Skeletal effects of castration on two eunuchs of Ming China

Jacqueline T. ENG1,*, Quanchao ZHANG2, Hong ZHU2

1Department of Anthropology, Western Michigan University, Kalamazoo, MI 49008, USA
2Research Center for Chinese Frontier Archaeology, Jilin University, Changchun 130012, China

Received 30 April 2009; accepted 24 September 2009

Abstract The practice of castrating men is an ancient one. Eunuchs have served as guards to harems and as palace chamberlains for many early courts, but details about their lives are often hazy or shrouded in secrecy. Although the changes wrought to their physical appearance from castration are well-documented, little is known about the magnitude of the skeletal changes resulting from the loss of sex hormones associated with the procedure. Such a loss of hormones, especially before puberty, affects skeletal growth and development and may result in early osteoporosis as well as impacting quality of life. The burials of two eunuchs from the Ming Dynasty (1368–1644 AD) of imperial China provide an opportunity to examine the consequences of castration upon the human skeleton. These eunuchs may have been castrated at different periods in their lives. One eunuch appears to have been castrated before the development of secondary sexual characteristics; the delayed epiphyseal closure accompanying androgen deficiency may account for his long limbs. Skeletal evidence also sheds light on the lives of these eunuchs, including their oral health, history of childhood stress, and activity patterns.

Key words: castration, eunuch, height, paleopathology, China

Introduction
Castration is any action—surgical, chemical, or otherwise—by which a biological male loses testicular function. Eunuchs (castrated men) were part of the societies of ancient Mesopotamia, Assyria, Israel, Ethiopia, Egypt, Persia, Greece, Rome, Byzantium, Korea, and China (Tsai, 1996; Scholz, 2001). In the 16th–19th centuries, castrati such as Farinelli were castrated before puberty to preserve their soprano voices for opera and for liturgical singing in the Catholic Church (Jenkins, 1998). In Eastern Europe, members of the Christian Skoptzy sect (18th–early 20th century) underwent castration in response to Christ’s counsel to amputate body parts to attain purity through the avoidance of sin (Matthew 18: 8–9 and 19: 12 KJV). Even today, castrated men (hijra) exist in India and small numbers of eunuchs serve as guards in parts of the Middle East (Scholz, 2001, p. 26), while countries such as the United States sometimes castrate men as social control measures for deviant aggressive and sexual behavior, either surgically or via other means such as chemical treatment (Scott and Holmberg, 2003). In ancient cultures, eunuchs were entrusted to guard women’s quarters or act as chamberlains because they were deemed safe from the sexual appetites that tempted normal men. Arguably the most famous and long lasting example of eunuch service is in China, where the eunuch system was firmly entrenched in the imperial culture and persisted for over 25 dynasties (4000 years) until the early 20th century when the last emperor was removed from power.

Castration procedure in imperial China
While castration typically involves the removal or mutilation of the testes, the penis may also be removed (penectomy), and this total removal of external genitalia was the practice in dynastic China (Mitamura, 1970). In the late 19th century, Stent (1877) gathered data on the castration procedure of the Qing Dynasty (1644–1912 AD). More recent interviews with surviving eunuchs indicate that procedures were relatively similar in the later years of the dynasty. As described by Anderson (1990), the operations were performed by government-approved, unsalaried specialists outside the western gate of the imperial palace. During the procedure, the abdomen and upper thighs were tightly bound with strings or bandages, and then the genitalia were washed in hot pepper-water as a local anesthetic. While semi-reclined and held down by assistants, the specialist used a slightly curved blade (Figure 1) to slice off the scrotum, penis, and testes with a single cut (Wong and Wu, 1932). A plug was inserted into the urethra to prevent stricture formation, and the wound was covered and bound with moistened paper. The new eunuch was made to walk around for 2–3 hours before being allowed to lie down. During the next three days after the operation the eunuch was not allowed to drink water or urinate. After this period, the plug was removed, and if urine appeared, the operation was deemed a success, with full recovery of the wound expected after about 100 days. In addition to severe pain, however, many died from hemorrhage, infection, urine blockage, or other complications, and urinary incontinence appears to have
been a common occurrence.

The mortality rate for such an operation was reportedly not higher than found for any other surgery at the time, with about 2% for eunuchs of the Qing Dynasty (Wu and Gu, 1991). This rate is considerably lower than other accounts of high mortality from other regions, such as a survival rate of only 25% for those castrated in Coptic monasteries in Egypt for the slave trade, possibly owing to differences in sanitary conditions (Scholz, 2001). The highest documented mortality rate in China was during the early Ming Dynasty (1368–1644 AD) when 329 of the 1565 boys (20%) from the defeated Miao tribe in southwestern China died from the castration procedure (Tsai, 1996).

**Previous studies: physical effects of castration**

Little research has been published about the skeletal consequences of castration in humans (see Zitzmann and Nieschlag, 2001, for critique of studies), although many reports describe the endocrinological effects of castration on laboratory animals (e.g. Wink and Felts, 1980; Schenck and Slob, 1986; Zumpe et al., 1992; Dixson, 1993; Davis, 2000). Castrated males lose function of their testicles, and are thus sterile and have greatly reduced production of sex hormones, testosterone in particular. Silberberg and Silberberg (1971) have summarized previous research on the effects that the absence or deficiency of sex steroids have on the skeletal development of humans and other mammals. In particular, testicular hormones strongly influence the development of tubular and flat bones, as well as the development of secondary sexual characteristics. Testicular deficiency causes a delay in the closure of epiphyses and the age at which they normally unite during puberty. The earlier that castration occurs, the longer the delay until epiphyseal closure. This delay results in disproportionately long bone lengths between those elements that fuse before puberty, which are not at all or less affected by castration, and the long bones whose epiphyses normally unite during puberty. Thus, deprivation of male steroid hormones delays closure of epiphyses and prolongs the growth period, and also influences the maintenance of bones.

In animals such as rats and macaques, osteoporosis has been linked to castration owing to the subsequent loss in male sex hormones (Wink and Felts, 1980; Schenck and Slob, 1986). Other studies have been conducted on men who have undergone orchietomy (removal of a testicle), or chemical castration as hormone therapy for prostate cancer. Both forms of castration result in osteoporosis as measured by femoral neck mineral density (Daniell et al., 2000), and appear to increase susceptibility to osteoporotic fractures (Daniell, 1997; Smith et al., 2006). It has been suggested that osteoporosis in castrated males is linked to: (1) the absence of protein-anabolic action of the male steroids, which leads to decreased osteogenesis during remodeling; and (2) decreased bulk and strength of the skeletal muscles (Heller and Shipley, 1951).

Most medical studies have focused on hypogonadism as the cause of androgen loss in human males, although a few studies have been conducted on eunuchs. Read (1921) studied the metabolism of eunuchs by analyzing urine samples from several adult “Oriental” eunuchs. The eunuchs secreted abnormally high levels of ammonia and creatine, which were comparable to levels normally expected from a prepubescent boy or female (or an adult male afflicted by certain types of illnesses or dietary problems). One eunuch castrated at age 29, after the development of secondary sex characteristics, secreted creatine levels comparable to normal males. Read concluded that the removal of male sexual organs in prepubescent males results in the eventual chemical and physical development of secondary female characters in those castrated males.

More recent clinical studies are limited to men who have been castrated for health issues, or surgical repair for those castrated from assault or accidents, while studies of genital self-mutilation mainly focus on the psychological aspects (Catalano et al., 2002; Brett et al., 2007; Wassersug and Johnson, 2007). Studies of the *hijras* (also known as *hijaka*) in India mainly concentrate on the cultural aspects of their institutionalized third-gender role (e.g. Nanda, 1985; Patel, 1988), while issues of health often center on risky sexual behaviors (e.g. Baqi et al., 2006), making generalizations of their health status problematic. Investigations into the long-term health effects of castration have focused on three groups of men: the Skoptzy; the court eunuchs of the Chinese Empire; and those of the Ottoman Empire (Wilson and Roehrborn, 1999). The numbers among all three groups have dwindled significantly, and the last known eunuch of the Chinese imperial court died in 1996 (Seth, 1996).

Wilson and Roehrborn (1999) have summarized the most commonly documented long-term medical consequences of castration upon these three groups of men. The health effects include: enlargement of the pituitary, breast enlargement (gynecomastia), reduction and/or disappearance of the prostate, and skeletal changes. Of the latter, osteoporosis in the form of bone thinning in the skull and kyphosis of the spine, and the failure of epiphyseal closure were documented among Skoptzy and Chinese eunuchs. The effects were typically more pronounced in those eunuchs who had been castrated at a younger age, before development of secondary sexual characteristics. These physiological changes also appear in modern clinical studies of males with hypogonadism and androgen deprivation (Heller and Shipley, 1951; Wilson et al., 1980; Flaig and Glode, 2008).

Wu and Gu (1991) also studied the long-term effects of castration upon 26 surviving eunuchs of the Chinese Qing court. Seven became eunuchs between the ages of 10 and 14...
years, and 18 between 16 and 26 years, while one could not recall. At time of their examination in 1960, the men comprising this sample had been eunuchs for an average of 54 years. Characteristics they shared with descriptions of other castrated men included: beardlessness; enlargement of breasts in nine eunuchs out of 25; tall stature in 12 (where height > 170 cm); and five displayed unusually small prostates. The average height was 167.7 cm (range 152–179 cm), and five of the tallest 12 had been castrated before the age of 15 years.

Physical characteristics also ascribed to court eunuchs include increase in body weight and voice change to a more falsetto pitch. The former may be attributed to the reduction in physical activity and the ready availability of food as a palace servant. Clinical studies of patients with orchietomy show an average weight gain of 10% that is generally localized in the abdominal and hip region, which increased patient risk of diabetes and cardiovascular disease (Zitzmann and Nieschlag, 2001; Keating et al., 2006). Moreover, changes in the lungs and cardiovascular systems from hormonal changes decreased the ability for efficient oxygen uptake and blood flow throughout the body (Tsai, 1996), also likely resulting in decreased physical exertion. The retention of a boyish, high voice stems from low levels of testosterone during puberty, which prevents male-type laryngeal development (Jenkins, 1998). The dramatic decrease in sex steroids also leads to general loss of elasticity, with wrinkling of the skin, stiffening of joints, and decrease in muscle strength (Tsai, 1996). There is no evidence that castration significantly affects male lifespan (Wilson and Roehrborn, 1999).

Studies of human castration have many limitations, not the least of which is the relative rarity of modern cases and cultural taboos. The long history of institutionalized eunuchism in ancient China provides the potential to study the health consequences of castration from a biocultural standpoint. This paper describes the skeletal remains of two adult eunuchs from pre-modern China, documenting the skeletal and dental changes that may be associated with castration, as well as skeletal changes reflective of the imperial servant lifestyle.

**Materials and Methods**

In 2003 the skeletal remains of two adult males were excavated by a team led by Professor Chen Guang (then at the Peking Archaeological Institute). These burials were located in the cemetery at Wutasi, Beijing, People’s Republic of China. This cemetery had over 60 burials, with several tombs marked as interments of Ming Dynasty (1368–1644 AD) palace eunuchs based on the associated tomb inscriptions (Di and Cao, 2003). Among these eunuch burials, the two studied in this paper include one eunuch we designated Burial M1, while the second, given the designation of Burial M2, had a tomb inscription and documentation in his burial indicating the eunuch’s name was ‘Huang Zhong,’ a eunuch of the Ming period (C. Guang, personal communication). Unfortunately, there are no other publications on the analysis of the excavation that could help verify with certainty the eunuch status of all burials labeled as such, but it has been documented in other cases that tomb inscriptions indicated the eunuch status of those interred, as such people were at times accorded relatively high status and given elaborate burial treatments reflecting that power (Mai, 1977). Thus, based on archeological context, these individuals, whose tomb inscriptions labeled them as eunuchs, are indeed eunuchs, and the osteological evidence also suggests a life of labor and/or abnormalities in epiphysial closure that are associated with eunuchism. The remains were examined while they were held at the Research Center for Chinese Frontier Archaeology at Jilin University, Jilin Province.

Osteological analysis followed protocol outlined in *Standards for Data Collection of Human Skeletal Remains* (Buikstra and Ubelaker, 1994). Owing to limitations in time and available equipment, osteological examination by one author (J. Eng) were conducted within a day and consisted of macroscopic observation and photographic documentation, without aid of an osteometric board to measure long bone length. The lengths of long bones were later estimated based on these photographs (taken with a scale) to approximate maximum lengths in centimeters. To determine the accuracy of these measurements estimated from photographs as compared to measurements from an osteometric board, J. Eng conducted a pilot study with sample adult long bones (*n* = 11). The same camera was used, replicating the staging of the photographs (i.e. location of the scale by the bones, angle of focus, and camera distance), and the procedure was repeated three times. Maximum length measurements estimated from the photographs of these sample bones were then compared to similar measurements taken from an osteometric board. The average standard deviation was a 2.4 mm over-measurement based on photographs, which shows that this technique produces relatively little measurement error.

The remains of the two individuals were well preserved with fully intact skulls (Figure 2), although not all postcranial elements had been recovered. They were clearly discrete individuals, not only indicated by the fact that the excavators had packed them separately and by the different colorations of the remains, attributable to differences in soil conditions for each burial, but also suggested by the body size and chronological age differences between the two skeletons (discussed below). Observations were made for sex and age determinations, and pathological conditions and activity-related skeletal changes were also recorded.

**Case 1: Burial M1**

Burial M1 is that of a relatively complete skeleton, but has some postmortem damage and is missing the right humerus, radius, and ulna, hand and foot bones, as well as several vertebrae. Age-related changes to pelvic morphology suggest that this person was in his mid-30s at time of death. Other features support this age assessment, including the degree of cranial suture closure, tooth wear, and full epiphysial closure of all long bones. Sexually dimorphic features of the skull and pelvis are clearly male. On the basicranium, just anterior to the right occipital condyle, the bone is thin and extremely porous, which may be the result of localized postmortem damage, although adjacent bony elements are not affected (Figure 3).
The central maxillary incisors and right M\textsubscript{1} have lesions from linear enamel hypoplasia, with three arrest lesions on left I\textsubscript{1}, two on right I\textsubscript{1}, and one on right M\textsubscript{1}. Crown formation of these affected teeth occurs at about the same time, so the lesions likely reflect the same stress events. There is evidence of an alveolar abscess around right M\textsubscript{3}, antemortem tooth loss of left I\textsubscript{1}, and slight alveolar resorption around left M\textsubscript{1} and right M\textsubscript{1}. The left mandibular condyle displays slight proliferative growth on the superior portion, and is more bulbous than the right, suggesting slight temporomandibular joint disease on the left, although the condylar fossa exhibits no change.

Degenerative changes (pitting, marginal new bone proliferation, and/or eburnation) were observed in the following postcranial joints: the left shoulder, left elbow, left hip, and left knee, which has eburnation on the anterior portion of the lateral condyle (Figure 4). All of the five preserved vertebrae (one cervical, two thoracic, two lumbar) show moderate development of osteophytes on the margins of their bodies,
and both lumbar vertebrae exhibit a Schmorl’s node on the superior surface.

The left tibia has a healed fracture just distal to midshaft that resulted in a shortening of about 6 mm in length relative to the right tibia (Figure 5). Associated with this healed fracture are the remnants of slight bony buildup of the callus located on the medial aspect, as well as osteoperiostitis in the surrounding area, extending 11.9 cm.

**Case 2: Burial M2 (‘Huang Zhong’)**

This male, named ‘Huang Zhong,’ is also a relatively complete skeleton, missing only the smaller elements (hand and some foot bones), most vertebrae, clavicles, and ribs. Age estimation included assessment of multiple indicators of development. The epiphyses of several long bones were only partially fused or completely unfused, in the case of his distal ulnae. This pattern of fusion would normally indicate that he died in his mid-to-late teens (Table 1). However, castration is known to delay the rate of epiphysis closure in individuals castrated before maturity (Silberberg and Silberberg, 1971), while tooth formation is regulated more strongly by non-sex steroids such as growth hormone (Zhang et al., 1992). In his case, the third molars had fully erupted and have slight wear, and furthermore, the auricular surface retains slight (youthful) transverse ridges. Thus, based on the dental (and pelvic auricular) information ‘Huang Zhong’ (Burial M2) was likely a young adult, about 20–24 years old at death.

Compared to Burial M1, who was in his 30s at time of death, Burial M2 has much less overall wear on teeth, consistent with a younger adult age determination. Several
sexually dimorphic features of the cranium (supraorbital margin, glabella, mastoid process, and nuchal area) are ambiguous, but the mandible, subpubic region, and greater sciatic notch have a male morphology. The pelvic morphology is relatively diagnostic considering his young age (e.g. Walker, 2005).

There are two linear enamel hypoplasia lesions present on the lower right canine. The lower left central and lateral incisors (Figure 6) have 'fused' crowns and roots (also known as ‘double teeth’ or ‘twinning’), a result of primary developmental abnormalities of the teeth whereby two separate tooth buds united at some time during their development (Aguilo et al., 1999).

The postcranial elements do not have any marked pathological conditions. There is no skeletal indication as to cause of death. As seen in Table 2, the length of Burial M2’s long bones and associated stature estimates are substantially longer than those of Burial M1. Using femur length to calculate stature based on Trotter and Gleser (1958), Burial M1 has a stature of approximately 179 cm, while Burial M2 has a stature of approximately 188 cm. In addition to his tall stature, the bones from Burial M2 were relatively gracile.

**Long bone dimensions**

To determine whether body size and long bone lengths of the two burials were affected by the documented hormonal effects of castration, these data were compared to measurements taken from other archeological skeletal samples collected by the primary author (J. Eng). These other samples derive from different time periods and varied sites along China’s northern region and from central China in Henan province (Eng, 2007; Walker and Eng, 2007). Mean measurements of the humerus, femur, and tibia from these samples were compared to the corresponding eunuch long bone measurement where available (the ulna and radius of Burial M2 were not included owing to lack of distal epiphyseal fusion) (Table 3). The measures of the eunuch long bones were then transformed to Z-scores to compare with each region (Table 4).

In most instances, the long bones of both eunuchs were longer than the comparative groups (Z-score > 2.00). Both eunuchs have longer femoral lengths than the comparative regions (except for Burial M1’s comparison to the northwestern sample). Of note are the unusually high Z-scores of Burial M2, the eunuch who may have been castrated in his youth. Burial M2 has Z-scores of 5.00 SD or higher compared to all groups except the northwestern sample, where the Z-score was still above 2.00. On the other hand, the data on humerofemoral and crural limb proportions (respectively, humerus: femur and tibia: femur) of these eunuchs fall within the range of proportions found in the comparative samples (Table 5).

**Discussion**

The earliest records of eunuchs in China consist of pictographs on the oracle bones of the Bronze Age Shang Dynasty.
Eunuchs were known generally as mestic supply of eunuchs from among the impoverished castrati as tribute to China (Tsai, 1996). There was also a domestic source of eunuchs that often suffered famine, the only recourse from starvation was self-castration or castration of a son, since imperial eunuchs were assured a life of relative comfort with regular stipend, room and board within palace walls. While self-castration was repeatedly prohibited, when dynasties such as the Ming sank into financial decay, desperate males, often adults, took this course of action and clamored for work at the palace (Anderson, 1990).

Eunuchs served the emperor, his queens and concubines, and other members of the royal family. During the Ming Dynasty there were 24 official agencies charged with various aspects of palace maintenance, including care of furniture, gardens, kitchens, ritual, clothes, entertainment, and armory, so that their presence permeated all aspects of imperial life (Mitamura, 1970). Beginning in the Ming Dynasty, some were educated and became imperial secretaries, furthering eunuch infiltration into the inner circles of the court. Ancient Chinese historians describe them as venal, greedy sycophants, perhaps in part because of jealousy over eunuchs’ intimate access and influence over the emperor and imperial policy (Yi, 1951; Tsai, 1996). By the end of the Ming Dynasty, the number of eunuchs nationwide swelled to an estimated 100,000, and they were fixtures of nearly every governmental agency. The cases of eunuchs who wielded extreme power were relatively rare, and most palace eunuchs led routine lives that were restricted and dull (Tsai, 1996). In the present study, the burial treatment and lack of elaborate grave goods associated with the two burials analyzed here suggest they were ordinary eunuchs, though ‘Huang Zhong’ may have been a eunuch of some note as his name was inscribed for his tomb.

### Interpretation of Ming sample

**Long bone lengths and height**

The skeletal effects of castration are more clearly evident in the long-limbed Burial M2, the young adult ‘Huang Zhong.’ As noted previously, there is likely to be some slight over-measurement (approximately 2.4 mm) using the photographs to estimate long bone length, but even accounting for that difference, the limbs are still relatively long. When observed the humerofemoral and crural limb proportions of these individuals to comparative ancient Asian samples, there is no marked difference, suggesting there was no unusual disproportion in limb development in these eunuchs. On the other hand, the maximum lengths of Burial M2’s humerus, femur, and tibia are significantly greater than that of the comparative samples. Taken together, the longer limb dimensions of Burial M2 and the retarded rate of epiphyseal...
closure relative to tooth development in this individual sug-
ggest that Burial M2 was castrated before puberty. However,
when compared to the average height (168 cm) of surviving
20th-century Chinese eunuchs in Wu and Gu’s (1991) study,
both Burial M1 and Burial M2 are taller than Wu and Gu’s
criterion for tall stature (height > 170 cm). Thus, with re-
spect to the marked differences between the long bone
lengths of these two eunuchs, this may be a factor of: (1) ge-
etic heterogeneity and height potential related to their ori-
gins from different populations; or (2) the different ages at
which they were each castrated, with the longer-limbed
Burial M2 castrated in pre-puberty before epiphysial closure
of long bones; or (3) individual differences in frailty be-
tween them including influences from childhood health and
nutrition. These factors may not be mutually exclusive.

Osteoporosis

Although circumstances prevented weighing and taking
radiographs of the skeletons, bones did not feel markedly
lighter than ‘normal’ ancient bones of East and Central
Asian populations that the authors have observed. Burial M1
has some signs suggestive of osteoporosis, though these in-
dicators may be due to his more advanced age at death. His
skull has slight porosity in the basioccipital area, and al-
dicators may be due to his more advanced age at death. His
skull has slight porosity in the basioccipital area, and al-
though the localization of the visible porosity does not fully
support osteoporosis, there may have been further thinning
not immediately visible throughout the skull. Burial M1 had
few vertebrae to study for possible kyphosis, but there are
degenerative changes in all vertebrae present, which may
also be due to age-related changes or lifestyle. The healed
fracture on the left tibia may also be (very slight) evidence
for osteoporosis, though accidental injury is a much more
likely cause.

Oral health

The presence of enamel hypoplasia on both eunuchs indica-
stes stress during childhood, which may be expected as
most eunuchs of this period were either castrated to escape
poverty, to serve as tribute, or as prisoners of war. Neither
individual has dental caries, but Burial M1 has an avelor
abscess, antemortem loss of a tooth, and resorption of the
alveolar bone—all indicative of poor dental health. The
fused left incisors in Burial M2’s mandible marks a relative-
ly rare find, at least among people of European ancestry (less
than 1%, e.g. Jarvinen et al., 1980; Barac-Furtinovic and
Skrinjaric, 1991), although it was found in slightly higher
frequencies (~4%) in one modern Japanese sample (Yonezu
et al., 1997). When present, it is more prevalent in males and
in the anterior teeth, usually of the mandible (Razak and
Nik-Hussein, 1986; Duncan and Helpin, 1987; Yonezu et
al., 1997). Although no environmental factors have been
linked to the development of fused teeth, it is more frequent
among siblings (Razak and Nik-Hussein, 1986). Clinical
problems associated with fused teeth include increased prev-
ance of caries, supernumerary teeth, impaction of succes-
sors, and aplasia (Brook and Winter, 1970; Ravn, 1971), but
such was not the case for Burial M2, whose teeth appeared
unaffected.

Degenerative joint disease

Burial M1 has signs of degenerative changes at several
major joints, while Burial M2 has none. Burial M1 was older
than Burial M2 at age of death, which may account for the
higher observation of degenerative lesions. It should also be
noted that castrated boys were often more favored by the
court ladies and treated like young girls, and thus had fewer
manual labor activities than adult eunuchs (Mitamura,
1970). Thus, if Burial M2 had been castrated in youth, and
died soon afterwards in his early adulthood, this may explain
why it appears he led a relatively less active lifestyle than
Burial M1.

Conclusion

The burials of two Ming palace eunuchs provide new in-
sight into the skeletal changes associated with castration, as
well as clues to eunuch life in the Chinese imperial court.
These eunuchs may have been castrated at different periods
of growth and development, as suggested by the long limbs
and partially fused epiphyses of the young adult ‘Huang
Zhong’ (Burial M2). Arthritic changes and a healed fracture
in Burial M1 suggests he led a harsher life than experienced
by Burial M2, who may have had a more pampered life fa-
vored by court ladies, if he was castrated in youth. Dental
health suggests both experienced childhood stress, possibly
owing to poverty or wartime, which may have precipitated
their entry into the financially secure eunuch service. While
this report has offered some new information on the lives of
two eunuchs from the Ming Dynasty, it is by no means a
general life characterization of the health of eunuchs. Future
studies of other eunuch burials will shed further light into
this once secretive, yet fascinating cultural phenomenon.

Acknowledgments

This research was funded by support given to J. Eng by the
following granting agencies during an early visit to
China (in 2003) and during the collection of her dissertation
data: Fulbright-Hays Doctoral Research Abroad Program
(Award No. p022a040064); Pacific Rim Research Grant,
University of California (Project Reference No. 04TPRRP
08-0011); Humanities and Social Sciences Research Grant,
UCSB; and the National Science Foundation Graduate Re-
search Fellowship. The authors would like to extend deepest
thanks to Professor Chen Guang for permission to analyze
the material. J. Eng would like to thank her dissertation ad-
visor, Dr Phillip Walker, and several members of the Walker
Lab who read and commented on early drafts.

References

double teeth. A retrospective clinical study of their morpho-
logical characteristics and associated anomalies. International
Anderson M.M. (1990) Hidden Power: The Palace Eunuch of
Imperial China. Prometheus Books, Buffalo.
(2006) Seroprevalence of HIV, HBV and syphilis and associ-
ated risk behaviours in male transvestites (hijras) in Karachi,