AN UNUSUAL ETRUSCAN GOLD DENTAL APPLIANCE FROM POGGIO GAIELLA, ITALY: FOURTH IN A SERIES

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ABSTRACT Among the 20 known ancient dental prostheses from Etruscan archaeological contexts is an unusual example that was recovered from Poggio Gaiella, Italy. The form and construction technique used in making the Poggio Gaiella piece suggests that it was used as a restraining band to hold loose teeth in place within a maxilla. The possibility that these appliances provide evidence for early cases of leprosy rather than tooth evulsion is discussed.

INTRODUCTION

Johnstone's (1932a,b) observation that the Etruscans were the first to construct true dental bridges has been supported by all subsequent research. Various examples suggest that these appliances were first made over 2,600 years ago by a few talented individuals who may have carried their craft to unusual heights. These achievements were not continued after the decline of ancient Rome, being re-invented and elaborated upon only by modern practitioners. While most of the ancient appliances appear to have been cosmetic, some may have had therapeutic value as well. A significant discovery is that these Etruscan appliances were worn only by females (Becker Ms. A), suggesting that cosmetics and vanity were important dental concerns.

The history of the origin of Etruscan dental appliances (Becker, 1992) has been outlined in the first three parts of this series (Becker, 1994b,c, 1995). The extensive literature relating to ancient dental prostheses invariably focuses on the actual examples found in the southern third of ancient Etruria and in areas, generally nearby, in which these Etruscans were to be found. These data enable us to conclude that these appliances only were worn by South Etruscans, who inhabited one of the three zones of the Etruscan realm that appears to have had its own cultural integrity. Attempts to discuss construction techniques and possible applications of these appliances are infrequent, and often entirely speculative.

Precise archaeological data relating to any of the known prostheses is surprisingly limited (Becker, in press). The Valsiarosa appliance (Becker, 1994a) is the only example of a dental appliance for which a specific tomb context has been published (Cozza and Pasqui, 1981; Waarsenburg, 1990; Becker 1994a, Ms. B). Some archaeological contexts from which dental appliances were recovered now are being inferred through modern studies of the excavation records and artifact assemblages that have long been stored in museum basements (Waarsenburg, 1994; Becker 1994d). These gaps in the archaeological record may be, to a limited extent, compensated for only by detailed studies of each of the appliances. An outstanding descriptive example is Clawson's (1934) contribution for Eastern Mediterranean wire appliances of a later date. Careful studies of the dental and skeletal materials found in association with these prostheses became a major focus of a recent program to record the entire corpus of these ancient appliances and the information related to them (Becker, Ms. A).

FUNCTIONS

The Poggio Gaiella band (Fig. 1) is one of the few examples that may have served to stabilize loose teeth. Most probably the Etruscan examples, like the later wire appliances known from theEastern Mediterranean, served to prevent or retard the loss of teeth loosened by periodontal disease or by a blow. Simple gold bands were used by the Etruscans in constructing these functional appliances, but decorative aspects of these Etruscan types cannot be ignored.

The simplicity of this type of prosthesis need not reflect chronological aspects of ancient dentistry, although this particular appliance is one of the more sophisticated examples of this functional category of retention bands. The fourth century date suggested for this appliance (Menconi and Fornaciari, 1985), if accurate, indicates that this piece was made during the first half of the approximately six centuries during which gold appliances are known to have been made by the Etruscans.

THE POGGIO GAIELLA APPLIANCE

The Poggio Gaiella appliance is presently curated in the Museo Archeologico Etrusco, Florence (Inv. no. 11782). It is a single, complex band now broken into two pieces. It originated in Poggio Gaiella in Citta della Pieve, which is 7 km south of Chiusi and 43 km southwest of Perugia.

The appliance was originally in the maxilla, and surrounded eight teeth from the left first premolar to the right first premolar. This appliance is not original to the mandible in which it is now located (Becker Ms. B). This appliance now is located around the left first premolar to the right second premolar (nine tooth spaces) of a mandible from which the left lateral incisor was lost in restoring the jaw (Fig. 1).

According to Menconi and Fornaciari (1985), the appliance dates to the fourth century BC. The original wearer of the appliance was female (derived from the size of the appliance, not the display skull)(Becker Ms. B). Previously published references are: Dunn (1894:4, Fig.), Platschick (1904:239, Fig. 2 from "Giojella"), Frassetto (1906:156), Cassoti (1927:627, copies only; 1947:671-2; 1957:105, Fig. 5), Ghinst (1930:407, after Dunn 1894), Bobbio (1958:Fig. 14, after Cassoti 1957), Hoffmann- Axthelm (1985:78, Fig. 65, not in 1981 edition), Penso (1984:possibly shown in Figs. 143-145), Menconi and Fornaciari (1985:94), Capasso (1986:52-55, with 3 Figs.), Emptoz (1987:557, 558, Fig. 20, no. XXIV), Corruccini and Pacciani (1989:61-2, Figs.1,2), Laviosa, Capasso and Baggieri (1993:131, Figs. V4, V5; these two color plates from the Soprintendenza Archeologica della Toscana in Firenze are the best now available), Becker (1995:Fig. 2), and Bliquez (1996:2646-2648, 2652-2653; Figs. 5-11).

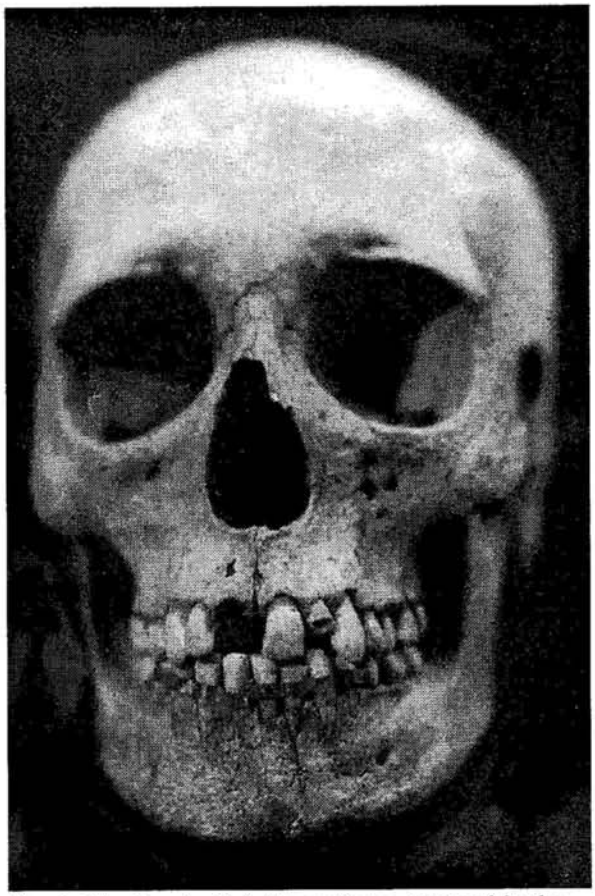

Fig. 1. The Poggio Gaiella appliance mounted in the mandible of a skull, now at the Museo Nazionale di Archeologia in Florence, Italy.

HISTORY OF THE POGGIO GAIELLA APPLIANCE

The commonly cited location for the tomb that yielded this prosthesis is Poggio Gaiella, a hill in Cittá della Pieve, near Chiusi. The earliest known account of the Poggio Gaiella appliance, written by its owner (Dunn 1894:4), notes that *"A Firenze pure, in possesso di chi scrive, vi è un cranio etrusco portate sulle mascella inferiore un nastro d'oro, che collega tutti gli incisivi, i canini ed i bicuspidati."* [In Florence, in the writer's possession, one sees an Etruscan skull, in the mandible of which is a gold ribbon that binds all the incisors, canines, and premolars]. Platschick (1904) says that Dunn's skull and mandible were found *"a Giojella, presso Chiusi"* [at Gaiella, near Chiusi], but does not indicate that the appliance was found with it.

Dunn, at some time after 1894, donated this skull to the National Archaeological Museum in Florence (Corruccini and Pacciani 1989:61), as indicated by a catalogue card. Pacciani (oral communication March 1994) says that the card reads "dono di Dunn." I have not verified this information, and the exact date of this transfer remains unknown. Although Casotti (1927:627) states that the skull was owned by Dunn (presumably about 1927), Casotti simply may have been copying Platschick's (1904) text. The Poggio Gaiella appliance and associated skull were in Florence by 1957, where Casotti (1957:105, Fig. 5) saw them in Sala XLIII of the Archaeological Museum. Therefore, we remain uncertain as to when this skull and/or the appliance were transferred to the Museum.

Capasso (1986) provides illustrations which indicate that the Poggio Gaiella example has been in two pieces for some time. Also showing that this band is in two pieces is a reverse print of the view shown by

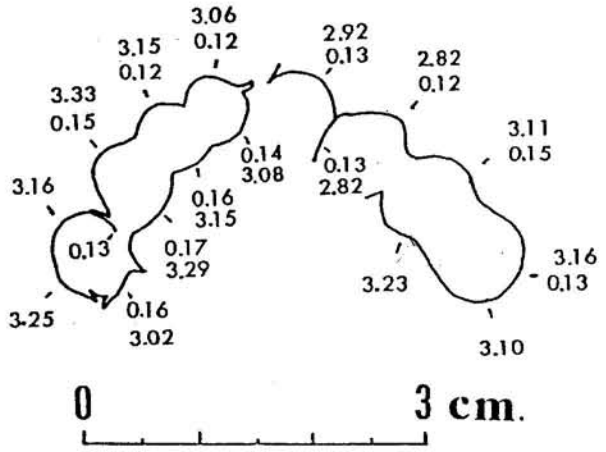

Fig. 2. Precise drawing of the Poggio Gaiella appliance from above, as the two pieces were seen by the author in the display mandible. The paired measurements are given in mm, and include the thickness of the gold bands (placed near the appliance), as well as the breadth (or height) of the band at the same point.

Corruccini and Pacciani (1989:Fig. 2), and possibly a reversed print of this mandible in Capasso's (1986:53) figure. Note should be made that Capasso's illustration of the Poggio Gaiella appliance (Capasso 1986:54) derives from the same negative as that used by Corruccini and Pacciani (1989:Fig. 2). However, one of the two is printed in reverse. Further note should be made of the drawings used by Capasso and Di Tota (1993:Figs. 2, 3), which are exactly those used by Capasso (1986:55) in his publication except that one is the reverse of the other. These and other problems are reviewed by Bliquez (1996).

The Poggio Gaiella appliance, now in two pieces, clearly was not actually original to the skull and jaw with which it now is found. Discussion of the skulls associated respectively with the Poggio Gaiella and the Valsiarosa appliances will be the subject of a future report (Becker Ms. B). In January of 1994 the Poggio Gaiella and Valsiarosa appliances were on display at an exhibition in Rome that had been developed by Prof. Luigi Capasso of the Ministerio di Bene Culturale (Capasso 1993). The exhibition, entitled "Storia della Chirugia Italiana", was then at San Michele in Trastevere, Rome, where Prof. Capasso kindly arranged for me to make a provisional review of this appliance. Subsequently the Poggio Gaiella appliance and the skull were returned to the storage area of the Museo Archeologico Etrusco in Firenze, where I made this study in March of 1994.

From my examination of the configuration and sizes of the extremely distorted pieces of the Poggio Gaiella appliance (Fig. 2) I believe that it originally surrounded eight teeth, from a maxillary left first premolar to the right first premolar. Not only is this suggestion supported by the relative sizes of the curves in this clearly distorted appliance, but this interpretation would include spanning two premolars as suggested by Dunn. Thus Dunn may have been evaluating this appliance correctly. The problems of the present placement of this appliance may have arisen only after Dunn had donated the Poggio Gaiella appliance to the museum, probably mounted in the same skull in which it now is found.

With reference to Dunn's (1894) belief that this is a prosthesis which would have been worn in the mandible, I suggest that the original skull did not survive and that Dunn made his evaluation either on the basis of the configuration of the appliance or perhaps the location in a mandible as he first saw it (Becker Ms. B). The distortions now evident in the appliance include extreme bending and folding and several breaks (Fig. 2). This damage suggests that the appliance was forced into the mandible of an intact skull derived from an unknown, even possibly relatively modern, source. The band appears to have been torn, and several cold welds have separated, with subsequent bending of long sections of the appliance. Among the breaks may be one at a point where these two parts had been joined. The reconstruction of the original configuration of this appliance is depicted in Figs. 3 and 4.

DESCRIPTION OF THE APPLIANCE

Detailed examination of the two parts which are identified as the Poggio Gaiella appliance has not confirmed that these two elements originally were joined, although this probably was the case. Both pieces of the appliance are so unrelated to the teeth in this display mandible, so ill-fitted, and so badly bent that there is no possibility that these elements match with the teeth of this restored mandible (Becker Ms. B gives details about the display mandible). Casotti (1947:672, 1957:105) offers a complex, but fanciful, description of how this piece was held in place. The probability that Casotti never examined this piece may be inferred from Casotti's conclusion that the two pieces of this appliance once had been wired together and otherwise manipulated to serve as an orthodontic

corrective device to close gaps between the teeth (Capasso 1986:54). Not only is this a fanciful observation, but the fictitious goals of such a devise would be counterproductive. Moving the teeth only would have disrupted their dental alignment.

As mounted in the mandible when I first studied the Poggio Gaiella appliance (Figs. 2, 3A), it bore only a partial resemblance to its original position and form. The right end of the right unit (Fig. 3A; Platschick 1904:Fig. 2), now widely sprung, had been behind both right premolars of the display mandible, with the curved end passing between the right second premolar and right first molar. By rotating this right element 180 degrees, as shown in Fig. 3B, the appliance assumes its correct position. By focusing on this drawing (Fig. 3B) a description can be made that enables us to reconstruct the original form of this appliance (Fig. 3D).

On the distal extreme of the buccal aspect, the right unit is broken off, after a sharp bend. The tiny tail-like extension (a), that measures under 2 mm in length, was not connected with the straight piece (b) that also is a loose end, 2.82 mm wide (Fig. 2), extending lingually from the buccal aspect of the right unit. I believe that a piece of this appliance, once connecting (a) with (b), has been broken off and lost. These ends originally had passed around the maxillary right first premolar (Fig. 3C). The portion of the band passing between this maxillary right first premolar and the right canine, serving as a divider or brace, attached to (c), where it was cold welded onto the larger band. My visual observation suggests that this divider was part of the right first premolar ring that had been cold welded to the larger band of the right unit, as is the case with the construction of the left unit.

Beginning at the most distal part of the left unit we find an extremely bent and folded ring. This ring originally embraced a left first premolar and was mounted around the corresponding tooth in the display skull. As we now see this ring it has a very peculiar double internal fold along the distal-lingual surface (d), an equally peculiar bump at the distal-mesial portion (e), and a very (0.13 mm) thin band (f) that that had been cold welded in place. The weld on the buccal aspect still holds, but the attachment on the lingual aspect has separated. Microscopic examination might determine where this weld on the lingual surface had attached at the distal end of the bump. I suspect that the connection was at point (g) (Figs. 3B and 3C). The remainder of the left unit appears to be a simple ring (band) that spanned the area from a left

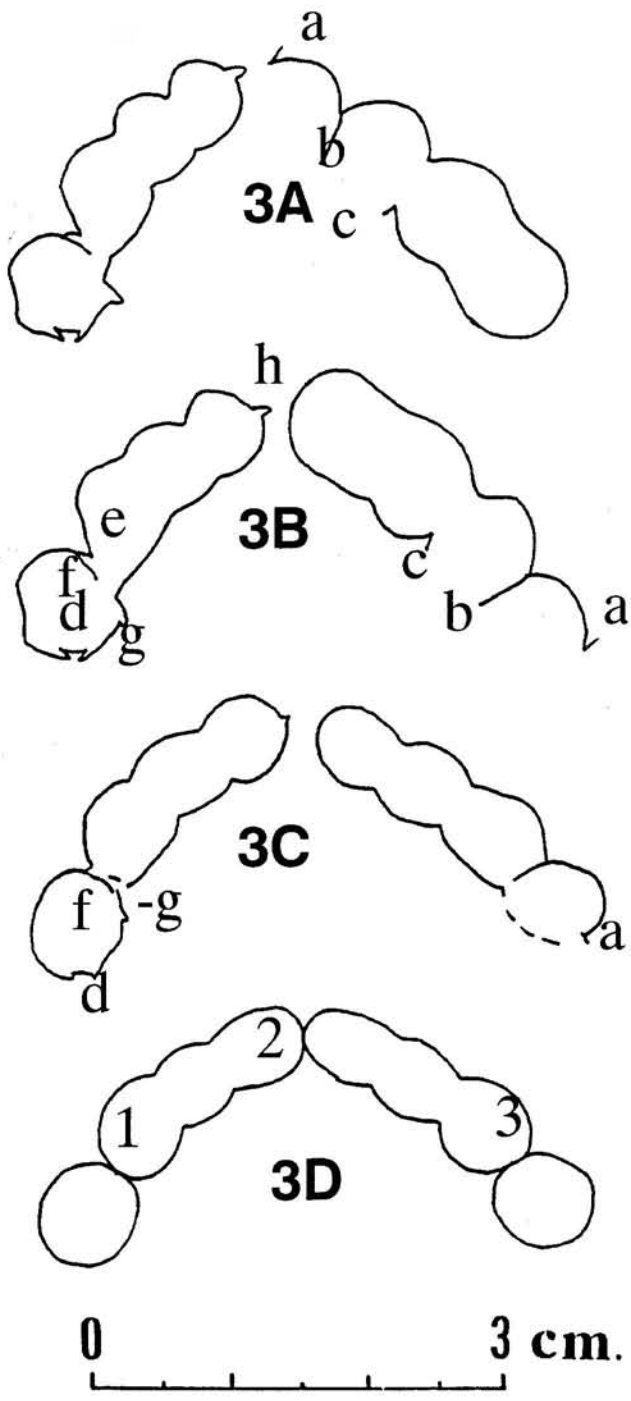

Fig. 3. The Poggio Gaiella dental appliance as seen from above as mounted in a display mandible (3A). The loose ends of the medial end of the right element are believed originally to have been part of the distal ring. Fig. 3B shows the right element rotated 180 degrees. Fig 3C indicates the process by which the original form of the appliance was reconstructed. Fig. 3D is a reconstruction of the four rings of the appliance showing the points at which three cold welds held it together.

canine to the left central incisor. The projection (h) on the left element may reflect its original point of attachment to the right element.

The Poggio Gaiella appliance is an interesting variation of a simple four ring prosthesis requiring only three simple cold welds to fasten the four pieces together (Fig. 3D). An effective means of securing the entire band would be to place braces (cross pieces) at either end to hold the band firmly to the anchor teeth. This appliance, therefore, is an unusual long band with braces between the teeth formed by welding the rings together.

Braced band appliances are designed to have their end rings looped over sound anchor teeth in order to support loose teeth. With an unusually long appliance such as this, assuming that the two existing units were part of a single prosthesis, braces at either end would be essential, but possibly not enough to prevent the center of the band from shifting. Stability could have been achieved by making two units, each carefully fitted with a braced area to loop a sound tooth (first premolars in this case) at the distal ends, and cold welding these two units together at the center. The center weld would reduce the flexibility inherent in an extremely long band and would increase its stability as well as help to hold it in place.

Two other techniques of manufacturing an appliance of this configuration, using long bands, are possible (Fig. 4, Nos. 1-3). In either of these two cases only two long bands would be needed, rather than four separate rings, to form the Poggio Gaiella appliance. By bending two long bands in a clever topological design, as shown in Fig. 4 (Nos. 1-3), only three cold welds would be needed. However, in either of these possible designs two of these three welds would be complex. That is to say that a complex weld would have to join three surfaces together at the same time. The simple four-ring appliance would need only three simple cold welds to unite the four pieces, and would have a much greater possibility of precisely fitting the individual rings closely to the teeth to be encircled before welding. Close fitting is very difficult when long bands are used. Considering all these possible variations I conclude that the Poggio Gaiella appliance is an interesting variation of a simple four-ring prosthesis.

MEASUREMENTS OF THE POGGIO GAIELLA APPLIANCE

Measurements suggest that the two elements considered to be parts of the Poggio Gaiella appliance are in fact part of a single dental prosthesis. Through the kindness of Dr. Jacopo Moggi-Cecchi (Universitá di Firenze) an extremely accurate, illuminated sliding dial caliper was used in this study (Mitutoyo Digimatic 500-110 electric), allowing measurements to be made to the hundredth of a millimeter (0.00).

The two pieces of this appliance, as they are mounted in the display mandible, had a maximum length of 41.76 mm. Drawing a straight line tangent to the curves of the two most distal parts, a line perpendicular from the most anterior aspect measures 20.41 mm long. The two elements may be considered individually as the right and left, with reference to their present position in the mandible (Fig. 1). The width of the right band varies along its length from 2.82 mm to 3.23 mm. The thicknesses vary from 0.12 to 0.15 mm. The left unit has widths that vary between 3.02 and 3.33 mm, while the thicknesses of the gold strip vary from 0.12 to 0.17 mm. The narrow aspects of the right unit are under 3 mm in width and are found at the mesial part of the appliance. The narrow aspects of the left unit, while wider than those of the right, also appear toward the mesial aspect. These variations do not provide evidence which can clearly be used to indicate that these are two pieces of a single appliance, nor can this be negated by these findings. Evidence from the Ghent appliance (Becker Ms. A) suggests that Poggio Gaiella may have been constructed in a similar fashion. However, the two pieces of the Poggio Gaiella appliance were parts of a complex band somewhat more elaborate than the Ghent appliance.

The measurements of the Poggio Gaiella prosthesis indicate that Ghinst (1930) was the most accurate in his estimation of the width of this appliance, suggesting that he may actually have made measurements of this piece (see also Casotti 1947, 1957). Tabanelli (1963:92, Tav. 49) provides only vague estimates of these dimensions, while Emptoz (1987) provides the least accurate guess regarding the width of the band (at 4.5 mm).

The length of this appliance would suggest that the teeth of the real Poggio Gaiella skull actually had been loosened by periodontal disease or a blow, and were being held in place by this band. The very length of this

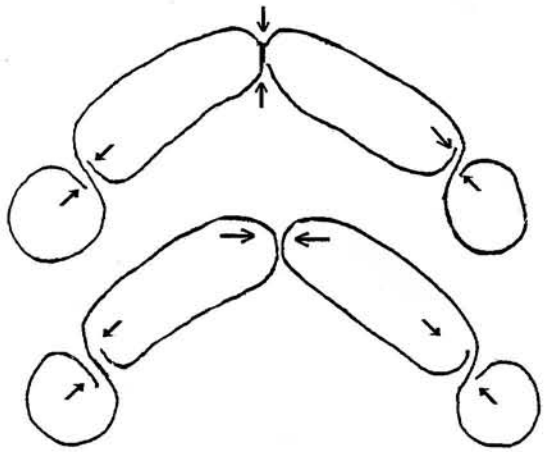

Fig. 4. Two alternate techniques by which the Poggio Gaiella band may have been constructed from two long gold strips. Both of these differ from the possible technique of simply welding four separate rings together.

long band suggests that this appliance was not purely decorative. The uniform width of the band all along its length clearly reinforces the conclusion that this was a functional, and not purely decorative appliance. If we are correct in inferring that this appliance was designed to hold teeth in place which had been loosened by a blow, a mandibular placement also would be possible. This appliance provides our best evidence from the Etruscan area to suggest that dental appliances were used as a therapy for teeth loosened by accidental trauma, as well as for cosmetic purposes. Periodontal disease requiring the use of this type of appliance would be expected in a relatively mature person. Since the skull and mandible associated with this individual do not derive from the person for whom the appliance was made we are unable to determine the actual periodontal condition of the user.

The fact that many of the pontics related to this appliance provided replacement teeth for central incisors has been noted earlier, with the suggestion that tooth evulsion was probably the cause of incisor loss among the users (Becker 1995). Recently the possibility that some of these dental appliances may have been made to stabilize teeth loosened by alveolar deterioration associated with leprosy has been considered. Since bone loss at the anterior margin of the maxillary suture in the area of prosthion is part of the symptomology of leprosy, dental loss in this area occurs at a relatively early age. This bone loss is bilateral. While many Etruscan dental pontics provide replacements for both upper central incisors, the replacement of only one incisor is more common than replacement of both incisors. This argues for tooth evulsion rather than leprosy as a factor in tooth loss.

SUMMARY AND CONCLUSIONS

The construction of the Poggio Gaiella appliance involves a pair, or a series, of welded rings that were carefully fitted to the teeth that they surrounded. The possibility also exists that only two rings were employed, by bending long strips of gold into figure-8's (Fig. 4). The skilled application of this appliance would have provided increased stability to this simple retention band. The Poggio Gaiella band has been damaged to the extent that we cannot accurately determine the dimensions of the teeth it was meant to surround, and it certainly was not made for the skull of the person with which it is now associated.

ACKNOWLEDGEMENTS

Special thanks are due Prof. L. Bliquez for sharing important information relating to this subject and for his important insights into this field of study. Thanks also are due Dott.ssa Gabriella Barbieri, Dr. Anna Maria Bietti Sestieri, Dott.ssa M. Cataldi Dini, Dr. Lucos Cozza, Dr. Jacopo Moggi-Cecchi, Dr. Elsa Pacciani, Prof.ssa Adele Ré, the staff of the British School at Rome and of the Museo di Forte Sangallo in Civita Castellana for valuable aid in various aspects of this research. Dr. Luigi Capasso, Dr. Francesco Nicosia and Dott.sssa Anna Maria Esposito (National Archaeological Museum in Florence) kindly permitted study of the Poggio Gaiella appliance and associated skull. The kind co-operation of Bruno Michelucci and the entire staff of the National Archaeological Museum is gratefully acknowledged. This study was conducted in association with research funded by the Daniel and Jacqueline Colyer Foundation, supplemented in part, by a travel award from West Chester University of Pennsylvania (CASSDA, Dr. J. Skerl). The manuscript was produced while the author was a Fellow in Anthropology at the University of Pennsylvania (Dr. G. Possehl, Chair). Any errors of interpretation or presentation are, of course, the responsibility of the author alone.

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