Linear Enamel Hypoplasia: What Can it Say About the Condition of Childhood?

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Introduction

Children are not well understood nor well represented in the archaeological record. In 1989, Grete Lillehammer called for more attention to be paid to children in the archaeological record; however, few archaeologists answered her call (Kamp 2001). In fact, when a symposium on childhood was organized for the Society of American Anthropology five years later, there were so few potential contributors that it took the organizers two attempts before the symposium could even take place (Kamp 2001:8). The lack of study has created a deficiency in the knowledge of the whole community, as understanding children is crucial to understanding how the population functions. This lack of representation of children in the archaeological record stems not only from preservation issues, but also from a lack of desire to ask questions about the nature of children and childhood. For example, children have smaller bones and as such, it takes less time for their bones to be broken down or lost. However, preservation is a problem that can easily be overcome when it comes to understanding children and childhood. While it is true that our childhood tends to be left simply to memories once we have completed it, some physical remains of childhood stay with a person forever: teeth.


Linear enamel hypoplasia can offer much needed information of what it is to be a child in a society where LEH is prevalent. Information that can be gleaned from examining LEH includes: differential treatment of the sexes, differences between the health status of elite children versus non-elite children, and the patterns and implications of early weaning.
Archaeological Problem

Feminist theory posits that women in the archaeological record have traditionally been portrayed as passive rather than active (Fedigan 1986). While this portrayal has changed in recent times, children have replaced females as the passive members of society. Curiously, children were left behind in the feminist movement in archaeology, despite the fact that a woman’s role as a mother is one of the strongest roles of both past and present females. Feminist theory seems to have divorced itself from this role of ‘woman the mother’ in its theories and studies (Sofaer Derevenski 1997:192). Instead, archaeologists have continued to see children as the object of others’ control, assuming that only adults are productive members of society (Kamp 2001:24).

Similar to perceptions of gender studies, the study of children and childhood is seen by many as intangible because the roles of children are culturally defined. However, the recent emphasis on gender studies in the archaeological record should force archaeologists to reconsider the possibility of discovering children and childhood (Kamp 2001:2).

While it may be difficult to find children in the archaeological record because of acidic soils or burial practices that omit them, there are several ways to locate them. Direct evidence can be uncovered through skeletal remains and material remains; indirect evidence can be uncovered by investigating daily life within the settlement, including the time, space and place in which activities were carried out (Danforth 1997).

However, there are barriers that run deeper than acidic soils or burial practices. The assumption that juvenile skeletons do not preserve as well as adult skeletons prevents archaeologists from looking for juvenile skeletons (Danforth 1997). Further, because children are not seen to be as important as the adults in society, they are not actively searched out (Danforth 1997). This excavation bias prevents further data from being gathered on juveniles. Moreover, this bias at work in previous excavations has led to a wealth of lost data that most likely will never be regained (Danforth 1997:130).

There are problems related to dealing with children in the archaeological record, even when children are found. Archaeologists try to recognize patterns in data, yet this task depends on their prior expectations, knowledge and models, all of which can lead to bias (Chamberlain 1997:248). Part of the problem is the concept of childhood is an adult creation (Sofaer Derevenski 1997:193). When dealing with the notion of childhood, a Western archaeologist cannot allow the contemporary Western view of children/childhood to cloud his/her view of children in another time or place. An archaeologist must remember that there have been many ways of viewing children within the community of study. For instance, during the Middle Ages in Europe children were viewed as mini-adults. Another view includes that of the Puritans, who believed that children were born sinful and needed guidance to triumph over evil. Historically in Western culture, children have been seen as capable of work from a very young age (Kamp 2001:4).

Despite the difficulties involved, children do need to be studied not only to learn about them, but also because, “an understanding of children’s economic role, attitudes towards children, the health of infants and children, and other aspects of childhood will improve not only our basic descriptions of a culture, but also our analysis of broader issues” (Kamp 2001:2).

Background

Teeth are often extremely well preserved in the fossil record, as enamel is the hardest tissue of the human body. Mature human dental enamel is made up of 96% inorganic material (crystalline hydroxyapatite), which is not subject to decay, 2% water and 2% protein (amelogenins and enamelin) (Goodman and Rose 1990, Hillier and Craig 1992: 381). Enamel is formed in layers by ameloblast cells. The ameloblast cells move away from the cusp of the tooth leaving a protein matrix, which is later calcified behind them. Any systematic disturbance that disrupts the ameloblast alters the direction of movement and as such, alters the enamel prism being formed.

If the ameloblast cells do not recover from a disturbance, these ameloblasts will form no further enamel; this results in enamel hypoplasia (Rose 1985). There are four types of enamel hypoplasia (EH): pits, vertical grooves, missing enamel and horizontal grooves (Guatelli-Steinberg & Lukacs 1999:77). Horizontal hypoplasia, more commonly referred to as linear enamel hypoplasia, can be a single sharp line on the crown, or a single groove/furrow/ridge on the crown surface (Guatelli-Steinberg & Lukacs 1999:77).
1999:77). Once the hypoplasia is formed, it serves as a permanent marker of the premature death of ameloblast cells because teeth, unlike bone, do not remodel after their formation.

Human dental development begins with the formation of deciduous incisors around four weeks in utero; as such, LEH can be used to monitor an individual from four weeks in utero (Alvesalo 1997). Permanent teeth, incisors, canines and first molars grow in the first year after birth and complete their growth between the ages of three and seven. Premolars and second molars develop during the third and fourth years and are completed from ages four to eight. Third molars develop between the ages of seven and twelve and are completed between ten to eighteen years of age (Hillson 2000).

To measure the age at which a particular episode of LEH occurs, the distance from the cemento-enamel junction (CEJ) to the LEH is measured; the distance can then be graphically converted to an age of development (Goodman & Rose 1990). This type of calculation is possible because research has established that the emergence of deciduous and permanent dentition does not differ greatly between or within groups, unlike other stress markers such as body size and skeletal maturity (Humphrey 2000).

Morbidity in general tends not to leave direct evidence on the bone. In children, the leading causes of death are respiratory and diarrhoeal diseases, which affect soft tissue and create even less chance to see morbidity of childhood within skeletal remains (Saunders & Barrens 1999). However, stress on the body can be seen in the structure of teeth as the lack of remodelling after formation allows a tooth to become a time capsule for the time period in which it was formed (Saunders & Barrens 1999). As a result, we can learn about childhood by studying the dental remains of adults, who are often better represented in the archaeological record (Rose et al. 1985:282, Saunders & Barrens 1999).

LEH is a non-specific stress indicator found on both deciduous and permanent teeth; stress includes both internal and external forces. Internal forces include: biological determinants, for instance, genetic predispositions and sex differences. External forces include: nutritional deficiencies, disease, childbirth (low birth weight and pre-maturity), accidents, fever, and violence (Alvesalo 1997, Skinner 1996).

A large number of studies on the causes of LEH have focused on vitamin deficiencies. Two of the most prominent are deficiencies in vitamin A and vitamin D. Vitamin A can be easily lost during a fever by voiding retinal-binding protein in urine; in fact, up to half of the adult daily requirement can be lost during to fever (Skinner 1996:836,849). The consequence of vitamin A deficiency is only a 2% decrease in growth, yet a 50% reduction in antibody synthesis (Skinner 1996:849). This reduction in antibodies opens the individual up to a host of other disease and viruses, which can place further strain on the body.

Vitamin D may also cause LEH by proxy; that is, a calcium-reduced diet creates a vitamin D deficiency, which can lead to diarrhoea and intestinal problems often resulting in further metabolic deficiencies (Olsen Kelley & Angel 1987:200). In general, other bodily systems tend to worsen if there is a decrease in mineral storage and a decrease in vitamin D (Seow 1992:327). To confirm the connection between vitamin deficiencies and enamel hypoplasia, studies have been completed on various mammals. Studies on dogs, for instance, have shown that deficiencies in vitamins A and D can cause enamel hypoplasia (Olsen Kelly & Angel 1987).

Due to the multi-causality of LEH, some researchers have questioned its use as a nutritional stress marker. However, research has shown LEH to be more often associated with populations suffering from nutritional deficiencies and/or infectious disease than other populations. Furthermore, studies have shown LEH to be more sensitive to nutritional status than tooth size, tooth emergence and bone mineralization (May et al. 1993: 49). Studies have also shown that LEH parallels other stress indicators such as height, weight and socio-economic status (Guatelli-Steinberg & Lukacs 1999:80). Whether LEH monitors nutritional stress specifically, or stress levels in general, LEH is strongly associated with stress. This association allows LEH to be used as an indicator of stress in a population or a population segment (Guatelli-Steinberg & Lukacs 1999:79).
The “Osteological Paradox” has several ramifications on the study of LEH (Wood et al. 1992). First, the children found to have LEH were the survivors of a stress episode. However, those children who died without any evidence of LEH do not necessarily represent healthy children; instead, they represent those who died before LEH could develop. This is possible because while LEH is a good indicator of stress, it does not represent all stressors. Sudden death will not be seen through LEH; as such, it should not be assumed that the children in the archaeological record without LEH were stress-free individuals (Skinner 1996: 847). To attempt to uncover which of these two options are reflected in the skeletal remains, other evidence on the particular community and particular individual need to be considered.

All children in the archaeological record were frail in life, as they died prematurely. To study the possible effects of individual frailty and the effects of morbidity upon mortality, one individual can be followed though childhood, comparing the defects of the deciduous and permanent dentition as well as the age of death (Storey 1997: 119).

Materials and Methods

To identify LEH, a bright light, 10x hand lens and dental probe are the only instruments needed. If a defect is so small that it can only be seen under a microscope, then it is probably not a true hypoplasia, as such researchers look for macroscopic as opposed to microscopic evidence (Goodman & Rose 1990: 92). To measure an episode of LEH, needlepoint Helios dial callipers are used and the data is rounded to the nearest tenth of a millimetre (Lukacs 1992: 7). To ensure best results, teeth should be cleaned in a nonabrasive manner to remove excess dirt and any obscuring items (Goodman & Rose 1990: 92).

The measured distance from the CEJ’s to LEH can be graphically converted to an age of development. The formula for this procedure is as follows: the age at formation is equal to the negative rate of enamel development (mm per year), multiplied by the distance of the defect from the CEJ (in mm), plus the age at crown completion (Goodman & Rose 1990: 97). This methodology was used in all of the studies using individuals of unknown age reviewed within this paper. For comparative purposes, information on the formation of the tooth matrix of different groups (i.e. males vs. females) is available and used in several of the studies reviewed here (Goodman & Rose 1990: 99).

There are some problems in the methodology of enamel hypoplasia; for instance, not all teeth show the same amount of hypoplasia. Research has shown earlier developing tooth crowns tend to have more hypoplasia than later developing tooth crowns (Goodman & Armelagos 1985: 487). This provides evidence of morphological developmental factors influencing the expression of EH (Goodman & Armelagos 1985: 488). However, not all of the differences can be explained via time in tooth development; thus, it is possible that there is increased genetic control over the development of certain teeth. Teeth believed to be heavily constrained by genetics are referred to as polar or key teeth. The upper central incisors, lower lateral incisors, canines, first premolars and first molars are considered the polar teeth. Hypoplasia is believed to affect these genetically controlled teeth. This is believed to be the case because EH may be the only way polar teeth can react to stress, given that genes tightly control the speed of development and size. Non-polar teeth, or those with less genetic control, can react to stress in a variety of ways such as slowing down development and decreasing in overall size. Studies providing evidence of the existence of polar teeth show that in response to nutritional stress, third molars decrease in size at a greater rate than first molars, with second molars being intermediate in this reaction (Goodman & Armelagos 1985: 491).

There is also a problem in examining teeth for LEH due to attrition. Attrition from chewing or cultural modifications of teeth can interfere with the ability to locate LEH and count the number of stress episodes. In this paper, deciduous teeth were examined and teeth with heavy wear or unusual wear patterns were excluded to reduce any confounding factors.

The following three sections of this paper each reflect their own methodology as they are from a variety of studies. A brief outline of the methodology will be discussed for each study.

Case Studies

Differential Treatment of the Sexes

LEH is an indicator of stress; as such, studies can use LEH in comparing different groups to one another in order to determine if one group experiences more stress than the other.
In some contemporary societies preferential treatment of one sex over the other exists. If the study of LEH in these cultures reveals a correlation between the high frequency of LEH episodes and the poorly treated sex, it may be used as evidence for differential sex treatment in past societies where cultural practices are unknown. However, when making comparisons between the sexes, female buffering must be taken into consideration (Guatelli-Steinberg & Lukacs 1999:73). The theory of female buffering suggests that females are better buffered against parasites and infectious disease as a result of the demanding role that reproduction places on the female body. In fact, research on nutritional stressors has shown that long-term effects of protein deprivation are more pronounced in males than females. For example, Rhesus macaque females gain weight better and are more efficient when placed on a low protein diet compared to males (Guatelli-Steinberg & Lukacs 1999:80). In humans, females may be more resilient at birth, as males tend to be larger with more muscle mass and less subcutaneous fat. This leads to a higher caloric requirement and less caloric reserves for males (Guatelli-Steinberg & Lukacs 1999:82). As a result of evidence for female buffering, many studies propose that males in a stressful environment will exhibit higher levels of LEH. In other words, LEH would only be found in females if the environmental stressors were high throughout the entire population. As such, a higher level of LEH in females than males might be used as a marker of preferential male treatment (Guatelli-Steinberg & Lukacs 1999:118).

1) Zhou & Corruccini (1998)

In 1998 Zhou & Corruccini conducted a study comparing EH of males and females during the Chinese famine (1959-1969). 3014 individuals were sampled and Goodman's modifications of Federation Dentaire International (FDI) were used for the classification of LEH. Age at LEH occurrence also followed Goodman’s 1987 methodology.

Zhou and Corruccini’s study found that the chances of possessing LEH during famine was greater than while not in a famine, securing LEH as representative of stress from the famine. In terms of the male to female ratio of LEH, there was no significant difference between rates of individuals possessing LEH (Zhou & Corruccini 1998).

There were several reasons for this lack of difference between the sexes despite the well-documented presence of male preferential treatment in China during this time period. First, the authors suggest that where there is high stress among the population as a whole, as seen through high stress markers and high mortality for the time period, preferential treatment may disappear as there is not enough resources to treat anyone preferentially. Second, females in China were so selected against that they died quickly without development of LEH, and were removed from the population studied. It is possible that many females were removed from the population due to premature death, since the death rate increased by 135% during the famine. However, females should possess less LEH than males in stressful circumstances because of female buffering; therefore, finding no significant differences between the sexes could be interpreted as weak evidence of male preferential treatment.

The Zhou and Corruccini study provides some evidence of differential treatment between the sexes despite the extreme and unusual circumstances of the Chinese famine. However, not all evidence of preferential treatment as seen through LEH comes from unusual circumstances like a political famine, nor is all of the evidence weak.

2) Goodman et al. (1987)

In 1987 Goodman et al. completed a study on the prevalence and development of LEH in Solis Valley, Mexico. This study is useful because it includes a diversity of socioeconomic and nutritional status. Furthermore, information concerning social systems and social practices was known for every individual used in the study. The study consisted of 300 Latino children from five communities; all of the participants involved were part of the Collaborative Research Support Program. This longitudinal study provided details on each family and each individual, including information on anthropology, food history, psychosocial and developmental, as well as socio-economic and environmental conditions. Goodman modified the FDI’s techniques for classification of LEH and other earlier dental techniques creating the methods used in Zhou and Corruccini’s aforementioned study.

The female rate for EH in Goodman’s study was over twice as high on the mandibular lateral incisor (polar tooth). Furthermore, while the male rate for EH dropped after the third year of life, the female rate of EH remained high.
(Goodman et al. 1987). From the rate of EH in each developmental zone, it is unlikely that the increased frequency in females over males was related to differential attrition or eruption. Based on these data the authors suggest that males might have had greater access to food, shelter and health care than females (Goodman et al. 1987:18 May et al. 1993).

These two studies suggest that in some communities males received preferential treatment over females, resulting in less stress. This connection seen between LEH and differential sex treatment allows archaeologists to hypothesize on preferential treatment of one sex over another. If males are being treated preferentially in a community, by way of better access to medical attention or other resources, archaeologists can also begin to make determinations on what it would be like to be a female living in that community. For example, preferential treatment can lead to changes in feelings of self worth (Barlow & Durand 2002). As such, females living in a community with male preferential treatment may see themselves as less worthy; which, may also contribute to other cultural beliefs or behavior within the community. Furthermore, if archaeologists can identify male preferential treatment, they can also ask questions about forms of resistance to this belief system possibly reflected within art, architecture or other cultural remains.

**Status Differences**

As reviewed in the study of LEH in determining differential treatment of the sexes, the comparison of groups though the frequency and number of LEH episodes can provide useful data for understanding the life of a child. This same process can be used to compare high status to low status children. If the rates of LEH are the same between the two groups (high status/low status), it can be concluded that a high level of stress across the population inhibits the ability to protect children and, as such, they have similar stress levels and occurrences. Alternatively, this finding could suggest that children are treated as a uniform group within the community and, as such, their familial resources do not protect high status children. To determine which is the more likely scenario, an investigation into burial practices may indicate the place of children within the culture.

If frequency/severity of LEH between high status and low status groups are different, with the low status group having lower rates/severity of LEH, than one could hypothesize that the poor children are dying before LEH can develop; further, that the rate of high LEH represents the survivors of high status children, most likely to due differential access to resources. One way to determine whether this is the case would be to see if there is a spike in the death records, similar to the Chinese famine situation. If there is a spike in the deaths of children, then such a pattern could suggest LEH is a sign of survivorship rather than frailty. However, if the frequency/severity of LEH is different, with the high status groups having lower rates/severity of LEH, one could hypothesize that high status children are protected from stresses via familial access to resources. As a result, the high status children lead very different lives from the poor children.

3) Lanphear (1990)

To examine this possibility I compared Kim Lanphear’s 1990 study of the Munroe Poorhouse population to the 1992 Little et al. study of the high status Weir family. Both of these studies involved the examination of clean, maxillary central incisors and the mandibular canines. Hypoplasias were aged using Goodman’s revisions of Massler’s chronology (Lanphear 1990, Barbara Little, e-mail to author October 21 2004).

In regard to samples, both studies dealt with white populations in the Southern United States between the time period of 1826 to 1907. Lanphear’s 1990 study consisted of 153 individuals. Her research found that 84% of the individuals under investigation had LEH. Little’s 1992 study found of the 13 individuals studied, 53.8% had LEH. To accommodate for the difference in sample size, a chi-squared analysis of the data was calculated. The calculations suggest that the difference between these two populations was statistically significant (p > 0.05).

Statistically, the Weir family suffered significantly less linear enamel hypoplasia than those buried in the Munroe County Poorhouse Cemetery. As such, the lives of the Weir family children were significantly different than the lives of the children from the Munroe Poorhouse in terms of stress levels. This difference in stress levels is most likely a result of nutritional differences since the groups are contemporary with each other and geographically similar, although access to monetary and food resources would have differed.
Research has suggested that moderate, but chronic nutritional deprivation in early childhood can temporarily retard acquisition of motor skills and may permanently stunt mental development (Steckel 1986:738). There have even been studies that suggest that malnutrition changes behavioural practices, with moderately malnourished children becoming apathetic, emotionally withdrawn, less aggressive, while being more dependent (Steckel 1986:739). This fact suggests that the lives of the Munroe Poorhouse children were perhaps less productive and more emotionally withdrawn than those of the Weir family children.

**Weaning**

Research has consistently linked LEH with times of high stress; as such, a spike of LEH seen across a community at a particular age may reflect developmental stress. One of the most stressful times in growth and development is the weaning process. Due to this correlation of stress and weaning, an extensive amount of research has been conducted on the link between nutritional pathological conditions and weaning.

During weaning there is a gradual loss of the nutrients and immunity previously supplied through breast milk. For instance, breast milk is the most adequate source of vitamin D for infants. The reduced immunity, as a result of the loss of breast milk, is compounded by the increase of contact from pathogens in the environment (Moggi-Cecchi et al. 1994: 303, Li et al. 1995, Cuccina 2002).

The decrease in breastfeeding is also associated with independence and a reduction in childcare (Terranova & Laviola 1995). Newfound independence results in more play and social interaction (Terranova & Laviola 1995). Thus, if one could determine when breastfeeding ceased one could then determine when a child became more independent and began to act as a social being within the community (Howes & Matheson: 1992).

The weaning hypothesis states that due to the high metabolic stress associated with the cessation of breastfeeding, LEH can be predicted to be greatest during this time period (Blakey et al. 1994). In fact, research has specifically linked Weanling diarrhoea as an indirect cause of LEH, lending support to this hypothesis (White 1994:288). However, the majority of studies find that LEH increases slightly after the historically documented weaning time. Such timing, however, does not necessarily discount the LEH weaning hypothesis (Blakey 1994).

4) Moggi-Cecchi et al. (1994) In 1994 Moggi-Cecchi et al. completed a study on nineteenth century individuals who lived in Florence, Italy. The project examined the age at which LEH first occurred. The study involved 83 crania and was conducted using Goodman’s methodology for determining the age at which LEH occurred. Historical data for the community suggested a weaning age of twelve to eighteen months. However, in Moggi-Cecchi et al.’s findings the age at which most individuals experienced their first instance of LEH was one and a half to two years of age, about six months after the historically documented weaning time. Those data, however, do not discard the weaning hypothesis because weaning is a gradual replacement of breast milk with food; so, a six-month lag in expressing the effects of reduced nutrition and antibodies is possible.

Overall, most studies of LEH peaks also show that peaks of hypoplasia tend to occur six to nine months after the historically documented weaning age. This has been attributed to “post-weaning stress” (Blakey et al. 1994:379). Post-weaning stress is associated with increased motor and language capabilities, which expose young children to frequent contact with an increased number of individuals and more substances, thus increasing the chance of developing disease (Blakey et al. 1994:379). Another reason why the peak time tends not to match weaning time is that hypoplasia has a bias towards more defects during the developmental phase (two to four years of age), which usually intersects the time of weaning (Blakey et al. 1994:380). However, in Codone & Rose’s 1992 study of microscopic enamel defects, no evidence of a bias was found for this developmental time period (cited in Blakey et al.1994:380).

Determining the time of weaning stress, not just the beginning of the weaning process, is important because it helps identify when an individual begins to have greater contact with environmental pathogens. The increased contact with pathogens suggests more contact with other individuals in the community, including playmates.

In cats, mice and rats the cessation of weaning, even at an early age, encourages a higher level of play than in control specimens who are still being weaned (Terranova & Laviola 1995:1268). This reveals information about a child’s life since children who participate in earlier social play have been found to be more
pro-social, sociable, as well as less aggressive and withdrawn later in childhood (Howes & Matheson 1992: 969). It was also found that the children who show emergence of reciprocal play early, exhibit an earlier development in cooperative play. (Howes & Matheson 1992:969)

Play is a crucial part of childhood as it contributes to mathematical thinking (Jarell 1998: 56), literacy development (Christie 1998: 80), risk-taking decision-making (Jambor 1998), humour development (Berger 1998) and mastery of social skills in general (Freitag 1998). Such research, which shows that the early weaning of a child is associated with higher levels of play and early play, could help speed up the process of social maturity allowing a child to have more responsibility at an earlier age. Steckel’s 1986 study of North American slaves in the nineteenth century cites children’s “transitions into the adult labour force” by the age of six to seven. Steckel also cites the weaning age as beginning as early as three months, based on the given mother’s cotton-picking rates. The research suggests a correlation, in this particular case, between early weaning and earlier life responsibility. However, at this point the hypothesis suggesting a correlation between earlier breastfeeding and increased responsibility is merely conjecture. Further studies cross-culturally would need to be completed in order to correlate early weaning with an increased early responsibility in children.

Future of Children in Archaeological Studies

The study of LEH can begin to explore what it would be like to be a child by providing information on such topics as preferential treatment, differences in rearing environments and the beginnings of individualization. Based on the research discussed in this paper, it is clear that LEH alone cannot offer enough data to confirm a particular claim with sufficient authority; good archaeological research requires multiple lines of evidence to substantiate a given claim. In the case of LEH, many different methods can be used to shed light on some of the questions concerning the legitimacy of the claims, or simply to back up a particular study’s findings.

To confirm the time of weaning in an individual, nitrogen stable isotope analysis could be used; this would allow the social and behavioural ramifications to be examined more reliably (Katzenberg 2000: 318). Further, isotopic studies can offer information on the types of diets children were consuming, in addition to information on the migration patterns of individuals during their childhood years. These types of studies would create more evidence that would allow for in-depth hypothesis testing on children in a particular culture. However, such isotopic studies have their drawbacks; firstly, isotopic studies are expensive to conduct; secondly isotope analysis is a destructive technique that may not be permitted on particular samples. However, with proper consent, isotopic studies in conjunction with LEH analysis could provide a clearer understanding of what it would be like to be a child in a particular society.

Another scientific technique that could be useful in these types of studies is DNA analysis, it can identify disease pathogens in skeletal remains. The technique would allow for a discovery of the pathogens contained within a particular individual. This would assist the archaeologists in pinpointing the cause of stress in an individual or population (Saunders & Barrens 1999).

Archaeological methods can also bolster the evidence provided by LEH studies. To determine whether children were seen as persons within a society, archaeologists could study burial patterns. For example, if children were considered “outsiders” one could look to see if normal (i.e. adult) mortuary practices for the community (i.e. location, grave goods, position) were applied to the graves of children (Crawford 2000:176). An example using archaeological methods to determine the state of childhood is the study of infanticide (cited in Mays 2000:180). To identify infanticide in a particular community, research can be completed on burial practices combined with observing peaks in age at death near the time of birth (Mays 2000:181). The practice of infanticide may indicate the belief that newborns were not considered persons. This is a notion that is not all that uncommon. In fact, Tooley (1983) argued that until an infant has a concept of self, it is not a person; as such, infanticide is acceptable (Mays 2000:181). In other cultures, reaching milestones may have been required before an infant/child was considered a person/member of the community, such as eating solid foods, walking, teething or receiving a name (Mays 2000:182).

Whatever the reason, information on both burial place and birthrates may provide insight into the lives of children.

Conclusion
Children have the power to influence adults. In psychological studies, it has been found that experiences with child interaction, and not necessarily with the adult’s own child, caused the adults in the study to: change values or priorities; recall forgotten or repressed memories from their own childhood; become more creative and more cognitively flexible; and observe the world with wonder and curiosity (Dillon 2002: 267). Psychology suggests that the reason for this strong influence of children on adults is related to genetic stratification; a theory whereby earlier modes of knowledge are not replaced by new ones, but coexist along a parallel line instead. As such, there are functional and multiple modes of knowledge existing within an adult. It is also theorized that the influence of children is due to dynamic intersubjectivity. This theory suggests development in adults does not move in a single line; instead, it reunites knowledge acquired from infancy and childhood with that knowledge gained in adolescence and adulthood (Dillon 2002:273). These psychological theories show how children affect the lives of the adults around them, be it how they remember their own past or how they think as an adult.

Furthermore, children are not merely smaller versions of adults; rather, they maintain their own sense of identity, world-view, priorities and social networks (Wilkie 2000:100, Crawford 2000). As such we cannot simply apply adult beliefs, social practices and behaviours across the population as a whole. More importantly, when conducting an excavation, it must be remembered that, “children contribute to the archaeological record whether or not we are competent to recognize them” (Chamberlain 1997:249 emphasis original).

The children of today are the adults and leaders of tomorrow; as such, understanding the sort of childhood they experienced not only allows bioarchaeologists to better understand this segment of society, but it also allows bioarchaeologists to understand why changes may have occurred. While LEH may only provide a glimpse into the past, it does provide and excellent starting point to fully investigate the lives of children.

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