THE DENTAL ANTHROPOLOGY OF THE FLETCHER SITE (20 BY 28)

Thesis for the Degree of M. A.
MICHIGAN STATE UNIVERSITY
JUDITH D. TORDOFF
1972

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FLETCHER SITE (20 BY 28)

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AN ABSTRACT OF A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

MASTER OF ARTS

Department of Anthropology

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The Fletcher site is a multi-component site located in Bay City, Michigan, and occupied by groups of Ottawa or Chippewa Indians. An Historic Period cemetery was excavated in the upper levels of the site. The dentitions of the individuals buried there were analyzed. Morphological variations were recorded and compared to those of other American Indians. Through analysis of pathological conditions in the teeth and comparison with groups from other sites in the Great Lakes region, it was possible to determine a measure of the environmental and nutritional stress experienced by this population.

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ACKNOWLEDGMENTS

I should like to thank the members of my committee, Dr. Terrell Phenice, and Dr. James Brown, for their help in the preparation of this thesis. Special thanks are due to William Lovis, Norman Sauer, Robert Mainfort, Herbert Whittier, Patricia Whittier, and Jeffrey Tordoff. Their help, suggestions, and friendship have been greatly appreciated.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

INTRODUCTION

Purpose

The purpose of this paper is to describe the dental characteristics of the people buried at an Historic Period cemetery in Bay City, Michigan, and to compare them with those of other populations from the Great Lakes Area.

Since teeth are the parts of the human body most likely to survive a long interment, they are an obvious target for analysis and comparison. They contain a number of genetically determined traits which can be compared with those of other populations. By analyzing the pathology of the dentition, the anthropologist may gain insight into the dietary habits of the people he is studying. Dental Anthropology as a significant field has grown rapidly in the past few decades. However, comparative material is still generally lacking. Therefore, a major concern in writing this paper is to provide a complete set of data on teeth for future reference. The most valuable statements by dental anthropologists will come only when a sufficient body of comparative data is formed. Some subjects may not be covered as thoroughly here as they could be. However, in the interest of providing as much data as possible, I have tried to cover a large number of topics. Any number of the dental traits discussed here could be further studied and expanded upon. Within the scope of this paper, that has not been possible.

My primary interest in comparing my data with that from other sites was in finding evidence for malnutrition and environmental stress among the people from the Fletcher site and other populations in the Great Lakes area. I was also interested in finding out whether or not a population, such as that from Fletcher, that had significant contact with Europeans, may be expected to indicate a higher incidence of caries and abscesses than a population with little or no contact. By trading with Europeans, indigenous groups gained access to such things as refined sugar and flour, and other exotic foodstuffs. Since these things have contributed to the rate of decay in the teeth of modern man, one would expect to find a rise in the number of individuals and teeth affected in indigenous groups once the goods were available through interaction with Europeans.

Description of the Site

The Fletcher site is located on the western bank of the Saginaw River in Bay City, Michigan. It is a multi-component site, occupied from Early Woodland to

Historic times by Central Algonquian groups of Ottawas or Chippewas. During the summers of 1967, 1968, and 1970, crews from Michigan State University excavated the site, uncovering an intense Late Woodland occupation, and an Historic Period cemetery, which Brown (personal communication) dates as having been in use as early as 1720 and as late as 1775. The site was definitely occupied during the 1750's and 1760's. These dates, plus analysis of grave goods, indicate the burials cover parts of both the French and British occupations. Though no Historic occupation has been located at the site, there is evidence of a possible contemporaneous occupation in close proximity to the burial grounds (Maxwell personal communication).

The Fletcher site was occupied seasonally. Analysis of burial orientation and contents of the graves indicates that spring and fall were the periods of most intense occupation. These periods coincide with the times of greatest food abundance: spawning fish, maple sugar and maple syrup in the spring, and corn, squash, and pumpkins in the fall.

Sites Supplying Comparative Data

Though not much comparative data on the dentition are available for this area, where possible, the Younge, Lasanen, and Juntunen sites will be used. These sites were chosen for several reasons. They are the closest sites to Fletcher, both geographically and temporally, for which there is any comparative data on the skeletal population. And they have all had less contact with Europeans than the Fletcher group. The Younge and Juntunen sites are both too early to have had European contact, and the Lasanen population had only sporadic contact with missionaries in that area.

The Younge Phase of the Younge Tradition dates from 900 A.D. to 1100 A.D. (Fitting 1966c:738), and has yielded eighty-eight burials. The site is located in southeastern Michigan. The Lasanen site, located in St. Ignace, Michigan, dates from the late seventeenth century. Seventy-six individuals, presumably of Ottawa stock, were recovered from ossuary-type burials. The Juntunen site, on Bois Blanc Island east of the Straits of Mackinac, yielded twenty to fifty individuals, again from ossuary burials. This site was occupied seasonally between 800 A.D. and 1400 A.D. (McPherron 1967:1).

Wilkinson (1970) has demonstrated that there are definite morphological relationships between the Younge and Juntunen sites. He also considers it quite possible that the relationships between these sites and the Serpent Mound series in Ontario may be bridged by some of the Ontario ossuaries. Though it has not been possible here, with the limited amount of comparative material available, it would indeed be interesting to note similarities between the Fletcher population and these others.

Obviously, comparisons between all skeletal characteristics will be necessary in order to reach any concrete conclusions.

The Sample

My sample consisted of the dentitions of eighty-four individuals ranging in age from neonate to over 40 years. A breakdown of individuals into age groups may be found in Table 1. A total of 1,926 teeth was present. Of these, 1,859 teeth were identifiable and sideable. Analysis was attempted only on identifiable and sideable teeth. Five hundred and sixty-one teeth were from males, 639 were from females, 68 were from unsexed adults, and 591 were from juveniles. Of the juveniles (below 18 years and unsexed), 352 teeth were deciduous. There were thirteen complete dentitions: ten adults and three juveniles.

A major problem encountered was the condition of the skeletal material. With the exception of the 1970 field season, no preservatives were used on excavated remains. Consequently, a great deal of the bone was flaking and breaking away. The skeletal material had also been moved several times, causing bones to be shuffled around in their boxes. With specific regard to teeth, a large number were lying loose in boxes and a great deal of enamel had chipped off. Besides being chipped, many teeth were partially rotted. Of the total number of identifiable, sideable teeth, 39% were non-measurable.

Table 1: Age Group Distribution for the Fletcher Site.

Age	Male	Female	Juvenile	Unsexed Adult	Total
Birth - 2			18		18
3 - 6			10		10
7 - 12			6		6
13 - 18	1	4	2		7
19 - 29	9	14		2	25
30 - 40	11	5		1	17
40+	1				1
Total	22	23	36	3	84

Another problem encountered was in comparing my data with the data from other sites. The data for dental traits gathered from Fletcher was tabulated for two results: frequency of occurrence among individuals and frequency of occurrence among the total number of teeth present or the total number of teeth of a particular morphological class. Most reports from other sites concentrated on only one kind of analysis, usually frequency of occurrence among individuals. In comparing sites, then, I have tried to make clear what kind of data was available and hence, the kinds of comparisons possible.

Methodology

All the data gathered for the dental characteristics of each individual were recorded on data sheets for teeth (Figures 1 and 2). In addition, key diagrams for males, females, and juveniles (below 18 years) were maintained to keep track of sample size and selected pathological traits. Classification of the degree of expression of pathology, or such epigenetic traits as shovel-shaped incisors and Carabelli's cusps was first broken down to presence or absence of the trait or condition. From there, if a trait was present it was recorded as being slight, definite, or pronounced. In the case of carious lesions, numerical values were attached to several size categories. The degree of attrition expressed by the

Site______	Burial No.______	Dug by:______
Site No.______	Feature No.______	Date:______
State______	Recorder______	Skull______ Mandible______
Material housed______	Date:______	Age______ Sex______

L --- Teeth Characteristics --- R

	M3	M2	M1	PM2	PM1	C	LI	CI	CI	LI	C	PM1	PM2	M1	M2	M3
Maxillary																
Mandibular																

L --- Teeth Wear --- R

	M3	M2	M1	PM2	PM1	C	LI	CI	CI	LI	C	PM1	PM2	M1	M2	M3
Maxillary																
Mandibular																

	Right					Left				
	SS	MD	BL	CM	Crowd	SS	MD	BL	CM	Crowd
I1										
I2										
	MD	BL	CM	Comment		MD	BL	CM	Comment	
C										
P1										
P2										
	Cusps	MD	BL	CM		Cusps	MD	BL	CM	
M1										
M2										
M3										

	Right					Left				
	SS	MD	BL	CM	Crowd	SS	MD	BL	CM	Crowd
I1										
I2										
	MD	BL	CM	Comment		MD	BL	CM	Comment	
C										
P1										
P2										
	Cusps	MD	BL	CM		Cusps	MD	BL	CM	
M1										
M2										
M3										

Code for Teeth Characteristics:

A	= Abscess
A-	= Abscess Missing
CO	= Caries on Occlusal surface
CB	= Caries on Buccal surface
CL	= Caries on Lingual surface
CM	= Caries on Mesial surface
CD	= Caries on Distal surface
—	= Missing A M
	= Missing P M
X	= Present in good condition
#	= Bone Missing
T	= Tartar
N	= Not erupted
NFE	= Not fully erupted
small letters	= deciduous teeth
CA	= Congenital absence
Car	= Carabelli's cusp

Pathologies:

Malocclusion:

Supernumerary teeth:

Enamel Pearls:

Figure 1. Data Sheet for Teeth.

Burial Number: ______________

Wear Pattern:

Ante-mortem chipping:

Periodontal Disease:

Carabelli's Cusp:
3rd molar mand. - mes-buc bud:

Enamel Hypoplasia:

Enamel Pearlz:

Crown Malformation:

Other/Special Anomalies:

Classification of Caries:

	Left													Right		
Max	M3	M2	M1	PM2	PM1	C	LI	CI	CI	LI	C	PM1	PM2	M1	M2	M3
Mand	M3	M2	M1	PM2	PM1	C	LI	CI	CI	LI	C	PM1	PM2	M1	M2	M3

Figure 2. Dentition: Fletcher Site, Bay City, Michigan, 2nd Check List.

molars was classified on the basis of Brothwell's numerical classification of molar wear (1965:69).

Individuals were sexed on the basis of general robustness of bone, especially skull and long bones, and on morphology of the hip bone, the skull, and mandible (Brothwell 1965, Anderson 1962, Phenice 1969). Several individuals were sexed on the basis of the Giles and Elliot method of discriminant function analysis of crania (1963). However, many of the necessary measurements were impossible to take due to poor bone preservation, and the method was not very useful. Aging of juveniles was accomplished almost solely by examining the stage of eruption of the teeth (Schour and Massler 1944). Beyond 18 to 20 years, age was calculated by observation of the pubic symphysis, the basilar suture, and tooth wear. Since the latter method, especially, is not reliable, the age range for older individuals is necessarily much greater.

In discussing the Fletcher population, the term juvenile is used to indicate individuals below 18 years of age. When referring to the adult population, I refer to all individuals over 18 years. Occasionally, when a distinction between adult and juvenile was not necessary, sexed individuals below 18 years were included in male/female comparisons. Such instances are clearly marked.

Dental measurements were recorded for all teeth in reasonably good condition. Heavily chipped teeth and those excessively worn were excluded from the sample. Dahlberg (1951) considers the crown module (CM) to be a good indicator of the overall size of a tooth. This figure is reached by dividing the sum of the buccal-lingual (BL) and mesio-distal (MD) diameters by two (Dahlberg 1951:164). Therefore, only these two measurements were taken. Ideally, some indication of crown height should be made. However, since the amount of wear on many teeth prevented this kind of estimation, the crown module was used as the best indicator of overall tooth size. Since the mesio-distal diameter may be important in distinguishing the teeth of different populations of the same racial stock (Moorrees as cited in Phenice 1969:pg.64), both this measurement and the crown module will be included in the metric tables.

Measurements were taken with a vernier sliding caliper calibrated in tenths of millimeters. The mesio-distal diameter was counted as the greatest distance between contact points on the tooth's mesial and distal surfaces. If a tooth was displaced or rotated, measurements were taken from the points where contact usually occurs, were the tooth in normal position. The buccal-lingual diameter was counted as the greatest distance between the buccal and lingual surfaces, wherever that might fall on the particular tooth. For example, with incisors this point would be close to the gum line of the tooth; with premolars it would be higher, where the greatest bulge in the buccal and lingual cusps is located. Maxillary molars, being rhomboid shaped, were the hardest teeth to measure. I have counted mesio-distal diameter here as the greatest distance between mesial and distal contact points. Buccal-lingual diameter was measured as the distance between the jaws of the caliper held flat against the buccal and lingual surfaces of the tooth.

CHAPTER I

MORPHOLOGY

Section 1: Genetic Traits

The dentition of man is divided into four morphological classes: incisors, canines, premolars, and molars. Each class has its own genetically determined variations and Dahlberg (1951) has found that the teeth of the American Indian may be characterized by several specific morphological traits.

The shovel-shaped incisor is perhaps the "most typical dental characteristic of the American Indian" (Dahlberg 1951:140), and is found more often in American Indians than in any other group. It is easily recognizable in the incisors by the appearance of prominent lateral borders on the lingual surface of the tooth. The trait is usually much more pronounced in the maxillary incisors than the mandibular series. The expression of shovel-shaping ranges from slight to pronounced, sometimes resulting in what is termed a "double-shovel," a concavity on the labial as well as the lingual surface.

Of longstanding interest to the dental anthropologist are the cusp patterns of the lower molars. Different populations show different degrees of divergence from, and modification of ancestral patterns (Dahlberg 1951:152). The most dominent cusp pattern for the lower first molars in modern man is still the Y5, or dryopithecoid pattern. This pattern is so named because when the tooth is viewed lingually, the grooves between its five cusps form a "Y." For the second molar, the +4 or +5 pattern is usually found. Here the grooves between either four or five cusps form a "+." The third molar is the most genetically unstable of the three, and its cusp pattern is often irregular. Of the four most typical cusp patterns, the +4 is the farthest morphologically from the Y5 pattern. Dahlberg (1951:152) calls it the most specialized or advanced pattern, and feels that it is reached through either the +5 or the Y4 stage, from the Y5 stage.

In recording cusp patterns for the upper molars, Dahlberg uses five categories, all based on the condition of the hypocone (disto-lingual cusp). A 4 indicates a well-developed hypocone, and a 4- indicates that the hypocone is reduced. A 3 means that the hypocone is completely missing from the tooth and a 3+ indicates a 3-cusped tooth with a cuspule on its distal border. Other teeth are irregular in pattern. Most maxillary first molars indicate a 4-cusped pattern. Moving distally, the hypocone may be expected to be reduced in size. The third molar most often indicates a 3 or 3+ pattern.

Paramolar cusps are defined as those extra cusps found on the buccal surfaces of the upper and lower premolars and molars (Dahlberg 1951:162). Of the most evolutionary significance is the protostylid, a derivative of the cingulum, and located on the mesio-buccal surfaces of the lower molars. These cusps have been found in the Australopithecines, Meganthropus, Sinanthropus, and in modern man. They occur in low percentages in American Indians, though pits or grooves in the same location are probably residual evidence of the cusp's presence in early man and may be found more often than a full cusp.

The most commonly discussed maxillary accessory cusp is the Carabelli's cusp, an extra cusp found on the mesio-lingual aspect of the molars. These cusps are evolutionarily recent characters, as they are not common to the fossil hominids (Dahlberg 1951:168). Like the protostylid, they are derivatives of the cingulum and are found in low percentages in the American Indian dentition. Again, pits and grooves are found somewhat more often than the full cusp.

The characteristics described above are found in similar frequencies in the teeth of the Fletcher population.

Shovel-Shaping

In every case but one, where an observation was possible on Fletcher permanent incisors the individual indicated some expression of the shovel-shaping trait. Unfortunately, up to 64% of some groups of teeth were too damaged or worn to permit observation. Yet, were all teeth in good condition, I feel that percentages would remain essentially the same, at least regarding presence or absence of the trait. Very few instances of a double-shovel occurred in the Fletcher material. Tables 2 and 3 list the occurrence of shovel-shaping with regard to frequency of the various degrees of expression. I have defined the strongest expression of this trait as being when the lateral borders are so pronounced that they make a definite fold on the lingual surface of the tooth. This expression occurred most frequently in female upper lateral incisors (43%). Male upper lateral incisors indicated a 27% frequency. Maxillary lateral incisors were usually as shovel-shaped, and often more so, than central incisors, as indicated by these percentages. Mandibular incisors were more likely to express the trait only slightly, with the central incisors being the only observed teeth that were definitely not shovel-shaped. Dahlberg (1951:141) rightly suggests that combining the figures for shovel-shaped and semi-shovel-shaped categories will give a more reliable base of comparison for the character in populations. Accordingly, of the Fletcher teeth observable, 99% indicated

Table 2: Degree of Expression of Shovel-Shaping on Permanent Incisors.

	Sample	1 No. Expression		2 Slight		3 Definite		4 Definite Fold		Cannot Tell	
		No.	%	No.	%	No.	%	No.	%	No.	%
Maxillary CI											
Male	22	--	--	--	--	6	27	2	9	14	64
Female	23	--	--	3	13	13	57	--	--	7	30
Maxillary LI											
Male	22	--	--	--	--	4	18	6	27	12	55
Female	23	--	--	1	4	7	30	10	43	5	22
Mandibular CI											
Male	22	--	--	7	32	1	4.5	--	--	14	64
Female	23	1	4	10	35	3	13	--	--	11	48
Mandibular LI											
Male	22	--	--	9	41	1	4.5	1	4.5	11	50
Female	23	--	--	10	43	3	13	--	--	10	43

Table 3: Percentage Frequency of Shovel-Shaped Permanent Incisors.

	Size				
	1	2	3	4	Cannot Tell
Maxillary CI	--	.05	.51	.05	.39
Maxillary LI	--	.02	.32	.32	.34
Mandibular CI	.02	.39	.08	--	.51
Mandibular LI	--	.42	.15	.02	.41

some expression of this trait. Again, because so many teeth were not observable, the figure may be a little high. Shovel-shaping of canines occurred in the Fletcher population, though it was more marked in deciduous canines.

Cusp Patterns

In recording cusp patterns of Fletcher molars, all teeth that were excessively worn were excluded from the sample. For the lower molars, the "Y" pattern was indicated where the protoconid (mesio-buccal cusp) was not in contact with the entoconid (disto-lingual cusp). Conversely, the "+" pattern was recorded when these cusps were touching. I have added two extra pattern groups to my sample, the +6 and Y6, because they occurred rather frequently. This pattern resulted when the hypoconid or hypoconulid of the molar was divided into two smaller cusps. For comparative purposes, the 6-cusped pattern should be included with whichever 5-cusped pattern it fits, either "Y" or "+."

The typical pattern sequence for Fletcher lower molars (Table 4) was Y5 - +5 - irregular. By combining Y5 and Y6 frequencies, a total of 93% of the first lower molars indicated a Y5 pattern. Of the second molars, 65% were either +5 or +6, with 20% of these teeth showing a Y5 pattern. Seventy-six per cent of the second molars,

Table 4: Fletcher Mandibular Permanent Molar Cusp Patterns.

	Y5		Y4		Y6		+5		+4		+6		Irregular	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
M1														
Male	12	92	--	--	1	8	--	--	--	--	--	--	--	--
Female	23	96	--	--	--	--	1	4	--	--	--	--	--	--
Unsexed Adult	2	100	--	--	--	--	--	--	--	--	--	--	--	--
Unsexed Juvenile	26	60	--	--	12	28	--	--	4	9	1	2	--	--
Total	63	77	--	--	13	6	5	6	--	--	1	1	--	--
M2														
Male	3	14	1	5	--	--	14	64	2	9	2	9	--	--
Female	9	28	--	--	--	--	15	47	4	12.5	4	12.5	--	--
Unsexed Adult	--	--	--	--	--	--	1	33	--	--	2	66	--	--
Unsexed Juvenile	2	14	1	7	1	7	7	50	2	14	1	7	--	--
Total	14	20	2	3	1	1	37	52	8	11	9	13	--	--
M3														
Male	2	10	--	--	--	--	6	30	2	10	2	10	8	40
Female	3	12	--	--	1	4	5	20	2	8	--	--	14	56
Unsexed Adult	--	--	--	--	--	--	--	--	--	--	2	50	2	50
Unsexed Juvenile	--	--	--	--	--	--	--	--	--	--	--	--	2	100
Total	5	10	--	--	1	2	11	22	4	8	4	8	26	51

however, had some variation of the "+" pattern. For the third molars, 51% were irregular, while +5 was second with 22%.

The typical cusp pattern sequence from first to third molars in the maxilla appears to be 4 - 4-/3 or 3+ - 3/irregular. In the Fletcher group a 4-cusped pattern was not uncommon for the second molar, yet the hypocone on these teeth was usually definitely smaller than that on the first molar. In these cases a 4 was assigned to the second molar because of the size of the hypocone. However, it is possible that the percentage of 4-'s for second molars should be somewhat higher. Nonetheless, Fletcher upper molars conformed to the sequence most common to American Indians. The first molar was almost invariably the 4 pattern (99%) with the second molar showing 77% either the 4- or 3+ pattern. Of the third molars, 89% were either 3+ or 3, while 7% were irregular (Table 5).

Supernumerary Cusps

In the Fletcher population, five individuals possessed protostylids, all on third molars. In three cases the cusps were bilateral; the others were unilateral. Seven individuals, four females and three males, possessed a groove on the mesio-buccal portion of the lower third molar. In only one instance was a groove noted on the first molar. These grooves could be

Table 5: Fletcher Maxillary Permanent Molar Cusp Patterns.

	4		4-		3+		3		Irregular	
	No.	%	No.	%	No.	%	No.	%	No.	%
M1										
Male	27	100	--	--	--	--	--	--	--	--
Female	32	94	2	6	--	--	--	--	--	--
Unsexed Adult	4	100	--	--	--	--	--	--	--	--
Unsexed Juvenile	36	97	1	3	--	--	--	--	--	--
Total	99	97	3	3	--	--	--	--	--	--
M2										
Male	4	17	12	50	8	33	--	--	--	--
Female	4	12	19	58	8	24	2	6	--	--
Unsexed Adult	3	75	1	25	--	--	--	--	--	--
Unsexed Juvenile	1	7	8	57	2	14	3	21	--	--
Total	12	16	40	53	18	24	5	7	--	--
M3										
Male	1	5	1	5	14	63	5	23	1	5
Female	1	3	--	--	18	60	8	27	3	10
Unsexed Adult	--	--	--	--	4	100	--	--	--	--
Unsexed Juvenile	--	--	--	--	3	60	2	40	--	--
Total	2	3	1	2	39	64	15	25	4	7

residual evidence of the full cusp present in early man (Dahlberg 1951:163). Two individuals, one male and one female, had bilateral extra mesial cusps on third molars. One juvenile had an extra lingual cusp on his first molars.

Five per cent, or four individuals from Fletcher possessed a full Carabelli's cusp on first permanent maxillary molars. In three cases the cusps were bilateral; the fourth instance was probably bilateral but the molar on the opposite side was chipped. One unsexed adult had an extra buccal-mesial cusp unilaterally on the second molar, and a male and female each had extra buccal-mesial cusps on their third molars. Twenty-nine individuals from Fletcher possessed a groove, pit, or both on the first permanent maxillary molar (20), or deciduous second molar (9). In sixteen cases the pit or groove was bilateral. On one juvenile, small distal cusps were located on first molars that otherwise indicated a 4-cusped pattern.

Other Genetic Traits

One instance of a congenitally absent maxillary canine was noted. In this case, no permanent canine had erupted and the deciduous canine was in its place. One maxillary permanent canine was malformed and can be described as peg-shaped. The occlusal surface of this tooth was worn flat on a plane running down from the labial edge to the lingual edge of the tooth. Four individuals had impacted lower third molars, only one being unilateral. There were no observations of congenitally absent lower molars, and only one was peg-shaped. Only one individual was observed to have congenitally absent maxillary third molars, a percentage substantially lower than that recorded for other Indian groups. However, so many maxillary alveoli were missing or damaged that an accurate frequency cannot be estimated for this population. It is probably at least a little higher. In one individual, an impacted right upper molar was malformed badly because it had not had enough room to develop properly. Its appearance was one of having been squeezed mesio-distally.

A male had three impacted supernumerary premolars. In the maxilla, one was located between the left lateral incisor and canine. In the mandible, supernumerary premolars were located between the right and left canines and first premolars. In the same individual, the right maxillary second premolar was rotated 190 degrees. The maxillary right second premolar was rotated distally approximately 45 degrees in an adult female, and in another individual the upper third molars were rotated 180 degrees. In three individuals, mandibular third molars were rotated disto-buccally approximately 45 degrees. Two of these instances were unilateral, the other bilateral.

Three males possessed three-rooted lower molars. In one individual the right first molar was three-rooted. A second individual possessed a right third molar with one mesio-lingual root, one distal root, and two buccal-mesial roots that were fused. The individual who had three supernumerary premolars had three-rooted third lower molars. The roots of these teeth were enlarged and twisted, and periodontal disease had produced a great deal of alveolar resporption. The third molars were decayed and practically falling out.

Four enamel pearls were noted. However, these enamel buds are often found on tooth roots below the surface of the alveolus. Consequently, any tabulation of frequency would be unreliable.

Crowding of teeth occurred in approximately one-third of the Fletcher group and was noted only in the incisors through premolars. It occurred much more frequently in the mandible than in the maxilla.

Since the sample of observable deciduous teeth was so small, accurate estimation of the frequency of these epigenetic traits was not possible. Too many teeth were lying loose in boxes and post-mortem damage was extensive.

Section II: Metric Analysis

The Incisors

The permanent incisors consist of eight teeth: two central and lateral incisors in each mandible and maxilla. In the Fletcher group, as in most other human populations (Ubelaker 1971:185), the maxillary central incisors are longer mesio-distally than are the lateral incisors. In the mandible, the opposite is true. Similarly, the crown module is larger for maxillary central incisors than for lateral incisors and the reverse in the mandible.

In both crown module and MD diameter, adult female central and lateral incisors from Fletcher were slightly larger than those of adult males (Table 6). As will become apparent, this was true of almost all teeth in the Fletcher series. In all means for Fletcher incisors, the female mean was somewhat higher than the mean for the total adult population, and the male mean was lower.

The Canines

Table 7 shows MD diameters and crown modules for permanent canines, of which there are two maxillary and two mandibular teeth. Maxillary female canines from the Fletcher site were larger than those of males. In the mandible, this was reversed, males being slightly larger than females as well as the mean for all adults. Fletcher canines conform to Dahlberg's description of the American

Table 6: Permanent Incisor MD Diameters and Crown Modules for the Fletcher Site (20 By 28).

		MD Diameter				Crown Module			
		No.	Mean (mm)	SD	Range	No.	Mean (mm)	SD	Range
Male									
Max.	Cl	7	8.11		7.0-8.8	6	7.43		6.9-7.8
	Ll	8	7.12		5.8-7.7	8	6.75		6.0-7.0
Mand.	Cl	11	5.14		4.1-5.6	10	5.36		4.9-5.75
	Ll	18	6.17		5.0-7.2	16	6.05		5.5-6.6
Female									
Max.	Cl	12	8.39		6.5-9.0	11	7.72		6.5-8.25
	Ll	15	7.52		6.1-9.9	15	6.95		6.0-8.3
Mand.	Cl	18	5.46		4.9-5.8	18	5.56		5.0-6.0
	Ll	19	6.23		5.7-6.7	19	6.15		5.6-6.75
Total									
Max.	Cl	29	8.40	.71	6.5-10.0	27	7.67	.49	6.5-8.75
	Ll	32	7.40	.85	5.8-9.9	30	6.87	.48	6.0-8.3
Mand.	Cl	36	5.38	.44	4.1-6.5	35	5.5	.31	4.9-6.2
	Ll	44	6.22	.48	5.0-7.3	43	6.12	.32	5.5-6.75

Table 7: Permanent Canine MD Diameters and Crown Modules for the Fletcher Site (20 By 28).

	MD Diameter				Crown Module			
	No.	Mean (mm)	SD	Range	No.	Mean (mm)	SD	Range
Maxilla								
Male	19	7.93		7.1-8.8	18	8.06		7.4-8.55
Female	24	8.13		7.4-9.1	24	8.24		7.0-9.0
Total	48	8.02	.48	7.1-9.1	45	8.13	.50	7.0-9.0
Mandible								
Male	21	7.12		6.1-7.9	21	7.49		6.85-8.2
Female	21	7.10		6.4-7.9	20	7.33		6.7-8.25
Total	48	7.06	.46	6.1-7.9	47	7.35	.45	6.55-8.25

Indian canine as "slender, pointed, and of moderate size," often with a well-developed cingulum on the lingual surface of the upper canine (Dahlberg 1951:148).

The Premolars

The premolars, four maxillary and four mandibular, replace the first and second deciduous molars. It has been shown in some white populations that the crown form and pattern of these teeth actually resemble that of the first deciduous molar by a change in crown proportion of the premolar (Dahlberg 1951:148). MD diameters and crown modules were uniformly larger for Fletcher females than for males (Table 8). Maxillary premolars were larger teeth than those in the mandible. The only exception here was the MD diameter of the mandibular second premolars, which exceeded that of the maxillary second premolar. This conforms with data gathered by Douglas Ubelaker (1971) on Arikara Apaches from the Leavenworth site in Kansas, a slightly later Historic occupation. Of the upper premolars, the first was larger; in the mandible, the converse was true. This occurred in both MD diameters and crown modules.

The Molars

The largest teeth in the human dentition are the molars, of which there are six mandibular and six maxillary teeth. Mandibular molars usually have two

Table 8: Premolar MD Diameters and Crown Modules for the Fletcher Site (20 By 28).

	MD Diameter				Crown Module			
	No.	Mean (mm)		Range	No.	Mean (mm)		Range
Male								
Max. PM1	26	7.09		6.6-8.0	23	8.26		7.3-8.7
PM2	22	6.73		6.1-7.5	20	7.99		7.35-8.8
Mand. PM1	24	6.87		6.1-7.3	24	7.42		6.95-7.9
PM2	27	7.04		6.3-7.6	26	7.65		7.0-8.35
Female								
Max. PM1	25	7.15		6.5-7.9	25	8.42		7.4-9.3
PM2	28	6.82		6.2-7.7	22	8.11		7.35-9.05
Mand. PM1	31	6.95		6.2-7.8	29	7.46		6.85-8.55
PM2	30	7.11		6.2-8.0	29	7.71		6.75-8.55
	No.	Mean (mm)	SD	Range	No.	Mean (mm)	SD	Range
Total								
Max. PM1	62	7.13	.37	6.2-8.0	61	8.32	.42	7.3-9.3
PM2	58	6.80	.44	6.1-7.7	50	8.06	.45	7.3-9.05
Mand. PM1	63	6.94	.39	6.1-7.8	60	7.46	.32	6.85-8.55
PM2	65	7.11	.49	6.2-8.1	63	7.70	.46	6.75-8.65

roots, one mesial and one distal. Often, these roots are fused in the third molar. In the maxilla, molars regularly have three roots, one lingual and two buccal. Again, in the third molar two or all of these roots may be fused together.

Mandibular molars are the largest molars. MD diameters and crown modules for Fletcher lower molars are listed in Table 9. In the first molar, the female crown module was larger than that of males, but the male MD diameter was larger. Both measurements in the second molar were larger for females, and in the third molar, both were larger for males.

Female first and second upper molars were slightly larger than those for males, with the figures reversed for the third molars (Table 10). As with the lower molars, there was a tendency toward reduction in size from the first to the third maxillary molars.

Table 11 compares maxillary MD diameters and crown modules for the teeth from the Fletcher, Younge, and Juntunen sites. With one exception, Fletcher crown modules were larger than those for both Juntunen and Younge. (The CM for Juntunen maxillary canines was larger than that for Fletcher.) The same held true for MD diameters except that Juntunen lateral incisors were larger than those from Fletcher. As a whole, Fletcher maxillary teeth were slightly larger than

Table 9: Mandibular Permanent Molar MD Diameters and Crown Modules for the Fletcher Site (20 By 28).

	MD Diameter				Crown Module			
	No.	Mean (mm)	SD	Range	No.	Mean (mm)	SD	Range
				Molar 1				
Male	22	11.75		11.0-12.3	22	11.34		10.8-11.8
Female	25	11.67		7.3-13.2	24	11.41		9.4-12.5
Total	76	11.88	.40	7.3-13.5	75	11.45	.54	9.4-12.75
				Molar 2				
Male	27	11.38		10.4-12.6	25	11.03		10.2-12.05
Female	28	11.45		10.3-12.6	26	11.07		10.25-12.0
Total	67	11.45	.65	10.3-13.0	63	11.05	.57	10.2-12.1
				Molar 3				
Male	24	11.35		9.5-12.6	23	10.99		9.75-11.85
Female	21	11.27		9.8-13.7	19	10.92		9.6-12.9
Total	47	11.33	.79	9.5-13.7	44	10.97	.67	9.6-12.9

Table 10: Maxillary Permanent Molar MD Diameters and Crown Modules for the Fletcher Site (20 By 28).

	MD Diameter				Crown Module			
	No.	Mean (mm)	SD	Range	No.	Mean (mm)	SD	Range
Molar 1								
Male	23	10.74		10.1-11.4	22	11.22		10.55-11.75
Female	28	10.90		10.1-12.3	26	11.37		10.3-12.4
Total	73	10.80	.48	10.0-12.3	71	11.22	.50	10.2-12.45
Molar 2								
Male	25	10.36		9.5-11.5	24	10.92		10.05-11.65
Female	32	10.41		9.4-12.2	31	11.05		10.05-12.1
Total	63	10.41	.50	9.4-12.2	61	11.01	.51	10.05-12.1
Molar 3								
Male	26	9.03		7.6-10.0	26	10.03		9.4-10.9
Female	25	9.00		7.7-9.9	25	9.95		8.7-10.75
Total	56	9.06	.58	7.6-10.1	56	10.05	.55	8.7-11.15

Table 11: Maxillary MD Diameters and Crown Modules for the Fletcher (20 By 28), Younge (20 LA 3), and Juntunen (20 MK 1) Sites.

	Fletcher		Younge		Juntunen	
	MD (No.)	CM (No.)	MD (No.)	CM (No.)	MD (No.)	CM (No.)
C1	8.40(29)	7.67(27)	7.78(16)	7.10(15)	8.48(22)	7.63(20)
L1	7.40(32)	6.87(30)	7.27(19)	6.82(16)	7.11(19)	6.47(19)
C	8.02(48)	8.13(45)	7.77(22)	8.01(22)	8.01(26)	8.16(32)
PM1	7.13(62)	8.32(61)	6.54(23)	7.84(20)	6.64(32)	8.13(35)
PM2	6.80(58)	8.06(50)	6.42(21)	7.90(19)	6.70(26)	8.06(34)
M1	10.80(73)	11.22(71)	10.30(34)	10.89(34)	10.50(41)	11.13(46)
M2	10.41(63)	11.01(61)	9.49(29)	10.33(27)	9.81(38)	10.77(46)
M3	9.06(55)	10.05(56)	8.63(16)	9.49(16)	8.54(29)	9.99(37)

Juntunen teeth, which were usually slightly larger than those from Younge. The teeth from all three sites, however, were rather close to each other in size.

Comparisons between the mandibular teeth from these sites are listed in Table 12. Again, the teeth were similar in size. Juntunen molar crown modules were all slightly larger than those from Fletcher, as was the canine MD diameter. The pattern for mandibular teeth was essentially the same, however, with Fletcher teeth being the largest, followed by Juntunen and Younge.

In comparing molar crown modules from Fletcher and Lasanen (Table 13) it is evident that in the first and second lower molars, both males and females from Fletcher were larger than either sex from Lasanen. In the third molar, Lasanen females were larger than any of the others. First and second maxillary molars from Fletcher males were smaller than the Lasanen teeth, and among females, the Fletcher first and second molars were larger. Though I feel the number of measurable teeth from the Lasanen site was too small for meaningful comparison, it is interesting to note that in both cases most female teeth were larger than male teeth.

Crown modules for the deciduous dentition are listed in Table 14.

Table 12: Mandibular MD Diameters and Crown Modules for the Fletcher (20 By 28), Younge (20 LA 3) and Juntunen (20 MK 1) Sites.

	Fletcher		Younge		Juntunen	
	MD (No.)	CM (No.)	MD (No.)	CM (No.)	MD (No.)	CM (No.)
C1	5.38(36)	5.50(35)	5.24(11)	5.18(9)	5.20(14)	5.25(13)
L1	6.22(44)	6.12(43)	5.60(15)	5.93(13)	6.08(16)	5.91(15)
C	7.06(48)	7.35(47)	6.73(20)	7.16(19)	7.32(24)	7.34(22)
PM1	6.94(63)	7.46(60)	6.48(25)	7.31(25)	6.92(34)	7.42(32)
PM2	7.11(65)	7.70(63)	6.63(28)	7.50(27)	6.95(33)	7.41(32)
M1	11.88(76)	11.45(75)	11.06(28)	11.16(26)	11.53(40)	11.50(33)
M2	11.45(67)	11.05(63)	10.88(19)	10.81(18)	11.27(41)	11.14(40)
M3	11.33(47)	10.97(44)	10.61(24)	10.53(23)	11.17(26)	11.07(25)

Table 13: Molar Crown Modules for the Fletcher (20 By 28) and Lasanen (20 MA 21) Sites.

	Male		Female	
	Fletcher	Lasanen	Fletcher	Lasanen
Maxilla				
M1	11.22	11.30	11.37	11.02
M2	10.92	10.93	11.05	11.00
M3	10.03	9.66	9.95	10.24
Mandible				
M1	11.34	10.65	11.41	10.96
M2	11.03	10.51	11.07	10.88
M3	10.99	10.38	10.92	11.39

Table 14: Crown Modules for the Deciduous Dentition From the Fletcher Site (20 By 28).

	No.	Mean	Range
		Maxilla	
ci	4	5.74	5.5 - 5.85
li	5	5.16	4.75 - 5.35
c	9	6.24	5.85 - 6.9
ml	15	8.12	7.45 - 8.7
m2	21	9.92	8.95 - 10.95
		Mandible	
ci	7	4.02	3.75 - 4.25
li	10	4.37	4.0 - 4.7
c	16	5.48	4.7 - 5.95
ml	19	8.19	7.25 - 9.8
m2	26	10.10	9.35 - 11.0

CHAPTER II

PATHOLOGY AND ENVIRONMENTALLY INFLUENCED TRAITS

Genetically determined traits do not account entirely for the condition of any set of teeth. A particular combination of genes may result in soft enamel, or saliva inadequate to properly cleanse the teeth, but a poor diet or one deficient in necessary vitamins may produce decay and disease in the best of teeth. Adequate nourishment is especially necessary when teeth are forming, or the enamel may become malformed. Even if diet is good at this time, disease can temporarily halt the production of enamel. Coarse and gritty food can lead to chipping and excessive wear of the teeth and this in turn may lead to decay and loss of teeth.

The determination of diet through analysis of archaeological information is important for making nutritional and developmental studies. By observing mortality curves and pathologies, it should be possible to estimate the amount and kinds of environmental stresses experienced by archaeological populations.

Cook (1971:3) states that, "It is clear that nutrition, particularly in immature individuals, is an important factor in the adjustment of a population to its environment, and is closely related to its biological success." Further, " . . . comparison of properly chosen indicators of growth arrest, failure of bone growth, diet, and maturational delay and reproductive wastage in the first 15 years of life should be valuable in measuring biological efficiency of archaeological culture units" (Cook 1971:8).

During the first years of life, especially during the weaning process, a child's nutritional requirements are high, while the amount of food he can eat is low. As the child gets older and his caloric requirements higher, his milk diet should be supplemented more and more with high protein foods. In underdeveloped countries, however, low protein foods such as cassava, sweet potatoes, maize, and refined sugar are often substituted (Cook 1971:4). If this continues, malnutrition may develop and the incidence of disease rises. In such situations the combination of infectious disease and malnutrition is synergistic (Scrimshaw as cited in Cook 1971). As a result, sub-adult mortality increases as well as retardation of growth.

Cook relates the significantly higher growth rates in Middle and late Middle Woodland populations from

Illinois, to subsistence base. She finds that "weanlings in . . . intensive hunter-gatherer groups . . . are nutritionally far better off than their counterparts in communities practicing maize agriculture" (1971:17), because of the variety of high protein foods available to them and the low protein value of corn. Furthermore, ethnographic literature shows that the exclusive use of maize as weaning food is the general practice among American Indian groups practicing corn agriculture.

We find that the skeletal population of the Fletcher site is a young one (Table 1). Of a total of eighty-four individuals, forty-one are under the age of 20. Another twenty-five are between 21 and 30 years of age. Between 13 and 29 years there are eighteen females and ten males, a ratio probably related to the effects of childbearing. It appears, then, that the people from Fletcher were experiencing stress of some sort, and that children were particularly vulnerable.

There are two primary indications that a lack of adequate nutrition was one factor affecting this population: dental hypoplasia and periodontal disease.

Dental Hypoplasia

When referring to the dentition, hypoplasia usually means defective formation. In discussing the occurrence of enamel hypoplasia in the Fletcher population, this term is used to refer to faulty structural development of the enamel. Deficient calcification, irregular distribution and/or partial absence of the enamel are all indications of enamel hypoplasia. This disorder is caused by a disruption of the development of the teeth, such as a vitamin deficiency or disease. By noting its presence, the health of earlier populations may be partially assessed. Hypoplasia, like other pathologies, is not new to modern man. Signs of hypoplastic pitting were noted by Robinson (1952) in the Australopithecine genus Paranthropus.

The term gross hypoplasia has been given to those indications visible to the naked eye (Brothwell 1965:152). Gross hypoplasia ranges from transverse bands of pitting and grooving in the enamel to actual deformity of the occlusal surface of the teeth. In the Fletcher material evidence of hypoplasia was divided into two categories: linear hypoplasia and hypoplastic deformation. The frequency of individuals affected by the lines and pitting of linear hypoplasia is tabulated in Table 15. A large percentage of the Fletcher population suffered from this condition. The percentage of juveniles is probably low due to the amount of post-mortem chipping and discoloration of deciduous teeth, making observation difficult. Though the canines and molars are usually the most frequently affected teeth (Brothwell 1963:281), most of the linear hypoplasia from Fletcher was noted

Table 15: Percentage Distribution of Gross Hypoplasia.

	Linear Hypoplasia		Hypoplastic Deformation	
	No.	%	No.	%
Males	18	86	2	10
Females	15	79	3	16
Total	35	81	6	14
Juveniles	15	37	8	20

Table 16: Teeth Affected by Hypoplastic Deformation.

Permanent				Deciduous			
Tooth	No.	%		Tooth	No.	%	
M1	21	40	} 93%	m1	14	56	} 84%
M2	15	28		m2	7	28	
M3	13	25					
				Li	2	8	
PM2	3	5		c	2	8	
C	1	2					

on the anterior teeth. However, calculus deposits and the resulting discoloration and residue could have made it more difficult to distinguish linear hypoplasia on the molar teeth.

Seventeen per cent of the population suffered from a hypoplastic deformation of occlusal surfaces (Tables 15 and 16). This condition is likely a further extension of the effects of gross hypoplasia. The deformation affected primarily the occlusal surfaces of teeth, destroying their normal appearance (Plate I). Of the teeth thus affected, 93% of the permanent teeth and 84% of the deciduous teeth were molars.

The presence of both forms of hypoplasia is perhaps the strongest dental evidence that the Fletcher population suffered from insufficient nutrition. Of the teeth affected by a hypoplastic deformation, 59% were forming before one year of age. Sweeney et al. (1966) found that the presence of linear hypoplasia on the deciduous incisors of Guatemalan children was apparently correlated with infectious diseases during the first thirty-five days of life. It is also probable that the weaning process produced undo nutritional stress on young children, hence the slightly imperfect formation of permanent teeth in the form of linear hypoplasia. It is indeed unfortunate that there is no comparative material on

Plate I. (a) Hypoplastic Deformation of Deciduous Molar

Plate I. (b) Hypoplastic Deformation of Mandibular Permanent Molars

(Photography by James I. Ebert)

the incidence of enamel hypoplasia in the Great Lakes region. It would be interesting to compare this important measure of nutritional stress with other groups.

Periodontal Disease

Periodontal disease (phyorrhea) is one of the two major causes affecting tooth loss, along with carious lesions and abscesses (Brothwell 1965:147). This disease is an infection of the alveolar bone and soft tissues of the mouth caused by such conditions as unclean mouths, irritation by calculus deposits, attrition, and lowered tissue resistance due to faulty diet. Its effects produce a recession of alveolar bone resulting in the loosening and eventual loss of teeth. All four causes were probably working on the Fletcher population. Though no estimate of the frequency of calculus deposit was possible since so much of it had flaked off, many individuals had deposits, mainly in the molar region. A number of teeth were worn extensively and/or unevenly. Some teeth, especially incisors and canines, were worn almost to their roots.

Noting the presence of this condition was difficult since all that can be observed is the alveolar bone. In minor infections only the soft tissues may be affected, thus the frequency of occurrence may be less than actually noted (Brothwell 1965:147). The major indications noted in recording periodontal disease were resorption and porousness of alveolar bone, and ridging along the alveolar margin.

In the adult population 72% (31) showed some degree of periodontal disease. There was no substantial difference between the number of males and females affected, but it is interesting that females may have been affected earlier than males. Of the affected males, 60% were over 30 years, but 64% of the affected females were between the ages of 19 and 29. The ratios may be essentially even though, since there are more females between 19 and 29 (14) and more males over 30 (12).

From the Younge site, Byron Hughes (1937) found that 53% of the males and 42% of the females suffered from periodontal disease, compared to 71% for males and 74% for females from Fletcher.

Ante-Mortem Chipping

Some evidence of type of diet and living conditions may be gained by examining the amount of ante-mortem chipping of the teeth. Eighty-eight per cent of the individuals over 13 years from the Fletcher site had chipped teeth. Of the total number of observable teeth from this group, 34% were chipped before death (Table 17). Almost all males and females had chipped teeth, but more male than female teeth were chipped. Eighty-three per cent of the total number of chipped teeth occurred

Table 17: Ante-Mortem Chipping in the Fletcher Population (Individuals Above 13 Years).

	Total No. of Indiv.	Indiv. With Chipped Teeth	% of Total	Ages 13-18		Ages 19-29		Ages 30-40+	
				No.	%	No.	%	No.	%
Males	22	20	91	1	5	8	40	11	55
Females	23	19	83	4	21	10	53	5	26
Total	50	44	88	8	18	19	43	17	39

	Total Tooth Sample	No. of Chipped Teeth	% of Total	Ages 13-18		Ages 19-29		Ages 30-40+	
				No.	%	No.	%	No.	%
Males	560	229	41	5	2	79	35	145	63
Females	639	161	25	24	15	102	63	35	22
Total	1313	441	34	34	8	221	50	186	42

in individuals over 19 years. Of the females with chipped teeth, 63% were between the ages of 19 and 29, while 63% of male chipped teeth were from individuals over 29. Again, this distribution may be due to the fact that the females from the Fletcher skeletal population were younger than the males, with only six women over 30 years as opposed to twelve men.

The first permanent molar was most often chipped in both males and females (Table 18). This is logical, since this tooth is the first permanent tooth to erupt. Among the other teeth, chipping was fairly evenly distributed. The third molar was the least affected in all individuals.

The fact that no one area in the dentition was affected much more often than another may indicate that the major cause of chipping was just gritty food rather than any particular cultural activities. It would be interesting to compare various methods of cooking with amount of tooth chippage, however. Food that is cooked slowly in a pot should contain less grit than something laid in an open fire, for instance (Phenice and Brown personal communication). In any case, the Fletcher site is a sandy one, and if there was indeed an occupation in the vicinity, invading sand and grit would be impossible to avoid. The abrasive qualities of such material undoubtedly contributed to the amount of wear noted on the teeth.

Table 18: Distribution of Ante-Mortem Chipping Among Tooth Types in Fletcher Adults.

	Male		Female		Total	
	No.	%	No.	%	No.	%
Cl	19	8	21	15	49	12
Ll	27	12	16	12	53	13
C	35	16	18	13	58	14
PM1	35	16	12	9	53	13
PM2	28	12.5	20	15	53	13
M1	38	17	31	23	79	19
M2	29	13	15	11	50	12
M3	13	6	4	3	23	6

Carious Lesions

Only the well-defined caries were recorded from the Fletcher site. Those lesions I was unsure of were excluded from the study. Cavity size, location, and position were recorded on key diagrams. Table 19 lists the frequency of carious lesions for sexed individuals between the ages of 13 and 40+. Caries were found in deciduous teeth but with less frequency. Where it was possible to tell with a reasonable amount of assurrance, abscesses that had resulted from caries were included in these figures.

Though a large percentage of the adult population (81%) was affected by caries, only 114 teeth (10%) accounted for the 126 carious lesions found in individuals above 18 years (Table 20). There was no significant difference between the number of males and females with carious teeth, but females had more carious teeth than males. Caries recorded were placed into three size categories: (1) up to 2mm in diameter, (2) 2 to 5mm, and (3) over 5mm. As was expected individuals from 13 to 18 had size 1 caries, individuals from 19 to 29 had more size 1 and 2 caries with some size 3 lesions, and 30+ individuals had predominantly size 2 and 3 lesions.

Of the 501 teeth from the Lasanen sample 24 or 5% were carious compared with 10% of the Fletcher teeth from adults. Unfortunately, there are no figures

Table 19: Frequency of Carious Lesions Within the Fletcher Population Ages 13 - 40+

Age	No. Individuals	No. Affected	No. Teeth	No. Carious	No. Caries	Size		
						1	2	3
				Males				
13-18	1	0	28	0	0	0	0	0
19-29	9	8	256	22	23	11	8	4
30-40	11	9	274	25	25	5	8	12
40+	1	1	3	2	2	0	1	1
Total	22	18	561	49	50	16	17	17
				Females				
13-18	4	4	116	7	8	8	0	0
19-29	14	10	414	36	45	25	14	6
30-40	5	5	109	25	27	2	16	9
40+	0	0	0	0	0	0	0	0
Total	23	19	639	68	80	35	30	15
				Total				
13-18	5	4	144	7	8	8	0	0
19-29	25	19	728	59	69	37	22	10
30-40	17	15	393	53	55	7	26	22
40+	1	1	3	2	2	0	1	1
Total	48	39	1268	121	134	52	49	33

Table 20: Percentage Distribution of Carious Lesions Among Fletcher Adult Population.

	No. Carious Teeth	%	No. Individuals	%
Males	40	8.7	18	86
Females	61	12.0	15	79
Total	114	10.0	35	81

tabulating the number of individuals from Lasanen that were affected by carious lesions. Figures for the Juntunen and Younge sites were tabulated only for frequency of individuals affected by caries. It was found that 11.8% of the individuals from Juntunen and 29.6% of those from Younge were affected by carious lesions. These figures are significantly lower than the 81% of Fletcher adults with caries.

In the Fletcher sample there was no significant difference in the number of caries found in the maxilla and mandible (Table 21). In the maxilla, caries were fairly evenly distributed between tooth types, especially among females. The first and third molars showed the heaviest concentration of caries, with the second molar and the premolars coming next. The main exception to this situation was with females, whose second molars showed the lowest rate of decay in this sex. This may be related to the fact that 41% of the females' teeth lost ante-mortem were second molars. In the mandible, there was a very definite shift distally in frequency of carious teeth with 85% for males and 89% for females occurring in the molars. The possibility that this resulted because more maxillary molars were lost ante-mortem would not seem to be significant since there appears to be no great difference between mandible and maxilla there. The same sort of shift occurred in the

Table 21: Distribution of Carious Lesions Among Tooth Types--Fletcher Adults.

	Male		Female	
	No. Carious	%	No. Carious	%
		Maxilla		
Cl	0	--	5	12.5
Ll	2	9	4	10
C	1	4	6	15
PM1	3	12.5	5	12.5
PM2	5	21	4	10
M1	3	12.5	6	15
M2	5	21	3	7.5
M3	5	21	7	17.5
		Mandible		
Cl	0	--	0	--
Ll	0	--	0	--
C	0	--	1	3
PM1	4	15	1	3
PM2	0	--	2	6
M1	7	27	8	25
M2	6	23	9	28
M3	9	35	11	34

frequency of teeth lost ante-mortem, however. This sort of occurrence must be related to dietary habits as well as genetic factors. Third molars showed the highest rate of decay in the mandible, though among the molars, rates of carious lesions were again essentially even.

In addition to there being little difference in number of caries occurring in the mandible and maxilla, there was little significant difference in the side where the caries occurred. As might be expected, most caries occurred on the occlusal surfaces of the upper and lower molars (Table 22). Almost as many occurred on the buccal surfaces of the lower molars. The buccal and disto-buccal grooves, which in Indians and Eskimos often are rather deep and end in a pit (Dahlberg 1951:160), are very favorable places for decay. Other locations are in interproximal areas, also favorable places for the collection of bacteria leading to decay.

Abscess and Ante-Mortem Tooth Loss

Since one of the major causes of ante-mortem tooth loss is the occurrence of abscesses, these topics will be considered together. Where it was possible to determine the cause, abscessed-missing teeth were included in both sets of calculations.

One hundred and thirty-six teeth were missing ante-mortem from the Fletcher adults: sixty-one from females,

Table 22: Position of Carious Lesions in the Fletcher Population.

		PM1	PM2	M1	M2	M3
Maxilla	Occlusal Surface	--	1	4	3	5
	Buccal Surface	--	--	--	--	--
	Lingual Surface	--	--	2	--	--
	Distal Surface	1	3	1	1	3
	Mesial Surface	4	4	2	2	4
Mandible	Occlusal Surface	--	1	6	5	9
	Buccal Surface	1	--	6	9	6
	Lingual Surface	--	--	--	1	3
	Distal Surface	2	1	--	3	2
	Mesial Surface	1	--	3	2	1

seventy-four from males, and one from an unsexed adult (Table 23). Forty-four per cent (19) of the forty-three adults were missing teeth ante-mortem. Of these individuals, eight were female, ten were male, and one was an unsexed adult.

Compared to the Younge and Juntunen sites, a smaller percentage of individuals from Fletcher lost teeth before death. From the Younge and Juntunen sites, 77.8% of the Younge individuals and 52.6% of those from Juntunen indicated ante-mortem tooth loss, while 44% of the Fletcher adult population was affected.

As stated above, little difference in number of AM missing teeth was found between mandible and maxilla (Table 24). In the maxilla, frequency among male teeth was fairly even with concentration in the molars. Female AM tooth loss was found almost exclusively in the molar region. This area was the most heavily affected in the mandible for both sexes, with the third molar missing most frequently. It is, of course, possible that some of the missing third molars were congenitally absent, which would raise the incidence of that trait somewhat. Lateral incisors through premolars were almost never missing, but 14% of the female and 18% of the male central incisors were gone. I think it is more likely that cultural activities rather than pathology accounted for this, however.

Table 23: Percentage Frequency of Teeth Missing Ante-Mortem.

Age	Maxilla				Mandible			
	Female		Male		Female		Male	
	No.	%	No.	%	No.	%	No.	%
19-29	1	3	3	9	3	11	2	5
30-40	32	97	15	44	25	89	27	67.5
40+	--	--	16	47	--	--	11	27.5

Table 24: Percentage Distribution of AM Missing Teeth Among Tooth Types.

	Cl	Ll	C	PM1	PM2	M1	M2	M3
Maxilla								
Male No.	5	2	3	4	2	6	5	7
%	15	6	9	12	6	18	15	21
Female No.	0	3	0	0	3	5	12	10
%	--	10	--	--	10	15	36	36
Mandible								
Male No.	7	1	0	0	7	9	7	9
%	18	3	--	--	18	22.5	18	22.5
Female No.	5	0	0	0	3	5	5	10
%	18	--	--	--	11	18	18	36

Of the Fletcher adults, 51% had abscessed teeth (Tables 25 and 26). Approximately the same number of abscessed teeth was observed in males and females. However, half as many females as males were affected, indicating that those females with abscessed teeth often had multiple infections.

The Younge site indicated a higher percentage of abscessed teeth among individuals (64%) than did Fletcher (51%). From Younge, 76.9% of the males and 47.4% of the females were affected as compared to 67% and 37% respectively from Fletcher. Since the Juntunen skeletal material comes from ossuary type burials, no fixed estimate of individuals is possible. It is estimated that between twenty-five and fifty persons are represented by the skeletal material present (McPherron 1967:231). Six individuals indicated abscessed teeth from this group. If it is assumed that twenty-five individuals were present, only 24% were affected by abscesses, a figure substantially lower than that from Fletcher.

The distribution of abscesses among tooth types is illustrated in Table 27. Male maxillary first molars and female second molars were most often affected. In the mandible, the first molars of both sexes were most frequently abscessed. Central and lateral incisors and canines were rarely abscessed.

Table 25: Frequency of Abscesses Within the Fletcher Population Ages 13 - 40+

Age	No. Individuals	No. Affected	No. Teeth	No. Abscessed	No. Abscessed Missing
			Males		
13-18	1	0	28	0	0
19-29	9	3	256	11	2
30-40	11	10	274	21	4
40+	1	1	3	1	0
Total	22	14	561	33	6
			Females		
13-18	4	0	116	0	0
19-29	14	2	414	8	4
30-40	5	5	109	16	6
40+	0	0	0	0	0
Total	23	7	639	24	10
			Total		
13-18	5	0	144	0	0
19-29	25	5	728	19	6
30-40	17	16	393	38	10
40+	1	1	3	1	0
Total	48	22	1268	58	16

Table 26: Percentage Distribution of Abscesses Among the Fletcher Adult Population.

	No. Individuals	%	No. Abscessed Teeth	%
Males	14	67	39	7
Females	7	37	34	7
Total	22	51	73	6

Table 27: Distribution of Abscesses Among Tooth Types.

	Male		Female	
	No.	%	No.	%
		Maxilla		
Cl	--	--	0	--
Ll	1	5	1	6
C	0	--	2	12.5
PM1	3	16	3	19
PM2	4	21	0	--
M1	7	37	3	19
M2	3	16	4	25
M3	1	5	3	19
		Mandible		
Cl	0	--	1	12.5
Ll	1	7	0	--
C	0	--	0	--
PM1	1	7	1	12.5
PM2	2	14	1	12.5
M1	6	43	3	37.5
M2	2	14	2	25
M3	2	14	0	--

Again, it must be remembered that the adult skeletal population from the Fletcher site is a young one. There were twenty-five adults between 19 and 29 years and eighteen above 30 years. From the Younge site, three individuals were between the ages of 13 and 35, and sixty were over 35 years. Thus, comparisons between these two sites regarding frequency of individuals with carious lesions, AM tooth loss and abscesses may be misleading. It is to be expected that a younger population such as that from Fletcher, would have more carious lesions and less AM missing teeth and abscesses, whereas an older population would most probably indicate the reverse, as the Young population does. Since carious lesions often lead to abscesses and then to loss of teeth, it is logical to suppose that, were there more individuals over 30 years in the Fletcher sample, the incidence of abscesses and AM tooth loss would rise. Figure 3 shows that between the ages of 13 and 18, AM loss and abscessed teeth are virtually nonexistent, while carious lesions are quite prevalent. Between 19 and 29 years, the number of individuals affected by AM loss and abscesses rises somewhat, while almost all individuals indicate carious lesions in their teeth. However, above 30 years, more individuals are affected by abscessed teeth than by simple caries. There are, of course, other causes of abscessed teeth, one being advanced

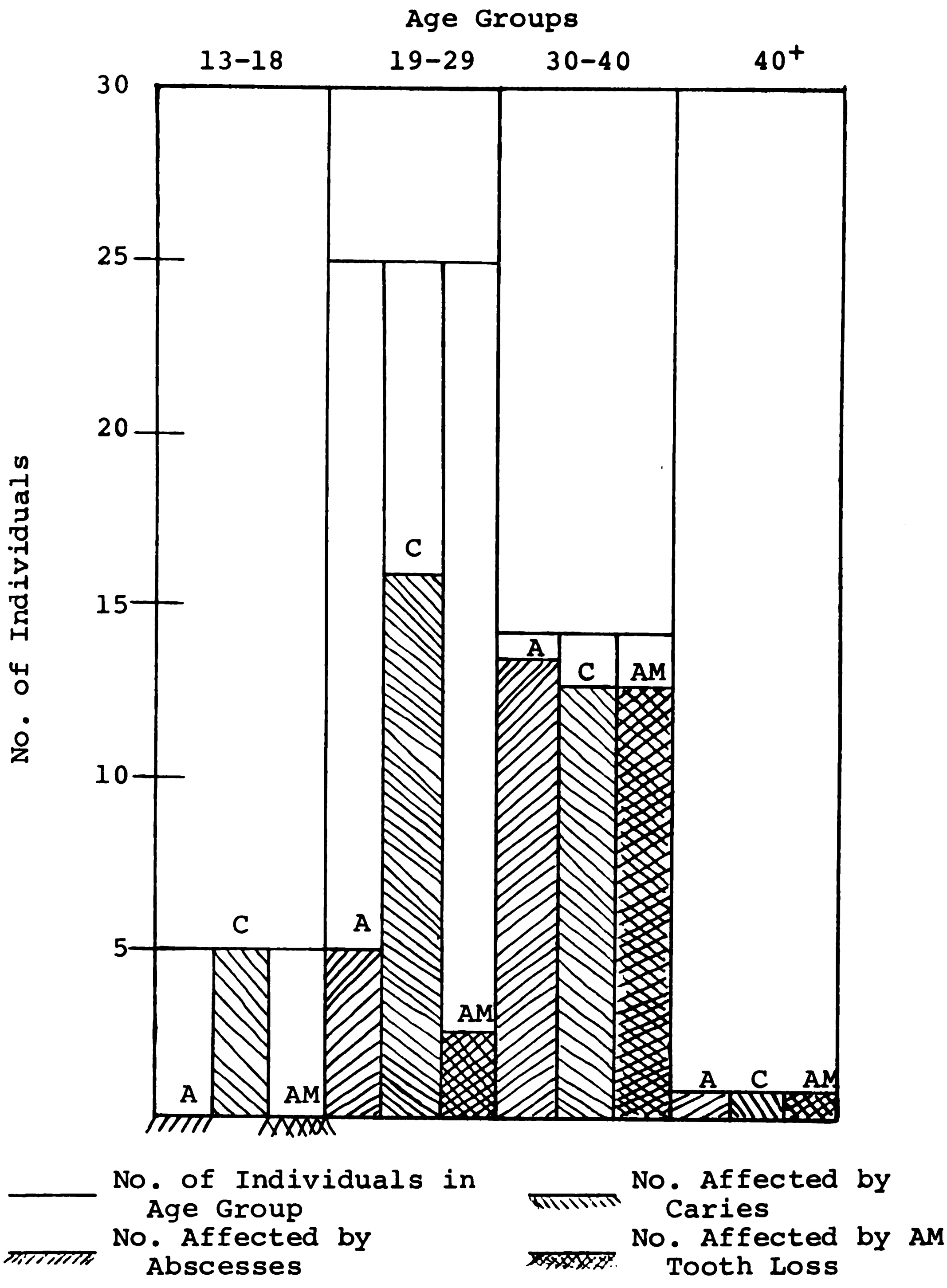

Figure 3. Distribution of Caries, Abscesses, and AM Tooth Loss within Fletcher Age Groups.

attrition. From the Younge site 76.7% of the males and 47.4% of the females indicated tooth wear that was classified as "very pronounced" (Hughes 1937:152). This may partially explain the higher percentage of abscesses and AM loss for the Younge site. The people from Younge may have been eating food and otherwise using their teeth in such ways as to produce the high degree of attrition indicated by Hughes. This could definitely lead to a higher rate of abscessed and AM missing teeth. A relatively small percentage of individuals from Fletcher showed extremely advanced attrition.

From this, it is evident that the differences in composition of age groups within the two populations partially explains why the percentages of individuals indicating abscessed teeth, AM loss of teeth, and carious teeth are divergent. I feel, however, that this explanation does not detract from the theory that the later Fletcher population suffered from relatively more dental pathology than did the earlier group. The percentage of individuals with abscessed teeth from Fletcher is only 13% less that from the Younge site, yet the percentage of individuals with carious teeth from Fletcher is over 50% higher than that from Younge. The fact that the Fletcher skeletal population is younger than the Younge population may, in theory, bring the figures for individuals with abscessed teeth much closer together.

However, I feel the divergence in figures for individuals with carious teeth and AM missing teeth is too great to be eradicated by estimating figures for more evenly distributed age groups in the two populations. It is likely, then, that the more rigorous use of the teeth and the consequent high degree of attrition, as well as the overall greater age at death of the Younge skeletal population, has led to the higher numbers of abscessed teeth and teeth lost ante-mortem from this population.

Though necessary for the correct assessment of pathological differences between sites in the Great Lakes area, such comparisons are not possible for the Lasanen and Juntunen since I was unable to locate references in which well-defined age groups were described.

Other Environmentally Influenced Traits

One definitely man-made alteration of a tooth was observed, in a 30-40-year-old male. Between the right maxillary PM2 and M1 and mandibular M1, a squared-off hole had been worn (Plate II). The hole was neither the right shape nor size to have been worn by a pipe of the type usually secured from Europeans. The best explanation I can offer is that a thong was drawn between the teeth often enough to create such an

Plate II.

(a) Holes in the Occlusal Surfaces of Mandibular Permanent Ml's

Plate II.

(b) Holes in the Occlusal Surface of Maxillary Permanent Ml's

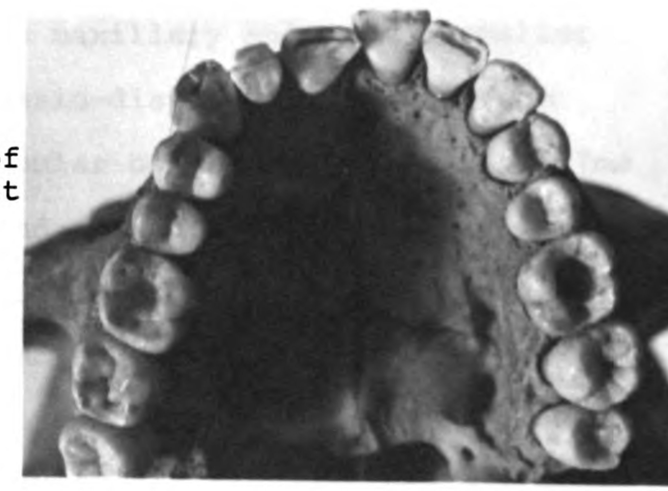

Plate II.

(c) Man-Made Alteration of Teeth

(Photography by James I. Ebert)

angular shape. The rounded buccal edges of the hole indicated that the thong was drawn principally from the inside of the mouth to the outside. Secondary dentin was solid on both molars, but an abscess had developed beneath the mandibular molar and the tooth was about to fall out.

A young male (20-25 years) possessed an unusual set of holes in the center of the occlusal surfaces of all four first permanent molars (Plate II). Each molar contained one hole. The maxillary holes were smaller measuring 3mm and 5mm mesio-distally by 3mm and 4mm bucco-lingually. Mandibular holes measured 6mm and 7mm mesio-distally by 5mm and 6mm bucco-lingually. All edges were smooth and none of the holes showed any sign of decay. A wad of crumbled, osseous trabeculae was present in one hole, presumably left from chewed bone. Secondary dentin was firm on all surfaces and all other teeth present were in excellent condition. Starting at the rims of the holes, the sides sloped slightly outward, then in to the center, forming a rounded bottom. No other deformation of the teeth affected was visible; the cusps were all normal and in the usual patterns.

Several possible causes for these holes exist. They might have been formed during the development of the teeth. Though no marks were visible on the surfaces of the pits, it is possible that the holes were drilled.

It is known that drills were used during the 1700's and contact with Europeans may have made such treatment available to the Fletcher group. Another possibility is that something that would break down the enamel was held between the teeth, perhaps for medicinal purposes. Slight, smoothed indentations are visible on the mandibular second molars. If these are new holes starting, it is unlikely that a drill was used; rather, the second idea would seem to be the more probable.

CONCLUSION

The Fletcher site was occupied seasonally during the 1750's and 1760's by groups of Ottawas or Chippewas. These groups practiced agriculture, exploited local resources, and traded with both the French and British. By analyzing the teeth of the skeletal population, statements may be made regarding the nutritional status of the group and a comparison of genetic traits with those of other populations is possible.

The Fletcher population conforms to Dahlberg's (1951) description of American Indians regarding genetically determined traits. Shovel-shaping of incisors occurs in extremely high frequencies, while paramolar cusps occur rarely. Both maxillary and mandibular molars tend to decrease in size from first to third. Fletcher molars are similar in size to those of Dahlberg's Pima Indians. Compared to the Younge and Juntunen sites, the teeth from Fletcher are generally slightly larger.

There are two primary indications that suggest a lack of adequate nutrition in the Fletcher population: periodontal disease and dental hypoplasia. Of the two, dental hypoplasia is perhaps the most telling, since the former may be caused by other factors. Over 80% of the adult population from Fletcher was affected by some degree of linear hypoplasia. The factors leading to enamel hypoplasia, disease and inadequate nutrition, lead also to increased mortality rates in the young and have contributed to the high number of children in the Fletcher sample. Unfortunately, there are no other data on dental hypoplasia in the Great Lakes area with which to compare my findings from Fletcher.

Periodontal disease is partly the result of vitamin deficiency in the later years of life. Over 70% of the Fletcher adults suffered from this disease, a significantly higher percentage than that recorded from the Younge site, especially since the mean age of the skeletal population from Younge is greater than that from Fletcher.

From the amount of ante-mortem chipping on the Fletcher teeth, it is evident that there was a certain amount of grit and unchewable matter in the diet. Over 80% of the individuals above 13 years had chipped teeth, and 34% of the teeth from these individuals were chipped. There was little difference in the amount of chipping between males and females. Also, no one area of the dentition was chipped much more heavily than another. It is likely, then, that sand and grit in food, and animal and fish bone caused most of the chipping observed.

The abrasive qualities of sand and dirt contributed to the amount of wear on the teeth as well as to ante-mortem chipping. The degree of wear noted on the Fletcher teeth was sometimes extensive, but not as much as was indicated for the teeth from the Younge site, where 65.3% of the adults showed attrition that was labeled pronounced. This is probably also related to the fact that the individuals from Younge were generally older when they died than those from Fletcher.

The Fletcher site shows a much higher rate of individuals affected by carious lesions than any of the other sites discussed here. But both the Younge and Juntunen sites indicate higher rates of ante-mortem tooth loss and abscessed teeth among individuals. As stated above, this may be partially explained by the distribution of individuals in age groups within the skeletal populations. It is to be expected that a skeletal population of younger individuals would show less abscessed teeth and teeth lost ante-mortem and more carious lesions than older ones. It is also likely that the earlier adaptations and diets of Younge and Juntunen necessitated a more rigorous use of the teeth than the Historic adaptation of Fletcher, based partially on agriculture. Added stress on the dentition could contribute to higher rates of abscessed teeth and ante-mortem loss, as well as to the amount of wear on the teeth.

The fact that over 80% of the Fletcher population was affected by caries, as opposed to 29.6% and 11.8% for Younge and Juntunen, however, would seem to indicate a general increase in the occurrence of carious lesions in the Historic population. One cause of this increase was very likely contact with Europeans. By trading with the French and British, a variety of new foodstuffs would become available, notably refined sugar and flour. The regular presence of such goods in the diet should produce a rise in the occurrence of carious lesions.

Two things are needed now in order to fully utilize the data on the Fletcher dentition. A good body of comparative data on dental traits and a full analysis of the Fletcher skeletal material are necessary in order to understand the implications of the dental pathologies described. In this way, patterns of environmental and nutritional stress may be more fully explored.

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