buccal (B) surface of posterior teeth and the labial (LA) surface of anterior teeth are directed toward the cheek or lips, respectively. This thesis utilizes only the term buccal for this surface in both posterior and anterior teeth. The fifth and final tooth surface is known as the lingual (L) surface. This surface is the inward surface that faces the tongue.

**Disease, Restoration, and Attrition**

The mouth is home to a wide variety of microscopic organisms: bacteria, viruses, yeasts, and protozoa. Many different habitats for these invaders can be found in the mouth: fissures and pits, surfaces of the cusps and sides of the crown, area between teeth, and gingival crevice or sulcus around the neck of the tooth. Disease processes of the jaws and mouth include caries, periodontal disease, periapical osteitis, antemortem tooth loss, and malocclusion. The last two of these examples are not necessarily caused by disease due to viral or bacterial infections. A structure is described as diseased once it can no longer operate efficiently. The site at which an abnormality occurs is known as a lesion. Damage to the structure may be confined to soft tissues or may involve widespread hard tissue destruction and repair (Hillson 1986). The common causes of tooth loss are dental caries in the younger population and periodontal disease in the older population.

Caries, or *caries dentium*, is the name used for tooth decay. Dental caries represents progressive destruction of tooth structure due to bacterial acid formation. A carious lesion is characterized by the demineralization of enamel, dentine, and/or
cementum by microorganisms that inhabit the plaque on crown surfaces. Caries start at the enamel surface of the crown or at exposed parts of the neck, working its way through the dentine into the pulp cavity. Caries may also start in roots exposed by periodontal disease. The crown can be totally destroyed and other periodontal difficulties, such as an abscess, may arise. If left untreated, the affected tooth may fall out and the alveolus will close in time. However, inflammation can spread into surrounding bone (Caselitz 1998).

A carious lesion on the crown surface is first visible as a microscopic opaque spot in the enamel. This spot may be white or stained brown. Over time, the spot becomes large enough to be viewed without a microscope. The enamel surface becomes rough and, eventually, a small cavity appears. Hillson (1986) notes variability in the results of different observers when opaque spots are included in a study. For this reason, these spots were not included in this research, only visible cavities. This cavity will continue to grow until it is treated. If the cavity reaches the pulp chamber, the soft tissues are exposed to infection (Figure 2.5). This exposure can lead to inflammation, bone destruction, and tooth loss. Severe attrition or a traumatic fracture of the crown may cause a similar result. Local inflammation sets in and pus collects in the area. This pus is often restricted by a wall of fibrous tissue, forming an abscess. The pulp chamber may contain the inflammation for a while, but eventually the pulp is killed by the progressing lesion. When this death occurs, the infection can proceed down the root canal into the bone and connective tissue. Because of its location at the apex of the root, this is known as periapical inflammation. Chronic periapical inflammation results in bone resorption. Pus accumulates in the lesion to form an abscess. The pus must be removed in order for the lesion to heal. Bone and tissues are resorbed, forming a channel to the surface called
a sinus or fistula that usually penetrates the gum on the buccal side of the alveolar process (Hillson 1986).

![Image of tooth decay](image)

**Figure 2.5: Tooth Decay**
(a) Decay has penetrated the enamel and dentin; restoration should occur at this stage; (b) Decay has reached the pulp; root canal therapy is necessary at this stage. Adapted from Sopher (1976)

One of the purposes of regular dental examination is the detection and arrest of dental caries in its earliest stages. Once caries is detected, the carious tissue is removed and the structure and function of the tooth are restored. Most caries restoration involves the filling of the cavity after the affected tissue has been removed (Figure 2.6). Fillings can be comprised of a variety of materials. Preferred materials vary with time, geographical region, personal preference, and affordability. Probably the most common are amalgam fillings, usually having the look of dull pewter. This type is used predominantly on posterior teeth because of its obvious appearance, but is used in about 80 percent of all restorations (Sopher 1976). Resin and ceramic fillings are more natural in appearance. If a carious lesion kills the pulpal tissue, the tooth can only be treated by root canal therapy or extraction of the tooth. Teeth that are extremely affected by a carious lesion, or have required root canal therapy are usually capped, or crowned. Crowns replace the entire natural crown of a tooth. They can be metal, acrylic resin, or
The resin or porcelain, again, provides a more attractive or natural look to the restored tooth.

**Figure 2.6: Cavity Restoration**
(a) diseased tooth, (b) excavated cavity, (c) cavity restored with filling. Adapted from Sopher (1976)

The host’s resistance and diet affect the extent of dental caries. Morphological crown complexity, tooth size, trace elements in food and water, developmental defects, dental wear, and immunologic characteristics of saliva are all factors of host resistance. Dietary factors that influence caries progression include the types of foods eaten, methods of food preparation, eating habits, and duration and degree of mastication (Scott and Turner 1988). Between 1945 and 1951, a series of experiments demonstrated a correlation between annual sugar consumption and the frequency of carious lesions (Hillson 1986).

To anthropologists, caries is the most important dental disease because of its association with the evolution of food production. Caries is an ancient and widely spread disease that already existed in the australopithecines of South Africa, one of the earliest known hominids that existed 4.4 to 1.2 million years ago (Klein 1999). Low caries rates have been observed in Mesolithic and early Neolithic times. The rate of caries remains relatively constant between the middle of the ninth to the middle of the fifth millennium.
B.C. Then rates increase dramatically in the span of only one century. “Caries promoting conditions could be linked to the spreading use of grains. The caries rate then remains nearly stable up to the Middle Bronze Age and increases continuously from the middle of the second millennium to late Roman times or the middle of the first millennium A.D.” (Caselitz 1998: 207). A second increase in the rate, which may be the result of the introduction of new foodstuffs into Europe from the Americas, begins in the sixteenth century. Caries rates have continued to climb, reaching a record high at present (Caselitz 1998).

Studies have revealed many important facts about caries. Parents and offspring tend to, but do not necessarily, have similar caries experiences. Women are more affected by the disease than men, but within one individual, left and right sides are usually affected equally (Hillson 1986). The first molar is generally thought to be the most affected tooth. However, this opinion has not been supported by any extensive data. Upper molars are less affected than their lower opponents, and posterior teeth are more affected than anterior teeth (Caselitz 1998).

Occlusal attrition, or wear, has been studied to determine any correlation to factors of sex, age, tooth position, and dental caries. Several stages of attrition have been described: 0, no attrition; 1, attrition of enamel; 2, dentine visible; and 3, exposure of secondary dentine (Goose 1963) (Figure 2.7). These stages were slightly adjusted for this thesis; 0, crown or tooth missing; 1, no attrition; 2, attrition of enamel; 3, dentine visible; and 4, severe visibility of dentin. Molnar (1971) noted that in studies of heavily worn teeth of California Indian skeletal remains, types and degree of wear showed considerable variation. “The sex of the individual was found to be a major factor in tooth wear and a
higher degree of attrition was found among females. As would be expected, the older
individuals had the most heavily worn teeth but this relationship was not constant and
some differences were seen. Tooth position was also an important variable in
determining the degree of wear” (Molnar 1971: 182), due to tooth grinding, mastication,
and occupational use.

![Figure 2.7: Attrition Stages](image)

(a) 0- no attrition, (b) 1- attrition of enamel, (c) 2- dentine visible,
(d) 3- exposure of secondary dentine. Adapted from Rogers
(1987)

**Sex, Age, Socioeconomic Status, and Race**

Few obvious and consistent differences exist between male and female teeth,
according to past studies. These differences include size and rate of dental growth.
Tooth eruption appears to be more affected by sex differences, hormonal disturbances,
and dietary deficiencies than by racial differences (Miles 1963).

Teeth can provide information in several ways as to the age of an individual at the
time of death. Teeth are the most reliable indicator of age if an individual is fourteen
years old or younger. This fact is due to the consistent rate with which teeth erupt. Simple naked-eye observation of emergence and attritional changes can be adequate for an estimation of age. Radiographic methods or histological techniques supplement these observations and reveal tooth deterioration more accurately.

Dental restorations may indicate the economic, regional, and racial background of an individual. Methods of restoration used in certain countries or regions may be rare or not used in other areas. The amount of expensive restorations found in an individual may suggest social status (Kieser-Nielsen 1980). Wear patterns and staining can suggest occupation or personal habits such as smoking.

Attempts have been made to determine the extent to which crown morphology can be utilized to determine predictable patterns of biological relationships among human populations.

A biological trait can be useful in historical-evolutionary analyses only if a significant component of its variation is genetic. Phenotypic differences between groups through time and space can then be assumed to reflect temporal gene frequency changes or underlying genetic differences, respectively. Aspects of the human dentition most likely to have a strong genetic component--tooth size, morphology, and number--have been analyzed (Scott and Turner 1988: 100).

Early French and German anthropologists and odontologists showed that some morphological variants, such as cusp number of molars, differed between the major races of humankind (Scott and Turner 1997). The classic papers of Hrdlička (1920) and Hellman (1928) on shovel-shaped incisors (Figure 2.8) and lower molar morphology,
respectively, were among the earliest studies of differences in crown trait frequencies between geographical races. The world population is traditionally divided by physical anthropologists into three categories: Caucasoid, Mongoloid, and Negroid. Caucasoids are people of European descent. Mongoloids are people of Asian descent, including Native and Latin Americans. Negroids are people of African descent. However, recent trends in physical anthropology have modified these terms to be more specific or politically correct. Caucasoids and Negroids are now typically referred to as whites and blacks, respectively. Mongoloids are now usually divided into two groups: Asians and Southwest Mongoloids. This thesis will use the terms white, black and Mongoloid.

![Figure 2.8: Incisor Variation](occlusal view)
(a) normal incisor, (b) shovel-shaped incisor. Adapted from Bass (1995)

Probably the most frequently discussed racial dental trait is shovel-shaped incisors, most prevalent in Mongoloids. However, this trait is only one of many morphological characteristics connected to geographic variation. The size and shape of teeth seem little affected by environmental factors and, therefore, genetic factors must play a major role in these differences (Goose 1963). Significant correlations between racial and subracial groups and tooth size have been noted in studies. Enamel pearls (Figure 2.9) occur more frequently on the premolars of Mongoloids than whites or blacks. Carabelli’s cusp or tubercle is frequently demonstrated in the negative form with
pits and grooves in Mongoloid populations and in the positive form with projections or tubercles in white populations (Rogers 1988) (Figure 2.10).

Figure 2.9: Enamel Pearl
(a) occlusal view, (b) cross-section. Adapted from Rogers (1988)

Figure 2.10: Carabelli’s Cusp/Tubercle

Dahlberg’s (1951) paper on American Indian dental morphology provides a description of the dental morphology of whites. This description was still considered one of the best available in 1982 when Mayhall, Saunders, and Belier conducted a study and proposed a Caucasoid Dental Complex for the results. They were following the example of Hanihara, who composed a Mongoloid Dental Complex (1966) after he conducted studies of the deciduous dentition. These dental complexes were hoped to be useful in determining the racial background of a group of individuals. The Caucasoid Dental Complex includes: absence of shovel-shaped incisors; high frequency of bilateral counter winging or straight axial alignment of the central incisors; absence of premolar occlusal tubercles (enamel pearls); high frequency of Carabelli’s cusp; and absence of expressions of the protostylid of the sixth cusp and of the seventh cusp (Mayhall et al. 1982).
CHAPTER 3: MATERIALS AND METHODS

This study includes the dentition of 41 forensic cases in the LSU FACES Collection. Two of these cases are subadults, but both are teenagers and their dentition is permanent except for the eruption of third molars. All cases had been cleaned and catalogued prior to this research. They had also been entered into a computer database. Selection for inclusion in this study was conducted through this database. A search of the database showed 29 identified cases with a complete cranium and 81 unidentified cases with a complete cranium. Of the 29 identified cases, four were no longer located in the lab collection; five were missing the mandible or were too fragmented to be useful. An additional identified case that had not been selected by the database was included in this study at the request of Mary Manhein. The reason for this case’s omission from the database list is that only the maxilla and mandible are present so the case was not registered as a complete cranium. The unidentified cases were selected randomly. Some cases that were drawn were not used in this study because they were not present in the lab or were missing the mandible. A total of 21 identified cases and 20 unidentified cases were selected.

A database was developed using Microsoft Access to enter and assess the information recorded during this study. All characteristics examined in this study had several significant variations. These variations, or options, were assigned number codes for the database (Appendix A). Two forms were used when evaluating a case. The first form recorded the data in number codes to be entered into the database (Appendix B). The second form was a dental chart utilized by the LSU FACES laboratory (Appendix C). Cases were evaluated in the lab and the forms were filled out. The information was
then entered into the database for analysis. Absent third molars with no obvious corresponding socket were recorded as antemortem loss. No attempt to separate congenital absence from antemortem loss or extraction was made. For this reason, third molars were excluded from analysis of antemortem tooth loss. Broken teeth of all degrees were recorded as partial presence. Further examination of these teeth was done to whatever extent was allowed by the condition of the tooth. In some of these instances, only the root was present and, therefore, no analysis of crown characteristics was possible. These characteristics were recorded as unknown. In other instances, only a small chip was missing from the crown and all characteristics could be assessed.

For the identified cases, the information provided by the lab database and files for sex, age, and race was obviously correct and was used for the purpose of this thesis. The individual’s name was never taken from the files and they are known only by the LSU case number in all data recorded for this thesis. Socioeconomic status was based upon the individual’s occupation at the time of death. However, this determination may not be an accurate portrayal of a person’s economic position. The exact amount of household income was not known in any case and, therefore, socioeconomic status is not based on an individual’s level of income. For this reason, the designation of socioeconomic status is not absolute and analysis involving this identifier is highly questionable. In future studies, knowledge of income in numerical terms is recommended. For unidentified cases, previous conclusions about sex, age, and race were accepted as accurate and were not reassessed for this thesis.

In all cases, the information provided by the database and lab cards was checked against the files. Radiographs were consulted in all cases for determining the presence of
root canal therapy, third molars, and for confirming cavity placement. In one case, fillings were observed during this thesis research which were not noted in the existing file. Radiographic evidence was inconclusive and a microscope was used to make the final determination. The teeth in question did have resin fillings and the changes were made to the file.

Queries were performed through the Microsoft Access database and reports were generated from these queries. The reports were examined to determine frequencies and correlations of the traits important to this study. Two-way frequency tables were created to examine connections between traits. Chi-square tests were used to determine significant relationships between characteristics. The level of significance in all tests was 0.05.
CHAPTER 4: RESULTS

A total of 41 cases was used in this study, 21 identified cases and 20 unidentified. A possible 1,312 teeth were included in this study of 41 individuals. Data were recorded for all teeth, at least noting whether the tooth was present or not. Of the 21 identified cases, seven were individuals of lower socioeconomic status and 14 were of middle socioeconomic status. The 41 total cases include 23 males and 18 females. Statistically significant relationships between identifiers and dental characteristics may not, necessarily, be subject to generalization due to the small sample size and regional variation. However, they may be indicative of future studies. Table 4.1 shows the number and types of cases used in this study.

Table 4.1 Count of Case Types

<table>
<thead>
<tr>
<th>Identifiers</th>
<th>Age</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subadult</td>
<td>19-29</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>Male</td>
<td>UID**</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>UID</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td></td>
</tr>
<tr>
<td>Mongoloid</td>
<td>Male</td>
<td>UID</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>UID</td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>Male</td>
<td>UID</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>UID</td>
</tr>
<tr>
<td></td>
<td>Lower</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Middle</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

*Socioeconomic Status

** Unidentified
Tooth Wear

Two of the characteristics examined in this study were tooth wear and staining. Tooth wear was rated in the degree of severity as described in Chapter 2. Staining was rated similarly based on coloration and size of stain. A small yellow stain (involving less than half of a single crown surface) would be given a “2” for slight staining, whereas a large brown stain (involving nearly a whole surface or more) would be given a “4” for significant staining.

A total of 28 cases exhibited tooth wear for a possible 896 affected teeth. Of these teeth, 215 were not in sufficient condition for determining tooth wear. Tests only include cases with tooth wear. Cases without tooth wear are not represented in the “absent” column. This column merely shows the number of teeth without tooth wear that are present in individuals who have tooth wear on some teeth.

A significant relationship exists between the level of tooth wear and the type of tooth (Table 4.2). Molars and premolars have the lowest frequencies of tooth wear. Canines and incisors have the highest frequencies of wear at all levels where wear is present. The lower right lateral incisor was the most frequently affected tooth in this study.

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>175</td>
<td>32</td>
<td>9</td>
<td>8</td>
<td>224</td>
</tr>
<tr>
<td>Premolars</td>
<td>143</td>
<td>24</td>
<td>11</td>
<td>6</td>
<td>184</td>
</tr>
<tr>
<td>Canines</td>
<td>41</td>
<td>37</td>
<td>13</td>
<td>5</td>
<td>96</td>
</tr>
<tr>
<td>Incisors</td>
<td>78</td>
<td>63</td>
<td>22</td>
<td>14</td>
<td>177</td>
</tr>
<tr>
<td>Total</td>
<td>437</td>
<td>156</td>
<td>55</td>
<td>33</td>
<td>681</td>
</tr>
</tbody>
</table>

$x^2=86.293$, df=9, $p\leq0.001$ (Significant)
A relationship also exists between the level of tooth wear and an individual’s sex (Table 4.3). Fifteen males and 13 females exhibited tooth wear. Females have more teeth without wear than males. Females also demonstrate a lesser degree of tooth wear when it occurs than males.

<table>
<thead>
<tr>
<th>Sex</th>
<th>(N)*</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>(15)</td>
<td>193</td>
<td>99</td>
<td>42</td>
<td>30</td>
<td>364</td>
</tr>
<tr>
<td>Female</td>
<td>(13)</td>
<td>244</td>
<td>57</td>
<td>13</td>
<td>3</td>
<td>317</td>
</tr>
<tr>
<td>Total</td>
<td>(28)</td>
<td>437</td>
<td>156</td>
<td>55</td>
<td>33</td>
<td>681</td>
</tr>
</tbody>
</table>

\[ x^2=51.644, \text{df}=3, p \leq 0.001 \text{ (Significant)} \]
* Notes the number of cases represented

Chi-square tests show a correlation between the level of tooth wear and socioeconomic status (Table 4.4). Unidentified cases comprise half of the 28 affected cases. The other half consists of four individuals of lower socioeconomic status and 10 middle socioeconomic status individuals. Only 28.57% of identified cases with tooth wear are of lower socioeconomic status. The other 71.43% of identified cases are of middle socioeconomic status. Therefore, individuals of middle socioeconomic status show a greater degree of wear than individuals of lower socioeconomic status.

<table>
<thead>
<tr>
<th>S.E. Status</th>
<th>(N)*</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Status</td>
<td>(4)</td>
<td>60</td>
<td>32</td>
<td>4</td>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>Middle Status</td>
<td>(10)</td>
<td>156</td>
<td>56</td>
<td>22</td>
<td>27</td>
<td>261</td>
</tr>
<tr>
<td>Total</td>
<td>(14)</td>
<td>216</td>
<td>88</td>
<td>26</td>
<td>27</td>
<td>357</td>
</tr>
</tbody>
</table>

\[ x^2=15.785, \text{df}=3, p \leq 0.002 \text{ (Significant)} \]
* Notes the number of cases represented

Race and the level of tooth wear are also correlated (Table 4.5). Whites have the greatest degree of tooth wear and comprise 15 of the 28 cases. Mongoloids have only
three cases with tooth wear; none exhibits significant wear. The other 10 cases are black individuals. These individuals have the greatest frequency for teeth without wear.

### Table 4.5 Tooth Wear Distribution by Race

<table>
<thead>
<tr>
<th>Race</th>
<th>(N)*</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>(15)</td>
<td>187</td>
<td>83</td>
<td>45</td>
<td>32</td>
<td>347</td>
</tr>
<tr>
<td>Mongoloid</td>
<td>(3)</td>
<td>49</td>
<td>18</td>
<td>5</td>
<td>0</td>
<td>72</td>
</tr>
<tr>
<td>Black</td>
<td>(10)</td>
<td>201</td>
<td>55</td>
<td>5</td>
<td>1</td>
<td>262</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(28)</td>
<td>437</td>
<td>156</td>
<td>55</td>
<td>33</td>
<td>681</td>
</tr>
</tbody>
</table>

$x^2=63.738$, df=6, $p \leq 0.001$ (Significant)

* Notes the number of cases represented

A significant relationship exists between age and level of tooth wear (Table 4.6).

This relationship is illustrated by the presence of slight wear on only four teeth in subadults and the lack of slight wear or teeth without wear in the oldest age range. The group age 40-49 shows a higher frequency of slight and moderate tooth wear than the group age 50-59, but the latter group has a higher frequency of significant tooth wear.

### Table 4.6 Tooth Wear Distribution by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subadult</td>
<td>(1)</td>
<td>28</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>19-29</td>
<td>(11)</td>
<td>197</td>
<td>62</td>
<td>18</td>
<td>4</td>
<td>281</td>
</tr>
<tr>
<td>30-39</td>
<td>(9)</td>
<td>165</td>
<td>52</td>
<td>7</td>
<td>0</td>
<td>224</td>
</tr>
<tr>
<td>40-49</td>
<td>(4)</td>
<td>24</td>
<td>25</td>
<td>18</td>
<td>3</td>
<td>70</td>
</tr>
<tr>
<td>50-59</td>
<td>(2)</td>
<td>23</td>
<td>13</td>
<td>3</td>
<td>12</td>
<td>51</td>
</tr>
<tr>
<td>70+</td>
<td>(1)</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>14</td>
<td>23</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(28)</td>
<td>437</td>
<td>156</td>
<td>55</td>
<td>33</td>
<td>681</td>
</tr>
</tbody>
</table>

$x^2=316.872$, df=15, $p \leq 0.001$ (Significant)

* Notes the number of cases represented

### Staining

A total of 22 cases included in this study have staining on one or more teeth. Out of a possible 704 teeth, 196 have staining and 186 teeth were not in sufficient condition
for analysis of this trait. As in tooth wear analysis, the “absent” column shows the 322 teeth that were present in these 22 cases, but showed no staining.

Table 4.7 shows a significant relationship between staining and tooth type. Canines have the greatest degree of staining. The frequency of slight and significant staining is highest on canine teeth. However, at the moderate staining level, canines have the lowest frequency of all types of teeth. Molars have the highest frequency of moderate staining, but the lowest frequencies in the slight and significant categories. Molars also have the highest frequency of teeth with no staining.

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>126</td>
<td>33</td>
<td>21</td>
<td>0</td>
<td>180</td>
</tr>
<tr>
<td>Premolars</td>
<td>90</td>
<td>34</td>
<td>11</td>
<td>1</td>
<td>136</td>
</tr>
<tr>
<td>Canines</td>
<td>34</td>
<td>29</td>
<td>5</td>
<td>2</td>
<td>70</td>
</tr>
<tr>
<td>Incisors</td>
<td>72</td>
<td>46</td>
<td>13</td>
<td>1</td>
<td>132</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>322</td>
<td>142</td>
<td>50</td>
<td>4</td>
<td>518</td>
</tr>
</tbody>
</table>

\[x^2=25.720, \text{df}=9, \ p \leq 0.002 \text{ (Significant)}\]

A correlation is present between the degree of staining and the sex of an individual (Table 4.8). Thirteen males and nine females exhibit staining. Males demonstrate more staining at all levels than females. Females have a higher frequency of teeth with no staining than males.

<table>
<thead>
<tr>
<th>Sex</th>
<th>(N)*</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>(13)</td>
<td>146</td>
<td>101</td>
<td>48</td>
<td>4</td>
<td>299</td>
</tr>
<tr>
<td>Female</td>
<td>(9)</td>
<td>176</td>
<td>41</td>
<td>2</td>
<td>0</td>
<td>219</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(22)</td>
<td>322</td>
<td>142</td>
<td>50</td>
<td>4</td>
<td>518</td>
</tr>
</tbody>
</table>

\[x^2=63.630, \text{df}=3, \ p \leq 0.001 \text{ (Significant)}\]

* Notes the number of cases represented
No relationship was found between staining and socioeconomic status (Table 4.9). Nine of the 22 cases with staining are unidentified, four are lower socioeconomic status, and nine are middle socioeconomic status. Frequencies between lower and middle socioeconomic status were approximately equal at each level of staining. The socioeconomic status of an individual does not affect the amount of staining that a person may have.

<table>
<thead>
<tr>
<th>Table 4.9 Crown Staining Distribution by Socioeconomic Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>S.E. Status (N)</strong></td>
</tr>
<tr>
<td>Lower (4)</td>
</tr>
<tr>
<td>Middle (9)</td>
</tr>
<tr>
<td>Total (13)</td>
</tr>
</tbody>
</table>

\[ x^2 = .690, \text{ df=2, } p>0.05 \text{ (Not Significant) } \]

* Notes the number of cases represented

Table 4.10 shows no relationship between staining and race. No Mongoloids exhibited staining. Whites and blacks have basically equal frequencies in all categories of staining. An individual's race does not affect the amount of staining he may have.

<table>
<thead>
<tr>
<th>Table 4.10 Crown Staining by Race</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Race</strong></td>
</tr>
<tr>
<td>White (14)</td>
</tr>
<tr>
<td>Black (8)</td>
</tr>
<tr>
<td>Total (22)</td>
</tr>
</tbody>
</table>

\[ x^2 = 1.146, \text{ df=3, } p>0.05 \text{ (Not Significant) } \]

* Notes the number of cases represented

A significant relationship does exist between the age of an individual and the severity of staining (Table 4.11). The age group 40-49 has the highest frequency of moderate and significant staining. The age group 30-39 has the highest frequency of
slightly stained teeth and the lowest frequency of unstained teeth. The subadult group
has the highest frequency of unstained teeth and the lowest in all other categories.

Table 4.11 Crown Staining Distribution by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>Absent</th>
<th>Slight</th>
<th>Moderate</th>
<th>Significant</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subadult</td>
<td>(2)</td>
<td>59</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>62</td>
</tr>
<tr>
<td>19-29</td>
<td>(8)</td>
<td>130</td>
<td>59</td>
<td>9</td>
<td>0</td>
<td>198</td>
</tr>
<tr>
<td>30-39</td>
<td>(6)</td>
<td>67</td>
<td>59</td>
<td>21</td>
<td>2</td>
<td>149</td>
</tr>
<tr>
<td>40-49</td>
<td>(5)</td>
<td>48</td>
<td>19</td>
<td>16</td>
<td>2</td>
<td>85</td>
</tr>
<tr>
<td>50-59</td>
<td>(1)</td>
<td>18</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>(22)</td>
<td>322</td>
<td>142</td>
<td>50</td>
<td>4</td>
<td>518</td>
</tr>
</tbody>
</table>

\[ x^2=71.984, \text{df}=12, p \leq 0.001 \text{ (Significant)} \]
* Notes the number of cases represented

Recovery Method and Postmortem Tooth Loss

Two types of recovery methods were possible for each case. In the first method, the LSU lab received the skeletal remains from police or other official investigators. In the second method, Mary Manhein and other lab workers traveled to the location of the remains and recovered the material according to procedures similar to those used in archaeology. The latter method is suspected to be more thorough in terms of complete collection of bones and teeth because of the rigorous excavation methods of archaeology. Thirty-six cases used in this study were transported to the lab; 20 of these remain unidentified and 16 have been positively identified. Only five cases were recovered in the field, all of which have been identified.

A total of 27 cases exhibited postmortem tooth loss, showing no sign of alveolar bone/socket resorption. Twenty-three were transported to the lab, 16 unidentified cases and 11 identified cases. The other four cases were recovered in the field and were all identified. Eighty-seven teeth were lost postmortem from the possible 864 teeth of these 27 cases. Seventy-eight of the lost teeth were from cases transported to the lab, 55 from
unidentified cases and 23 from identified cases. The other nine lost teeth were from identified cases recovered in the field. The tooth most frequently lost after death is the lower right central incisor. In this study, 11.49% of the 87 teeth lost postmortem were the lower right central incisor. Central incisors were 34.48% of teeth lost postmortem. Incisors were the most frequently lost type of tooth at 52.87%. In the following tables, the “not lost postmortem” column includes teeth that were lost antemortem. This column only contains the remaining teeth of cases that exhibit postmortem loss.

Table 4.12 shows postmortem tooth loss for each tooth type for each recovery method. No relationship exists between recovery method and postmortem tooth loss for each tooth type. All tooth types showed similar frequencies of teeth lost in cases that were transported to the lab and similar frequencies of teeth lost in cases recovered in the field.

Table 4.12 Postmortem Tooth Loss for each Tooth Type by Recovery Method

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Transported to Lab</th>
<th>Recovered in Field</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>12</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>Premolars</td>
<td>12</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>Canines</td>
<td>13</td>
<td>1</td>
<td>14</td>
</tr>
<tr>
<td>Incisors</td>
<td>41</td>
<td>5</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td><strong>78</strong></td>
<td><strong>9</strong></td>
<td><strong>87</strong></td>
</tr>
</tbody>
</table>

\(x^2 = 0.502, \text{df}=3, p>0.05\) (Not Significant)

Table 4.13 shows no relationship between recovery method and postmortem tooth loss. The frequencies of teeth lost postmortem in cases that were transported to the lab and in cases recovered in the field were similar. Frequencies of teeth not lost postmortem in cases transported to the lab and in cases recovered in the field were also similar to each other.
### Table 4.13 Postmortem Tooth Loss by Recovery Method

<table>
<thead>
<tr>
<th>Recovery Method</th>
<th>(N)*</th>
<th>Lost Postmortem</th>
<th>Not Lost Postmortem</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transported to lab</td>
<td>(23)</td>
<td>78</td>
<td>658</td>
<td>736</td>
</tr>
<tr>
<td>Recovered in Field</td>
<td>(4)</td>
<td>9</td>
<td>119</td>
<td>128</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(27)</td>
<td><strong>87</strong></td>
<td><strong>777</strong></td>
<td><strong>864</strong></td>
</tr>
</tbody>
</table>

$x^2=1.532$, df=1, $p>0.05$ (Not Significant)

* Notes the number of cases represented

Postmortem tooth loss does not have an effect on whether or not an individual is identified (Table 4.14). The frequency of teeth lost postmortem in unidentified cases is similar to the frequency of teeth lost postmortem in identified cases. The frequencies of teeth not lost postmortem are similar between unidentified cases and identified cases.

### Table 4.14 Postmortem Tooth Loss by Identification

<table>
<thead>
<tr>
<th>Identification</th>
<th>(N)*</th>
<th>Lost Postmortem</th>
<th>Not Lost Postmortem</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unidentified</td>
<td>(16)</td>
<td>55</td>
<td>457</td>
<td>512</td>
</tr>
<tr>
<td>Identified</td>
<td>(11)</td>
<td>32</td>
<td>320</td>
<td>352</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(27)</td>
<td><strong>87</strong></td>
<td><strong>777</strong></td>
<td><strong>864</strong></td>
</tr>
</tbody>
</table>

$x^2=0.628$, df=1, $p>0.05$ (Not Significant)

* Notes the number of cases represented

### Antemortem Tooth Loss and False Teeth

Thirty cases in this study demonstrated antemortem tooth loss, for a possible 960 teeth. Third molars account for 120 of these teeth. Since this study did not distinguish between antemortem loss and congenital absence of third molars, all third molars were removed from this part of the study. Eight cases showed antemortem loss of only third molars, leaving 22 cases included in this part of analysis. Discounting third molars, 167 teeth were lost antemortem. Of these teeth, 124 did not appear to be compensated for by the presence of bridges or dentures. The “not lost antemortem” column only includes the teeth in cases that show antemortem loss.
A relationship exists between tooth type and antemortem loss (Table 4.15). Molars have the highest frequency of antemortem loss. Premolars have the second highest frequency of antemortem loss, which is only slightly greater than that of canines and incisors. Canines and incisors are relatively equal in the frequency of teeth lost antemortem.

Table 4.15 Antemortem Tooth Loss by Tooth Type

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Not Lost Antemortem</th>
<th>Lost with no bridges or dentures</th>
<th>Lost with bridge or denture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>166</td>
<td>60</td>
<td>14</td>
<td>296</td>
</tr>
<tr>
<td>Premolars</td>
<td>194</td>
<td>36</td>
<td>10</td>
<td>240</td>
</tr>
<tr>
<td>Canines</td>
<td>105</td>
<td>8</td>
<td>7</td>
<td>120</td>
</tr>
<tr>
<td>Incisors</td>
<td>208</td>
<td>20</td>
<td>12</td>
<td>240</td>
</tr>
<tr>
<td>Total</td>
<td>673</td>
<td>124</td>
<td>43</td>
<td>840</td>
</tr>
</tbody>
</table>

\[x^2 = 35.596, \text{ df}=6, p \leq 0.001\] (Significant)

Table 4.16 shows a correlation between antemortem loss and sex of an individual. Thirteen males and nine females exhibit postmortem loss. Males exhibit the greater frequency of antemortem tooth loss. Females have a higher frequency of teeth not lost antemortem.

Table 4.16 Antemortem Tooth Loss by Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>(N)*</th>
<th>Not Lost Antemortem</th>
<th>Lost Antemortem</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>(13)</td>
<td>327</td>
<td>121</td>
<td>448</td>
</tr>
<tr>
<td>Female</td>
<td>(9)</td>
<td>346</td>
<td>46</td>
<td>392</td>
</tr>
<tr>
<td>Total</td>
<td>(22)</td>
<td>673</td>
<td>167</td>
<td>840</td>
</tr>
</tbody>
</table>

\[x^2 = 30.622, \text{ df}=1, p \leq 0.001\] (Significant)

* Notes the number of cases represented

Socioeconomic status is associated with antemortem tooth loss (Table 4.17). Unidentified cases with antemortem tooth loss accounted for 11, exactly half, of the cases.
with antemortem tooth loss. Individuals of middle socioeconomic status have more antemortem tooth loss than those of lower socioeconomic status.

Table 4.17 Antemortem Tooth Loss by Socioeconomic Status

<table>
<thead>
<tr>
<th>S.E. Status</th>
<th>(N)*</th>
<th>Not Lost Antemortem</th>
<th>Lost Antemortem</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower</td>
<td>(3)</td>
<td>133</td>
<td>7</td>
<td>140</td>
</tr>
<tr>
<td>Middle</td>
<td>(8)</td>
<td>254</td>
<td>54</td>
<td>308</td>
</tr>
<tr>
<td>Total</td>
<td>(11)</td>
<td>387</td>
<td>61</td>
<td>448</td>
</tr>
</tbody>
</table>

\[ x^2 = 12.853, \text{df}=1, p \leq 0.001 \text{ (Significant)} \]
*Notes the number of cases represented

Antemortem loss is also connected with race (Table 4.18). Thirteen whites, one Mongoloid, and eight blacks have antemortem tooth loss. Mongoloids have the least teeth lost antemortem, which occurs in only one case. Whites have the highest frequency of teeth lost antemortem. Blacks are intermediate between the two other races.

Table 4.18 Antemortem Tooth Loss by Race

<table>
<thead>
<tr>
<th>Race</th>
<th>(N)*</th>
<th>Not Lost Antemortem</th>
<th>Lost Antemortem</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>(13)</td>
<td>388</td>
<td>116</td>
<td>504</td>
</tr>
<tr>
<td>Mongoloid</td>
<td>(1)</td>
<td>52</td>
<td>4</td>
<td>56</td>
</tr>
<tr>
<td>Black</td>
<td>(8)</td>
<td>233</td>
<td>47</td>
<td>280</td>
</tr>
<tr>
<td>Total</td>
<td>(22)</td>
<td>673</td>
<td>167</td>
<td>840</td>
</tr>
</tbody>
</table>

\[ x^2 = 10.498, \text{df}=2, p \leq 0.006 \text{ (Significant)} \]
*Notes the number of cases represented

Table 4.19 shows a relationship between antemortem tooth loss and an individual’s age. The frequencies of lost teeth for each age group show an increase paralleling an increase in age. The two oldest age groups demonstrate a large increase in frequency of lost teeth from the preceding age groups. However, it is important to note that each of these older groups is represented by only one case with almost complete antemortem tooth loss.
Table 4.19 Antemortem Tooth Loss by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>Not Lost Antemortem</th>
<th>Lost Antemortem</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-29</td>
<td>(6)</td>
<td>262</td>
<td>18</td>
<td>280</td>
</tr>
<tr>
<td>30-39</td>
<td>(7)</td>
<td>253</td>
<td>27</td>
<td>280</td>
</tr>
<tr>
<td>40-49</td>
<td>(5)</td>
<td>98</td>
<td>42</td>
<td>140</td>
</tr>
<tr>
<td>50-59</td>
<td>(2)</td>
<td>56</td>
<td>28</td>
<td>84</td>
</tr>
<tr>
<td>60-69</td>
<td>(1)</td>
<td>4</td>
<td>24</td>
<td>28</td>
</tr>
<tr>
<td>70+</td>
<td>(1)</td>
<td>0</td>
<td>28</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>(22)</td>
<td>673</td>
<td>167</td>
<td>840</td>
</tr>
</tbody>
</table>

*x²=257.805, df=5, p ≤ 0.001  (Significant)*

*Notes the number of cases represented

False teeth, or dentures, compensated for 39 teeth that were lost antemortem. Twenty-eight of these belonged to one middle class white male who was over seventy years of age at the time of his death. The other 12 belonged to an unidentified white female who is estimated to have been between 40 and 49 years of age at the time of her death. Since only two cases exhibited false teeth, no statistical analysis was performed on this characteristic. Antemortem lost teeth were noted to be part of a dental bridge in four instances. Three of these bridges occurred in an unidentified white male estimated to be between 40 and 49 years of age. The other bridge occurred in a middle class white female also between the ages of 40 and 49. These teeth are included in the analysis of crowned teeth in the next section.

**Crowns**

Cases in this study which have crowned, or capped, teeth include 10 out of the total 41 cases. A possible 320 teeth are represented in these 10 cases. Of these 320 teeth, 60 teeth were incomplete and no assessment could be made; 213 teeth did not have a crown; and 47 teeth were crowned. Crowns belonging to five unidentified cases account for 134 of the total 260. Five different types of crowns were observed on these 10
individuals: porcelain, gold, gold with engraving, porcelain and silver, and porcelain and gold. The second of these types, gold, does not refer to an actual gold crown, but to a metal crown covered with a gold plating or polish. This type is the least expensive of all the ones observed because they are not custom made for a patient but are simply bent into shape around the tooth. As a result, these crowns are often not tight enough or properly sealed around the tooth and become loose, requiring further treatment. Crowns of porcelain are more expensive because they are custom made, fit snugly on a tooth and require little maintenance or readjustment. The third crown type mentioned above, gold with engraving, was found on only one individual’s two upper central incisors. This individual has been positively identified as a black male of lower socioeconomic status who was in his early twenties when he died. Crowns were also located on the two upper lateral incisors in this man’s dentition, but these were gold without engravings. Each central incisor had a different symbol etched into the crown (Figure 4.1).

![Figure 4.1 Upper Central Incisors with Engraved Gold Crowns](image)

Table 4.20 shows no relationship between the type of crown used and the type of tooth on which it is used. A person’s choice of crown material does not appear to be affected by its location in the mouth. However, upper incisors are the most commonly crowned tooth type. The “no crowns” column only includes teeth without crowns that are present in cases that do have some teeth with crowns.
Table 4.20 Crown Type Distribution by Tooth Type

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>No Crowns</th>
<th>Porc.*</th>
<th>Gold</th>
<th>Engraved Gold</th>
<th>Porc. &amp; Silver</th>
<th>Porc. &amp; Gold</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>68</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>83</td>
</tr>
<tr>
<td>Premolars</td>
<td>64</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>73</td>
</tr>
<tr>
<td>Canines</td>
<td>32</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>Incisors</td>
<td>49</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td>68</td>
</tr>
<tr>
<td>Total</td>
<td>213</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td>26</td>
<td>260</td>
</tr>
</tbody>
</table>

\[ x^2 = 19.423, \text{ df} = 15, p > 0.05 \ (\text{Not Significant}) \]

*Porcelain

No correlation between a person’s sex and the type of crown he or she selected was found either (Table 4.21). Six males and four females have crowns. Whether a person is male or female does not change the choice in crown material. Females have a lower frequency of total crowns than males.

Table 4.21 Crown Type Distribution by Sex

<table>
<thead>
<tr>
<th>Sex (N)*</th>
<th>No Crowns</th>
<th>Porc.*</th>
<th>Gold</th>
<th>Engraved Gold</th>
<th>Porc. &amp; Silver</th>
<th>Porc. &amp; Gold</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (6)</td>
<td>127</td>
<td>1</td>
<td>7</td>
<td>2</td>
<td>4</td>
<td>21</td>
<td>162</td>
</tr>
<tr>
<td>Female (4)</td>
<td>86</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>5</td>
<td>98</td>
</tr>
<tr>
<td>Total (10)</td>
<td>213</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td>26</td>
<td>260</td>
</tr>
</tbody>
</table>

\[ x^2 = 7.705, \text{ df} = 5, p > 0.05 \ (\text{Not Significant}) \]

*Notes the number of cases represented

Only 11 crowns occur in identified cases and only one individual of lower socioeconomic status has crowns. Given the small sample size, a correlation between socioeconomic status and crown types was not tested. Table 4.22 shows the distribution of crown types by socioeconomic status. People of middle socioeconomic status primarily choose a type of porcelain crown. People of lower socioeconomic status are more likely to choose a type of gold crown.
Table 4.22 Crown Type Distribution by Socioeconomic Status

<table>
<thead>
<tr>
<th>S.E. Status</th>
<th>(N)*</th>
<th>No Crowns</th>
<th>Porc.</th>
<th>Gold</th>
<th>Engraved Gold</th>
<th>Porc. &amp; Silver</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Class</td>
<td>(1)</td>
<td>28</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>32</td>
</tr>
<tr>
<td>Middle Class</td>
<td>(4)</td>
<td>87</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>94</td>
</tr>
<tr>
<td>Total</td>
<td>(5)</td>
<td>115</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>126</td>
</tr>
</tbody>
</table>

*Notes the number of cases represented

Race does affect crown type (Table 4.23). No crowns were found in the three Mongoloid cases included in this study, but six whites and four blacks have crowns.

Whites had a much higher occurrence of crowns than blacks. Whites show a significant preference for the porcelain and gold type crown. Blacks show fairly equal frequencies for all crown types, but the gold type is present in slightly higher frequency than the other types.

Table 4.23 Crown Type Distribution by Race

<table>
<thead>
<tr>
<th>Race</th>
<th>(N)*</th>
<th>No Crowns</th>
<th>Porc.</th>
<th>Gold</th>
<th>Engraved Gold</th>
<th>Porc. &amp; Silver</th>
<th>Porc. &amp; Gold</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>(6)</td>
<td>113</td>
<td>2</td>
<td>5</td>
<td>0</td>
<td>6</td>
<td>24</td>
<td>150</td>
</tr>
<tr>
<td>Black</td>
<td>(4)</td>
<td>100</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>110</td>
</tr>
<tr>
<td>Total</td>
<td>(10)</td>
<td>213</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td>26</td>
<td>260</td>
</tr>
</tbody>
</table>

$x^2=19.738$, df=5, $p \leq 0.002$ (Significant)

*Notes the number of cases represented

Table 4.24 shows a relationship between age and crown type. Individuals between 19-29 years of age have the lowest frequency of crowns and prefer gold crowns.

People in the age group of 30-39 years of age show equal frequencies of the porcelain type and the porcelain and gold type of crown. Individuals between 40-49 years of age have the highest frequency of crowns and prefer the porcelain and gold type crowns.

People 50-59 years of age also prefer the porcelain and gold type of crown.
Table 4.24 Crown Type Distribution by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>No Crowns</th>
<th>Porc.</th>
<th>Gold</th>
<th>Engraved Gold</th>
<th>Porc. &amp; Silver</th>
<th>Porc. &amp; Gold</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-29</td>
<td>(3)</td>
<td>82</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>88</td>
</tr>
<tr>
<td>30-39</td>
<td>(3)</td>
<td>63</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>69</td>
</tr>
<tr>
<td>40-49</td>
<td>(3)</td>
<td>46</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>6</td>
<td>19</td>
<td>75</td>
</tr>
<tr>
<td>50-59</td>
<td>(1)</td>
<td>22</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>28</td>
</tr>
<tr>
<td>Total</td>
<td>(10)</td>
<td>213</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>7</td>
<td>26</td>
<td>260</td>
</tr>
</tbody>
</table>

x²=57.289, df=15, p≤0.001 (Significant)
*Notes the number of cases represented

Abscesses

Abscess lesions were noted associated in 23 cases in this study, for a possible 736 teeth. Out of the possible 736 teeth, 78 had abscesses. One hundred and seventeen teeth were not in sufficient condition for assessment. Forty of the teeth with associated abscesses had some type of dental restoration, such as a crown or filling. The other 38 had no signs of dental treatment. Only one abscess was associated with a tooth that had been treated with root canal therapy. Abscesses were recorded based on which side of the alveolar bone they occurred, toward the cheek and lips (buccal), or toward the tongue (lingual). One tooth had an abscess on both the buccal and the lingual side. In the database, this was recorded with a separate code. Therefore, while only 78 teeth were affected by abscesses, 79 abscesses occurred in this study. The “no abscess” column only includes teeth present without abscesses in cases with some teeth with abscesses.

Table 4.25 shows no relationship between the location of an abscess and the type of tooth associated with it. Molars, premolars, canines, and incisors all were affected equally by abscesses on the buccal side. Molars and incisors were affected similarly on the lingual side. An incisor is the type of tooth with an abscess on both the lingual and buccal side.
Table 4.25 Abscess Distribution by Tooth Type

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>No Abscess</th>
<th>Buccal</th>
<th>Lingual</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>171</td>
<td>22</td>
<td>3</td>
<td>0</td>
<td>196</td>
</tr>
<tr>
<td>Premolars</td>
<td>141</td>
<td>22</td>
<td>0</td>
<td>0</td>
<td>163</td>
</tr>
<tr>
<td>Canines</td>
<td>76</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>86</td>
</tr>
<tr>
<td>Incisors</td>
<td>153</td>
<td>16</td>
<td>4</td>
<td>1</td>
<td>174</td>
</tr>
<tr>
<td>Total</td>
<td>541</td>
<td>70</td>
<td>7</td>
<td>1</td>
<td>619</td>
</tr>
</tbody>
</table>

$x^2=9.166$, df=9, p>0.05  (Not Significant)

No correlation exists between an individual’s sex and the location of abscesses (Table 4.26). Ten males and 13 females have abscesses. Males and females are similarly affected by abscesses. Frequencies for all abscess types are consistent between males and females.

Table 4.26 Abscess Distribution by Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>(N)*</th>
<th>No Abscess</th>
<th>Buccal</th>
<th>Lingual</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>(10)</td>
<td>246</td>
<td>33</td>
<td>1</td>
<td>0</td>
<td>280</td>
</tr>
<tr>
<td>Females</td>
<td>(13)</td>
<td>294</td>
<td>37</td>
<td>6</td>
<td>1</td>
<td>339</td>
</tr>
<tr>
<td>Total</td>
<td>(23)</td>
<td>541</td>
<td>70</td>
<td>7</td>
<td>1</td>
<td>619</td>
</tr>
</tbody>
</table>

$x^2=3.648$, df=3, p>0.05  (Not Significant)

*Notes the number of cases represented

The location of abscesses is not affected by the socioeconomic status of an individual (Table 4.27). Eleven cases with abscesses were unidentified; five were of lower socioeconomic status; seven were of middle socioeconomic status. Individuals of lower and middle socioeconomic status show similar frequencies in the location and occurrence of abscesses.

Table 4.27 Abscess Distribution by Socioeconomic Status

<table>
<thead>
<tr>
<th>S.E. Status</th>
<th>(N)*</th>
<th>No Abscess</th>
<th>Buccal</th>
<th>Lingual</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Status</td>
<td>(5)</td>
<td>128</td>
<td>20</td>
<td>1</td>
<td>0</td>
<td>149</td>
</tr>
<tr>
<td>Middle Status</td>
<td>(7)</td>
<td>162</td>
<td>21</td>
<td>5</td>
<td>1</td>
<td>189</td>
</tr>
<tr>
<td>Total</td>
<td>(12)</td>
<td>290</td>
<td>41</td>
<td>6</td>
<td>0</td>
<td>338</td>
</tr>
</tbody>
</table>

$x^2=2.985$, df=3, p>0.05  (Not Significant)

*Notes the number of cases represented
Table 4.28 shows a relationship between race and the location of abscesses.

Fourteen whites, two Mongoloids, and seven blacks have abscesses. Mongoloids have the highest rate of occurrence of abscesses, but were represented by only two individuals with abscesses. Blacks have the lowest rate of occurrence of abscesses.

<table>
<thead>
<tr>
<th>Race</th>
<th>(N)*</th>
<th>No Abscess</th>
<th>Buccal</th>
<th>Lingual</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>(14)</td>
<td>314</td>
<td>49</td>
<td>1</td>
<td>1</td>
<td>365</td>
</tr>
<tr>
<td>Mongoloid</td>
<td>(2)</td>
<td>41</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>52</td>
</tr>
<tr>
<td>Black</td>
<td>(7)</td>
<td>186</td>
<td>14</td>
<td>2</td>
<td>0</td>
<td>202</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(23)</td>
<td><strong>541</strong></td>
<td><strong>70</strong></td>
<td><strong>7</strong></td>
<td><strong>1</strong></td>
<td><strong>619</strong></td>
</tr>
</tbody>
</table>

\[x^2=29.000, \text{df}=6, p\leq0.001 \text{ (Significant)}\]

*Notes the number of cases represented

A connection also exists between the location of abscesses and an individual’s age (Table 4.29). The age groups 19-29 and 30-39 are affected equally by abscesses. The group of 40-49 year olds has the highest frequency of abscesses, most of which are buccal. The oldest group, of 50-59 year olds, has the lowest occurrence of abscesses, but this group contains only one individual.

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>No Abscess</th>
<th>Buccal</th>
<th>Lingual</th>
<th>Both</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-29</td>
<td>(11)</td>
<td>290</td>
<td>29</td>
<td>6</td>
<td>0</td>
<td>325</td>
</tr>
<tr>
<td>30-39</td>
<td>(6)</td>
<td>146</td>
<td>15</td>
<td>1</td>
<td>0</td>
<td>162</td>
</tr>
<tr>
<td>40-49</td>
<td>(5)</td>
<td>78</td>
<td>25</td>
<td>0</td>
<td>1</td>
<td>104</td>
</tr>
<tr>
<td>50-59</td>
<td>(1)</td>
<td>27</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>28</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>(23)</td>
<td><strong>541</strong></td>
<td><strong>70</strong></td>
<td><strong>7</strong></td>
<td><strong>1</strong></td>
<td><strong>619</strong></td>
</tr>
</tbody>
</table>

\[x^2=29.268, \text{df}=9, p\leq0.001 \text{ (Significant)}\]

*Notes the number of cases represented

Root Canal Therapy

Root canal therapy is used to treat infections that have reached the pulp cavity of a tooth, as described in Chapter 2. In this study, 11 teeth were discovered to have been
treated with root canal therapy. As mentioned above, only one of these teeth had an
associated abscess. These 11 teeth were found in a total of five cases. Two cases were
unidentified individuals and the remaining three were of middle socioeconomic status.
Therefore, no statistical analysis of root canal distribution by socioeconomic status could
be performed. Four of these cases were male, three were white and the fourth was black.
The one female case with root canal therapy was a middle class Caucasian. She had only
one tooth with a root canal and this is the single tooth associated with an abscess. No
relationship was found between root canal therapy and tooth type, sex, race, or age as
shown in Tables 4.30, 4.31, 4.32, and 4.33.

Table 4.30 Root Canal Therapy by Tooth Type

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>No Root Canal</th>
<th>Root Canal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>34</td>
<td>5</td>
<td>39</td>
</tr>
<tr>
<td>Premolars</td>
<td>26</td>
<td>4</td>
<td>30</td>
</tr>
<tr>
<td>Canines</td>
<td>20</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Incisors</td>
<td>34</td>
<td>2</td>
<td>36</td>
</tr>
<tr>
<td>Total</td>
<td>114</td>
<td>11</td>
<td>125</td>
</tr>
</tbody>
</table>

\[ x^2 = 3.956, \text{ df}=3, p>0.05 \text{ (Not Significant)} \]

Table 4.31 Root Canal Therapy by Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>(N)*</th>
<th>No Root Canal</th>
<th>Root Canal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>4</td>
<td>94</td>
<td>10</td>
<td>104</td>
</tr>
<tr>
<td>Female</td>
<td>1</td>
<td>20</td>
<td>1</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>114</td>
<td>11</td>
<td>125</td>
</tr>
</tbody>
</table>

\[ x^2 = .513, \text{ df}=1, p>0.05 \text{ (Not Significant)} \]

*Notes the number of cases represented

Table 4.32 Root Canal Therapy by Race

<table>
<thead>
<tr>
<th>Race</th>
<th>(N)*</th>
<th>No Root Canal</th>
<th>Root Canal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>4</td>
<td>93</td>
<td>7</td>
<td>100</td>
</tr>
<tr>
<td>Black</td>
<td>1</td>
<td>21</td>
<td>4</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>5</td>
<td>114</td>
<td>11</td>
<td>125</td>
</tr>
</tbody>
</table>

\[ x^2 = 2.019, \text{ df}=1, p>0.05 \text{ (Not Significant)} \]

*Notes the number of cases represented
Table 4.33 Root Canal Therapy by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>No Root Canal</th>
<th>Root Canal</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>19-29</td>
<td>(1)</td>
<td>30</td>
<td>1</td>
<td>31</td>
</tr>
<tr>
<td>30-39</td>
<td>(2)</td>
<td>41</td>
<td>5</td>
<td>46</td>
</tr>
<tr>
<td>40-49</td>
<td>(1)</td>
<td>20</td>
<td>3</td>
<td>23</td>
</tr>
<tr>
<td>50-59</td>
<td>(1)</td>
<td>23</td>
<td>2</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>(5)</td>
<td>114</td>
<td>11</td>
<td>125</td>
</tr>
</tbody>
</table>

$\chi^2=1.982, \text{df}=3, p>0.05$ (Not Significant)

*Notes the number of cases represented

Caries

In this study, 30 cases exhibited carious lesions. Out of a possible 960 teeth, 199 teeth were affected, 266 teeth could not be analyzed (this number includes false teeth and crowned teeth), and 495 teeth had no signs of caries. Table 4.34 shows a relationship between caries and tooth type. Molars were the most affected tooth type. The lower right second molar was the most affected tooth in this study. However, all first and second molars were nearly equally affected. Incisors were the least affected tooth type.

Table 4.34 Caries Distribution by Tooth Type

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Non-Carious</th>
<th>Carious</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>100</td>
<td>132</td>
<td>232</td>
</tr>
<tr>
<td>Premolars</td>
<td>138</td>
<td>53</td>
<td>191</td>
</tr>
<tr>
<td>Canines</td>
<td>89</td>
<td>7</td>
<td>96</td>
</tr>
<tr>
<td>Incisors</td>
<td>168</td>
<td>7</td>
<td>175</td>
</tr>
<tr>
<td>Total</td>
<td>495</td>
<td>199</td>
<td>694</td>
</tr>
</tbody>
</table>

$\chi^2=163.986, \text{df}=3, p\leq0.001$ (Significant)

No connection appears to exist between caries and an individual’s sex (Table 4.35) or between caries and an individual’s socioeconomic status (Table 4.36). Males and females accounted for 15 cases each. Twelve cases with caries were unidentified, six were of lower socioeconomic status, and 12 were of middle socioeconomic status. Females are slightly more affected by caries than males. Individuals of middle
socioeconomic status are slightly less affected than individuals of lower socioeconomic status. These differences were not found to be statistically significant.

<table>
<thead>
<tr>
<th>Table 4.35 Caries Distribution by Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

\[x^2=3.451, \text{ df}=1, p>0.05 \text{ (Not Significant)}\]

*Notes the number of cases represented

<table>
<thead>
<tr>
<th>Table 4.36 Caries Distribution by Socioeconomic Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.E Status</td>
</tr>
<tr>
<td>Lower Status</td>
</tr>
<tr>
<td>Middle Status</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

\[x^2=2.931, \text{ df}=1, p>0.05 \text{ (Not Significant)}\]

*Notes the number of cases represented

Race does appear to affect the rate of caries in an individual (Table 4.37).

Nineteen cases were white, two were Mongoloid, and nine were black. Whites have the highest occurrence of caries. Blacks have the lowest frequency of caries.

<table>
<thead>
<tr>
<th>Table 4.37 Caries Distribution by Race</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race</td>
</tr>
<tr>
<td>White</td>
</tr>
<tr>
<td>Mongoloid</td>
</tr>
<tr>
<td>Black</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

\[x^2=10.471, \text{ df}=2, p \leq 0.006 \text{ (Significant)}\]

*Notes the number of cases represented

Table 4.38 demonstrates that a relationship exists between caries and the age of an individual. The age group of 40-49 year olds has the highest frequency of caries. The age group of 19-29 year olds has the lowest occurrence of caries.
### Table 4.38 Caries Distribution by Age

<table>
<thead>
<tr>
<th>Age</th>
<th>(N)*</th>
<th>Non-Carious</th>
<th>Carious</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subadult</td>
<td>(1)</td>
<td>22</td>
<td>10</td>
<td>32</td>
</tr>
<tr>
<td>19-29</td>
<td>(14)</td>
<td>268</td>
<td>101</td>
<td>369</td>
</tr>
<tr>
<td>30-39</td>
<td>(8)</td>
<td>154</td>
<td>43</td>
<td>197</td>
</tr>
<tr>
<td>40-49</td>
<td>(5)</td>
<td>23</td>
<td>27</td>
<td>50</td>
</tr>
<tr>
<td>50-59</td>
<td>(2)</td>
<td>28</td>
<td>18</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>(30)</td>
<td>495</td>
<td>199</td>
<td>694</td>
</tr>
</tbody>
</table>

$x^2=23.065$, df=4, $p \leq 0.001$ (Significant)

*Notes the number of cases represented

Other statistical analyses were done to determine if the location of a tooth affected the rate of caries. These chi-squared tests were designed to determine if the quadrant in which a tooth was positioned made a difference in the caries frequency. No relationships were determined in any of these tests. Table 4.39 shows an example of these tests.

### Table 4.39 Caries Distribution by Quadrant

<table>
<thead>
<tr>
<th>Jaw</th>
<th>Right</th>
<th>Left</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxilla</td>
<td>59</td>
<td>46</td>
<td>105</td>
</tr>
<tr>
<td>Mandible</td>
<td>48</td>
<td>46</td>
<td>94</td>
</tr>
<tr>
<td>Total</td>
<td>107</td>
<td>92</td>
<td>199</td>
</tr>
</tbody>
</table>

$x^2=.525$, df=1, $p>0.05$ (Not Significant)

### Cavity Surfaces

Some cavities, or carious lesions, involve more than one surface of a tooth. A total of 378 surfaces were affected by the carious lesions explained in the previous section. In this study, each different combination of involved surfaces was given a separate code in the database. To perform analysis of cavity surfaces, a cavity which involves more than one surface of a tooth is counted for each surface it involves. For example, a cavity which affects both the occlusal and buccal surfaces is included in the count of occlusal cavities and is counted again for buccal cavities. In this way, 378...
surfaces are affected by only 199 cavities. Since the previous section already analyzed the cavities to determine a relationship with the identifiers focused on in this study, this work will not be repeated based upon cavity surface. Instead, the aim of this section is only to determine the frequency that each surface is affected (Table 4.40).

<table>
<thead>
<tr>
<th>Identifiers</th>
<th>Cavity Surfaces</th>
</tr>
</thead>
<tbody>
<tr>
<td>Race (N)*</td>
<td>Occlusal</td>
</tr>
<tr>
<td>White (3)</td>
<td>Male</td>
</tr>
<tr>
<td>(2)</td>
<td>Lower</td>
</tr>
<tr>
<td>(4)</td>
<td>Middle</td>
</tr>
<tr>
<td>(3)</td>
<td>Female</td>
</tr>
<tr>
<td>(2)</td>
<td>Lower</td>
</tr>
<tr>
<td>(5)</td>
<td>Middle</td>
</tr>
<tr>
<td>Mongoloid (0)</td>
<td>Male</td>
</tr>
<tr>
<td>(1)</td>
<td>Female</td>
</tr>
<tr>
<td>(1)</td>
<td>Middle</td>
</tr>
<tr>
<td>Black (4)</td>
<td>Male</td>
</tr>
<tr>
<td>(1)</td>
<td>Lower</td>
</tr>
<tr>
<td>(1)</td>
<td>Middle</td>
</tr>
<tr>
<td>(1)</td>
<td>Female</td>
</tr>
<tr>
<td>(1)</td>
<td>Lower</td>
</tr>
<tr>
<td>(1)</td>
<td>Middle</td>
</tr>
<tr>
<td>Total (30)</td>
<td>180</td>
</tr>
</tbody>
</table>

**Percentages** 48% 14% 10% 15% 13%

*Notes the number of cases represented

**Fillings**

Of the 199 cavities noted in this study, 157 have fillings, 11 were never treated, and 31 were cases where it could not be determined if they had been filled. Only 25 of the previously mentioned 30 cases with cavities were treated. Table 4.41 shows a
relationship between filling type and tooth type. Filling material involving some type of
metal is preferred for posterior teeth and resin fillings are preferred for anterior teeth.

Table 4.41 Filling Type by Tooth Type

<table>
<thead>
<tr>
<th>Tooth Type</th>
<th>Unfilled</th>
<th>Amalgam</th>
<th>Resin</th>
<th>Gold</th>
<th>Amalgam &amp; Resin</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molars</td>
<td>10</td>
<td>105</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>122</td>
</tr>
<tr>
<td>Premolars</td>
<td>0</td>
<td>35</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>43</td>
</tr>
<tr>
<td>Canines</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Incisors</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>140</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>168</td>
</tr>
</tbody>
</table>

$x^2=59.147, \text{df}=12, p \leq 0.001$ (Significant)

A correlation also exists between filling type and sex (Table 4.42). Males are
limited to metal material for their fillings, but females use all types. Both males and
females prefer amalgam fillings. Males are more likely to have unfilled cavities than
females. However, no relationship exists between filling type and socioeconomic status
(Table 4.43).

Table 4.42 Filling Type by Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>(N)*</th>
<th>Unfilled</th>
<th>Amalgam</th>
<th>Resin</th>
<th>Gold</th>
<th>Amalgam &amp; Resin</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>(15)</td>
<td>8</td>
<td>49</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>59</td>
</tr>
<tr>
<td>Female</td>
<td>(15)</td>
<td>3</td>
<td>91</td>
<td>6</td>
<td>8</td>
<td>1</td>
<td>109</td>
</tr>
<tr>
<td>Total</td>
<td>(30)</td>
<td>11</td>
<td>140</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>168</td>
</tr>
</tbody>
</table>

$x^2=12.548, \text{df}=4, p \leq 0.02$ (Significant)

*Notes the number of cases represented

Table 4.43 Filling Type by Socioeconomic Status

<table>
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<th>S.E.</th>
<th>(N)*</th>
<th>Unfilled</th>
<th>Amalgam</th>
<th>Resin</th>
<th>Gold</th>
<th>Amalgam &amp; Resin</th>
<th>Total</th>
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<td>Total</td>
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<td>3</td>
<td>93</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>104</td>
</tr>
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</table>

$x^2=5.432, \text{df}=4, p>0.05$ (Not Significant)

*Notes the number of cases represented
Table 4.44 shows a relationship between filling type and race. Blacks have the highest frequency of unfilled cavities and the lowest frequency of amalgam fillings. Mongoloids have all amalgam fillings. Whites show the greatest variety of filling types.

![Table 4.44 Filling Type by Race](Image)

Age and filling type are also connected (Table 4.45). The oldest age group of 50-59 year olds has the highest frequency of gold fillings. The group of 40-49 year olds has the highest frequency of amalgam and resin filling types. The group of 19-29 year olds has the highest frequency of amalgam fillings.

![Table 4.45 Filling Type by Age](Image)

*Notes the number of cases represented
CHAPTER 5: DISCUSSION

As valuable as researchers and investigators already know dentition is for positive identification, it may prove just as valuable for general identification. Dental conditions may help support conclusions about sex, race, and age when more standard methods cannot be performed or can not be performed satisfactorily. This study revealed many significant relationships between dental conditions and the identifiers, sex, race, age, and socioeconomic status.

Tooth wear analysis showed a significant relationship with each of the identifiers tested. Canines and incisors are the most commonly and severely worn teeth, particularly the lower right lateral incisor. This conclusion was expected because, as the first stage of the digestion process, these teeth encounter foods in their toughest form. Anterior teeth are also commonly used for nonmasticatory functions, such as holding nails or pins and tearing or opening objects. The teeth of males are worn more than those of females. This result is not consistent with Molnar (1971) or with the idea that females’ teeth may be more worn due to earlier eruption than males. Perhaps this can be explained by the fact that men tend to have more manual labor jobs than women and, therefore, are probably more likely to use their teeth as a tool. Also, women are not usually pipe or cigar smokers, so they would not have extra wear from such items.

The correlation between socioeconomic status and tooth wear is not what might be expected. To think that individuals of a lower status would exhibit more tooth wear because of more manual labor jobs would be reasonable. However, in this study, individuals of the middle socioeconomic status showed more tooth wear. This correlation may be due to dietary differences or smoking choices, such as smoking a pipe.
instead of a cigarette. The connection between race and tooth wear may be due to dietary or genetic differences. Tooth wear differences according to age are predictable; the older a person is the more wear his or her teeth will get.

Staining of teeth was only found to be connected to three of the five identifiers. Incisors were the most frequently stained teeth. This conclusion was a little unexpected because incisors are the most visible teeth and, therefore, probably the most cared for. The teeth of males tend to be more commonly and severely stained than those of females. This outcome is probably the result of hygiene differences, both personal and professional, between the sexes. Socioeconomic status and race have no effect on staining. However, the age of an individual does relate to the amount of staining he has. Much like tooth wear and age, this result is logical in that as age increases so does the severity of tooth stains.

Postmortem tooth loss was not tested against the five identifiers because what happens to an individual’s teeth after he is dead should not be affected by his personal history. The most frequently unrecovered tooth is the lower right central incisor. Incisors are expected to be lost because they are single root teeth and are exposed easily, or early, in decomposition. The method of recovery does not affect the collection of teeth. Also, the fact that these teeth are lost does not hinder positive identification of the remains.

Antemortem tooth loss showed a correlation with all the identifiers. Molars have the highest rate of removal. Females would be expected to have a greater rate of antemortem loss because their smaller dental arcades are potentially more prone to overcrowding and, therefore, removal of teeth, but this was not the finding of this study.
Since the reason teeth were removed cannot be known in forensic cases, no conclusions about this result can be attempted. Members of the middle class have more teeth lost antemortem than members of the lower class. Better dental care is the most likely explanation for this; middle class individuals can afford to have their teeth treated as is necessary, but lower class people may not be able to pay for a tooth extraction and allow the tooth to remain. Whites have more antemortem tooth loss than either Mongoloids or blacks. Like tooth wear and staining, tooth extraction increases with age. This fact is also understandable.

Race, and age have an effect on crown type, but tooth type and gender do not. The upper incisors are the most likely to be crowned, but these are the most visible teeth in the mouth and a crown is certainly more attractive than a filling or diseased tooth. People of the middle socioeconomic status are able to afford the more expensive and more attractive porcelain crowns, but people of the lower socioeconomic status may not be able to do so. This monetary situation may account for the association of crown type and socioeconomic status. A cultural choice may be the reason for differences in crown types between races. As a person gets older, he may become wealthier or more willing to accept the higher expense of a porcelain crown for the benefit of its higher quality. Porcelain crowns are more expensive, but they are also more durable than metal crowns.

Race and age are the only identifiers that are connected with abscess formation. All teeth are basically equally affected; canines are slightly less affected than the other types of teeth. Mongoloids suffer the most from abscesses, followed by whites, and then blacks. These differences could be dietary or genetic in origin. Also, the small sample of Mongoloids in this study may present an inaccurate picture of this characteristic in this
race. Future studies in this area should include a larger sample of Mongoloids.

Abscesses most affect people 40-49 years of age.

Root canal therapy was not found to be associated with any of the four identifiers tested. Socioeconomic status could not be tested because no individual of lower socioeconomic status had a root canal. The only explanation is that when root canal therapy is required, it is done because the pain can be too severe if it is left untreated.

Caries rates are affected by tooth type, race, and age, but not by socioeconomic status or sex. Caselitz (1998) suggests that first molars are the most affected by caries, although he admits that no extensive research has been done. In this study, second molars were more affected, but only a slight difference separated first and second molars. This study agrees with Caselitz (1998) that posterior teeth are more affected than anterior teeth. He also states that upper teeth are less affected than their lower opponents. This study found that upper teeth were slightly more affected than lower teeth, but not significantly according to chi-squared testing. This study agrees with Hillson (1986) that left and right sides are equally affected. Testing showed no significant difference between the two sides. As stated by Hillson (1986) the teeth of females are more carious than those of males. However, in this study the difference between male and female caries rates was not statistically significant. Blacks are least affected by caries; whites and Mongoloids are relatively equally affected. The occlusal surface is the most affected crown surface because this is the chewing surface and, in posterior teeth, has cusps and crenulations that hinder thorough cleanly.

Filling type is related to all identifiers except socioeconomic status. Amalgam is the most common filling type at 85% of fillings for posterior teeth and 89% of all fillings.
Males prefer amalgam or gold fillings while females take advantage of resin fillings.

Mongoloids use amalgam, but whites use all types. Blacks have the highest tendency to leave cavities untreated. Younger people prefer amalgam fillings. Older individuals are less preferential and use all types.
CHAPTER 6: CONCLUSIONS

The goal of this research was to determine if dental conditions could be used to establish or help support the sex, race, age, and socioeconomic status of unknown skeletal remains. This research has not discounted this possibility. Socioeconomic status has the least amount of effect upon the dental characteristics examined in this study. However, the possible inaccuracy of the socioeconomic status designation, as mentioned in Chapter 3, should be kept in mind when discussing analysis involving this identifier.

Age and race have the most connections with the characteristics studied. This study had a small sample to examine and a wide range of dental characteristics. A narrowed characteristic list and a broadened sample size could produce a more accurate assessment of the possibilities of this topic. Tooth wear and antemortem tooth loss hold the most promise for future study since they correlated with all identifiers. Filling type was connected to all identifiers except socioeconomic status. Caries only related to three of the five identifiers, but given the high frequency of occurrence, this would be the most readily available characteristic to further this study. Out of a possible 42 correlations between dental characteristics and identifiers, 18 were proven unconnected and 24 showed existing relationships. More research into this area will determine which relationships are reliable and which are not.
WORKS CITED


## APPENDIX A
### DATABASE CODE TABLE

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<th>Definition</th>
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<th>Definition</th>
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<td>Unknown*</td>
<td>Cavity Surfaces</td>
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<tr>
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<td>Cavity Surfaces</td>
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<tr>
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<td>Female</td>
<td>Cavity Surfaces</td>
<td>2</td>
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<tr>
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*Not used in any case
# APPENDIX B

## DATABASE FORM

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</tr>
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VITA

Jennifer Gail Hopper McClanahan was born in Memphis, Tennessee. She graduated from The University of Memphis in May 1999 with a Bachelor of Arts in anthropology and a minor in geology. In January 2000, she began graduate school at Louisiana State University. After receiving a Master of Arts degree, she plans on working in the field of forensic science with law enforcement.