

DENTAL EVIDENCE FOR DIVISION OF LABOR  
AMONG THE PREHISTORIC IPIUTAK AND TIGARA  
OF POINT HOPE, ALASKA

A Thesis

Submitted to the Graduate Faculty of the  
Louisiana State University and  
Agricultural and Mechanical College  
in partial fulfillment of the  
requirements for the degree of  
Master of Arts

in

The Department of Geography and Anthropology

by  
Felicia Madimenos  
B.A., New York University, 2002  
May 2005

## ACKNOWLEDGMENTS

I would like to take this opportunity to first and foremost thank my committee, Ms. Mary H. Manhein, my advisor, and Drs. Robert Tague and Rebecca Saunders. I thank them for their patience, their motivational words, and enthusiasm throughout this process. I express much thanks to Dr. Kenneth Mowbray at the American Museum of Natural History who graciously allowed the study of the skeletal material.

Thanks go out to my parents, Praxitelis and Anna Madimenos, my brother, Praxi, and my sister, Alexandra, for their support and encouragement in this process. Even though they may never be able to explain what it is I do, I love the fact that they try.

Furthermore, I would like to thank those who have made me laugh along this journey. Thanks go out to Nicole Truesdell, Emily Hemberger, Suzanne Price, Annette Sobczynski, Jill Risucci, Vanessa Mercurio-Szjanoga, Paul Watts, and Jeremy J. Parks. I thank you for those countless hours spent proofreading my work and, especially, for your support and confidence in me.

Finally, I would like to acknowledge the financial support received from the Robert C. West Field Research Grant. This support proved invaluable to the completion of my research in a timely manner.

## TABLE OF CONTENTS

Acknowledgments.....	ii
List of Tables.....	v
List of Figures.....	vi
Abstract.....	vii
Chapter	
1    Introduction.....	1
2    Literature Review.....	3
Site Description.....	3
Ipiutak.....	4
Tigara.....	6
Dental Pathologies and Occupational Alterations.....	8
Caries.....	8
Attrition and Abrasion.....	11
Occupational Modifications.....	14
Striae and Anterior Wear.....	14
Dental Chipping.....	15
“Cuts”.....	15
Previous Research on Point Hope Material.....	16
3    Materials and Methodology.....	21
Burial Population.....	21
Methodology.....	21
Attrition.....	23
Caries and Antemortem Loss.....	25
Cultural Modifications.....	26
4    Results.....	30
Caries.....	32
Antemortem Loss.....	35
Attrition.....	37
Cultural Modifications.....	37
Cuts.....	40
Notches.....	41
Striae.....	42
Anterior Wear.....	43
5    Discussion and Conclusion.....	45
References Cited.....	51

Appendix: Dental Inventory Sheet.....56  
Vita.....58

## LIST OF TABLES

3.1	Number of Tigara specimens analyzed.....	22
3.2	Number of Ipiutak specimens analyzed.....	22
4.1	Frequencies and percentages of dental pathologies and modifications among Tigara males.....	30
4.2	Frequencies and percentages of dental pathologies and modifications among Tigara females.....	31
4.3	Frequencies and percentages of dental pathologies and modifications among Ipiutak males.....	31
4.4	Frequencies and percentages of dental pathologies and modifications among Ipiutak females.....	31
4.5	Frequency and percentage of caries distribution among the Tigara.....	33
4.6	Frequency and percentage of caries distribution among the Ipiutak.....	34
4.7	Age distribution and number of individuals with antemortem loss among the Tigara and Ipiutak.....	36
4.8	Comparison of percentages of carious lesions and antemortem loss.....	37
4.9	Average wear in millimeters compared to age.....	37
4.10	Frequency of cultural modifications on Tigara male dentition.....	38
4.11	Frequency of cultural modifications on Tigara female dentition.....	38
4.12	Frequency of cultural modifications on Ipiutak male dentition.....	38
4.13	Frequency of cultural modifications on Ipiutak female dentition.....	39
4.14	Percentage of cultural modifications on total observed teeth.....	40
4.15	Number of individuals with “cuts” among the Tigara and Ipiutak.....	41

## LIST OF FIGURES

2.1	Map of Alaska.....	3
2.2	Map of the Point Hope peninsula.....	3
2.3	Tigara female with trephined hole on labial surface of mandibular central incisor.....	19
3.1	16-20 year-old Tigara female exhibiting no occlusal attrition.....	23
3.2	21-25 year-old Tigara female exhibiting slight wear on maxillary molars. ....	24
3.3	46+ year-old Ipiutak male exhibiting moderate wear on right maxillary teeth.....	24
3.4	41-45 year-old Tigara female exhibiting heavy occlusal wear.....	25
3.5	16-20 year-old Tigara female with caries on occlusal surface of mandibular central incisors.....	25
3.6	46+ year-old Tigara female with antemortem loss on all anterior mandibular teeth.....	26
3.7	31-35 year-old Tigara female exhibiting striae on the occlusal surface of the right maxillary dental arcade.....	26
3.8	26-30 year-old Tigara female with notches on the maxillary left canine and premolar labial surfaces.....	27
3.9	26-30 year-old Tigara male exhibiting presence of a “cut” on left maxillary first molar.....	28
3.10	36-40 year-old Tigara female with extreme anterior wear along labial edge of mandibular incisors, canines, and premolars.....	28

## ABSTRACT

Among archaeological specimens, teeth can provide insight into the behaviors and cultural practices of a population. Inuit specimens are ideal for studying dentition because of the unique way teeth are used as tools. The prehistoric Ipiutak (ca. 100 B.C. – A.D. 500) and Tigara (ca. A.D. 900 – 1700) of Point Hope, Alaska, represent two environmentally similar, although culturally and temporally different, populations. Based on associated archaeological finds, the Ipiutak do not represent a whaling culture. Instead, they focused on hunting smaller sea mammals and caribou. Conversely, the Tigara represent a typical Inuit whaling culture. Whaling cultures depend on a distinct division of labor where men engage primarily in hunting while women tend to manufacturing of clothing and the collection of plants for consumption.

This research project investigates the notion of a sexual division of labor and how role-based behavior may be reflected in the dentition. Fifty-eight Ipiutak specimens and two hundred thirty-one Tigara specimens were analyzed for dental evidence of a sexual division of labor. Caries, antemortem loss, and attrition were noted as well as a number of occupational cultural modifications. The frequency of these pathologies and alterations was calculated to determine if a difference existed between sexes within and between populations.

The results demonstrate that teeth were used more intensively among Tigara females than males. This is reflected in heavy attrition, antemortem loss, and a number of cultural modifications. The Ipiutak males and females did not display a significant difference in the presence of dental pathologies and alterations. These results suggest a different social organization in the two cultures. The Tigara likely had a distinct sexual

division of labor characteristic of most Arctic whaling cultures. In contrast, the Ipiutak likely had no distinct sexual differences in their labor.

## CHAPTER 1: INTRODUCTION

Physical anthropologists and archaeologists recognize the importance of studying human skeletal remains in understanding and reconstructing the external environment. Dentition, in particular, has proven valuable because of the durability of the enamel within the archaeological record. Additionally, teeth remain the only skeletal element in direct contact with the external environment. Imprints of food preparation, dietary choices, and tool usage are left on teeth and reveal much about the quotidian life of the individual. In observing and analyzing the abrasion, attrition, and erosion of teeth, physical anthropologists can interpret a great deal about a population's subsistence strategies and habitual practices.

According to Stephen Molnar (1972:511), "if attrition is a normal by-product of man's contact with certain facets of his environment, then a study of worn teeth should reveal some record of past activities." Diet and food preparation techniques, as well as cultural modification habits, will be recorded in the dentition (Molnar 1972). Inuit populations have been particularly informative in understanding how external forces impact dentition. Among modern Eskimos<sup>1</sup>, anthropologists have observed the extensive use of teeth as a third "hand" such as using the incisors as knives (Molnar 1972). Eskimo women are known to chew hardened seal and walrus hides to soften them before making

---

<sup>1</sup> The term "Eskimo" is used in this research only when the cited author used this term. There is much confusion that surrounds the usage of the term "Eskimo" versus "Inuit". The American Heritage Dictionary (2000) sums up, "It is widely known that *Inuit*, a term of ethnic pride, offers an acceptable alternative [to "Eskimo"], but it is less well understood that *Inuit* cannot substitute for *Eskimo* in all cases, being restricted in usage to the Inuit-speaking peoples of Arctic Canada and parts of Greenland. While use of these terms ('Inuit' and 'Yup'ik') is often preferable when speaking of the appropriate linguistic group, none of them can be used of the Eskimoan peoples as a whole; the only inclusive term remains Eskimo." The term "Inuit" is typically reserved for those populations inhabiting eastern Russia, all of Alaska, and northern Canada to Greenland. Since the Tigara and Ipiutak populations fall under this jurisdiction, this researcher has chosen to use "Inuit" in her own research.

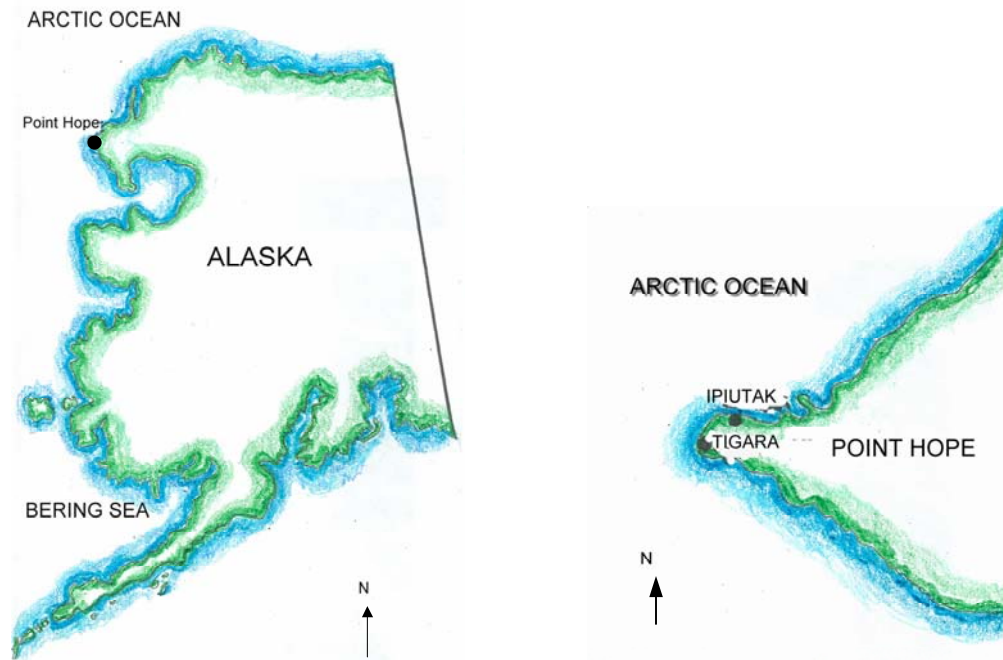
them into clothing (Molnar 1972). Tearing and cutting into frozen seal meat using only teeth are also a common practice (Molnar 1972).

The interaction between enamel and environment among Inuit populations has been a focal point for many physical anthropologists studying the Arctic (Scott and Turner 1988). Much research has been conducted analyzing sexual dimorphism in dentition including attrition and antemortem loss (Davies and Pedersen 1955; Pedersen 1947; Costa 1977, 1982; Tomenchuck and Mayhall 1979). The difference in dental patterns between males and females is due in large part to the division of labor characteristic of Inuit whaling cultures. Men are predominately the hunters while women tend to numerous domestic tasks including gathering plant foods and manufacturing of clothing. These role-based behaviors manifest distinct wear patterns on Inuit teeth. This current research is a cross-tribal analysis between two temporally and culturally different prehistoric Inuit populations that inhabited the same environment. An analysis of the populations' dental modifications and frequencies may be useful in reconstructing how they interacted with material culture and how this may reflect a division of labor.

## CHAPTER 2: LITERATURE REVIEW

### SITE DESCRIPTION

The Point Hope peninsula is located in northwest Alaska and extends into the Chukchi Sea, 125 miles above the Arctic Circle (Figure 2.1 and 2.2) (Larsen and Rainey 1948). Between 1939 and 1941, Froelich Rainey and Helge Larsen directed an Arctic expedition on the peninsula. The archaeological site at Point Hope was previously unknown to local Inuits. With the aid of J. Louis Giddings and Harry Shapiro, the excavations yielded over 10,000 artifacts, over 600 houses, and approximately 500 sets of skeletal remains. Through radiocarbon dating and associated artifacts, the remains were found to represent two distinct prehistoric populations: one, a 1,500-year-old culture called Ipiutak for the Inuit word meaning “the sand bar separating two lagoons” (Rainey 1971:10); the second, a 300-year-old culture called Tigara, after the name of the local village (Costa 1980).



**Figure 2.1. (left) Map of Alaska**  
**Figure 2.2. (right) Map of the Point Hope peninsula**

Larsen and Rainey (1948) separated the Ipiutak from the Tigara specimens based on associated grave goods and the type of burial in which the skeleton was found (i.e., in a coffin, on the surface, or in frames). Among the Ipiutak, the body was often left unprotected on the ground surface and sometimes covered with a pile of logs; the majority of the Tigara burials were found in log coffins (Larsen and Rainey 1948). The key difference between earlier Ipiutak burials and the later Tigara burials, however, is in the positioning of the body. The Ipiutak would extend the body, while the Tigara flexed the legs and positioned the head toward the west. Among these latter burials, the skeleton was also in a supine position (Larsen and Rainey 1948).

Point Hope is unique to the Arctic in both its size and age; in addition to its antiquity, the site is also the largest and longest, continuously occupied site discovered in the Arctic to date. Studying the pathologies and alterations of the dentition of these populations will provide insight into the long-term evolution of their social organization.

### **Ipiutak**

Defined by Larsen and Rainey, the Ipiutak culture (ca.100 B.C. – A.D. 500) occupied the area north of present-day Tigara on Point Hope (Schwartz et al. 1995). The Ipiutak immediately struck the researchers as a unique population because the cultural remains were atypical of western Eskimos; unlike at other archaeological sites, the modern local people could not identify the function and purpose of the tools retrieved.

The Ipiutak used finely flaked flint blades that were delicately engraved, a distinct aesthetic contrast to other contemporaneous cultures. Their artistic designs were unique to the area, bearing a striking resemblance to Scytho-Siberian art (Utermohle 1984). The typical house was square with rounded corners and built with driftwood instead of

whalebone (Utermohle 1984). In addition, oil lamps and harpoon floats, suggestive of whaling practices, were not found in association with this population. Instead, bows and arrows constituted the bulk of hunting implements (Larsen and Rainey 1948). The overwhelming presence of these artifacts suggested that the Ipiutak did not hunt whales but rather focused on caribou and smaller sea mammals such as seals and walrus. Additionally, excavations of the houses yielded a zooarchaeological assemblage with 53 percent from seal, 23 percent walrus, 12 percent bearded seal, and 10 percent caribou (Larsen and Rainey 1948). The remaining two percent consisted of birds, squirrel, polar bear, and whale. Seal, not whale, was the most important subsistence item (Larsen and Rainey 1948).

The Ipiutak were seasonal migrants, although it is debated which months were spent inland and which on the coast. Two theories were posed to explain Ipiutak seasonal migration. Larsen and Rainey believe that the Ipiutak spent their winters in the interior and migrated to the coasts during the summer and spring months to hunt and trade (Rainey 1971). Anderson (1962) suggested that some Ipiutak lived on the coasts during the winters, and, because of unfavorable ice conditions, whales were not accessible. As a result, the Ipiutak substituted smaller sea mammals and caribou for whales.

The archaeology at Point Hope yielded intriguing information, especially regarding gender-based behavior. Kashims, or men's work houses, are typical among present-day Eskimos as well as prehistoric Inuit cultures and tend to be reserved for whaling crews (Mauss 1979). Large Ipiutak houses, resembling kashims, were excavated at Point Hope, with numerous male and female tools found in the same provenience (Anderson 1984). This suggests that these large structures were activity centers for the

entire settlement (Anderson 1962). Typically, Inuit whaling populations engage in a distinct division of labor where males hunt and females work the hides for clothing. With both male and female tools intermingling, the social structure of the Ipiutak appears vastly different from other known prehistoric and historic Inuit cultures. The combination of unique tool engravings, the provenience of male and female implements, and the lack of whaling have made the Ipiutak culture an enigmatic one. As they do not morphologically and culturally resemble previous and subsequent Point Hope populations, the origin of the Ipiutak remains highly debated.

### **Tigara**

More is known about the Tigara people, ancestors to the historic Tikerarmuit populations at Point Hope (Utermohle 1984). The prehistoric Tigara people, who occupied the area from approximately A.D. 900 - 1700, resemble typical modern Inuit populations (Schwartz et al. 1995). What is known about the Tigara has been gathered through ethnographic research of present-day occupants of Point Hope, who are believed to be the descendants of the prehistoric Tigara population.

The Tigara culture is characterized as part of the broader Thule culture because of its focus on hunting sea mammals, in particular whales. The Thule cultures are also distinguished from other Arctic cultures by their permanent settlements at locations favorable for hunting whales and walrus (Larsen and Rainey 1948). Thus, the location of the Tigara settlement at Point Hope was probably chosen because of the migratory movements of the sea mammals and fish (Larsen and Rainey 1948). The Tigara people were typical of coastal populations in following a yearly hunting cycle. During the spring and summer months, when the ice packs surrounding the peninsula moved,

whales, fish, and herds of walrus were hunted. Seals were hunted during the winter months when the ice pack was tight against the peninsula (Larsen and Rainey 1948). Among the Tigara people, the movements of the ice pack governed an annual cycle of activities including hunting and religious ceremonies.

The Tigara house, much like present-day Inuit houses, was the central component to a community (Anderson 1984). The structure housed eight to twelve inhabitants, all closely related. This domestic arrangement allowed for three to four men to be available to supply the economic needs of the whole house while the females tended to the processing of food and production of clothing. Labor was thus divided among sexes, a division characteristic of most Inuit societies (Anderson 1984).

Important components of the whaling communities were kashims, or men's houses. Kashims were loci of social gatherings and dances, as well as places where men congregated to work or relax (Anderson 1984). Whaling crews, primarily men, were the primary residents of the kashim, and the hunt leaders usually erected the large building (Mauss 1979). Among present-day Inuit populations, whaling is a time-consuming task involving everyone in various aspects of the kill. Social groups are restructured for the hunting of whales, and a clear division of labor is necessary (Anderson 1984).

Hunting seals was a regular task throughout the year, and it required an uncomplicated procedure involving a few men at best (Rudenko 1961). Conversely, hunting whales was a more complicated endeavor involving venturing out to the open seas with a crew of cooperative and skilled hunters (Rudenko 1961). This task was the main occupation of men during the warm spring and summer months. Women may have participated in fishing and seal hunting alongside men, but their exclusive occupation was

gathering edible plants, preparing food, and working hides to manufacture clothes (Rudenko 1961). Skins from the animals were stitched and sewn by women who were responsible for the manufacture of clothing in the community.

## **DENTAL PATHOLOGIES AND OCCUPATIONAL ALTERATIONS**

Since Mummery's (1870) groundbreaking dental wear research, the correlation of dentition with diet and cultural practices has been recognized. Modification of teeth may result from food preparation techniques and from practices such as using teeth for holding, chewing, or cutting materials (Rogers 1988).

### **Caries**

While the chemical composition of food can have deleterious effects on the dentition, such as increased caries and antemortem loss, the use of teeth as functional tools can also impact dentition. The types of pathologies that result from the non-alimentary use of teeth include caries, heavy attrition, and antemortem loss. Dental caries are the most common pathology found among archaeological populations (Buikstra and Ubelaker 1994). Dental caries is a disease process that progressively decays the tooth structure through subsurface demineralization (Larsen et al. 1991; Rogers 1988). The main cause of carious lesions is the bacterial fermentation of refined sugars and carbohydrates. Extensively noted in numerous studies is the correlation between an increase in carious lesions and an increase in the intake of carbohydrates and sugars (Hillson 1996).

Inuit samples are ideal for the study of dental pathologies since numerous studies have shown that prior to white contact, Inuit populations were practically caries free

(Costa 1980). The relative absence of caries lasted until the early twentieth century, when white contact disrupted the traditional Inuit diet. Instead of a high-protein, high-fat diet of seal, walrus, caribou, and whale, Inuits were introduced to refined foods that were high in sugar and carbohydrates and contained food additives (Waugh 1930; Costa 1980). This non-traditional diet caused an increase of caries rates and periodontal disease among modern Inuit peoples. Additionally, sea mammals were found to contain high fluoride concentrations, which may have prevented the development of caries (So 1980). Since these animals were no longer the primary source of sustenance, the incidence of dental disease increased.

While diet is a major contributing factor to caries presence, there are a number of alternative exogenous and endogenous conditions that promote or discourage cariogenic activity. Other exogenous factors that affect the rate of carious lesions include diet, functional use of teeth, degree and rate of wear, and oral hygiene (Powell 1985). Among Neolithic and Bronze age dentitions from Denmark, Christopherson and Pedersen (1939) noted a low presence of carious lesions. They concluded that strong attrition, or the heavier use of teeth, functions as a type of mechanical cleaning because pits and fissures present on the teeth are eroded away before the caries site could begin to mineralize (Christopherson and Pedersen 1939). Studies of Greenland Eskimos reached a similar conclusion (Collins 1932; Pedersen 1947). The observations suggested that those Eskimos who became acculturated to western practices, purchasing clothing and food instead of self-manufacture and preparation, experienced a decrease in dental wear and an increase in carious lesions (Pedersen 1947).

Endogenous factors that have an effect on the rate of caries include coronal tooth morphology, the flow of saliva and its chemical composition, bacteria present in the mouth, and enamel integrity (Powell 1985). Morphological features of the tooth affect the susceptibility of various types of teeth to caries. Those teeth with more complex crenulations (i.e., posterior molar teeth) display a higher caries presence than smoother occlusal surfaces (i.e., anterior teeth) (Powell 1985). The posterior occlusal surfaces trap food particles, and, if the food decays, cariogenic bacterial fermentation will begin (Powell 1985). Conversely, anterior teeth are less susceptible to caries because of their smooth crown surfaces and the ease by which they are cleansed by natural mechanisms (i.e., saliva flow) or intentional cleansing (i.e., tooth pick).

The prevalence of caries can reveal much about the division of labor in a population. One study of prehistoric dietary change in California found that the difference in caries rates between males and females reflected a difference between the sexes in labor (Walker 1986). This division gave men and women unequal access to foods with anti-cariogenic properties (Walker 1986). Men specialized in hunting and fishing while women gathered plants, giving them greater access to grit-laden, high carbohydrate foods. This caused higher degrees of attrition and caries rates among women, while men, with less access to plant foods, displayed lower instances of caries.

In addition to the lack of carbohydrates in prehistoric Inuit diets, research studies suggested that those diets consisting of coarser foods have a natural cleansing process and, hence, produce a lower incidence of caries (Buikstra and Ubelaker 1994). Early Inuit diets were typically coarse because of the way frozen meat was stored and cooked. Among prehistoric and modern Inuits, cooking was most likely done on driftwood fires in

the open air, allowing for wind-borne sedimentary particles to be introduced into the food (Costa 1982). Meat was similarly stored in the outdoors and gritty elements were similarly introduced into the food. The coarseness of the food caused the occlusal enamel to erode quicker, leaving little time for the bacteria to ferment produce a carious lesion.

### **Attrition and Abrasion**

There exists a significant relationship between dental wear and cariogenic activity and, thus, an analysis of the prevalence of caries must also consider rate of attrition (Powell 1985; Buikstra and Ubelaker 1994). Dental attrition, broadly defined, is the erosion of the occlusal enamel. Pinborg (1970) distinguishes between physiologic attrition, wear due to the normal mastication as teeth crush food, and pathologic attrition, the result of non-alimentary use of teeth. Rogers (1988:62) reserves the term “attrition” to apply to wear that results from food consumption and “abrasion” to refer to “abnormal mechanical contact” due to exogenous factors.

Prehistoric teeth are often heavily worn and shortened through wear; the degree of attrition is much greater in these archaeological specimens than in modern skeletons (Ortner 2003). Molnar (1972) reported that with urbanization there is a decrease in dental attrition. Some endogenous factors that affect attrition rates include the quality of the teeth and the occlusion of maxillary and mandibular teeth (Ortner 2003). Moreover, exogenous factors contribute greatly to the high attrition rate among past peoples. These factors include the abrasiveness of available foods and the reliance on teeth as a tool. Preparation of food is also an important factor; among the Inuit frozen meat is eaten frequently due to the lack of fuel for cooking and this produces distinct wear on their

teeth (Molnar 1972). It is unknown what kind of food preparation techniques were used by prehistoric Inuit populations, but much has been deduced from modern ethnographic studies. Food is regularly eaten raw, which is probably how food was consumed in the past (Costa 1982). The open-air cooking and storing techniques are common among Inuit groups today and introduce coarse particles into the food.

As with the rate of caries, degree of attrition is expected to vary by sex and this variation may provide insight into the daily practices of the population (Campbell 1939; Molnar 1971). In cultures where the female is the major food-collector, the females' teeth would be subject to constant sampling and processing of fibrous plant materials (Molnar 1972). The action of processing carbohydrate-rich plant foods is reflected in the dentition with an increase in carious lesions. In addition to increased caries, female dentition should also reflect the heavier load placed on her teeth (Molnar 1972). However, some studies (Turner II and Cadien 1969; Tomenchuk and Mayhall 1979) found that Eskimo males exceeded females in their degree of attrition, a difference attributed to differential bruxism, or teeth grinding, and prolonged or heavier mastication among males. Davies and Pedersen (1955) found that among Greenland Eskimos, there was little difference between male and female dental attrition. This observation contradicted the hypothesis that females would exhibit more severe wear because of the job of chewing hide in the production of clothing (Davies and Pedersen 1955). Conversely, Leigh (1925) observed that among Eskimo populations, female teeth exhibited a higher degree of wear attributed to the time-consuming task of chewing hides.

The degree, rate, and angle of crown wear have become a focus for studies about subsistence, sex differences, geographical differences, and temporal trends (Scott and

Turner II 1988). Hunter-gatherer and agriculturalists can be distinguished from one another through a comprehensive analysis of dental attrition. Both groups exhibit pronounced wear, but the severity of attrition is due to different causes (Scott and Turner II 1988). While meat is not an abrasive food compared to fibrous plant items, consumption of frozen and tough dietary materials, such as that among the Eskimos, requires extensive chewing and powerful masticatory muscles (Scott and Turner II 1988). Additionally, Eskimos in extremely cold climates are known to eat large amounts of food, further contributing to the increase in mastication (de Poncins 1941; Costa 1980). Agriculturalists consuming grit-laden plant foods can often exceed hunter-gatherers in the degree of wear. Smith (1984) found that the agriculturalists exhibited more oblique wear of the teeth than hunter-gatherers.

Correlations between heavier usage of dentition and antemortem loss have been observed among prehistoric populations (Kelley et al. 1991). In modern populations, early loss of teeth is often the result of caries presence and/or periodontal disease (Scott and Turner II 1988). In younger age groups, early loss may be attributed to caries while periodontal disease causes a greater loss among older individuals (Costa 1980). The etiology of tooth loss in prehistoric groups is more complicated than in modern populations (Scott and Turner II 1988). Excessive wear is a more probable cause of antemortem loss in those populations with low caries rates. Within extant populations, upper and lower molars are the most susceptible to early loss, followed by incisors and premolars and finally, canines (Scott and Turner II 1988).

## **Occupational Modifications**

Occupational modifications are a type of dental abrasion connected to a person's occupation (Alt and Pichler 1998). Among the Eskimo, Turner II and Cadien (1969) note the use of the incisors to tear and cut fresh seal meat. In one instance, the researchers observed an Eskimo male using his teeth to pry open a steel gasoline drum whose lid was frozen shut.

### Striae and Anterior Wear

Occlusal striae, or grooves, and anterior wear may also be attributed to task-related wear. This type of occupational wear has been observed on an array of individuals, from basket makers to producers of clothing, all who exhibit occlusal grooves on their teeth (Milner and Larsen 1991). Stripping of sinew (Brown and Molnar 1990) and chewing leather (Lous 1970) are further examples of occupational modifications. In Eskimo populations, females chew boots to make them limber and work hides using teeth as a vise, while males wear down anterior teeth using them to untie lines or tighten a sled harness (Scott, personal communication, 2004). While chewing blubber and sealskin causes considerable wear on the occlusal surface of teeth, caribou sinew, used for threading clothes, may cause distinct interproximal or occlusal grooves. The use of the mouth for biting or pulling thread through teeth can produce abrasions if done persistently. Pedersen (1947, 1952) observed these transversely oriented grooves on the occlusal surface of anterior mandibular teeth in living Eskimo females caused by pulling sinews across their teeth.

## Dental Chipping

Another type of modification termed “pressure-chipping,” or notches, is the result of abrasion due to extensive chewing of hard food and may also manifest because of food preparation techniques (Turner II and Cadien 1969:303). It is characterized by severe crushing or flaking of the crown surfaces and occurs predominately in Eskimo populations in Alaska, Canada, and Greenland, all of whom are meat-eaters (Turner II and Cadien 1969). This type of modification is indicative of severe tooth use.

Antemortem chipping is distinguished from postmortem chipping by the smoothed edges of the fractured enamel (Milner and Larsen 1991). Additionally, the staining on the rest of the enamel should match the chipped portion. A study of dental chipping among prehistoric and protohistoric Aleuts, Eskimos, and northern American Indians found that Eskimos exhibited a much higher frequency of notches than the other two groups (Turner II and Cadien 1969). However, there was no sex difference in the frequency of chipping in all three populations (Turner II and Cadien 1969). A number of factors may be responsible for the prevalence of chips, including differential diet and prolonged mastication as well as endogenous factors such as bruxism and enamel hardness (Turner II and Cadien 1969).

## “Cuts”

An unintentional cultural modification not recognized in the scientific literature is referred to here as “cuts”. I have termed the modification “cuts” because it appears as if the tooth was “cut” in the transverse plane from occlusal surface to the cervico-enamel juncture. It is probable that this modification is an exacerbated tooth chip that fractured in the transverse plane and whose edges smoothed away by the same processes that wore

the occlusal surface (Barsley, personal communication, 2004). The presence of this type of modification is indicative of a severe use of dentition and probably not a result of the alimentary use of teeth.

## **PREVIOUS RESEARCH ON POINT HOPE MATERIAL**

Minimal research has been published on the Point Hope skeletal material. Lester and Shapiro (1968) conducted one study on the Ipiutak post-cranial remains involving the development of spondylolysis with age in the lumbar vertebrae. The defect, a result of stress fractures that partially or completely separate the vertebral body from the arch, is prevalent in the population and increased with age (Lester and Shapiro 1968; Ortner 2003). Cranial remains have been studied more, though not to any great extent.

Dr. Raymond Costa Jr. (1977) wrote his dissertation on some of the Point Hope material and published the results of a few studies in the early 1980s. He focused on analyzing the incidences of caries, gingivitis, and periodontal disease in the skeletal collection. Due to the confusion surrounding the relationship between the Ipiutak and Tigara collections, Costa's early research (1977) collapsed the Ipiutak and Tigara populations into one encompassing culture. In his research, Costa (1977) noted that they were considered a single population because of their similarities in skeletal structure. Later, Costa recognized the fallacy in his assumption, and in his subsequent studies (1980, 1982) a distinction was made between the Ipiutak and Tigara populations. Today, the most accepted theory is that Tigara and Ipiutak represent two distinct populations of the same environment but temporally, culturally, and physically different, a theory stemming from George Debetz's (1960) early skeletal research on the collection.

Debetz's analysis of the Point Hope collection was an interpopulational study of the physical differences between the Ipiutak and Tigara people. He applied over 80 measurements to 230 skulls. Although both belonged to the "Mongoloid branch," Debetz argued that there are distinct physical differences between the skeletal materials of the Ipiutak phase and the Tigara phase (1960:5). The classic Eskimo physical type, characterized by dominant facial breadth over brain case breadth, is not found among the Ipiutak. The lower skull height, narrow face, and mild prognathism of the Ipiutak more closely resemble the Yukagir from Siberia (Debetz 1960). Debetz concludes that the modern Eskimo cranio-facial characteristics present in other prehistoric Arctic populations are not reflected in the Ipiutak material. Hence, no distinct relationship exists between the Ipiutak and modern Inuit and between the Ipiutak and Tigara.

Aside from Costa's dental pathology studies and Debetz's craniometric analysis, little has been written and published on the collections. An extensive collection of studies exists on modern Eskimo dentition, but these deal primarily with attrition and caries rates after European contact. There is little discussion concerning prehistoric Inuit dentition (Costa 1977). Costa's work briefly acknowledged the role of diet on dentition but he did not discuss abrasion due to habitual activities.

In his 1980 study, Costa analyzed three Inuit skeletal samples, including the Ipiutak and Tigara of Point Hope along with materials from Jones Point, Kodiak Island. Costa studied the instances of caries and abscesses and acknowledged that differential diet among all the populations was a probable factor in the frequencies of dental disease. His sample size consisted of 26 Ipiutak males, 20 Ipiutak females, 88 Tigara males, and 112 Tigara females. The Jones Point collection included 39 males and 40 females. Due

to the small sample size, Costa (1980) excluded a statistical analysis of the results because he felt it would not contribute to the present study. He found that caries were prevalent in the Ipiutak populations versus the Tigara, with Jones Point exhibiting the lowest prevalence of carious lesions (1980). He attributed the differences in caries rate to differential diet and climate as well as to genetic factors. Costa concluded that there were varied dental disease rates among Inuit populations before European contact that resulted from differential diet, climate, and culture (Costa 1980).

Costa (1982) also used the Tigara and Ipiutak skeletal remains in his study of periodontal disease. In the 249 specimens examined, Costa found no marked difference in wear between males and females. Maximum or extreme wear was noted when there was a significant degree of dentine or pulp exposure. This occurred in the 26-30 year age group. In the same study, Costa noted that chronic gingivitis may cause osteoporosis of the interdental septa (a thin, bony wall between the tooth sockets). He observed that this was a severe problem among the Ipiutak population when compared to the Tigara but relatively mild when compared to modern American specimens. Costa (1982) concluded that the general mild periodontal disease in both groups is likely due to their high fat/high protein diet.

Even less has been published on cultural modifications of teeth. The only study available (Schwartz et al.1995) presented information on trepanation, an intentional modification reported among the Tigara remains (Figure 2.3). Specimen 99.1/268, a Tigara female between 16-20 years old, exhibited a trephined hole on the labial surface of the left mandibular central incisor. The hole runs from the labial to the lingual surface and has an associated abscess and caries. Dental mutilation for aesthetic purposes is not

known among pre- or post-contact Inuits, suggesting that the presence of dental trephination is related to the associated dental disease (Schwartz et al. 1995). The drilled hole was made obliquely toward the root canal and appears to be gouged out. The hole probably was drilled for therapeutic reasons to alleviate the pain of the infected tooth and alveolar bone. This specimen represents the first case reported on pre-contact Arctic tooth-drilling (Schwartz et al. 1995).



**Figure 2.3. Specimen 99.1/268. Tigara female with trephined hole on labial surface of mandibular central incisor. Note associated abscess. For an occlusal view of the caries, see Figure 3.5.**

The curator of the Point Hope collection, Dr. Kenneth Mowbray, has acknowledged the lack of available information on the Point Hope skeletal remains (personal communication, 2004). He is currently preparing a monograph that is currently being compiled at the American Museum of Natural History in New York. The monograph will provide more comprehensive insight into the lifeways of these populations. The necessity of more data as well as the countless number of studies that this collection yields made the Point Hope material ideal for research. This research

project illuminates on two skeletal collections using dentition as a means of gaining insight into how the people interacted with their external environment.

## **CHAPTER 3: MATERIALS AND METHODOLOGY**

### **BURIAL POPULATION**

The Ipiutak and Tigara skeletal collections are housed in the Division of Anthropology at the American Museum of Natural History in New York City, New York. All crania are stored in boxes and organized according to specimen number. The cranial remains are amazingly well preserved; some specimens even have ear ossicles. Associated post-cranial remains are located in another room and are similarly organized.

Over 500 specimens were excavated. Two hundred and eight-nine were adults and had associated teeth; these comprised my study sample. Fifty-eight individuals were Ipiutak and 231 were Tigara. Among the Tigara specimens, 94 were males and 137 were females (Table 3.1). Of the 58 Ipiutak specimens, 29 were males, and 29 were females (Table 3.2).

### **METHODOLOGY**

All of the specimens had been cleaned and catalogued prior to this research. Sex and age for each individual specimen were available from Costa's dissertation (1977:117-123). Costa (1977) employed a combination of post-cranial and cranial information for sexing and aging. Both non-metric and metric techniques were applied to determine sex. Costa sexed innominate bones based on subpubic angle, presence or absence of a preauricular sulcus, and size of the birth canal. In addition, the length of the pubis and ischium were measured and entered into Washburn's (1948) pubic index to separate males from females. If post-cranial elements were not available, Costa (1977) analyzed the skull for sexually diagnostic features, including robustness of the jaw and size of the mastoid processes.

Aging the skeletal material was based on Todd's (1920) technique of observing changes in the topography of the pubic symphysis. A supplemental technique used in Costa's (1977) research scored the degree of fusion of the iliac crest and the inferior border of the ischium. For the purposes of this study, only adult specimens over the age of 16 were analyzed; sub-adults yield little information by way of dental health, displaying few, if any, pathologies or alterations. While Costa categorized each individual within a five-year age interval, for the purposes of this research, intervals were combined into ten-year spans: 16-25, 26-35, 36-45, 46+. By collapsing Costa's categories, the number of specimens for each age group is expanded allowing for a more reliable statistical analysis.

**Table 3.1. Number of Tigara specimens analyzed.**

<b>AGE</b>	<b>FEMALE</b>	<b>MALE</b>	<b>TOTAL</b>
<b>16-25</b>	37	27	64
<b>26-35</b>	37	30	67
<b>36-45</b>	53	28	81
<b>46+</b>	10	9	19
<b>TOTAL</b>	<b>137</b>	<b>94</b>	<b>231</b>

**Table 3.2. Number of Ipiutak specimens analyzed.**

<b>AGE</b>	<b>FEMAL E</b>	<b>MALE</b>	<b>TOTAL</b>
<b>16-25</b>	9	8	17
<b>26-35</b>	13	10	23
<b>36-45</b>	6	6	12
<b>46+</b>	1	5	6
<b>TOTAL</b>	<b>29</b>	<b>29</b>	<b>58</b>

I created an inventory form for scoring the pathologies and modifications observed (Appendix). In addition to cultural modifications, I recorded three pathologies including incidence of caries, antemortem loss, and attrition.

## Attrition

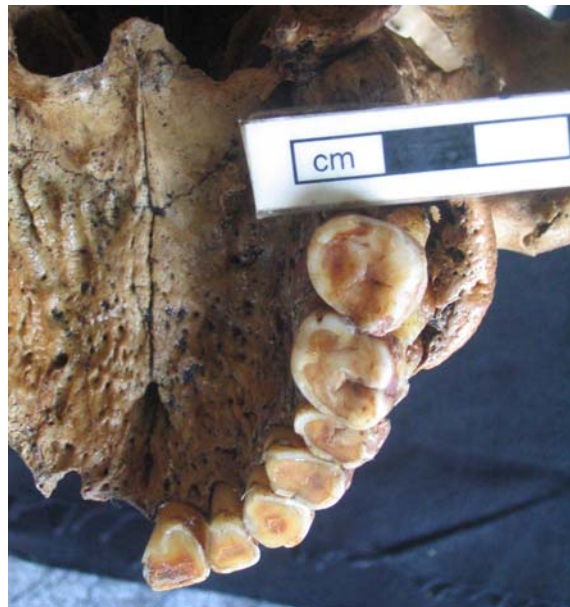
I used the method of scoring applied by Costa (1977). First applied by Leigh (1925), this technique is an efficient and accurate visual method of scoring and allows for a large number of specimens to be evaluated. This involved categorizing degree of attrition into one of four categories: none, slight, moderate, and heavy. “None” indicated when there was no occlusal attrition, approximately 0 mm of ablation (Figure 3.1). Minimal dentine exposure with slight occlusal attrition indicated “slight” wear, approximately 1.5 mm of tooth ablation (Figure 3.2). “Moderate” reflected that there was exposure of the secondary dentine, suggesting a high degree of occlusal attrition, approximately 3 mm of ablation (Figure 3.3). Finally, “heavy” indicated that the pulp chamber was exposed with extreme occlusal attrition, approximately 4.5 mm of ablation (Figure 3.4). Every tooth was given a separate attrition score, which was then averaged for the individual.



**Figure 3.1. Specimen 99.1/327. 16-20 year-old Tigara female exhibiting no occlusal attrition.**



**Figure 3.2. Specimen 99.1/287. 21-25 year-old Tigara female exhibiting slight wear on maxillary first molars. Note the emergence of supernumerary teeth in the anterior of the maxilla.**



**Figure 3.3. Specimen 99.1/91A. 46+ year-old Ipiutak male exhibiting moderate wear on right maxillary teeth.**

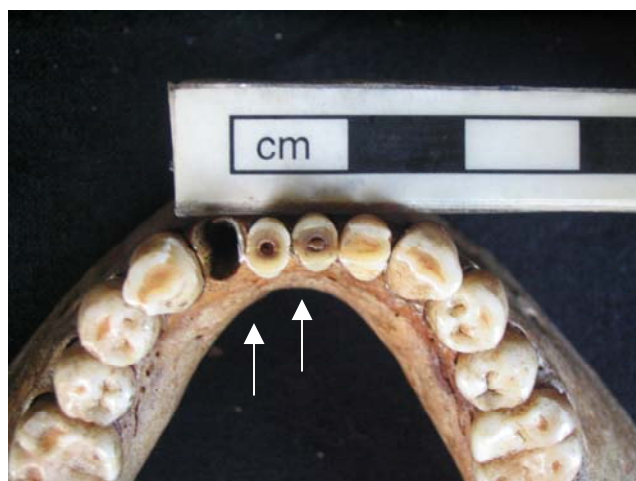


**Figure 3.4. Specimen 99.1/529. 41-45 year-old Tigara female exhibiting heavy occlusal wear.**

### **Caries and Antemortem Loss**

For each specimen, dental caries were noted as present or not present (Figure 3.5). In cases where more than one caries were present in an individual, each instance was recorded.

Antemortem loss was determined if there was no tooth present in the socket and the alveolar bone appeared to have been resorbed or in the process of resorption. For each individual, I counted every tooth lost before death (Figure 3.6).



**Figure 3.5. Specimen 99.1/268. 16-20 year-old Tigara female with caries on occlusal surface of mandibular central incisors.**



**Figure 3.6. Specimen 99.1/458. 46+ year-old Tigara female with antemortem loss on all anterior mandibular teeth. Note the extensive alveolar resorption.**

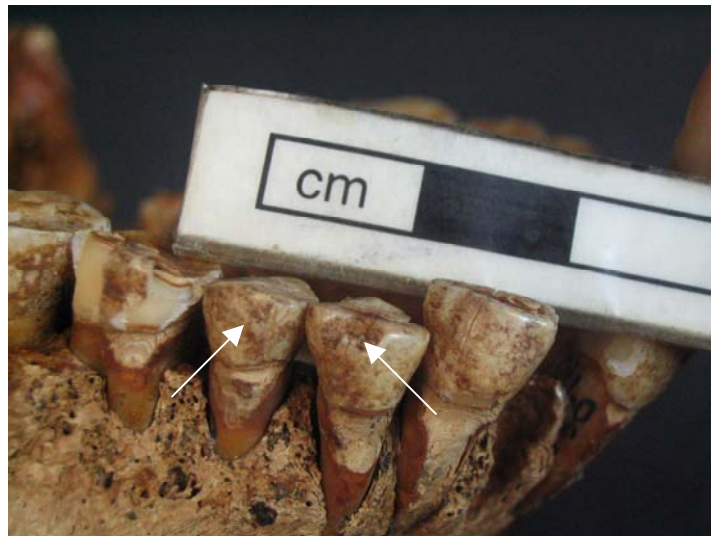
### **Cultural Modifications**

Dentition was examined for five categories of modification: striae, notches, “cuts,” and anterior wear. The presence of striae or grooves can indicate the pulling of string or sinew through the teeth (Figure 3.7). Notches were identified as small nicks



**Figure 3.7. Specimen 99.1/672. 31-35 year-old Tigara female exhibiting striae on the occlusal surface of the right maxillary dental arcade.**

on the tooth that appeared to have occurred antemortem (Figure 3.8). These nicks or chips are common among modern-day Eskimos, a reflection of the heavy use of teeth as tools. “Cuts” were defined as an absence of the mesial, distal, buccal, or lingual portion of the tooth. These “cuts” ran longitudinally from the occlusal surface to mid-root, running longitudinally through the roots to the cervico-enamel juncture (Figure 3.9). While the exact cause of these cuts has not been noted in the literature, the teeth were likely fractured in the transverse plane and subsequently polished smooth by the same chewing forces that wore down the enamel surface (Barsley, personal communication 2004).



**Figure 3.8. Specimen 99.1/224. 26-30 year-old Tigara female with notches on the maxillary left canine and premolar labial surfaces.**

Finally, anterior wear was noted. This type of wear manifests on the labial side of the upper and lower incisors, canines and sometimes premolars. If anterior wear was present, each tooth was recorded as one instance for the individual (Figure 3.10).



**Figure 3.9. Specimen 99.1/225. 26-30 year-old Tigara male exhibiting presence of a “cut” on left maxillary first molar.**



**Figure 3.10. Specimen 99.1/400. 36-40 year-old Tigara female with extreme anterior wear along labial edge of mandibular incisors, canines, and premolars.**

Using SPSS 12.0 for Windows, the information was charted and graphed according to the individual's age group. As a supplement to the empirical analysis

employed to record dental pathologies and cultural modifications, the data were analyzed statistically using two-way tables and the chi-square statistic. This researcher used  $p < 0.05$  as the level of significance for the chi-square results.

## CHAPTER 4: RESULTS

The Tigara and Ipiutak populations utilized their teeth for different purposes, evident in the subsequent analysis. The Tigara exhibited a greater presence of pathologies and cultural modifications than the Ipiutak. The only pathology that was notably greater in the Ipiutak population was the presence of caries.

Tables 4.1 - 4.4 summarize the overall frequency and percentages of dental pathologies and alterations present in all four sub-groups. Among Tigara males, more individuals exhibited a higher percentage of caries, notches, and overall cultural modifications than Tigara females. Tigara females, however, had a higher percentage of antemortem loss, cuts, striae, and anterior wear. In the Ipiutak population, males showed a higher percentage of carious lesions, notches, anterior wear, and overall cultural modifications. Anterior wear, in particular, affected a higher percentage of Ipiutak males than females. A greater percentage of Ipiutak females were affected by antemortem loss than males.

**Table 4.1. Frequencies and percentages of dental pathologies and modifications among Tigara males (n = 94; total number of teeth = 2,151)**

	Number of instances	Percentage of teeth affected by pathology or alteration	Number of individuals affected	Percentage of individuals affected by pathology or alteration
Caries	15	0.70	12	12.77
Antemortem Loss	230	7.65	44	46.81
Cuts	3	0.14	3	3.19
Notches	126	5.86	51	54.26
Striae	20	0.93	9	9.57
Anterior Wear	156	7.25	28	29.79
Overall Cultural Modifications	305	14.18	71	75.53

**Table 4.2. Frequencies and percentages of dental pathologies and modifications among Tigara females (n = 137; total number of teeth = 2,841)**

	Number of instances	Percentage of teeth affected by pathology or alteration	Number of individuals affected	Percentage of individuals affected by pathology or alteration
Caries	13	0.46	10	7.30
Antemortem Loss	438	9.99	70	51.09
Cuts	10	0.35	8	5.84
Notches	130	4.58	61	44.53
Striae	45	1.58	20	14.60
Anterior Wear	239	8.41	46	33.58
Overall Cultural Modifications	424	14.92	98	71.53

**Table 4.3. Frequencies and percentages of dental pathologies and modifications among Ipiutak males (n = 29; total number of teeth = 606)**

	Number of instances	Percentage of teeth affected by pathology or alteration	Number of individuals affected	Percentage of individuals affected by pathology or alteration
Caries	13	2.15	12	41.38
Antemortem Loss	72	7.76	13	44.83
Cuts	1	0.17	1	3.45
Notches	16	2.64	11	37.93
Striae	6	0.99	3	10.34
Anterior Wear	20	3.30	5	17.24
Overall Cultural Modifications	43	7.10	16	55.17

**Table 4.4. Frequencies and percentages of dental pathologies and modifications among Ipiutak females (n=29; total number of teeth = 559)**

	Number of instances	Percentage of teeth affected by pathology or alteration	Number of individuals affected	Percentage of individuals affected by pathology or alteration
Caries	13	2.33	7	24.14
Antemortem Loss	74	7.97	15	51.72
Cuts	1	0.18	1	3.45
Notches	13	2.33	8	27.59
Striae	5	0.89	3	10.34
Anterior Wear	6	1.07	1	3.45
Overall Cultural Modifications	25	4.47	11	37.93

## **CARIES**

The percentage of afflicted individuals was more than three times as great in the Ipiutak male sample as in the Tigara male sample. In the female samples, the percentage of afflicted individuals was also three times as great among the Ipiutak as in the Tigara (Tables 4.1 - 4.4).

Among the 231 Tigara, the total number of individuals affected by carious lesions is 22 (9.52%). Twelve males (12.77%) exhibited 15 carious lesions; 10 females (7.30%) exhibited 13 carious lesions. Multicarious teeth were present in the population as follows: among males, one individual was affected by two lesions, and one was affected by three lesions; among females, three individuals exhibited two carious lesions each. A chi-square analysis ( $\chi^2 = 1.93$ ,  $df = 1$ ,  $p = 0.16$ ) revealed that there is no significant association between sex and carious infections among the Tigara. By dividing the total number of caries by the total number of observed dentitions, a minimum number of caries was calculated for each individual, both male and female. The minimum number of carious lesions per female is 0.09; among males, the minimum number of caries per individual is 0.16.

The susceptible areas of infection were fairly consistent, concentrating in the posterior teeth, in particular, the maxillary and mandibular first and second molars. Two individuals showed carious lesions on their lower central incisors, including 99.1/268, the 16-20 year-old female that also exhibited an associated abscess and trephined hole. The intentionally modified hole ran from the labial surface through to the lingual surface and was probably drilled in an attempt to alleviate the pain of the caries and abscess. This

case represents one of the earliest examples of dental health care in the Americas (Schwartz 1995).

Table 4.5 illustrates the frequency of caries in each age group in the Tigara population. Individuals in the 16-25 age group exhibited a higher incidence of carious lesions. The greater number of caries present in the younger population may be attributed to the higher degree of antemortem loss among older individuals. A chi-square analysis revealed that there was no significant association between sex and presence of caries (Table 4.5).

**Table 4.5. Frequency and percentage of caries distribution among the Tigara\*.**

<b>AGE</b>	<b>FEMALE</b>	<b>MALE</b>	<b>TOTAL</b>
<b>16-25</b>	6 (54.5%)	5 (45.5%)	11 (100.0%)
<b>26-35</b>	2 (28.6%)	5 (71.4%)	7 (100.0%)
<b>36-45</b>	4 (44.4%)	5 (55.6%)	9 (100.0%)
<b>46+</b>	1 (100.0%)	0 (0.0%)	1 (100.0%)
<b>TOTAL</b>	<b>13</b> <b>(46.4%)</b>	<b>15</b> <b>(53.6%)</b>	<b>28</b> <b>(100.0%)</b>

$x^2 = 2.36$        $df = 3$        $p = 0.50$

\* Due to the small cell size, the expected values may be too small for the approximation involved in the chi-square test to be valid.

The total number of individuals affected by carious lesions among the Ipiutak was 19 in the sample of 58 (32.76%). Twelve males (41.38%) had a total of 13 carious lesions and seven females (24.14%) had 13 carious lesions. Multicarious teeth were present within the population as follows: among males, one individual was affected with

two caries; among females, three individuals had two caries each, and one individual had four caries. Chi-square analysis ( $\chi^2 = 1.96$ ,  $df = 1$ ,  $p = 0.16$ ) revealed no significant association between caries presence and sex in the Ipiutak population. Caries rate was calculated for both sexes to determine the minimum number of carious lesions per individual. Among females, the minimum number of caries for each individual was 0.45; among males, the caries rate was also 0.45 per individual.

Table 4.6 shows the frequency of caries in Ipiutak males and females within each age interval. Males in the 16-25 age group were affected the most, with seven lesions in a sample of eight individuals, while caries in females were more evenly distributed for each age group.

**Table 4.6. Frequency and percentage of caries distribution among the Ipiutak\*.**

<b>AGE</b>	<b>FEMALE</b>	<b>MALE</b>	<b>TOTAL</b>
<b>16-25</b>	3 (30.0%)	7 (70.0%)	10 (100.0%)
<b>26-35</b>	4 (57.1%)	3 (42.9%)	7 (100.0%)
<b>36-45</b>	4 (100.0%)	0 (0.0%)	4 (100.0%)
<b>46+</b>	2 (40.0%)	3 (60.0%)	5 (100.0%)
<b>TOTAL</b>	<b>13</b> <b>(50.0%)</b>	<b>13</b> <b>(50.0%)</b>	<b>26</b> <b>(100.0%)</b>

$$\chi^2 = 5.94 \quad df = 3 \quad p = 0.11$$

\* Due to the small cell size, the expected values may be too small for the approximation involved in the chi-square test to be valid.

Although chi-square analysis within each population revealed no correlation between sex and caries incidence (Tables 4.5 – 4.6), there is a significant association

between culture and presence of caries. A chi-square analysis ( $\chi^2 = 11.55$ ,  $df = 1$ ,  $p = 0.0007$ ) was conducted comparing the number of individuals affected with carious lesions among Tigara males and Ipiutak males. The test revealed a statistically significant association between culture and the presence of caries, with Ipiutak males exhibiting more caries relative to sample size. A chi-square analysis was also performed for Tigara females and Ipiutak females and the results ( $\chi^2 = 5.75$ ,  $df = 1$ ,  $p = 0.02$ ) indicated that there was a significant association between carious involvement and culture. In sum, while there is no association between caries and sex within the Ipiutak and Tigara populations, there exists a statistically significant association between culture and caries presence.

### **ANTEMORTEM LOSS**

Since antemortem loss is often the result of tooth decay and/or heavy attrition, it is important in assessing overall dental health in a skeletal population (Kelley et al. 1991). For both populations, antemortem tooth loss was age progressive (Table 4.7). The mild incidence of antemortem loss in the 46+ age group is attributed to the small sample size available for that category.

Among the Ipiutak, 15 females were missing a total of 74 teeth due to antemortem loss while 13 males were missing 72 teeth. Chi-square analysis ( $\chi^2 = 0.48$ ,  $df = 1$ ,  $p = 0.49$ ) comparing Ipiutak males to Ipiutak females revealed no significant difference in antemortem loss between sexes.

**Table 4.7. Age distribution and number of individuals with antemortem loss among the Tigara and Ipiutak.**

<b>Age</b>	<b>Tigara Male</b>	<b>Tigara Female</b>	<b>Ipiutak Male</b>	<b>Ipiutak Female</b>	<b>Total</b>
<b>16-25</b>	8	2	1	1	12
<b>26-35</b>	8	18	4	8	38
<b>36-45</b>	21	41	3	5	70
<b>46+</b>	7	9	5	1	22
<b>Total</b>	<b>44</b>	<b>70</b>	<b>13</b>	<b>15</b>	<b>142</b>

In the Tigara population, 70 females exhibited 438 instances of antemortem tooth loss and 44 males exhibited 230 instances. Table 4.8 illustrates the percentage of antemortem loss in Tigara females (9.99%) versus Tigara males (7.65%) indicating a higher incidence of loss in females over males. A chi-square analysis ( $\chi^2 = 23.57$ ,  $df = 1$ ,  $p = 0.000$ ) comparing antemortem loss in relation to sex among the Tigara revealed a significant association.

A chi-square analysis ( $\chi^2 = 1.73$ ,  $df = 1$ ,  $p = 0.19$ ) was conducted comparing Tigara females to Ipiutak females and the incidence of antemortem loss. Despite the higher percentage of antemortem loss in Tigara females as opposed to Ipiutak females (Table 4.8), the chi-square analysis indicated little difference between females and antemortem loss. Finally, a chi-square analysis ( $\chi^2 = 0.68$ ,  $df = 1$ ,  $p = 0.41$ ) comparing Tigara males to Ipiutak males and the overall frequency of antemortem loss revealed no significant difference between the males and antemortem loss.

**Table 4.8. Comparison of percentages of carious lesions and antemortem loss.**

	Tigara Male	Tigara Female	Ipiutak Male	Ipiutak Female
Number and percentage of carious teeth	15/2,151 (0.46%)	13/2,841 (0.70%)	13/606 (2.15%)	13/559 (2.33%)
Probable number of teeth originally present	3,008	4,384	928	928
Number and percentage of antemortem loss	230 (7.65%)	438 (9.99%)	72 (7.76%)	74 (7.97%)

**ATTRITION**

While attrition in both samples was age progressive, the majority of both populations exhibited moderate to heavy dental attrition, with Tigara females displaying the greatest average wear and Ipiutak males exhibiting the lowest average attrition (Table 4.9). Although both female groups showed greater mean attrition relative to their male counterparts, a chi-square analysis revealed that there is no statistically significant relationship between average degree of attrition and sex in either population (Table 4.9).

**Table 4.9. Average wear in millimeters compared to age.\***

	16-25	No. of individuals	26-35	No. of individuals	36-45	No. of individuals	46+	No. of individuals	Total Mean	Standard Deviation
Tigara Males	2.04	27	2.83	30	3.73	28	4.20	9	3.00	1.16
Tigara Females	1.61	37	2.89	37	3.94	53	4.02	10	3.03	1.23
Ipiutak Males	2.09	8	2.94	10	3.28	6	3.16	5	2.81	0.79
Ipiutak Females	1.55	9	3.18	13	4.04	6	4.17	1	2.89	1.20
	$\chi^2 = 0.33$		df = 3		p = 0.95					

\*Note that teeth were assigned a categorical attrition rate: none, slight, moderate, and heavy. The average wear in this table represents the averages of these categories. Teeth were not formally measured in millimeters.

**CULTURAL MODIFICATIONS**

Among both groups there were moderate incidences of unintentional cultural modifications (Table 4.10 – Table 4.13). Seventy-one Tigara males (75.53%) exhibited

305 instances of modifications (cuts, notches, striae, or anterior wear); 98 Tigara females (71.53%) showed 424 instances of tooth alterations. Sixteen Ipiutak males (55.17%) had 43 types of cultural modifications, while 11 females (37.93%) exhibited 25 instances of tooth alterations.

**Table 4.10. Frequency of instances of cultural modifications on Tigara male dentition.**

	Cuts	No. of Individuals with cuts	Notches	No. of Individuals with notches	<i>Striae</i>	No. of Individuals with striae	Anterior Wear	No. of Individuals with anterior wear	Total Cultural Modifications
<b>16-25</b>	1	1	46	18	1	1	20	6	68
<b>26-35</b>	1	1	49	19	6	2	57	6	113
<b>36-45</b>	0	0	27	11	7	5	56	12	90
<b>46+</b>	1	1	4	3	6	1	23	4	34
<b>TOTAL</b>	3	2	126	48	20	8	156	24	305

**Table 4.11. Frequency of instances of cultural modifications on Tigara female dentition**

	Cuts	No. of Individuals with cuts	Notches	No. of Individuals with notches	<i>Striae</i>	No. of Individuals with striae	Anterior Wear	No. of Individuals with anterior wear	Total Cultural Modifications
<b>16-25</b>	0	0	43	18	10	4	20	2	73
<b>26-35</b>	4	4	48	19	13	6	18	8	83
<b>36-45</b>	3	3	34	20	20	9	190	34	247
<b>46+</b>	3	1	5	4	2	1	11	2	21
<b>TOTAL</b>	10	4	130	37	45	10	239	10	424

**Table 4.12. Frequency of instances of cultural modifications on Ipiutak male dentition.**

	Cuts	No. of Individuals with cuts	Notches	No. of Individuals with notches	<i>Striae</i>	No. of Individuals with striae	Anterior Wear	No. of Individuals with anterior wear	Total Cultural Modifications
<b>16-25</b>	0	0	2	2	0	0	0	0	2
<b>26-35</b>	0	0	8	4	3	2	14	3	25
<b>36-45</b>	0	0	5	4	3	1	4	1	12
<b>46+</b>	1	1	1	1	0	0	2	1	4
<b>TOTAL</b>	1	0	16	2	6	0	20	0	43

**Table 4.13. Frequency of instances of cultural modifications on Ipiutak female dentition.**

	Cuts	No. of Individuals with cuts	Notches	No. of Individuals with notches	<i>Striae</i>	No. of Individuals with striae	Anterior Wear	No. of Individuals with anterior wear	Total Cultural Modifications
<b>16-25</b>	0	0	9	4	3	2	0	0	12
<b>26-35</b>	1	1	2	2	2	1	6	1	11
<b>36-45</b>	0	0	2	2	0	0	0	0	2
<b>46+</b>	0	0	0	0	0	0	0	0	0
<b>TOTAL</b>	1	0	13	0	5	0	6	0	25

Table 4.14 illustrates the difference between the Tigara population and the Ipiutak population in the presence of cultural modifications. Tigara females exhibited more than three times as many cultural modifications as in Ipiutak females, while Tigara males showed almost twice as many modifications as in Ipiutak males. Males and females in both populations exhibited comparable percentages of culturally modified teeth when calculated against the total number of observed teeth. Although slightly greater than the male counterpart, Tigara females showed the highest percentage of culturally modified teeth. A chi-square analysis ( $\chi^2 = 0.54$ ,  $df = 1$ ,  $p = 0.46$ ) was performed indicating no significant difference in presence of cultural modifications between Tigara males and females. Among the Ipiutak, however, a statistical analysis ( $\chi^2 = 4.21$ ,  $df = 1$ ,  $p = 0.04$ ) indicated a significant difference in the frequency of modifications and sex. Ipiutak males exhibited a higher percentage of overall cultural modifications (Table 4.14).

A chi-square analysis ( $\chi^2 = 21.51$ ,  $df = 1$ ,  $p = 0.000$ ) was conducted comparing Tigara males and Ipiutak males and their frequency of cultural modifications. The data revealed that there was a significant association between culture and presence of tooth modifications between males. Data in Table 4.14 further support this analysis; the percentage of modifications among Tigara males was 14.18% versus 4.47% in Ipiutak

males. A chi-square analysis ( $\chi^2 = 46.14$ ,  $df = 1$ ,  $p = 0.000$ ) was also performed comparing Tigara females and Ipiutak females and the frequency of cultural modifications. The data also revealed a statistically significant correlation between culture and presence of modifications. Table 4.14 illustrates this observation, presenting the percentage of modifications found in Tigara females (14.92%) versus Ipiutak females (4.47%).

**Table 4.14. Percentage of cultural modifications on total observed teeth.**

	Tigara Male	Tigara Female	Ipiutak Male	Ipiutak Female
Number and percentage of cultural modifications on teeth	305/2,151 (14.18%)	424/2,841 (14.92%)	43/606 (7.10%)	24/559 (4.47%)

### Cuts

The presence of “cuts” was mild for all four sub-groups. Tigara females exhibited the highest incidence of “cuts” on observed teeth, with 10 teeth showing this cultural modification (representing 2.36% of total modifications for females); only females over the age of 25 exhibited such alterations (Table 4.15). This type of modification was only manifested on either maxillary or mandibular molars. Anterior teeth were not “cut” in any individual. Among the other groups, three Tigara males exhibited three “cuts,” and one Ipiutak male and one female each exhibited this modification.

**Table 4.15. Number of individuals with “cuts” among the Tigara and Ipiutak\*.**

Age	Tigara Male	Tigara Female	Ipiutak Male	Ipiutak Female	Total
16-25	1	0	0	0	1
26-35	1	4	0	1	6
36-45	0	3	0	0	3
46+	1	1	1	0	3
<b>Total</b>	<b>3</b>	<b>8</b>	<b>1</b>	<b>1</b>	<b>13</b>

\* No chi-square analysis was conducted for “cuts” because the cell sizes were too low. The expected values may be too small for the approximation involved in the chi-square test to be valid.

### Notches

Aside from anterior wear, notches or chips were the most prevalent type of cultural modification (Table 4.10 - 4.13). The presence of notches in all four sub-groups was comparable for male and female counterparts. In the Tigara population, notches represented 41.31% of the total modifications for males, and 30.66% of the total modifications for females. A statistical comparison using a chi-square analysis ( $\chi^2 = 4.13$ ,  $df = 1$ ,  $p = 0.04$ ) revealed a significant distribution of notches in the Tigara population, with males exhibiting a higher frequency of the modification relative to sample size.

In the Ipiutak population, notches represented 37.21% of the total modifications among males, and 52.00% in females. Despite the relatively high percentage of notches in this population, a chi-square analysis ( $\chi^2 = 0.12$ ,  $df = 1$ ,  $p = 0.73$ ) indicated that there was no significant distribution of notches between sexes in the Ipiutak culture.

A comparison of the presence of notches between Tigara males and Ipiutak males revealed a statistically significant difference ( $\chi^2 = 10.02$ ,  $df = 1$ ,  $p = 0.002$ ) between males in both cultures and the presence of notches. The data indicated that there was an

association between culture and notches among males. Additionally, a chi-square statistical analysis ( $x^2 = 5.87$ ,  $df = 1$ ,  $p = 0.02$ ) revealed a significant difference in the culture and the presence of notches in Tigara and Ipiutak females. While data for males and females indicated a cultural difference in the presence of notches, the difference is stronger in females than in males.

### **Striae**

Striae were recorded for each tooth affected. They were found on the anterior maxillary and mandibular teeth. No posterior teeth exhibited this type of modification. Nine Tigara males exhibited 20 striae, while 20 Tigara females exhibited 45 striae; three Ipiutak males exhibited six instances of striae or grooving and three Ipiutak females exhibited five instances of striae (Tables 4.10 – 4.13). A chi-square analysis ( $x^2 = 4.08$ ,  $df = 1$ ,  $p = 0.04$ ) was performed comparing the presence of striae between Tigara males and females. The data revealed a statistically significant association between sex and presence of striae within this population. Conversely, a similar analysis for the Ipiutak population revealed no significant difference between sex and the incidence of striae ( $x^2 = 0.028$ ,  $df = 1$ ,  $p = 0.87$ ).

A comparison of Tigara and Ipiutak males using a chi-square analysis ( $x^2 = 0.018$ ,  $df = 1$ ,  $p = 0.89$ ) showed there was no difference in presence of striae due to culture. Additionally, a statistical analysis ( $x^2 = 1.15$ ,  $df = 1$ ,  $p = 0.28$ ) was conducted comparing Tigara and Ipiutak females and indicated there was no difference in the presence of notches due to culture. In sum, while an interpopulational comparison revealed no significant difference in the presence of striae and culture, an intrapopulational analysis

showed that in the Tigara population, there exists a strong association between sexes and the incidence of striae.

### **Anterior Wear**

Anterior wear among the Ipiutak population was mild in comparison to the Tigara collection (Tables 4.10 – 4.13). Each tooth was counted as one instance of anterior wear. Five Ipiutak males exhibited anterior wear on a total of 20 teeth (3.30% of total observed teeth); one Ipiutak female exhibited anterior wear on six teeth (1.07% of total observed teeth). Among 28 Tigara males, anterior wear was present on 156 teeth (7.25% of total observed teeth), while 46 Tigara females exhibited this type of attrition on 239 teeth (8.41% of total observed teeth).

An intrapopulational analysis was conducted using the chi-square statistic. In the Tigara population, there was no significant difference in the distribution of anterior wear between the sexes ( $\chi^2 = 2.26$ ,  $df = 1$ ,  $p = 0.13$ ). Conversely, in the Ipiutak culture, there was a significant association between sex and anterior wear ( $\chi^2 = 6.61$ ,  $df = 1$ ,  $p = 0.01$ ). Ipiutak males exhibited more than twice the amount of anterior wear as in Ipiutak females.

An interpopulational analysis between Tigara males and Ipiutak males also revealed a significant difference in the frequency of anterior wear and culture ( $\chi^2 = 12.36$ ,  $df = 1$ ,  $p = 0.0004$ ). Additionally, for female samples, a chi-square analysis was conducted ( $\chi^2 = 37.63$ ,  $df = 1$ ,  $p = 0.0000$ ) revealing a statistically significant association between culture and anterior wear. Anterior wear was exhibited eight times greater in the Tigara female population as in the Ipiutak female sample. In conclusion, while the Tigara exhibited no association between sex and anterior wear, the Ipiutak displayed a

correlation. Between populations, the data revealed an association between culture and anterior wear.

## CHAPTER 5: DISCUSSION AND CONCLUSION

Archaeologically, teeth are the most durable of skeletal remains. As a result, they are particularly important in understanding and reconstructing the lives of past populations. Investigations of dentition can reveal much about demography, health, and habitual practices of a population. By recording dental pathologies and unintentional cultural modifications, as well as their relative frequencies, insight may also be gained about the social structure of these populations. This study analyzed two prehistoric cultures that occupied the same location but whose associated artifacts suggested two different subsistence and social organizations. One of these populations, the Tigara, was a typical Inuit whaling culture. The second, the Ipiutak, was a unique population with no evidence of whaling. Dental analysis of 289 individuals, 231 Tigara and 58 Ipiutak, highlighted their different lifestyles.

One important issue to note is that males and females from all age groups studied are not equally represented in the skeletal samples. Tigara females between the ages of 36-45 are the most represented in the collection. Conversely, for both populations, individuals over the age of 46 are underrepresented. Therefore, it is important to acknowledge that the demography of these two populations may have some effect on the frequency of dental pathologies and cultural modifications recorded.

Caries presence for both groups was relatively minimal, a finding that is not surprising since a high carbohydrate diet had not yet been introduced to these populations. A diet dominated by proteins and fats afforded both prehistoric groups a low dental caries rate (Costa 1980). Only after white contact did the prevalence of caries increase among Inuit populations. The distribution of carious lesions between males and

females was even for both groups. These findings corroborate Costa's (1977, 1982) early research on the Ipiutak skeletal material and confirm the hypothesis that the population likely did not have a sexual division of labor that afforded one sex differential access to cariogenic foods.

However, despite the overall minimal appearance of carious lesions in both populations, the Ipiutak exhibited a minimum number of caries that was greater than the Tigara. Although the Tigara population was well represented in the skeletal sample in comparison to the Ipiutak, the earlier group had a relatively high caries rate. The key difference between both groups is that the Ipiutak were not a whaling culture like the Tigara. One explanation is that the Ipiutak may have been supplementing their small sea mammal and caribou diet with food that had high cariogenic properties, such as starchy seeds or roots. However, because of the difficulties in preservation of fibrous plant materials, this remains merely a hypothesis. In fact, it is more likely that the Tigara would have yielded more carious lesions. Their diet was probably similar to the current Point Hope diet consisting of sea mammals, caribou, and roots that were eaten raw, the latter being materials dense with carbohydrates (Waugh 1930; Costa 1980).

Another possible explanation for the negligible presence of caries in the Tigara is that the rate of attrition was greater within this population. A few researchers have found that groups with overall high rates of attrition have relatively low instances of caries (Powell 1985; Larsen 1995). The higher the degree of occlusal attrition, the less opportunity bacteria have to form carious lesions as the caries are removed before they fully develop (Hillson 1996). Powell (1985) has concluded that a higher rate of dental wear may be conducive to good dental health because it wears the prime caries loci. The

Tigara mean wear for both males and females was higher than the Ipiutak wear, suggesting the Tigara used their teeth to a heavier degree than the earlier population. In sum, carious lesions may not have been able to form as readily among the Tigara population because they had a greater rate of wear, and subsequently, antemortem loss. Antemortem loss was also found to be more prevalent in the Tigara population and was probably linked to the higher mean rate of attrition in this sample. The more severe use of teeth is intimately linked with premature loss of teeth. In sum, the higher degree of attrition and antemortem loss among the Tigara is likely related to the minimal amount of caries found in the population in comparison to the Ipiutak. Additionally, among the Ipiutak, the lower mean wear and antemortem loss and the greater presence of caries suggested an inverse correlation between rate of wear and caries.

A final explanation for the differences in caries rates could be simply that the two populations are genetically different. Debetz (1960) placed the Tigara and Ipiutak into two separate lineage groups and the difference in caries rates may be due to their susceptibility to tooth decay as a population (Costa 1980).

There is minimal to no sexual dimorphism in the average rate of attrition within both populations. A differential degree of wear between males and females has been noted among prehistoric American Indians, where females exhibited overall greater dental wear (Molnar 1971). Molnar et al. (1983) postulated that there was sexual dimorphism in tooth arch shape and size that led to this differential wear. Campbell (1939) suggested that the greater wear among females was due to diet differences - women consumed the tougher and more abrasive elements of each meal. Analyzing attrition in conjunction with other variables, this research demonstrated that individuals

with a higher mean wear also had higher instances of antemortem loss and, in some cases, a greater presence of cultural modifications. Attrition, then, appears to be intimately connected with the greater alimentary and non-alimentary use of dentition.

In comparing antemortem loss, premature loss of teeth and sex were significantly related. Tigara females had a higher percentage of loss, likely related to the higher degree of attrition recorded within this group. It has been noted in other research that antemortem loss and attrition are intimately related (Kelley et al. 1991). Among populations experiencing heavy attrition with pulp chamber exposure, tooth loss is likely to occur (Costa 1980). This research supports this hypothesis.

Cultural modifications occurred more frequently among Tigara females than Tigara males. Conversely, the presence of cultural modifications was less in Ipiutak females than males. Among Tigara females, the ten instances of transverse cuts indicated these teeth were used extensively enough to cause the molars to fracture. The “cuts” are likely a result of heavy use of the teeth; the functional use of the dentition caused the tooth to chip along the transverse plane. The result is a “half” tooth that has been smoothed by the same processes that wore down the enamel surface.

Unlike Turner II and Cadien’s (1969) findings, the presence of notches or chips of the dentition was not comparable for both sexes. Turner II and Cadien (1969) found that pressure chipping was exhibited in equal frequencies between sexes among the Aleut, Eskimo, and northern Native Americans (from Canada, Alaska, and Greenland). Instead, the distribution of notches in the Tigara varied between sexes; Tigara males exhibited a higher incidence of notches than females, relative to sample size. This type of modification is the result of using teeth as tools and the chipping of teeth against frozen

meats and hides (Turner II and Cadien 1969). Notches are common among Inuit present and past populations and affect all age groups (Scott, personal communication, 2005). However, the higher frequency of notches in Tigara males suggested they might have used their teeth in different ways than their female counterparts. Turner and Cadien (1969) suggested that chipping might also be due to the action of chewing bone to extract marrow. Perhaps this was an activity engaged in predominately by males. Another suggestion is that hide chewing among Tigara females did not significantly contribute to tooth chipping as originally hypothesized (Turner and Cadien 1969).

Striae, or grooves, considered in this research to indicate the action of pulling sinew or hide, were found to be similar between sexes. In many studies on occlusal grooving, these striae are often associated with only female dentition; however, these modifications were observed on male dentition as well (Larsen 1986). Among the Ipiutak, the presence of striae was minimal for both sexes. Despite the presence of grooving on Tigara male dentition, Tigara females do exhibit a higher frequency of striae.

Finally, anterior wear, examined in this research as an indication of pulling hide in a downward or upward motion through the teeth, was prevalent among the Tigara. Females exhibited more instances of anterior wear than males among the Tigara and Ipiutak males show more anterior wear than females. Suggestive in the greater number of overall cultural modifications, it is possible that Ipiutak males assisted or controlled the manufacturing of clothing and/or used their teeth more extensively as tools. Similarly, Tigara females, while engaging in gender-based behaviors, used their teeth more extensively than males.

The Ipiutak pairings showed comparable caries rates, mean degree of attrition, and percentages of antemortem loss, suggestive of a similar usage of dentition whether for dietary or non-dietary functions. Tigara males and females, conversely, exhibited statistically significant associations between sex, antemortem loss, and certain cultural modifications. Tigara females showed overall greater mean wear and the presence of striae and anterior wear, findings that are suggestive of differential use of teeth, probably due to the action of pulling hide through the dentition. The use of teeth could be alimentary or non-alimentary but analysis of the data indicates an extensive use of dentition among the Tigara female population relative to Tigara males.

The relationship between biology and culture is evident, particularly when analyzing dentition. Dental macrowear is useful in reconstructing lifeways, since teeth are in contact with external environmental forces as well as cultural modifiers. To fully understand attrition and abrasion of skeletal samples, more research on living populations must be conducted (Molnar 1972). This research analyzed how two populations interacted with their material culture and the environment and the way these interactions were reflected in their dentition. The information yielded from this study will prove valuable in reconstructing the lifeways of past populations.

## REFERENCES CITED

- Alt, Kurt W., and Sandra L. Pichler  
1998 Artificial modifications of human teeth. *In* *Dental Anthropology*. Kurt W. Alt, Friedrich W. Rösing, and Maria Teschler-Nicola, eds. Pp. 387-414. New York: Springer-Verlag/Wien.
- American Heritage Dictionary of the English Language: Fourth Edition  
2000 Eskimo. Electronic document, <http://www.bartleby.com/61/24/E0212400.html>, accessed April 6, 2005.
- Anderson, Douglas D.  
1962 Cape Krusenstern Ipiutak economic and settlement patterns. Master's thesis, Department of Anthropology, Brown University, Rhode Island.  
1984 Prehistory of north Alaska. *In* *Handbook of North American Indians, Volume 5: Arctic*. David Damas, ed. Pp. 80-93. Washington D.C.: Smithsonian Institution Press.
- Brown, Tasman, and Stephen Molnar  
1990 Interproximal grooving and task activity in Australia. *American Journal of Physical Anthropology* 81:545-553.
- Buikstra, Jane E., and Douglas H. Ubelaker  
1994 Standards for data collection from human skeletal remains. Arkansas: Arkansas Archeological Survey.
- Campbell, Thomas D.  
1939 Food, food values and food habits of the Australian Aborigines in relation to their dental conditions. *Australian Journal of Dental Research* 43:141-156.
- Christopherson, K.M., and P.O. Pedersen  
1939 Investigations into dental conditions in the Neolithic period and in the Bronze age in Denmark. *Dental Record* 59:575-585.
- Collins, H. B.  
1932 Caries and crowding in the teeth of the living Alaskan Eskimo. *American Journal of Physical Anthropology* 16:451-462.
- Costa., Raymond L., Jr  
1977 Dental pathology and related factors in archaeological Eskimo skeletal samples from Point Hope and Kodiak Island, Alaska. Ph.D. dissertation, Department of Anthropology, University of Pennsylvania, Philadelphia.  
1980 Incidence of caries and abscesses in archaeological Eskimo skeletal samples from Point Hope and Kodiak Island, Alaska. *American Journal of Physical Anthropology* 52:501-514.

- 1982 Periodontal disease in the prehistoric Ipiutak and Tigara skeletal remains from Point Hope, Alaska. *American Journal of Physical Anthropology* 59:97-110.
- Davies, T. G., and P.O. Pedersen  
1955 The attrition in deciduous teeth and first permanent molars in primitive and urbanized Greenland natives. *British Dental Journal* 99:35.
- Debetz, George F.  
1960 The paleo-anthropology of the early Eskimos (Ipiutak and Tigara). Anchorage, Alaska: U.S. Department of Interior, National Park Service, Beringia Program.
- de Poncins, Gontran  
1941 *Kabloona*. New York: Reynal.
- Hillson, Simon  
1996 *Dental Anthropology*. Cambridge: Cambridge University Press.
- Kelley, Mark A., Dianne R. Levesque, and Eric Weidl  
1991 Contrasting patterns of dental disease in five early northern Chilean groups. *In Advances in Dental Anthropology*. Mark A. Kelley and Clark S. Larsen, eds. Pp. 203-213. New York: Wiley-Liss, Inc.
- Larsen, Clark S.  
1986 Dental modifications and tool use in the western Great Basin. *American Journal of Physical Anthropology* 67:393-402.  
1995 Biological changes in human populations with agricultural. *Annual Review of Anthropology* 24:185-213.
- Larsen, Clark S., Rebecca Shavit, and Mark C. Griffin  
1991 Dental caries evidence for dietary change: An archaeological context. *In Advances in Dental Anthropology*. Mark A. Kelley and Clark S. Larsen, eds. Pp. 179-202. New York: Wiley-Liss, Inc.
- Larsen, Helge, and Froelich Rainey  
1948 Ipiutak and the Arctic whale hunting culture. *Anthropological papers of the American Museum of Natural History*, 42. New York: Order of the Trustees.
- Leigh, Rufus W.  
1925 Dental pathology of American Indian tribes of varied environmental and food conditions. *American Journal of Physical Anthropology* 18:179-195.
- Lester, C., and Harry Shapiro  
1968 Vertebral defects in the lumbar vertebrae of prehistoric American Eskimos. *American Journal of Physical Anthropology* 28:43-48.

- Lous, I.  
1970 The masticatory system used as a tool. *Dental Abstract* 15:457-458.
- Mauss, Marcel, and Henri Beuchat  
1979[1950] *Seasonal variations of the Eskimo*. James J. Fox, trans. London: Routledge & Kegan Paul, Ltd.
- Milner, George R., and Clark S. Larsen  
1991 Teeth as artifacts of human behavior: Intentional mutilation and accidental modification. *In Advances in Dental Anthropology*. Mark A. Kelley and Clark S. Larsen, eds. Pp. 357-378. New York: Wiley-Liss Inc.
- Molnar, Stephen  
1971 Sex, age, and tooth position as factors involved in the production of tooth wear. *American Antiquity* 36:182-188.  
1972 Tooth wear and culture: A survey of tooth functions among some prehistoric populations. *Current Anthropology* 13:511-525.
- Molnar, Stephen, Jeffrey K. McKee, and I. Molnar  
1983 Measurements of tooth wear among Australian Aborigines: I. Serial loss of the enamel crown. *American Journal of Physical Anthropology* 61-65.
- Mummery, John  
1870 On the relations which dental caries – As discovered amongst the ancient inhabitants of Britain and amongst existing aboriginal races – May be supposed to hold to their food and social condition. *Transactions of the Odontological Society of Great Britain* 2:27-102.
- Ortner, Donald J.  
2003 Dental disease and miscellaneous pathological conditions of the jaw. *In Identification of Pathological Conditions in Human Skeletal Remains*. Second Edition. Donald J. Ortner, ed. Pp. 589-608. San Diego: Academic Press.
- Pedersen, P.O.  
1947 Dental investigations of Greenland Eskimos. *Proceedings of the Royal Society of Medicine* 40:726-732.  
1952 Some dental aspects of anthropology. *Dental Record* 72:170-178.
- Pinborg, J.J.  
1969 *Pathology of the dental hard tissues*. Philadelphia: Saunders.
- Powell Mary L.  
1985 Analysis of dental wear and caries for dietary reconstruction. *In The Analysis of Prehistoric Diets*. Robert I. Gilbert, Jr. and James Mielke, eds. Pp. 307-338. Orlando: Academic Press, Inc.

Rainey, Froelich

1971 The Ipiutak culture: Excavations at Point Hope, Alaska. McCaleb  
Module in Anthropology: Module 8. Pp. 1-32. Massachusetts: Addison-Wesley  
Publications.

Rogers, Spencer

1988 The testimony of teeth: Forensic aspects of human dentition. Springfield, Illinois:  
Charles C. Thomas.

Rudenko, Sergei I.

1961 Ancient culture of the Bering Sea and the Eskimo problem. Paul Tolstoy, trans.  
Toronto: University of Toronto Press.

Schwartz, Jeffrey H., Jaymie Brauer, and Penny Gordon-Larsen

1995 Brief communication: Tigarán (Point Hope, Alaska) tooth drilling. *American  
Journal of Physical Anthropology* 97:76-82.

Scott, Richard G., and Turner, Christy II

1988 Dental anthropology. *Annual Review of Anthropology* 1988:99-126.

So, Joseph K.

1980 Human biological adaptation to arctic and subarctic zones. *Annual  
Review of Anthropology* 9:63-82.

Smith, B. Holly

1984 Patterns of molar wear in hunter-gatherers and agriculturalists. *American  
Journal of Physical Anthropology* 63:39-56.

Todd, T.

1920 Age Changes in the Pubic Bones, I: The White Male Pubis. *American Journal of  
Physical Anthropology* 3:285-334.

Tomenchuk, John, and John T. Mayhall

1979 A correlation of tooth wear and age among modern Igoalik Eskimos.  
*American Journal of Physical Anthropology* 51:67-78.

Turner II, Christy, and James D. Cadien

1969 Dental chipping in Aleuts, Eskimos and Indians. *American Journal of Physical  
Anthropology* 31:303-310.

Utermohle, Charles

1984 From Barrow eastward: Cranial variation of the Eastern Eskimo. Ph.D.  
dissertation, Department of Anthropology, Arizona State University, Tempe.

Walker, Phillip L, and John M. Erlandson

1986 Dental evidence for prehistoric dietary change on the northern Channel Islands, California. *American Antiquity* 51:375-383.

Washburn, Sherwood

1948 Sex differences in the pubic bone of Bantu and Bushmen. *American Journal of Physical Anthropology* 6:199-207.

Waugh, L.M.

1930 A study of the nutrition and teeth of the Eskimo of North Bering Sea and Arctic Alaska. *Journal of Dental Research* 10:387.

### APPENDIX: DENTAL INVENTORY SHEET

SPECIMEN NO \_\_\_\_\_ BURIAL NO \_\_\_\_\_ SEX \_\_\_\_\_  
 DATE \_\_\_\_\_ TRIBE \_\_\_\_\_ AGE \_\_\_\_\_

NO. OF TEETH

**DENTAL CARIES**

		MAXILLA							MANDIBLE										
		I1	I2	C1	P1	P2	M1	M2	M3			I1	I2	C1	P1	P2	M1	M2	M3
<b>TEETH INFECTED</b>	L									L									
	R									R									
<b>SIZE OF CARIES</b>	L									L									
	R									R									
<b>LOCATION</b>	L									L									
	R									R									

**S** = small (<1mm); **M** = medium (1-3mm); **G** = gross (> 3mm with pulp chamber involvement)]

**B** = buccal; **L** = lingual; **M** = mesial; **D** = distal

**ATTRITION**

		MAXILLA							MANDIBLE										
		I1	I2	C1	P1	P2	M1	M2	M3			I1	I2	C1	P1	P2	M1	M2	M3
<b>L</b>										<b>L</b>									
<b>R</b>										<b>R</b>									

*None = 0mm ablation      Slight = 1.5mm ablation      Moderate = 3.0mm ablation      Heavy = 4.0mm ablation*

**TOOTH LOSS**

		MAXILLA									MANDIBLE								
		I1	I2	C1	P1	P2	M1	M2	M3			I1	I2	C1	P1	P2	M1	M2	M3
L										L									
R										R									

**PM** = postmortem loss; **AM** = antemortem loss; **NS** = not shown

**DESCRIBE INTENTIONAL OR UNINTENTIONALCULTURAL MODIFICATONS**

## VITA

Felicia Chrisafo Madimenos was born in Brooklyn, New York, on December 1, 1980. She was graduated from New York University, New York, in May 2002 with a Bachelor of Arts degree in anthropology and Italian. She hopes to one day pursue a doctorate in anthropology with a biocultural focus.