Dental palaeopathology seen through historical, archaeological and biological sources in ancient Herculaneum (79 AD, Italy)

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Abstract. In the mid-eighteenth century, King Charles III of Spain started to explore the ruins of the ancient city of *Herculaneum*. Since then, several medical and surgical instruments made of bronze and iron have been found. The archaeological digs carried out in 1982 in the area corresponding to the ancient shoreline of *Herculaneum* brought to light not only human remains of about 250 victims killed during the eruption of Vesuvius in the year 79 AD, but also remains of carbonised food and other organic-based materials. Collaboration between different disciplines, including Archaeology, Physical Anthropology, History of Medicine, History of Odontostomatology and Palaeopathology, can provide us with more comprehensive pictures of diseases of the past, not only based on historical, literary and archaeological sources, but also directly on human remains. Through such an interdisciplinary approach, valuable information can be obtained on pathologies of the oral cavity and their distributions, on medical therapies and treatments, and on accessibility to healthcare, including odontostomatological care. An integrated study has allowed us to obtain useful data to reconstruct the habits and lifestyles of the ancient people of *Herculaneum*. In this report, three cases are presented to illustrate the importance of integration of data inferable from such different sources.

Key words: dental palaeopathology, *Herculaneum*, archaeological sources, historical sources, anthropological sources

Introduction

The ancient city of Herculaneum was located in the centre of the Gulf of Naples (Campania, Italy), and spread along the low hillsides of Mount Somma–Vesuvius. The fame of Herculaneum is due to the catastrophic volcanic eruption of Vesuvius that has been dated to the year 79 AD (1). The details of the sequence of relevant disastrous events consequent to the eruption of Vesuvius have been handed down to us by Pliny the Younger, the grandson of the General of the Roman fleet Pliny the Elder. In the famous letter that Pliny the Younger wrote to Tacitus to inform him of his uncle's death, the gravity of the circumstances can be perceived immediately. This indicated that over a very short time, the pyroclastic flows that rapidly descended the hillsides of Vesuvius buried entire cities and their inhabitants under tens of metres of volcanic material (2).

The first sporadic explorations of Herculaneum started under the patronage of King Charles III of Spain, in the XVIII century (3), and these contributed to the accidental rediscovery of this city. However, it was only between the 1920s and 1950s that there were substantial changes in the history of the research conducted in *Herculaneum*, due to the appointment of

Amedeo Maiuri as Superintendent of the Excavations and Antiquities of Campania. The start of these profitable open-pit excavation campaigns had significant impact on the definition of the urban and suburban layout of the ancient city, as well as on the rediscovery of its inhabitants (4). The research conducted in the 1980s under the direction of Giuseppe Maggi was then fundamental. Indeed, in these years the new data that emerged during the excavations of the vast suburban area of *Herculaneum* shed new light on many aspects of the inhabitants that had until then remained unsolved. Unlike *Pompeii*, where hundreds of human remains were found of those who encountered their death during the eruption, in *Herculaneum*, the almost total lack of victims within the city led to the hypothesis that most of the inhabitants had managed to escape before the city was completely buried (5).

From 1982, hundreds of human remains belonging to the protagonists of the huge tragedy that followed the eruption were found on what was identified as the ancient shoreline of *Herculaneum* (6–10). This was even more sensational following the discovery of further human remains inside and in the immediate vicinity of the western *fornici* (port warehouses) (11).

It was in these two areas that the first of the six pyroclastic flows (known as *surge I*) that reached *Herculaneum* during the final stages of the eruption killed those who had survived until then. Studies conducted on the remains of the victims have provided useful data that have allowed clarification of the possible dynamics that led to the deaths of hundreds of *Herculaneum* inhabitants. For those who had still been unable to find shelter or refuge inside the port warehouses, their deaths were probably instantaneous due to the rapid exposure of the bodies to the intense heat of the pyroclastic flow. This is different from those who had managed to access the port warehouses by this time. From studies of the chromatic and thermal alterations suffered by the bones of those who were found in and near the port warehouses, it appears that they did not suffer the direct effects of the violent thermal exposure of *surge I*. In this case, it is likely that their deaths occurred as a result of burn shock, without excluding possible serious obstruction of the respiratory tract as a consequence of inhalation of the ashes contained within the pyroclastic flow (7,12,13). The arrival of successive flows of mud and pyroclastic materials definitively buried the remains of the inhabitants of this ancient city, thus sealing them for centuries in their final positions at the time of their deaths. The singularity of these circumstances of the burial of *Herculaneum*, together with the exceptional nature of the main cause of death of its inhabitants and the extraordinary state of conservation of the archaeological and osteological material, has provided researchers with a unique opportunity to reconstruct the lives and ways of life of its inhabitants.

The considerable osteological sample on which it was possible to conduct multiple interdisciplinary studies has allowed a more in-depth picture to be constructed of the last moments of life of those who had tried in vain to find shelter in environments that they deemed most safe, and who had hoped to flee by sea. This population has thus provided considerable information on an ancient community whose people did not die from natural causes or following illness, but from a catastrophic natural event.

The relevance of integrated and interdisciplinary studies

In recent years, the growing interest in the status of health and disease of ancient populations has generated ever-closer collaborations between different disciplines. These here have included Archaeology, Physical Anthropology, History of Medicine, History of Odontostomatology, Palaeopathology, and other related disciplines.

In the case of *Herculaneum*, the palaeobiological studies carried out on the osteological remains of the victims of the eruption have already provided large amounts of useful information. This has included an understanding of not only the habits and lifestyles of the victims, but also their status of health and the pathologies with which the general population was afflicted. These osteological remains constitute the primary source through which it is possible to derive direct information about medical or dental interventions, although it is not always possible to observe the results of these operations at a macroscopic level. Therefore, there is the need for interactions between

data inferable from the interpretation of the material evidence that survives in the archaeological artifacts (including medical and surgical instruments), and the study of the biological remains of an osteological or organic-based nature, without neglecting the data obtainable from literary sources. For example, the instruments and remains of organic-based substances that can be associated with odontostomatological treatments and practices make it possible to trace their field of use. However, the medical texts may well be the valid tool for an understanding of the real dental skills and knowledge in the ancient world.

Therefore, using such interdisciplinary approaches, efforts are being made to understand the pathologies of the oral cavity and how these pathologies were distributed in this population of *Herculaneum*. Once all possible useful historical, social and cultural information has been obtained, this can help us to understand on the one hand what therapies were applied or applicable to promote the maintenance of good health of the oral cavity, and on the other hand what surgical procedures were known and exercised by the Roman physicians at the time of the eruption. In this perspective, the main sources of information have allowed an in-depth picture on these topics to be defined: (i) direct biological sources represented by the osteological and dental remains of the victims of the ancient city; (ii) literary sources coeval to the I century AD; and (iii) archaeological evidence related to elements associated with treatment of dental pathologies; e.g., surgical instruments, food and other organic-based remains.

Biological sources

Palaeopathology is the scientific discipline that deals with investigation and reconstruction of the state of health and disease of ancient human skeletal remains. It is considered to be one of the primary sources through which bioanthropological information can be obtained. The teeth are not only the most highly mineralized tissue of the human body, but also the hardest and most chemically stable ones. Indeed, teeth are preserved even after the deterioration of their supporting structures. Furthermore, in contrast to bone tissue, teeth interact directly with the environment during chewing, and for this precise reason, they can provide information on both the type of diet and the health of an individual.

Literary sources

Aulus Cornelius Celsus and Scribonius Largus were two of the main medical authors for the writing of technical–scientific treatises on *Ars Medica* in the I century AD. They both provided exhaustive and sufficiently detailed summaries on the dietetics, pharmacology and surgery of the time. However, the works of Pliny the Elder and Pedanius Dioscorides are no less important.

Aulus Cornelius Celsus

The encyclopaedist Aulus Cornelius Celsus is particularly significant here, as he handed down to us what is considered to be the first systematic treatise on theory and medical practice of the I century AD: *De Medicina*. These eight books make up the corpus of a treatise that not only carefully and thoroughly illustrates the complex medical and surgical panorama of his time, but also allow better delineate of the specific aspects of the general medicus and the chirurgus. As indicated in the preface of the seventh book of *De Medicina*, the medicus chirurgus was considered to be a professional figure who specialized in body care through application of a skilful, young and firm hand (14).

Of further interest, Celsus traced an exhaustive and meticulous picture of the individual and specific symptoms associated with innumerable pathologies, along with their relevant treatments. Therefore, this treatise is a true encyclopaedic collection of all of the therapeutic and surgical treatments known at the time, to combine the high anatomical and physiological knowledge of the time with the instrumental knowledge of Celsus.

Several surgical instruments were mentioned for which the uses are reported in terms of both general and more specific interventions. Although most of the Roman medical instruments were indeed multifunctional, for dental practices Celsus referred in particular to two specific tools. In Chapter XII of Book VII, the encyclopaedist mentioned the *forfex* and the *rizagra*,

referring to diseases of the mouth that required the work of the hand.

Convinced of the importance of pharmacology, Celsus referred to an analgesic therapy in relation to dental pathologies. From what is detailed in the *De Dentibus* section, immediate extraction was not always suggested for toothache. This intervention was expressly recommended only if various plant-based medicines did not improve the pain, or when the tooth was loose enough to be extracted without consequences for the periodontal bone of the maxilla or mandible. Also, in relation to the danger of this intervention, for the maxillary dentition, Celsus mentioned possible bruising related to the temples and the eyes. In this case, he considered it essential to first incise the gingiva to prepare for the release of the tooth, which was then extracted with forceps. It was also important that the tooth was extracted straight, to prevent the roots from breaking the bone in which it was held, particularly for the molars. Similarly, extraction of teeth fractured due to caries could also pose a risk in terms of laceration of the bone under the gingiva. For the treatment of caries, among the suggested analgesic remedies there was the use of an ointment prepared with hot flour and figs, that was applied both inside and outside the oral cavity. On the other hand, for severe carious cavities with consequent gingival suppuration and with extraction being necessary, Celsus indicated that the cavity should be filled with a lead amalgam. This was designed to avoid breaking the dental crown during the intervention, which was carried out using the *rizagra*. An alternative to the use of lead amalgam and instrumental extraction of the crown was seen by the use of a zested peppercorn or an ivy berry, which would facilitate the fragmentation of the crown itself. More generally, to relieve toothache, which was considered among the worst pains that one could suffer, Celsus believed that it was useful to keep in the mouth an astringent solution based on cinquefoils root mixed with wine, or henbane root combined with salt and zest of poppy boiled in wine and mixed with honey (14). The juice of figs cooked in vinegar were equally useful as an analgesic, which were mixed with *mulsum* and apples. As an alternative to these remedies, he suggested the application to either the cheeks or directly to the sore part woollen bandages soaked in a compress based on zest of unripe and dry pomegranate mixed with zest of pine, opium, galbanum, myrrh or cardamom.

For stomatology and pathologies of the soft parts of the oral cavity, such as mouth ulcers and suppurations of the gingivae and aphthae, the danger of these pathologies was stressed beyond the difficulty of therapeutic treatment (15). Even in this case, before carrying out surgery, Celsus believed that efforts should first be made to treat both the inflammation and the most serious ulcers using topical treatments based on compresses made with the same natural substances used for dental pathologies. Similarly, the knowledge of useful practices for complete healing of fractures and dislocations inherent to the mandible and maxilla was vast (14).

Scribonius Largus

Scribonius Largus was another important figure in the panorama of the history of medicine inherent to the pharmacology and treatment of pathologies of the oral cavity. Contemporary to Aulus Cornelius Celsus, Scribonius handed down one of the most valuable and detailed pharmacopoeia treatises of the ancient Roman world: the *Compositiones* (16).

In his work, Scribonius reported the nomenclature of more than 200 species of plants and about 100 mineral and animal-derived substances that were used for the preparation of countless drugs. The 271 medical recipes are meticulously ordered based on the diseases that affected the human body from top to bottom, from head to foot, and from general to specific (17). Scribonius was scrupulous in his details of the compositions of the drugs, the doses of the ingredients, the methods and timing of the administration, and in some cases, the description of the equipment and the containers necessary for their preparation. These details also showed particular knowledge in relation to both the toxicities of some substances and his direct experience in the practice of medicine (18).

Like Celsus, Scribonius also referred to painful affections of the teeth and gingivae and the most serious pathologies relating to the mouth, throat and uvula, which included the *cancer os corripit*: mouth cancer (17). On buccal affections, Scribonius clarified the importance of carrying out differential diagnosis

to distinguish the abscess (parulis) from the benign neoplasia (epulis), which originates from the gingival mucosa. In the treatment of painful phenomena associated with teeth, Scribonius stressed the importance of using analgesic preparations, with most used as mouthwashes based on cinquefoils herb root cooked in wine, or alternatively based on cypress berries decocted in water. As an alternative to mouthwashes and decoctions, Scribonius recommended application directly to the teeth of a poultice based on henbane root that had previously been boiled in water and was subsequently wrapped in linen bandages. As an alternative analgesic therapy, the *Compositiones* also suggested direct chewing of wild mint leaves, purslane, pyrethrum root and oleander leaves, all of which are vegetable substances recognized for their sedative, analgesic, astringent, anti-inflammatory and antibacterial properties. When the pain disappears, to prolong the soothing effects of the medicaments, it was necessary to spread a poultice composed of giant hogweed juice, incense and seedless raisins directly to the tooth. If the teeth loosen, it was considered appropriate to consolidate them by gargling using donkey milk or hot wine, to which dock or sorrel roots had been added. In this regard, it was also useful to apply a remedy based on alum and honey, or alum amalgamated with sour vinegar and cedar resin. When the gingivae were painful, Scribonius recommended the application of soft wool balls soaked in very hot oil.

Based on its emollient and water-repellent properties, the use of wool in the medical field was highly appreciated, both as a means of containing or absorbing compresses, and for covering surfaces affected by contusions, fractures or wounds. The choice to use treated wool as an adjuvant in the application of medicaments was well expressed in the treatise of Scribonius and in *De Medicina* and *Naturalis Historia*. Specifically, Celsus and Scribonius referred to the use of wool treated and soaked in sulphur, which was known for its anti-inflammatory properties, to both soothe a toothache and as a bandage to protect the head in case of parotid affections. Pliny the Elder also gave indications for the use of treated wool, which he said should be soaked in olive oil, wild fig juice, vinegar, old wine or honeyed wine, to both relieve toothache and heal general affections of the mouth (19).

Pedanius Dioscorides

Some decades after Scribonius, there was Pedanius Dioscorides, who was a Greek physician, botanist and pharmacologist who practiced in Rome at the time of the Emperors Claudius and Nero. In his vast *Materia Medica*, Dioscorides defined in detail the medical uses of plants, minerals and diverse products of animal origin. It is interesting that innumerable therapeutic properties were recognized for all of the substances described. For the problem of faltering teeth, toothache or carious cavities, Dioscorides suggested a medicament based on a specific mineral substance: the *sori*. Furthermore, for the treatment of gingivitis and aphthae, or only to strengthen teeth that were no longer fully firm in the alveolus, Dioscorides recommended the use of schistose mixed with vinegar or honey (20).

Pliny the Elder

The *Naturalis Historia* of Pliny the Elder has also been dated to the I century AD, in which an immense amount of information was collected about the medical knowledge of his time (21). Indeed, it includes extensive descriptions of substances of animal, mineralogical and botanical origin that were used for the preparation of innumerable medicaments. For dental precepts, Pliny the Elder focused on various problems relating to the oral cavity, as the treatment of toothache and the healing of caries. Unlike Celsus and Scribonius, who showed a more scientific approach to these problems, Pliny the Elder also made numerous references to magical or ritual practices that involved the use of decoctions or mixtures based on things like frog hearts and earthworms boiled in oil, or the ashes of wolf or fox heads, and bull bile. Nevertheless, in *Naturalis Historia* he also considered it appropriate to use analgesic mouthwashes based on medicinal herbs that were known for their soothing and anti-inflammatory properties, such as mallow, giant hogweed and henbane root.

Archaeological evidence

Medical and surgical instruments

The discovery of a considerable number of surgical instruments in both *Pompeii* and *Herculaneum* testifies

that the knowledge in the medical field was already relatively advanced when these two cities were destroyed (22). In the dental field, the Roman physician would probably have made use of a vast *instrumentarium*, which would have included several elements, such as the *forceps herculanensis* and the *rizagra*, as cited by Celsus (14,23). The first of these, the *forceps herculanensis*, was a bronze instrument made up of two curved, notched and joined branches interpreted as *odontagra*, and was useful for the removal of unstable teeth within its alveolus (24). However, although the rizagra was probably a multifunctional tool, in the dental field it was interpreted as pliers, for extraction of dental roots.

Remains of carbonised food

The archaeological site of *Herculaneum* is unique in its kind, as the pyroclastic material produced by the eruption of Vesuvius not only buried and sealed the city, thus killing its inhabitants, but also resulted in carbonization of diverse organic-based materials, such as wood and food. The remains of innumerable foods not only made it possible to understand how the diet of inhabitants was very rich and varied, but also offered new perspectives on the relationships between health and nutrition in the Roman period (25). Food had a key role in Roman medicine, as many foods were recognized as having healing properties for various diseases.

Dental palaeopathology seen through the diverse sources of information

Below we provide three examples that illustrate the importance of integrating data from these different sources of information.

Plants, food and therapeutic remedies in the I century AD

In the ancient world, the boundary between substances of vegetable and animal origin that are normally consumed as a meal or for medicinal purposes was very blurred. It is not infrequent that written sources indicate the names of plants and foods to be used in the preparation of drugs. These drugs were mostly composed of medicinal plants or foods known for their calming, astringent, antibacterial, anaesthetic and antiseptic properties, and they were processed differently depending on the part used and on the result that was desired. Most of the substances were first macerated or mixed with water, oil, wine and honey. Subsequently, they were generally administered through the skin and mucous membranes in the form of ointments, infusions, decoctions, poultices, powders and mixtures.

Celsus, Scribonius, Pliny the Elder and Dioscorides provided examples of the *continuum* perceived in these ancient times between dietetics and medicine. Furthermore, for pathologies that affected the masticatory system, they referred in their works to the intake of specific fruits, vegetables and substances of animal origin, including honey (26). In light of these considerations, it is essential to try to define any possible correlations between the organic remains found in *Herculaneum* and the possible curative remedies applied both generally in the medical field, and more specifically in the odontostomatological field. For example, among the organic remains preserved, the figs and pomegranates are of particular interest, as the use of these two specific fruits (both fresh and dried) was recommended to relieve toothache, and to treat pathologies inherent to the soft parts of the oral cavity. Generally, once the pomegranates and figs had been collected, they were stored under several layers of straw before being crushed using a press, to improve their drying (27). Analyses carried out on samples of these specific fruits revealed how this particular conservation method resulted in the proliferation of actinomycetes, such as *Streptomyces* spp. These were then unknowingly ingested by the inhabitants, together with the antibiotics that they produced (28). On the other hand, the study of bone remains has shown how the ancient inhabitants of *Herculaneum* took doses of antibiotics during their lifetime (e.g., tetracyclines, streptomycins). It has been hypothesized that the Romans unknowingly produced these natural antibiotics and ingested them for therapeutic purposes, by ingesting fruits contaminated with *Streptomyces* spp.

Indeed, although the consumption of pomegranates and figs was probably intermittent, and although the levels of natural antibiotics that they contained would have been relatively low, there was low frequen-

cy of non-specific bone infections in *Herculaneum*. Furthermore, there was low incidence of inflammatory processes localised to the tissues adjacent to the apex of the dental roots (i.e., periodontium and alveolar bone).

For medical treatments, medicines based on *Punica granatum* (pomegranate) or *Ficus carica* (fig) were also suggested for the treatment of mouth and tongue ulcers, canker sores, gingivitis, and diverse pathologies related to the palate and uvula, and also for when the gingivae withdrew from the teeth. Recent studies have confirmed that the ingestion of pomegranate leaves, fruit, seeds and bark is useful to counteract the actions of various pathogens, due to their antifungal and antimicrobial properties (29). In contrast to the scarcity of non-specific diseases, there was high incidence of infectious pathologies, such as brucellosis. This suggested the hypothesis that not all of the inhabitants obtained regular doses of natural antibiotics through their food. Although it cannot be said with absolute certainty that there was any correlation between ingestion of foods containing natural antibiotics and the treatment of some infectious diseases, it is believed that these protected part of the population from infections (30).

Thus, the biological and archaeological evidences support the literary sources, where Pliny the Elder, the pharmacologist Dioscorides and medical authors as Celsus and Scribonius list the medicinal uses to which specific fruits, such as pomegranate, were intended for their remarkable properties.

Environmental factors and their influence on dental pathologies

Analysis of the dentition of the ancient inhabitants of *Herculaneum* revealed low incidence of infectious pathologies. In contrast, there was higher frequency of individuals who suffered from dental enamel hypoplasia, which is a pathology associated with a physiological disorder of enamel formation during childhood. As the enamel cannot be remodelled through life, defects in the development of enamel can be clearly seen, to provide a snapshot of the moment when the period of physiological stress occurred.

To determine how much of the information reported in historical sources can be confirmed by biological sources, a study was carried out on the dentition affected by enamel hypoplasia. The aim was thus to identify any correlations with the disastrous earthquake of 62 AD, as mentioned by Lucius Annaeus Seneca, Publius Cornelius Tacitus and Gaius Suetonius Tranquillus. The data obtained showed that among the victims, there were two age groups that showed relevant models of enamel hypoplasia; a first peak occurred among the individuals who were approximately 6 years old at the time of the earthquake, and a second group involved those who had undergone a moment of severe physiological stress approximately 10 years before the earthquake. From a bio-anthropological point of view, the bimodal distribution of enamel hypoplasia can be interpreted as the consequence of two different historical moments that were characterized by instability in the supply of food resources or by a lack of hygiene conditions, with the consequent epidemic episodes. Considering the ages of the individuals who showed the first peak of enamel hypoplasia and the date of the earthquake of 62 AD, there indeed appears to be a correlation between these two events (31). The high proportion of individuals with enamel hypoplasia has also been interpreted by some as a consequence of endemic fluorosis (32). In such cases of marked hypomineralisation and severe alterations of the enamel, a correlation has been proposed between a form of chronic fluorosis and an excessive content of fluorine in the drinking water (33). On the other hand, in the Vesuvian area, the presence of toxic levels of fluorine in the soil and the aquifers can be associated with its geovulcanological nature. Indeed, during volcanic activity, Vesuvius released fluorine in a highly soluble form, which will have easily penetrated the underground layers and subsoil. In many cases, this would have then entered plants and waters subsequently ingested in the daily diet of the local population. The high concentration of fluorine in most of the teeth of the *Herculaneum* inhabitants is important evidence that they mainly drank heavily contaminated groundwater.

Therefore, the historical evidences provided by Seneca, Tacitus and Suetonius, together with geovulcanological and archaeological information, report on how the consequence of diverse environmental factors could influence the health of the inhabitants of *Herculaneum* prior to their death by the eruption of

Vesuvius, being this information supported by the biological sources.

Dentists and applied dentistry

Generally, in the first Imperial period, the figure of the *medicus*, and even more that of the dentist, remains to be defined. It is not possible to establish with certainty who specifically dealt with surgical or topical treatments of pathologies inherent to the oral cavity. For the dental profession, it is not certain whether these professionals were specialized physicians, as we understand today, or if they were figures who generally dealt with the treatment of various pathologies that included those associated with the oral cavity. Nevertheless, as deduced from the medical treatises, even if the figure of the dentist was not well defined, there were different therapeutic treatments and surgical procedures known and applied in the dental field.

The medical treatises of the I century AD testify that extraction was the most widespread dental practice, which was considered to be particularly dangerous when not performed correctly and with a skilful hand. Indeed, an unsuccessful intervention might prevent correct healing of the periodontal bone. It is plausible that the first professional dentists were aware of having to completely remove both the tooth and the root using specific tools that were suitable for this surgery. In general, although direct evidence of dental extractions is relatively rare for the ancient world, the discovery of a *taberna* that was apparently used by a barber–dentist at the Temple of Castor and Pollux in the Roman Forum shed new light on the subject (34). The research conducted on the numerous teeth, instruments and containers for medicaments found in this environment, led to the hypothesis that there was in Imperial Rome the figure of an expert professional who practiced systematic and accurate dental extractions (35).

Further archaeological evidence on the dental techniques applied in relation to the instability of the teeth was provided by the discovery of a dental prosthesis in the Roman necropolis of Viale della Serenissima in Rome. This dental bridge was created with the support of gold thread, and testifies directly to the implementation of these dental precepts that were well documented in literary sources (36). For the *Herculaneum* context, although the loss of *antemortem* teeth was frequently recorded for the victims of the Vesuvian eruption, no orthodontic appliances, or remains thereof, were found, along with no more general evidence of surgical treatments associated with dental extractions.

However, although hypotheses about these possible practices cannot be advanced, studies carried out on the oral cavity of a victim allowed the description of a case of healed maxillofacial fracture. This applied to an adult female individual whose examination of the maxillofacial region revealed evidence of dislocation and fracture of the mandibular right condyle, as well as traumatic dental injuries. The traumatic injuries observed were interpreted as the result of a probable violent impact that directly involved the chin region. In this case, the force of the impact was then transmitted in the direction of the mandible, maxilla and the related teeth. In particular, the indirect impact between the two dental arches resulted in fractures of three dental crowns. The morphology of the lesions, together with the location and their extension, suggested that these occurred following an accidental fall, which would have occurred when the individual was aged between 7 and 15 years old (37). Unfortunately, there was no certain evidence of any medical surgical intervention practiced for treatment of the fracture of the mandible and its relative dislocation, although it is certain that no dental extraction was performed.

Therefore, it is deduced from the medical treatises coeval to the I century AD, such as those of Celsus and Scribonius, that there were different therapeutic treatments and surgical procedures known and applied in the dental field, with archaeological evidences supporting this information. Unfortunately, at this moment, among the biological remains from *Herculaneum* no evidence has been found of the practice of medical-surgical interventions or therapeutic treatments.

Conclusions

The analysis of skeletal remains not only allows the study of the history and evolution of diseases of past populations, but also allows reconstruction of their

health conditions. Furthermore, the collaboration between different disciplines has provided a more comprehensive and in-depth picture of diseases of the oral cavity in the *Herculaneum* population. In particular, this relies not only directly on the human remains, but also on historical–literary and archaeological sources.

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