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Seven Hundred Seventy Eight Bite Marks: Analysis by Anatomic Location, Victim and Biter Demographics, Type of Crime, and Legal Disposition*

ABSTRACT: A study of the etiology, anatomic location, victim demographics and legal disposition of bite mark cases was made with the purpose of updating and augmenting previous research in the field. The information may be of interest to a myriad of professional disciplines including Forensic Odontologists, Medical Examiners, Detectives, Profilers, Emergency Room Personnel, Coroners, Psychologists, and Family Service Counselors, as bite marks provide both physical and biological data. While bite marks were found on all anatomic regions of the body some sites are significantly more likely to receive bites, and the frequency that an area is bitten may vary with the type of crime. Sex and age of the victim may also impact the resulting location and frequency of bites.

A survey form for bite mark cases was created and mailed to all Diplomates of the American Board of Forensic Odontology. The survey form was also included in the American Society of Forensic Odontology newsletter. The survey requested that the recipient fill out a separate form for each case for which the recipient was the primary investigator of a patterned injury. The data from the resulting surveys were entered into a Microsoft Excel spreadsheet. The responses detailed two hundred thirty two (259) bite mark cases that included seven hundred (778) individual bite marks. Harvey (1976) and Sweet and Pretty (2000) published studies finding the highest percentage of bites to the breasts. In 1983 Vale and Noguchi published the paper indicating that the most frequently bitten area was the upper extremities.

The survey forms were sent to approximately 1100 forensic dentist in 26 countries. The forensic experience level of the dentists varied from neophyte to very experienced. The data were analyzed and the results reported and organized in the following categories; Victim Distribution by Gender, Victim Distribution by Age, Child Abuse Distribution by Age and Gender, Sexual Assault Distribution by age and Gender, Homicide Distribution by Age and Gender, Bite Mark Distribution by Gender and Location, Number of Bite Marks per Victim, Bite mark Distribution Comparison to Previous Research, Child Abuse Suspect Age Distribution by Age and Sex, Homicide Suspect Age Distribution by Age and Sex, Sexual Crimes Suspect Age Distribution by Age and Sex, and Bite Mark Incidence by Anatomical Area and Type of Crime.

Fifty-two forensic odontologists from seven countries responded. Nineteen responders were Diplomates of the American Board of Forensic Odontology. The number of cases reported by each responder ranged from one to thirty-three and the average number of cases reported was 4.5. In this broad based study, females were bitten more often than males. The average male victim was younger than the average female victim. Males that were victims tended to be either very young or very old. The youngest victim was a two-month-old boy and the oldest victim a 95-year-old woman. Perpetrators were male more often than female and there was an average of 1.4 suspects per case. The results show that most bites occurred on the arm, followed by the breast. If broken down by gender, males were bitten on the arm more than females, and females were bitten on the breast more often than males. The data show patterns in location and number of bites that seem related to both the type of crime and the age of the victim.

KEYWORDS: forensic science, forensic odontology, bite marks, location, distribution, incidence

For more than forty years, bite marks have played an important role as evidence in violent crimes. The information found within these pattern injuries can help law enforcement to include or exclude people as potential perpetrators. By educating law enforcement personnel, medical examiners, physicians, emergency room personnel, nurses, and forensic odontologists on the frequency and anatomic distribution of bite marks we will better serve the forensic community, as early recognition will result in better documentation.

Lowry (1936) published a study of 122 bite marks in a hospital study. He found that the highest percentage of bites were to the extremities (76%) and the face and head (8%). Speirs in 1941 partly confirmed Lowrey's findings in his bite mark study of 114 cases. He found that 64% of the bites were to the extremities, but a higher percentage than that reported by Lowry, (40%) were to the face and head. Harvey (1976) published a study of 74 bite marks in coroner's cases finding the highest percentage of bites to the breasts (31%) and the extremities (13%). In 1983 Vale and Noguchi published the paper *Anatomical Distribution of Human Bite Marks in a Series of 67 Cases*, a Los Angeles County Medical examiner based study from 1970 through 1981, which included 164 bite marks. They found the areas most frequently bitten were upper extremities (22%) and then breasts (10.4%).

In 2000, Sweet and Pretty published a study entitled *Anatomical Location of Bitemarks and Associated Findings in 101 Cases from the United States*. They searched the U.S. Court of Appeals database for the period 1972–1999 and selected 101 cases, which totaled 148 bite marks. They found that breasts (31.3%) were most frequently bitten followed by the arm (18.8%).

Each of these studies looked at specific populations. Harvey's, as well as Vale and Noguchi's research involved cases from corners offices, therefore the bites were on predominantly deceased subjects.

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Sweet and Pretty's research surveyed appellate cases from the United States Court of Appeals database. The specificity and distinctiveness of the populations analyzed in these earlier papers may explain the variations in the rates of distribution of bite marks between those studies.

Methodology

A survey form (Fig. 1) for bite mark cases was created and mailed to all Diplomates of the American Board of Forensic Odontology. The form was also included as an insert in the American Society of Forensic Odontology newsletter. Overall, the survey form reached approximately 1100 forensic dentists in 26 countries. The forensic experience level of the dentists varied from entry level to very experienced. The survey requested that the recipient fill out a separate form for each case for which the recipient was the primary investigator of a pattern injury. The survey was designed to elicit information about the victim, the country in which the incident occurred, the nature of the incident (if criminal in nature, the type of crime), and the quantity and distribution of the pattern injuries. The responder was asked to give his or her opinion of the evidentiary quality of the bite mark(s) and to discuss the legal disposition of each case. The survey included questions about the alleged perpetrator or perpetrators. It further asked whether suspect information was collected, how many suspects were involved, and if any of the suspects were bitten and if so the location of the bite(s). The age and gender of the suspect(s), and if there was a conviction in the case, was also information that was requested on the form. An opened comment section was also provided, so the respondent could give any other information they deemed pertinent. The responses detailed two hundred fifty nine (259) bite mark cases that included seven hundred seventy eight (778) individual bite marks. Twenty-two Diplomates of the American Board of Forensic Odontology (ABFO) returned one hundred fifty seven surveys, and thirty members of the American Society of Forensic Odontology (ASFO) returned one hundred two surveys. Ten countries were represented in the study, Australia (12 responses), Canada (15), Denmark (1), Mexico (2), Norway (1), Panama (4) Thailand (1), Turkey (11), Unites States (211), and West Africa (1).

The data were entered into a Microsoft Excel spreadsheet then analyzed and compared to previous research in the field.

Results

Gender and Age Distribution

Overall, Females (65%) were victims more often than men (35%) in this study (Figs. 1, 2). Looking at the distribution of victims and

Bite Mark Survey

Please complete a separate survey for each bite mark you have been the primary investigator.

VICTIM INFORMATION

Victim's Age_____ Male ☐ Female ☐

Date of Incident _____

How many bite marks were identified_____

Was the crime sexual in nature Yes ☐ No ☐

Was the crime a homicide Yes ☐ No ☐

Was this a case of suspected child abuse? Yes ☐ No ☐

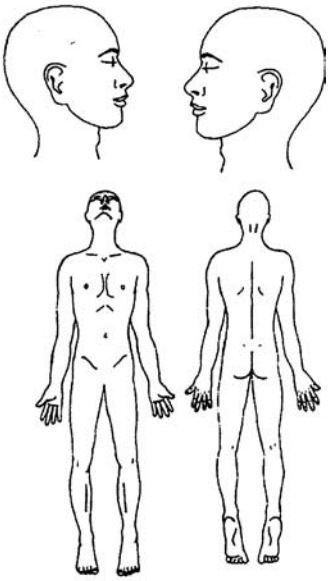
Were any of the bite marks of evidentiary quality? Yes ☐ No ☐

Did the case go to trial? Yes ☐ No ☐

In what Country did the incident occur? _____

Additional pertinent information_____

_____



Indicate position of Bite Marks with an "X"

SUSPECT INFORMATION

Was suspect information collected? Yes ☐ No ☐

From how many suspects? _____Were there bite marks on any of the suspects? _____

Number and location of marks _____

What was/were the suspect's age/s and sex? Male ☐ Female ☐

Was there a conviction in the case? Yes ☐ No ☐ Not yet gone to trial ☐

Additional pertinent information_____

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Thank you in advance for you cooperation

FIG. 1—*Bite Mark Survey Form.*

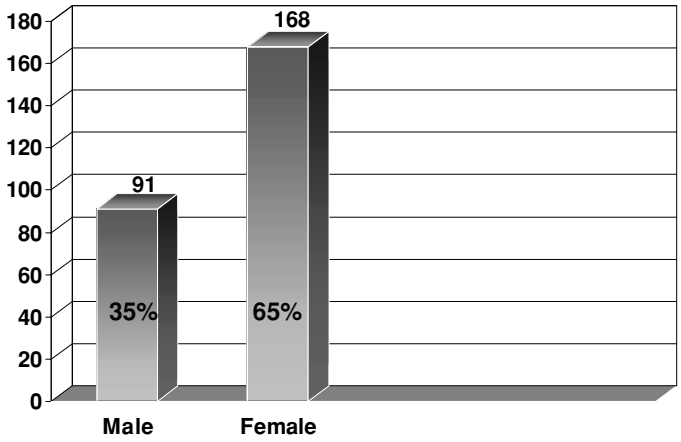

FIG. 2—*Victim distribution by gender.*

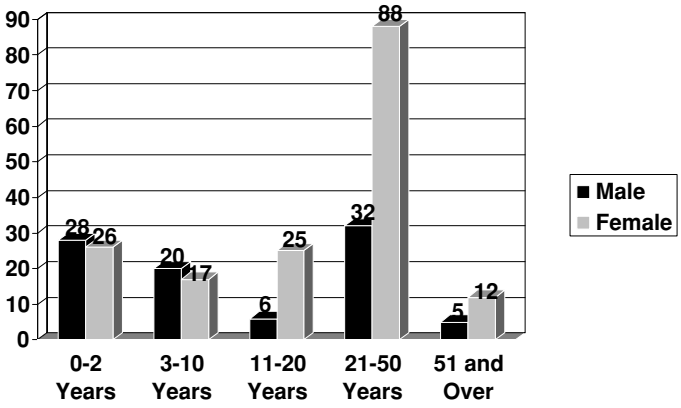

FIG. 3—*Victim distribution by age.*

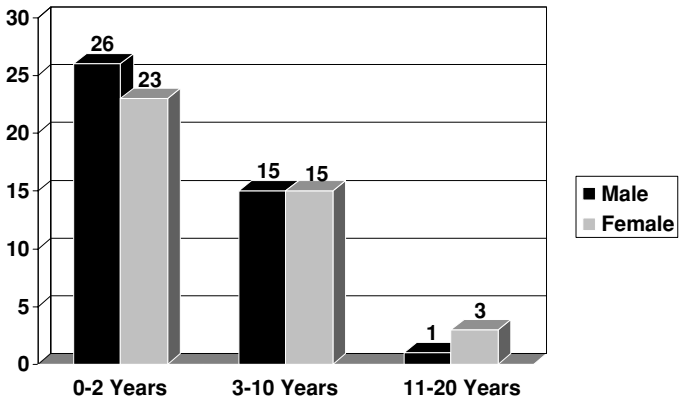

FIG. 4—*Child abuse distribution by age and gender.*

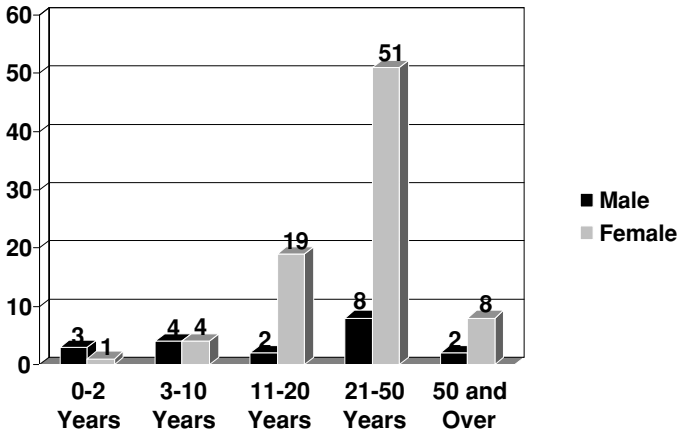

FIG. 5—*Sexual assaults distribution by age and gender.*

comparing males versus females the results show that from birth through 10 years of age females and males are bitten at a similar rate. Age range comparisons show that at ages of 11–20 years females are bitten 4.16 times more often than males, from 21–50 years of age females are bitten 2.75 times more often, and in victims 50 years of age and older females are bitten 2.4 times more often than males (Fig. 3).

Gender and Age Distribution in Varying Types of Crimes

The distributions of type of crime(s) within the study are 46.7% homicide, 39.4% sexual assault and 32.8% child abuse. The total exceeds 100% because some cases involved multiple types of crime.

Examining the age distribution by type of crime involved (child abuse, sexual assault and homicide) showed somewhat different results (Figs. 4–6).

In sexual assaults, the data show similar rates of victimization through the age of 10. However, from 11–20 females are bitten 9.5 times more often, from 21–50 6.4 times more often, and in the over 50-age group 4 times more often than males.

Homicide victim data in this study shows a similar distribution as sexual assaults. Males and females are bitten at similar rates until the age of 10. The age bracket of 11–20 year olds shows females bitten 7 times more often, in the age bracket of 21–50 females are bitten 2.2 times more often than males and in the over 50 group similar rates of victimization between males and females are noted.

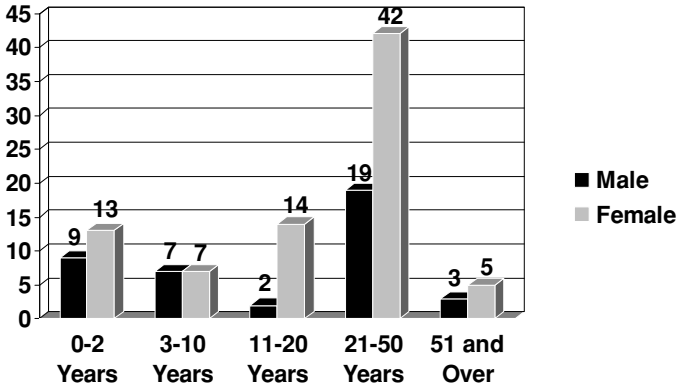

FIG. 6—*Homicide distribution by age and gender.*

Distribution of Bite Marks by Age and Gender of Victim

The overall distribution by percentage of bite marks in this study was arms (22.7%), back (12.1%), legs (11.7%), face (10.3%), breasts (9.3%), and in tenth place hands (3.5%) (Table 1).

However, when bites on the hands and arms are combined are the pooled percentage of bites to the upper extremities is 26.6%. This is significant since this means that the upper extremities are bitten over twice as often as the next closest area.

TABLE 1—*Bite mark distribution by gender and location.*

Total		Female		Male	
Arm	22.70%	Arm	18.70%	Arm	29.60%
Back	12.10%	Back	16.30%	Legs	14.60%
Legs	11.70%	Breast	14%	Face	11.10%
Face	10.30%	Face	10%	Non-Human	8.70%
Breast	9.20%	Legs	10%	Shoulder	8.40%
Shoulder	7.10%	Shoulder	6.30%	Buttocks	5.20%
Non-	5.80%	Buttocks	4.50%	Back	4.90%
Buttocks	4.70%	Neck	4.50%	Genitalia	4.20%
Neck	3.60%	Hand	4.50%	Chest	3.10%
Hand	3.50%	Non-Human	4.10%	Hand	2.80%
Abdomen	2.40%	Abdomen	3.20%	Ear	2.10%
Ear	2.30%	Ear	2.40%	Neck	2.10%
Genitalia	2.20%	Genitalia	1.00%	Breast	1.40%
Chest	1.30%	Head	0.61%	Abdomen	1.00%
Head	0.51%	Chest	0.20%	Head	0.30%
Waist	0.13%	Waist	0%	Waist	0.30%

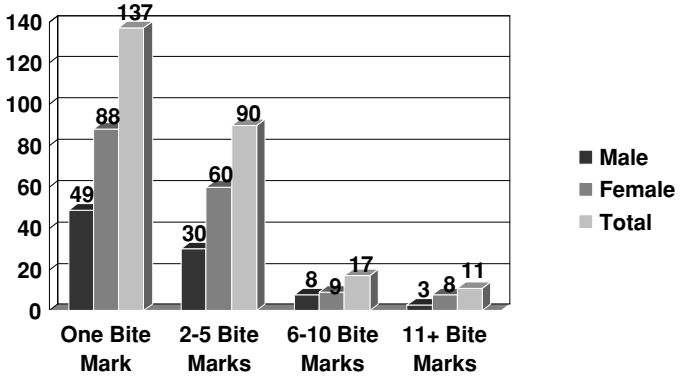

FIG. 7—*Number of bite marks per victim.*

However, if the data is separated between males and females, a different picture emerges. With males, the areas most frequently bitten are upper extremities, (32.4%) legs, (14.6%) and face (11.1%). In contrast, the areas most frequently bitten with females are, upper extremities, (23.2%) back, (16.3%) and breast (13.8%).

The range in the number of bite marks per victim was from one to forty-five, with an average of three. Forty-three percent of victims had more than one bite mark (Fig. 7).

Incidence of Bite Marks

When cases are sorted for the rate of occurrence, or incidence, a different picture is noted. The reason to look at incidence versus distribution is that as previously stated 43% of victims had more than one bite mark, and in one case, a single victim had 45 bite marks. The propensity for more than one bite mark to influence the data is significant.

Overall incidence was arm (22.4%), legs (12.1%), breast (11.2%), face (10.7%), and shoulder (8.2%) (Table 2).

Sorting the data by type of crime shows different patterns:

> Sexual Assault—Breast (18.6%), arm (15.9%), face (13.3%), legs (9%), and shoulders (8.5%).
> Homicide—Arms (24.3%), legs (14.3%), breast (12.7%), face (10.6%), and shoulders (9%).
> Child Abuse—Arms (28.6%), legs (18.9%), back (8.5%), buttocks and face bitten equally (7.3%), shoulder (10%).

It is important to note that the categories can be combined, for example, a child can be sexually assaulted and murdered.

Comparison of This Study with Earlier Studies

The distributions of bite marks seen in this study are most similar to those reported by Vale and Noguchi. Pretty and Sweet's distributions more closely correlate to Harvey's study especially in that both studies show that the areas most frequently bitten were breasts. In contrast, the current study and the study of Vale and Noguchi show that the upper extremities are most often bitten. These variations may be explained by the variations in sources of data, types of cases surveyed, and the life status of the victims in the various cases (Fig. 8).

Suspect Demographics

Gender and Age Distribution in Varying Types of Crimes

Overall males (79%) were suspects of crimes more often than females (21%). However, the age distribution of males and females differ. Male suspect's age ranges from 1 to 50 year(s) of age. While female suspect's age, ranges from 2 to 70 year(s). When comparing the age distribution of males and females a different picture is seen. Males in this study most commonly bite between the ages of 17

TABLE 2—*Bite mark incidence by anatomical area and type of crime.*

Total Incidence		Sexual Crimes		Homicide		Child Abuse	
Arm	22.4%	Breast	18.6%	Arm	24.3%	Arm	28.6%
Legs	12.1%	Arm	15.9%	Legs	14.3%	Legs	18.9%
Breast	16.7%	Face	13.3%	Breast	12.7%	Back	8.5%
Face	10.7%	Legs	9.0%	Face	10.6%	Buttocks	7.3%
Shoulder	8.2%	Shoulder	8.5%	Shoulder	9.1%	Face	7.3%
Back	6.9%	Back	6.9%	Back	6.9%	Shoulder	6.1%
Hand	5.7%	Neck	6.9%	Hand	5.3%	Abdomen	5.5%
Buttocks	4.1%	Genitalia	5.3%	Genitalia	3.2%	Ear	4.3%
Neck	4.1%	Hand	4.8%	Abdomen	3.2%	Breast	3.6%
Non Human	3.2%	Buttocks	3.7%	Ear	2.6%	Genitalia	3.0%
Abdomen	3.2%	Abdomen	3.2%	Buttocks	2.1%	Hand	3.0%
Genitalia	3.0%	Ear	1.6%	Chest	2.1%	Chest	1.2%
Ear	2.7%	Head	1.1%	Non Human	1.6%	Neck	1.2%
Chest	1.4%	Non Human	0.5%	Head	1.0%	Head	0.6%
Head	0.7%	Chest	0.5%	Neck	1.0%	Waist	0.6%
Waist	0.2%	Waist	0.0%	Waist	0.5%	Non Human	0.0%

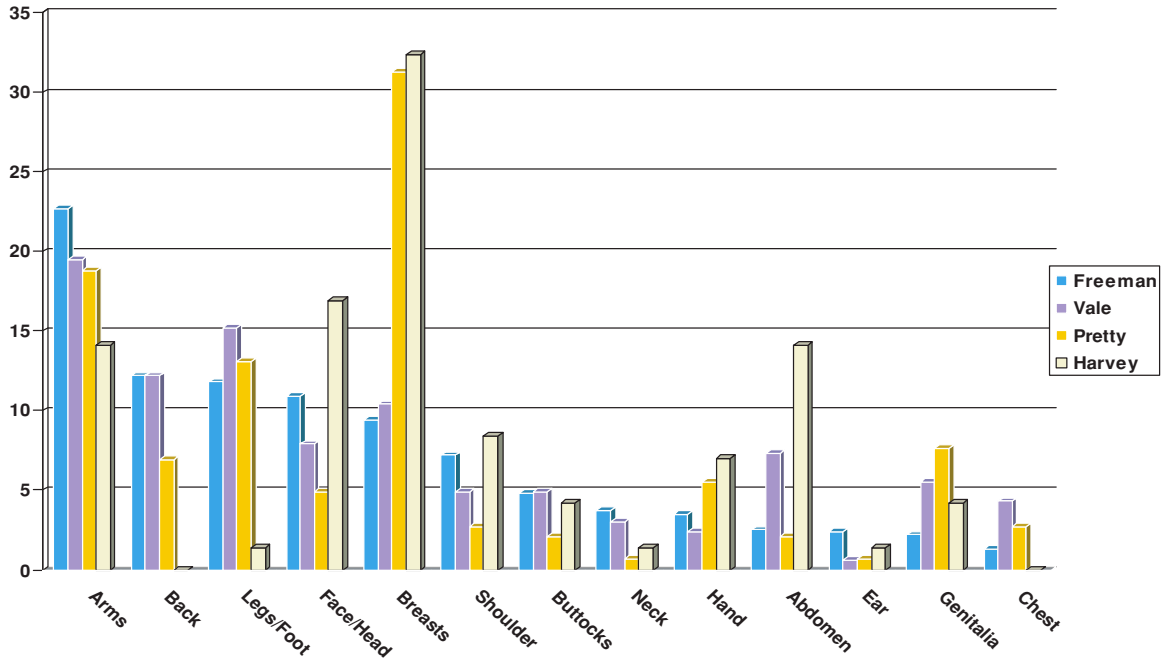

FIG. 8—*Bite mark distribution percentage comparison to previous research.*

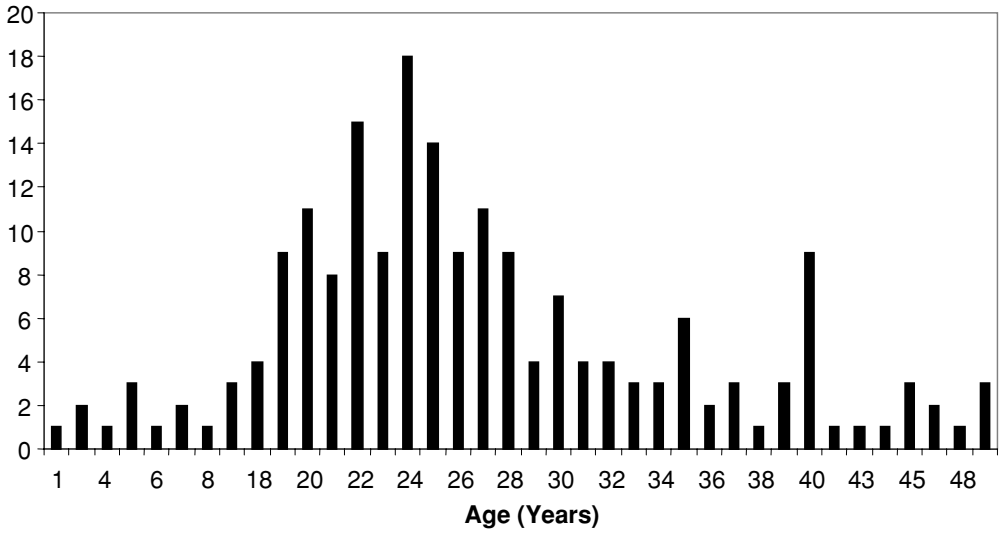

FIG. 9—*Male suspect age distribution.*

to 35. Females in this study most commonly are bitten between the ages of 19 to 26 (Figs. 9, 10).

Sorting the data by differing crimes shows similar patterns between males and females for child abuse and homicides; however, a different pattern is seen with sexual crimes. (Figs. 11–13).

Cases in Which Victims Bite Their Attackers

In nineteen of the cases in this study, the victims bit their attacker(s). Of the attackers that were bitten, there were eighteen males and three females and they received a total of twenty-four individual bite marks. The bite mark distribution was as follows; arm (10), hand (5), face (5), thigh (1), penis (1), shoulder (1), and chest (1). Fourteen of the nineteen victims that bit their attacker were female and five were male. The distribution by type of crime shows that ten were in sexual assaults, nine in homicides, and three in child abuse cases. Some cases, of course, involved more that one type of crime.

Legal Disposition

Overall, in this study the legal dispositions reported that 120 suspects were convicted and 41 were not convicted. In 36 cases the trials were pending at the time of the study. Of the limited number of responders that reported sentencing information there were two reports of death sentences, three life sentences, and two sentences of twenty-five years.

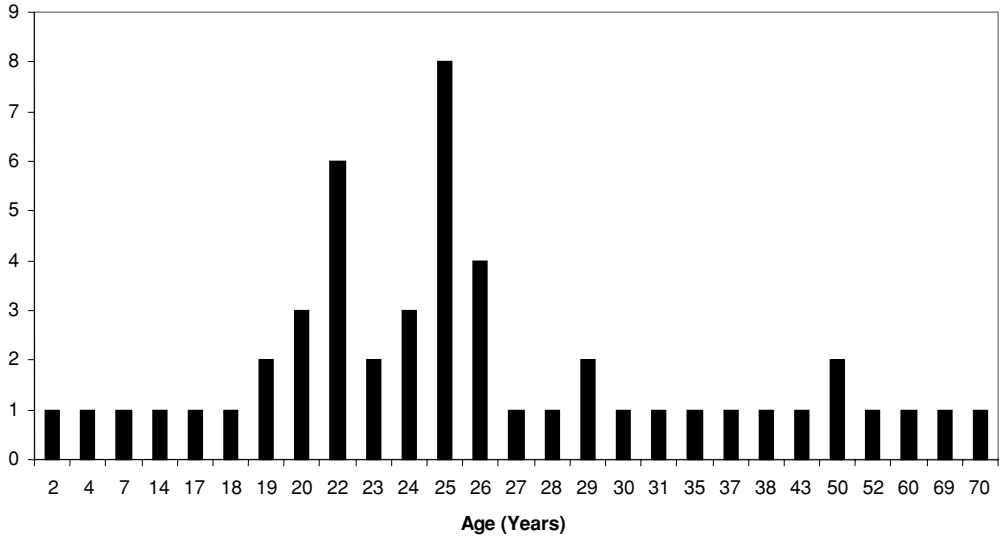

FIG. 10—*Female suspect age distribution.*

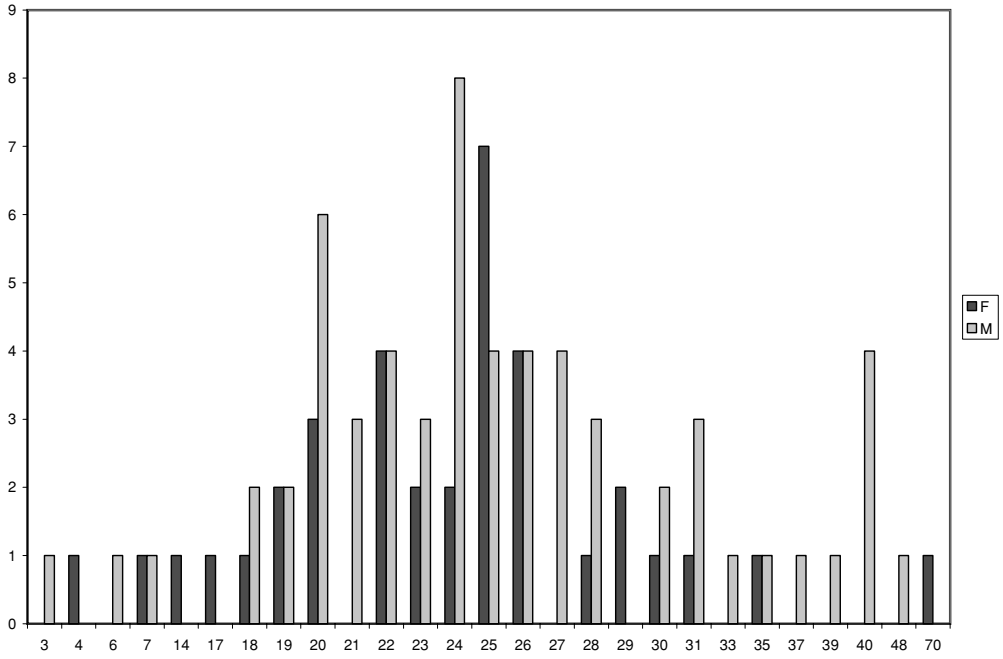

FIG. 11—*Child abusesuspect age distribution by age and sex.*

In cases where the victim left a bite mark on their attacker, there were fifteen convictions. One suspect was not convicted and three trials were pending. There was a conviction rate of 94% in these cases.

Conclusions

1. Bite marks are found on almost all areas of the body.
2. Bite marks seen in a given case may be single or multiple
3. Bite marks are found on both victims and perpetrators of violence
4. Patterns of distribution of bite marks are discernable and variable and are based in part upon these factors:
   a. The type of crime involved
   b. The age of the victim
   c. The sex of the victim
   d. Whether the bite mark is on the victim or the attacker.
   e. The age and sex of the perpetrator
5. Victim and suspect demographics indicate that investigators in the types of crimes reported would be wise to carefully and thoroughly examine both victims and suspects for possible bite marks.
6. A large number of cases (43%) reported that there was more than one bite mark. Where a single bite mark is discovered extra care must be undertaken to determine whether other bite marks exist.

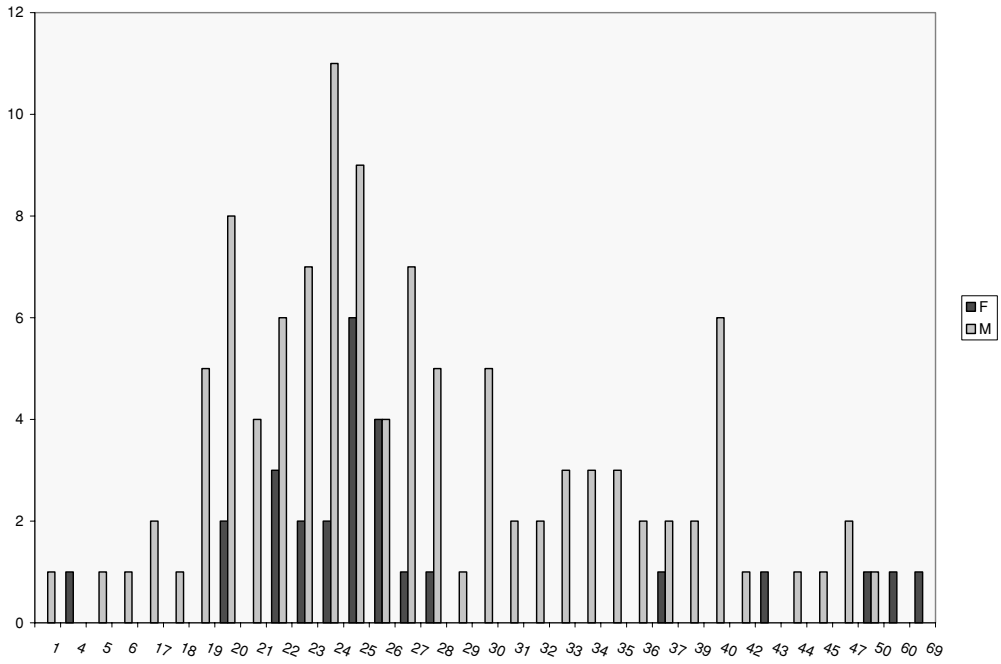

FIG. 12—*Homicide suspect age distribution by age and sex.*

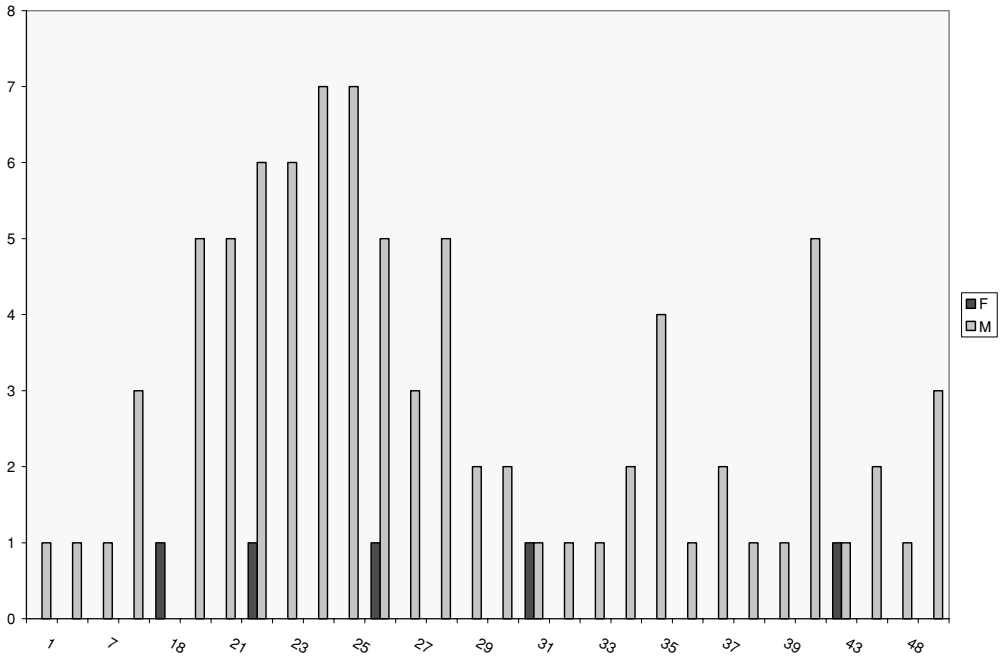

FIG. 13—*Sexual crimes suspect age distribution by age and sex.*

Acknowledgments

The authors would like to acknowledge those who took time from their busy schedules to respond to this survey. Additionally we would like to thank Dr. Susan Rivera, Editor, at that time of the American Society of Forensic Odontology for including the survey in the newsletter. Thanks also go to the American Board of Forensic Odontology for allowing us to contact their Diplomates and to the President at that time, Dr. Bryan Chrz, for encouraging the members to respond.

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