Vignette

**Trephination in Anatolia: Case Report and Review**

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**Abstract**

Trephinations have been performed throughout Anatolia starting from the Neolithic Age. This study contributes to the international literature reviewing trephination cases from different regions of Anatolia previously reported in Turkish publications, and also presents a new trephination case found in Assos (Canakkale, Western Anatolia). The trephination case presented belongs to a middle-aged female and is located on the right side of the frontal bone, with a largest diameter of 27 mm. The borders of the opening showed evidence of complete healing, indicating survival.

**Keywords:** Skull; trepanation; frontal bone

**INTRODUCTION**

The oldest known and most fascinating practice in the history of medicine is trepanation or trephination. Although these two terms are interchangeable for all intents and purposes and imply a depression or perforation in the calvarium, originally trepanation comes from the Greek word 'trypanon' meaning a ‘borer’ and refers to making a surgical opening in a skull by any means or instrument, whereas ‘trephination' refers to a more recent method of opening a skull by removal of a disk of bone(11,17).

Trephinations were performed as a therapeutic method on a living subject (real trephination), on a corpse for obtaining a bony fragment of the skull which had magical and ceremonial significance in preventing illness, or as a surgical trephination on the calvaria performed on a living subject without total diploe extraction and without touching the inner table of the skull (symbolic trephination)(13). Real trephinations were
done to cure cerebral diseases such as repair of cranial trauma, particularly depressed fractures. In epilepsy, infantile convulsions, headache and various cerebral diseases believed to be caused by confined demons, trephination was performed to let out the evil spirit, and in paralysis, cerebral palsy, severe depression, or mental retardation to prepare a hole for allowing the spirit to return to cure the disease\(^{(8,24)}\).

Different forms of trephination techniques have been used for trephination including scraping, sawing, boring, drilling and connecting twist drill holes. Abrasive or sharp stones or incisive instruments were used for this procedure. Herbal preparations of datura, yuca or coca were used for anesthesia. The ancient surgeon probably held the head fixed with his left arm or between his knees and then operated with his right hand, which explains the high frequency of parietal cranioectomies\(^{(3)}\). Certainly the brain tissue itself was never operated on\(^{(19)}\).

For a period in the 19th century, authors suggested the procedure was performed only postmortem and in 1867 Paul Broca first suggested that the procedure was performed also on living subjects. He claimed that in some cases the individual survived, based on signs of bone repair, which was a shock to the scientific world at those times. According to anthropologists who have studied trephined skulls, patient survival rate varies greatly from 23.4% to 80%\(^{(6,18,25)}\). Although skulls from the Mesolithic (Middle Stone Age) cultural period have also been found to have round depressions suggestive of rudimentary trephination efforts, which would date the earliest examples at 10 000 BC, mainly Neolithic (New Stone Age) trephinated skulls have been found throughout Western Europe and Asia, indicating that such primitive surgery was widely used by 3000 to 2000 BC\(^{(19)}\).

Trephinations have been performed throughout the world among a wide range of cultures from Northern and Southern America\(^{(10,12,18,22,23)}\), to Western Europe, Asia\(^{(20)}\), North and East Africa\(^{(17)}\), Australia\(^{(25)}\), Balkans\(^{(9)}\), and Middle East\(^{(2)}\).

In Africa, trephination is still practiced today for the relief of headache and the removal of fracture line after a head injury and they avoid opening the dura, and only rarely for a magic ceremony or for the release of evil spirits\(^{(17)}\).

Much of the writing concerning ancient cranial trephination has understandably come from Europe and South America. The first trephinated skull reported in Anatolia was found in 1954 in Kültepe and is from the Bronze Age, which followed by other skulls from archaeological studies in different regions. These trephinations were presented in national publications, but not much was contributed to international literature. This study presents a case of trephinated skull from 600 B.C., also presenting other skulls from different excavation sites belonging to the Antique age Anatolia.

**MATERIAL AND METHODS**

The frontal bone piece was discovered in 2002 by the author Ercan Nalbantoglu during a survey of Assos skeletal remains. It was originally found in a tomb in 1991 in the necropolis of Assos (Behramkale) excavations in Canakkale, Western Anatolia. Sex and age were determined on the basis of common anthropological methods. The size of the trephination was made using a millimeter graph. Postoperative survival evidenced by the presence of bone growth was evaluated.

**RESULTS**

The trephination belongs to an adult female and is located at the frontal region on the right side. The defect resembles a half-triangle in shape with smooth sloping edges. There is complete lack of evidence to support a violent origin for this frontal bone, and temporal and occipital bones of the skull that were found together. The largest diameter of the trephination is 27
mm. The borders of the trephination indicate both drilling and scraping techniques were used. It is assumed that the individual survived after the operation based on the borders of the opening being beveled and cicatrized, indicating complete healing (Figs. 1, 2).

**Fig 1:** Sketch of the localization of the trephination.

**Fig 2:** Trephination case from Assos. Note the borders of the opening are beveled and cicatrized, indicating healing.
DISCUSSION

Trephination cases from different regions of Anatolia, starting from the Neolithic Age to Byzantine period were reported in the last 50 years. The first trephination case reported from Anatolia was by Senyurek (1958) from Kultepe (Kayseri, Central Anatolia) found in 1954 during Kultepe excavations organized by Professor Tahsin Ozguc on an adult male skull, approximately 50 years old. The trephination belonged to Bronze Age, 2000 BC\(^21\). The trephination was on the occipital bone and the smooth bone surfaces suggested that this individual survived the trauma.

Ozbek reported cases of trephination from three different regions. His first report was the most recent trephination case from Anatolia, belonging the Byzantine period was found in 1985 in a late Byzantine necropolis from Iznik (Bursa, Western Anatolia)\(^{21}\). The trephination was observed on an adult male as a big hole on bregma with a 75X50 mm diameter, and traces of a perforating wound on the bone were observed on the parietal bone, which was claimed to be the possible reason for the trephination. This individual survived after the operation\(^{14}\). He reported another case of trephination found in 1978, from Neolithic Age in Cayonu (Diyarbakir, Southeastern Anatolia)\(^{16}\). The trephination was observed on an adult male in the parietal bone, 8-10 mm in diameter. Another case reported by Ozbek (1992) was from Aceramic Neolithic Period in Asikli (Aksaray, Central Anatolia)\(^{15}\). The trephination was 11 mm in diameter, on the occipital region of a young woman. Backofen (1985) and Cireli et al. (1993) reported three trephination cases from Ikiztepe (Samsun, Northern Anatolia) found by paleoanthropologist Ercan Nalbantoglu in the excavations headed by Professor Bilgi\(^{14}\). One of the trephonations was on the lambdoid suture and the other two on the vertex of the skull. All three trephonations were done by scraping. These belonged to Bronze Age and showed signs of bone repair Gulec (1988) reported two cases of trephination from 900-700 B.C., observed in Dilkaya (Van, Eastern Anatolia)\(^{14}\). The first case belonged to a young woman, located just behind the bregma point, ellipsoid in shape and 50X27.5 mm in size. Thirteen small drill holes were found around this trephination site. The individual survived after the operation. The second case was observed on the parietal bone, round in shape and 19 mm in diameter, with 5 small drill holes around.

Deniz and Sentuna (1989) reported a trephination case from Neolithic Age in Kurucay Hoyuk (Burdur, Central Anatolia) on the right parietal bone of an adult, as three trephinations, each of them 5 mm in diameter\(^{5}\).

The literature presented above suggests this form of cranial surgery was performed in different regions of Anatolia. This case report contributes to the literature another site of trephination from Western Anatolia (Assos, Canakkale) and presents to the international literature a review of trephonations found in different archeological studies in Anatolia.

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