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Foot binding in a Ming dynasty cemetery near Xi'an, China

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ABSTRACT

This paper describes the morphology of the feet of a population of elite women from the Ming dynasty (1368–1644 CE) in Shaanxi province. This is a social stratum, time, and place in which foot binding was practiced. Among a group of 31 skeletons exhumed from the cemetery, eight were women with well-preserved foot bones. Macroscopic examination revealed that half these women (4/8) had clearly altered foot bones: the metatarsal bones, and the few observable phalanges, were gracile and small, while the tarsal bones exhibited a slight reduction in size but no dramatic change in morphology. The other half of the women (4/8) had apparently unmodified metatarsal bones. T-tests comparing linear measurements of the foot bones between the two groups revealed that metatarsal bones were the most affected by binding, and among the tarsal bones, the talar trochlea and calcaneal dimensions were most impacted. This small group of skeletons reveals that some elite women in Shaanxi apparently still did not practice foot binding in the late Ming dynasty, or practiced a much milder form of foot binding, and that there was considerable variation even among those who did practice it.

1. Introduction

Chinese foot binding is a form of body modification, well known today around the world, and widely discussed as a historical form of gendered violence and control of women's bodies (Stone, 2012). The origins of foot binding are uncertain, and our understanding of them relies on literary sources and legend, but it is generally accepted that the practice existed by the Northern Song dynasty at the latest (960–1127 CE) (Drucker, 2007; Levy, 1992). Foot binding began with the upper classes, eventually spreading through all strata of society and across all of China; it was probably widely practiced by the time of the Ming dynasty (1368–1644 CE), and was certainly widespread by the time of the Qing dynasty (1644–1911 CE) (Levy, 1992; Wang, 2000). By the Republican period (1912–1949 CE), supporters of modernization pushed to have foot binding banned, and began a campaign to change popular opinion about the practice. Binding steeply declined, and was eradicated completely after the Chinese Communist Party took power in 1949 (Gamble, 1943; Gerry, 1996; Ko, 2005; Levy, 1992; Wang, 2000). After nearly 1000 years and countless lives affected, foot binding is now almost beyond the reach of living memory.

Over this enormous stretch of time and space, the prevalence and method of foot binding changed to reflect fashions and values, including shifting attitudes towards women's roles in society, the nature of chastity, the desirability or danger of hedonism, etc. (Ko, 2005; Wang, 2000). By the Ming dynasty, bound feet had come to represent not only the ideal of womanhood and a form of obligatory bodily adornment among certain classes, but the Chinese empire and Han ethnic identity itself. Within this widespread practice, vast differences existed among local customs, such that a single comprehensive narrative of foot binding is nearly impossible to produce (Ko, 1997).

Beyond historical texts and objects such as shoes made for bound feet, the skeletal remains of women with bound feet are a critical source of data on the history, impact, and meaning of this practice in specific times and places. Skeletal remains pick up where archaeological and historical data leave off, giving us a window into the embodied experiences of women whose feet were bound, and revealing how their social lives were inscribed in their skeletons (Agarwal, 2016; Stone, 2012). To that end, this paper presents the skeletal evidence for foot binding from a Ming Dynasty cemetery at the site of Yangguanzhai, near the modern city of Xi'an, in central China's Shaanxi province.

2. Chinese foot binding

The exact form of foot binding was not uniform across time and space. In the early centuries of its practice, the intent of binding was to make the foot narrower and pointed; only later did it take on the arched

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shape seen in the latter days of the practice (Wang, 2000). The ideal size was said to be three "inches" (*cun*, a Chinese unit of measure), though the size of a standard inch also changed through time. In general terms, the shrinking and reshaping of the foot was accomplished by beginning to bind a girl's foot in childhood.

In historically documented cases, binding was usually begun between the ages of 5 and 7. At one year after birth, the female foot is approximately half its adult size, but it does not reach mature size until age 14. Furthermore, epiphyseal fusion in foot bones does not commence until after 10 years of age in females (the calcaneus begins fusion at 10–12 years, the heads of the second through fifth metatarsals at 11–13 years, etc.) (Scheuer and Black, 2004). Therefore, binding the feet in childhood, particularly before the age of 10, curtailed a significant amount of growth and impacted the morphology of the foot bones.

The binding was performed either by a female relative or by a professional foot binder. In the later form of the practice, the second through fifth toes were folded under the sole of the foot, and the front of the foot brought as close to the heel as possible, to increase the height of the arch and shorten the length of the foot. The binding accomplished these changes by inhibiting the growth of the bones, altering the ligaments and tendons, and changing the angles of joints, and not by breaking the bones, as is sometimes claimed (Drucker, 2007).

Long bandages were secured around the foot and then the entire foot was covered with a sock and a shoe, often elaborately embroidered. The bandages had to be frequently changed and the foot washed and rebound for the rest of the woman's life (Wang, 2000). The alterations to the foot also profoundly altered women's gaits and made walking difficult and painful. Despite this, when the practice reached its peak, even peasant and servant women, who were required to do agricultural and household labor, had their feet bound, though only in regions where dry-field rather than wet paddy agriculture was practiced, where feet could be left perpetually covered (Blake, 2008; Drucker, 2007; Wang, 2000). No reliable data are available for the exact rate of foot binding, though it is known to have varied by locale and social status, and reached the height of its popularity in the nineteenth century (Qin et al., 2015; Wang, 2000). The practice was almost exclusively limited to the Han people, the ethnic majority of China (Blake, 2008; Ko, 1997; Levy, 1992; Wang, 2000).

Historical sources, while containing abundant references to foot binding, are not adequate for reconstructing the variations in the practice through time and space. Many treatises, poems, novels, and essays mention the practice, usually praising the beauty of footbound women (Drucker, 2007; Peng, 2013). Most descriptions of the practice, however, rely on metaphor, innuendo, and poetic imagery (feet are described as "slender," "pointed," "bowed," shaped like lotuses or water chestnuts, etc.) (Ko, 2005; Levy, 1992). Explicit descriptions of foot binding became available beginning in the 19th century, when anti-foot binding crusaders, including both Chinese people and foreigners such as missionaries, set about photographing and documenting the phenomenon. Titillating souvenirs such as footbound women's shoes, photographs of prostitutes exposing their bound feet, and even, disturbingly, preserved feet themselves were brought back to the West by sailors and other travelers and became part of museum collections (Reznikov et al., 2017). In the 20th century, first-hand accounts by footbound women themselves were also published (Levy, 1992).

Women living with bound feet today number in the hundreds, virtually all over the age of 80 and many over the age of 90. Podiatrists, radiologists, and public health experts have taken on the task of documenting the morphological, biomechanical, and health consequences of foot binding in living footbound women, sometimes with the hope of improving their medical care. X-ray studies (Guo, 2011; Howard and Pillinger, 2010; Richardson, 2009), foot print analysis (Reischl et al., 2008), and gait analysis (Gu et al., 2015; Zhang et al., 2015) have all been applied to these now-elderly women. The studies have found some common characteristics of extant bound feet:

- the calcaneus tends to have a more vertical orientation than in unbound feet (Howard and Pillinger, 2010; Reznikov et al., 2017; Richardson, 2009);
- all or most foot bones are reduced in size, some with dramatically altered morphology, especially the metatarsal bones and phalanges of rays 2 through 5 (Gu et al., 2015; Guo, 2011; Howard and Pillinger, 2010);
- arthropathies throughout the foot and ankle, and changes in the angles of articulations, are common (Guo, 2011; Ma et al., 2013);
- the pattern of weight bearing in the feet is shifted, with the heel bearing more weight and the toes no longer functioning in their normal capacity during standing or walking (Gu et al., 2015; Qin et al., 2015; Reischl et al., 2008; Reznikov et al., 2017);
- the ankle has less motion in the sagittal plane (Gu et al., 2015; Zhang et al., 2015);
- bone density is reduced in the foot, and some studies have found that bone density is reduced in other weight bearing parts of the skeleton as well, while other studies have not found this to be the case; the discrepancy is possibly due to lifelong differences in physical activity among groups of footbound women (Cummings et al., 1997; Guo, 2011; Howard and Pillinger, 2010; Pan et al., 2013; Qin et al., 2015; Richardson, 2009);
- development of anisotropic microarchitecture of trabecular bone in the calcaneus is somewhat disrupted (Reznikov et al., 2017);
- and elderly women with bound feet experience falls that result in fractures more often than women without bound feet do, though working class rural women seem to have been somewhat protected from this effect by remaining active all their lives (Cummings et al., 1997; Qin et al., 2015; Richardson, 2009).

These studies have been performed on the last generation of women to have their feet bound, during the Republican period (1912–1949). To understand the method of foot binding and the experiences of footbound women from earlier periods, historical accounts are valuable, but archaeological evidence is also essential, as it contributes data on variations in technique, the antiquity of the process, and the individual experiences of footbound women. Unfortunately, published archaeological data on foot binding are scant. Some shoes for bound feet have been discovered in mortuary contexts (Stone, 2012), and detailed studies of such shoes have also been undertaken (Ko, 2001; Li, 2012). These studies have confirmed that an earlier form of foot binding was intended to make the foot smaller, while the foot remained straight. Shoes from the Southern Song dynasty (1127–1279) were much longer than those of later eras, and the desired shape was pointed but not arched (Gao, 1995; Wang, 2000; Zhu et al., 2017). A mummy of this era—a rare published example of human remains with bound feet—was buried with her shoes and foot wrappings, and had feet measuring 18 cm long (Li et al., 1990). Only in the Ming Dynasty did the extreme version of the "three-inch golden lotus" begin to be practiced, while the earlier style likely persisted for some time alongside it.

Studying the skeletal remains of footbound women can reveal not only the evolution of foot binding across time and space, which reflected changing aesthetics and moral values, but also the prevalence of the practice, and the impact binding had on the rest of women's bodies. Currently, only a small number of bioarchaeological studies have presented evidence for foot binding, all from the Ming and Qing dynasties in north China, including the modern-day provinces of Shanxi (Zhu et al., 2017), Shandong (Zhao et al., 2017), and Henan (Lee, 2012). This paper presents data from the remains of women from Ming dynasty Shaanxi province.

3. Materials and methods

The site of Yangguanzhai is a large middle Neolithic village of the Miaodigou and Banpo IV periods (4000–3000 BCE) immediately to the north of the modern city of Xi'an (Fig. 1). It has been under excavation