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### Surgical instruments for plastic surgery operations in Ancient Greek and Byzantine times

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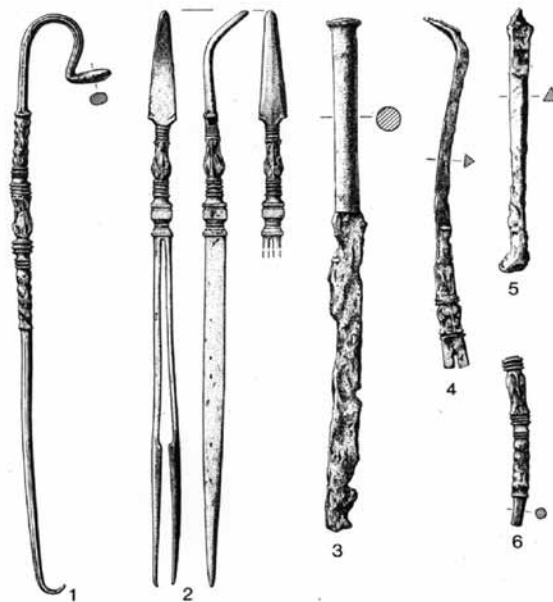
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# Surgical instruments for plastic surgery operations in Ancient Greek and Byzantine times

Marios Papadakis<sup>1</sup>



**Figure 1.** Instruments from the 3<sup>rd</sup> century CE: (1) sharp retractor, (2) different types of lever forceps, (3) chisel, (4) lever, (5-6) two fragments. Aschersleben, Kreismuseum.

## Abstract

**Background-Objective:** Even though the term “plastic surgery” was first introduced in the 19th century, the study of ancient Greek and Byzantine medical manuscripts reveals a significant number of plastic surgery operations performed during these periods. The aim of this work is to present the surgical instruments that were used to conduct such operations.

**Material-Method:** The original manuscripts of ancient Greek and Byzantine physicians, including Hippocrates, Galen, Oribasius, Aetius, Paul of Aegina and Alexander of Tralles, were studied and analysed. The references concerning plastic surgery instruments were marked and are presented.

**Results-Discussion:** Ancient Greek and Byzantine physicians performed several plastic surgery procedures, i.e. reconstructions of defects in the nose, ears, eyelids, lips, cheeks, and forehead, while surgical restoration of female breasts, hypospadias, elderly loose jawbone, penile tumours, syndactyly, and polydactyly was also described in detail. Several surgical instruments with various functions were used for these procedures, such as tools for tissue cutting (scalpels, chisels), for tissue grasping (forceps), tissue preparation, haemostasis (cauteries), as well as tissue suturing. Many of these tools had a wide range of uses, while others appear to have been specifically designed for plastic surgery procedures.

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**Conclusion:** Ancient Greek and Byzantine physicians possessed a comprehensive set of surgical instruments that effectively supported a wide range of plastic surgery procedures.

**Key Words:** *Surgical instruments, plastic surgery, antiquity, Byzantium*

## Introduction

Despite the emphasis on scientific knowledge, the practice of surgery remains fundamentally a manual craft, as the etymology of the word suggests (from Latin, *chirurgia*; Greek: *χείρ* or *kheir* = hand, *ἔργον* or *ergo* = work). Similar to other crafts, the development of tools and instruments has played a crucial role in facilitating, expanding, and refining surgical practices, addressing situations where manual dexterity alone proves inadequate or impractical<sup>1</sup>. It is speculated that the earliest surgical instruments were adapted from everyday objects used in domestic, artisanal, and potentially military contexts, and that the initial need for instrumental intervention arose from injuries such as severe wounds, foreign bodies lodged in tissues, and complex fractures<sup>2</sup>. Although there is concrete evidence of early surgical procedures involving skull trepanation for trauma or epilepsy and circumcision for cultural or hygienic reasons, the exact origins of these interventions remain uncertain, reaching back into ancient times<sup>1,2</sup>.

While archaeological discoveries provide valuable insights into ancient surgical instruments, their functions are not always immediately apparent through examination alone. Furthermore, many instruments have not been unearthed by archaeologists and are only known through depictions in illustrated works. Thus, additional information can be gleaned from conventional or digital books based on the writings of early physicians such as Galen (AD 130-200), Oribasius (AD 325-403), Aëtius (AD 502-575), and Paul of Aegina (AD 625-690)<sup>1,2</sup>. To our knowledge, there is no study focusing on the instruments used in plastic surgery operations during the ancient Greek and Byzantine times.

## Material and Methods

The research and analysis of ancient operations and instruments in plastic surgery were based on (a) Ancient Greek Literature as found in the *Thesaurus Linguae Graecae* (TLG), (b) the study of classical medical and historical writings, and (c) the search for contemporary literature on the history of plastic surgery in reputable medical databases (ISI, PubMed).

The study focused on all physicians of Ancient Greek Medical Literature. Remarkably, within the works of several physician-writers, a significant portion of their predecessors' work is preserved through citations. For example, Oribasius includes information and techniques from his predecessor Antyllus, who, in turn, reproduces part of the work of Herodorus of Alexandria and Archigenes of Apamea. Thus, several treatises, such as Oribasius' "Synagogue" and Aegineta's "Epitome," serve not only to present the personal observations of their authors but also to "compile" the existing knowledge up to that point, which is particularly useful when it comes to surgical interventions and techniques.

## Results

The surgical instruments that were found are presented in the table below. The operations performed represent the whole spectrum of plastic surgery, i.e. reconstructive surgery, hand surgery and aesthetic surgery.

## Discussion

The Byzantine period witnessed a continuous lineage of physicians who meticulously collected, systematised and expanded upon the medical wisdom inherited from their Greco-Roman predecessors. These physicians' medical encyclopaedias formed the foundation of Arabic medical knowledge and served as standard textbooks in Western medicine until the Early Modern period, spanning from the 16th to the late 18th century<sup>30</sup>. Byzantine plastic surgery, as evident from the surgical content predominantly found in the writings of Oribasius of Pergamon and Paul of Aegina, appeared to have reached a highly advanced state of development<sup>1,2</sup>.

The surgical instruments found to be used in plastic surgery operations can be classified as follows:

- (a) tissue-cutting instruments, e.g. *anarraphikon* similar, *epacmon* *psalidion*, *pterygotomus*. Chisels were mainly made of iron in various shapes and sizes, hence the many different names, while scissors were made of both copper and iron<sup>2</sup>.
- (b) tissue-exploration instruments, e.g. *mele*, *coparion*,

**Table 1.** Overview of all plastic surgery instruments found<sup>3</sup>.

	<b>Name of instrument in ancient Greek</b>	<b>Name of instrument in Latin</b>	<b>Description and use</b>	<b>Number of Refs</b>	<b>Ancient physician</b>
1	Άγκιστρο	ancistron	a sharp hook/retractor, used in eyelid operations, i.e. eyelid adhesion removal <sup>3</sup>	6	Paul of Aegina <sup>4</sup> , Aetius <sup>5</sup>
2	Αγκτήρ	ancter, ancteras	a bandage, plaster, pin, or clasp for holding the lips of a wound together <sup>3</sup> .	17	Galen, Paul of Aegina, Aetius, Oribasius
3	Αιγίλωπικόν καυτήριον	aegilopicon cauterion	a cautery for treating aegilops (= a lacrymal abscess that has opened externally) <sup>3</sup> .	1	Paul of Aegina <sup>6</sup>
4	Αναρραφικόν σμιλίον	anarraphicon smilion	a scalpel used in anarrhaphé (=operation for entropion or for relaxation of the eyelid by drawing it back and securing it with sutures, with or without excision of a portion) <sup>3</sup> .	3	Paul of Aegina <sup>7</sup> , Aetius <sup>8</sup>
5	Βελόνη	belone	a thread, used in the operation of ectropion <sup>3</sup> .	3	Paul of Aegina, Aetius (Antyllus) <sup>9</sup>
6	Βλεφαροκάτοχον	blepharocatochus	an instrument for holding the lids fixed. It is mentioned for the operation of anarraphé (i.e. entropion correction) on the eyelid <sup>3</sup> .	1	Paul of Aegina <sup>10</sup>
7	Βλεφαρόξυστον	blepharoxyston, blepharoxystum	an instrument for scraping the inner surface of the eyelid used in trachoma <sup>10</sup> .	1	Paul of Aegina <sup>11</sup>
8	Επίδεσμος	desmos	a tight dressing, used in harelip surgery, to prevent the approximation of the traumatic lips after the incision is made. It is also useful for restoration of nasal fractures <sup>12</sup> .	12	Galen, Paul of Aegina, Oribasius
9	Έπακμον ψαλίδιον	epacmon psalidium	a sharp scissors, used for removing of the skin excess in patients with scrotal rhacosis <sup>14</sup> .	1	Paul of Aegina <sup>13</sup>
10	Επίκοπον σανίδιον	hepicoxon	A (possibly wooden) block, where ancients were placing the excess scrotal skin in order to strike it with a chisel (the method was applied in elderly patients with relaxation of the scrotal skin (rhacosis) <sup>14</sup> .	1	Paul of Aegina <sup>13</sup>
11	Καλαμίδα από πτερόν χηνείον	calamis	a goose feather straw that allowed nasal breathing after tamponade in cases of nasal fractures <sup>12</sup> .	1	Paul of Aegina <sup>15</sup>
12	Κυαθίσκος μήλης	cyathiscos, cyathiscus	A type of probe with a concave end (a spoon-like instrument), used in correcting ectropion, after the initial excision of excess tissue <sup>14</sup> .	2	Galen, <sup>16</sup> Paul of Aegina <sup>17</sup>
13	Λεπτόν κοπάριον	lepton coparion	a probe used in the operation for the pterygia on the nails <sup>3</sup> .	1	Paul of Aegina <sup>18</sup>
14	Λημνίσκος	lemniscus	a pledget for the application of healing ointments in cases of nasal ulcers. It was also used to treat abscesses <sup>12</sup> .	3	Paul of Aegina <sup>15</sup> , Oribasius <sup>19</sup>
15	Μήλη	mele	a sound or probe used to reduct nasal bone fractures <sup>12</sup> .	1	Paul of Aegina <sup>15</sup>
16	Μηλωτ(ρ)ίς	melot(r)is	a probe or sound, used in the eyelid adhesions. Paul also refers to its use as a cautery to destroy the root of hairs after epilation <sup>3</sup> .	3	Aetius <sup>20</sup> , Paul of Aegina <sup>21</sup>
17	Μοτός, Μοτάριον	motus	a tent for preventing contractions and adhesions, used in eyelid operations.	1	Paul of Aegina <sup>4</sup>
18	Μύδιον	medion	A type of forceps used for grasping excess tissue in the operation of anarraphé, as well as for grasping warts, acrochordons and supernumerary fingers before their excision <sup>3</sup> .		Oribasius, Paul of Aegina
19	Πτερυγοτόμος	pterygotome, pterygotomus	a sharp-pointed knife for removal of pterygium (a pathological condition in which the fibrous tissue extends into the cornea), used for releasing adhesions between the upper eyelid and the cornea, conjunctiva, or tarsal plate <sup>3</sup> .	8	Paul of Aegina, Aetius
20	Ρινοσπάθιον	rinuspatium	A scalpel for nasal operations <sup>22</sup> .	1	Severus iatrosophista <sup>23</sup>

**Table 1.** Overview of all plastic surgery instruments found<sup>3</sup> (Continued).

	Name of instrument in ancient Greek	Name of instrument in Latin	Description and use	Number of Refs	Ancient physician
21	Σαρκολάβος	sarcolabus	flesh forceps, for grasping acrochordons and encanthises (=encysted lesions developed over inner canthus) <sup>25</sup> .	1	Paul of Aegina <sup>24</sup>
22	Σμιλίον	smilion	a scalpel with various uses, especially in eyelid surgery <sup>3</sup> .	9	Paul of Aegina, <sup>10</sup> Aetius
23	Σμιλιωτός εκκοπεύς	smilition	an instrument shaped like a smilion, used to cut supernumerary fingers <sup>26</sup> .	1	Oribasius <sup>27</sup>
24	Σφηνίσκος	spheniscus	a wedge-shaped bandage used as a tamponade in nasal fractures <sup>6</sup> .	1	Paul of Aegina <sup>15</sup>
25	Τριχολαβίς	tricholabis	An epilation forceps. Because of its fine structure it was also useful for the removal of slight bone parts in cases of comminuted nasal bone fractures <sup>3</sup> .	2	Paul of Aegina <sup>15,21</sup>
26	Ψυχροκαυτήριον	psychrocauter	a type of cautery used in the excision of the thymi of the penis. It was also used for removal of benign skin lesions, such as warts and fibroepithelial polyps <sup>12</sup> .	2	Paul of Aegina

lepton. Probes were often combined with other tools, and their tip was sharp, rounded, or oval. They were mainly made of lead or tin. Here we should emphasise the confusion between “probe” and “scalpel”. Although Paul of Aegina replaces the word “probe” with the word “scalpel” when reproducing a text by Hippocrates, the French translator René Briau translates “scalpel” as “needle”, believing that it comes from the verb “to cut”. However, Milne considers that “scalpel” is identical to “probe”, noting that “there is generally great confusion between the words denoting probes and those denoting needles”. Besides tissue exploration, probes were also used for local application of substances, mainly ointments<sup>31</sup>.

(c) tissue-grasping (forceps) and holding (hooks) instruments, e.g. blepharocatochus, ancistrion. Celsus uses only one term for forceps, unlike the many Greek terms, due to the easier derivation in the Greek language than in Latin.

(d) tissue-preparation instruments, e.g. melotris.

(e) tissue-suturing instruments, e.g. ancter.

(f) haemostatic instruments (cauteries), e.g. crescent-shaped cautery, fine cautery. In the Hippocratic collection, they are also designated by the term “iron”, as they were almost always made of iron (which is a good heat conductor)<sup>31</sup>.

(g) draining instruments, e.g. calamis

(h) cryotherapy instrument, i.e. cold cautery, *psychrocauterion*.

(i) filling materials, e.g. spheniscus.

(j) bandaging materials, e.g. strap (epidesmos)

(k) anti-adhesion materials, e.g. lemniscus.

## CONCLUSION

In conclusion, ancient Greek and Byzantine physicians possessed a comprehensive set of surgical instruments that effectively supported a wide range of plastic surgery procedures.

## ΠΕΡΙΛΗΨΗ

### Χειρουργικά εργαλεία χρησιμοποιούμενα στην Πλαστική Χειρουργική κατά την Αρχαία Ελληνική και Βυζαντινή Περίοδο

Μάριος Παπαδάκης

**Εισαγωγή:** Παρά το γεγονός ότι ο όρος «πλαστική χειρουργική» εισήχθη για πρώτη φορά τον 19ο αιώνα, η μελέτη των αρχαίων ελληνικών και βυζαντινών ιατρικών χειρογράφων αποκαλύπτει έναν σημαντικό αριθμό επεμβάσεων πλαστικής χειρουργικής κατά τη διάρκεια αυτών των περιόδων. Σκοπός αυτής της εργασίας είναι να παρουσιάσει τα χειρουργικά εργαλεία που χρησιμοποιήθηκαν για τη διενέργεια αυτών των επεμβάσεων.

**Υλικό-Μέθοδος:** Εξετάστηκαν και αναλύθηκαν τα πρωτότυπα κείμενα των αρχαίων Ελλήνων και Βυζαντινών ιατρών, συμπεριλαμβανομένων των Ιπποκράτη, Γαληνού, Οριβασίου, Αιτίου, Παύλου του Αιγινήτου και Αλεξάνδρου του Τραλλιανού. Οι αναφορές που σχετίζονται με τα εργαλεία πλαστικής χειρουργικής σημειώθηκαν και παρουσιάζονται.

**Αποτελέσματα-Συζήτηση:** Οι αρχαίοι Έλληνες και βυζαντινοί ιατροί πραγματοποίησαν αρκετές επεμβάσεις πλαστικής χειρουργικής, όπως αποκαταστάσεις ελλειμμάτων στη μύτη, τα αυτιά, τις βλεφαρίδες, τα χείλη, τις παρειές, το μέτωπο, ενώ περιγράφεται επίσης αναλυτικά η χειρουργική αποκατάσταση μαστού, υποσπαδία, χαλαρού οσχέου σε ηλικιωμένους, όγκων πέους, συνδακτυλίας και πολυδακτυλίας. Για αυτές τις επεμβάσεις χρησιμοποιήθηκε μεγάλος αριθμός χειρουργικών εργαλείων με διάφορες λειτουργίες, όπως εργαλεία κοπής ιστών, εργαλεία σύλληψης και παρασκευής ιστών, αιμόστασης, καθώς και συρραφής. Πολλά από αυτά τα εργαλεία είχαν ευρύ φάσμα χρήσης, ενώ άλλα φαίνεται να έχουν σχεδιαστεί ειδικά για τις επεμβάσεις πλαστικής χειρουργικής.

**Συμπέρασμα:** Οι αρχαίοι Έλληνες και βυζαντινοί ιατροί διέθεταν ένα πλήρες σετ χειρουργικών εργαλείων που υποστήριζαν αποτελεσματικά μια ευρεία γκάμα επεμβάσεων πλαστικής χειρουργικής.

**Λέξεις κλειδιά:** Χειρουργικά εργαλεία, πλαστική χειρουργική, αρχαιότητα, Βυζάντιο

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\* References 4-10, 13, 15-21, 24 and 29 refer to TLG content, as read with the software Diogenes (<http://www.durac.uk/pj.heslin/Software/Diogenes/>)