Original Article

Oral lesions in Liber Continens and The Canon of Medicine: medical approaches, modes of knowledge transmission, and reflections on modern dentistry

Merve Erdem[1], İbrahim Topçu[2], Ahmet Beyatlı[3], Beyzanur Kaç[4*], Ismail Uzar[5]

1. DDS, PhD, Department of History of Medicine and Ethics, Maltepe University Faculty of Medicine, Istanbul, Türkiye.
2. MD, PhD, Department of History of Medicine and Ethics, Hamidiye Faculty of Medicine, University of Health Sciences Türkiye, Istanbul, Türkiye.
3. PhD, Medicinal and Aromatic Plants Program, Hamidiye Vocational School of Health Services, University of Health Sciences Türkiye, Istanbul, Türkiye.
4. Research Assistant, Department of History of Medicine and Ethics, Hamidiye Faculty of Medicine, University of Health Sciences Türkiye, Istanbul, Türkiye.
5. MD, Resident Doctor, Department of Pediatrics, İstanbul Medipol Üniversitesi, Istanbul, Türkiye.

Abstract

During the medieval Islamic era, and before dentistry emerged as an independent discipline, Rhazes and Avicenna documented their observations on oral and dental health within their broader medical works. This comparative historical analysis examines ulcerative oral lesions within the framework of humoral medicine, using Rhazes's *al-Ḥāwī fī al-Ṭibb* (*Liber Continens*) and Avicenna's *al-Qānūn fī al-Ṭibb* (*The Canon of Medicine*), and evaluates them for diagnosis, classification, drug repertoire (*materia medica*), and routes of administration.

The findings reveal that Rhazes provides an extensive, multilayered therapeutic repertoire drawing on clinical observations and earlier scholars, while Avicenna adopts a more systematic and classificatory approach. Herbal and mineral drugs constitute the core of both of their therapeutic repertoires. Direct clinical observations are highlighted by the association of childhood oral thrush with milk and an emphasis on the delicacy of the oral mucosa. Their complementary historical approaches offer valuable insights that may warrant further investigation into modern pharmacology.

Keywords: *History; Medieval; Literature; Oral lesions; History of medicine.*

***Corresponding Author**
Beyzanur Kaç
Address: Department of History of Medicine and Ethics, Hamidiye Faculty of Medicine, University of Health Sciences, Istanbul, Türkiye.
Tel: (+90) 53 66 52 03 79
Email: beyzanur.kac@sbu.edu.tr

Received: 13 May 2026
Accepted: 7 Jul 2026
Published: 30 Sep 2026

Citation to this article:
Erdem M, Topçu İ, Beyatlı A, Kaç B, Uzar I. Oral lesions in Liber Continens and The Canon of Medicine: medical approaches, modes of knowledge transmission, and reflections on modern dentistry. J Med Ethics Hist Med. 2026; 19: 16.
https://doi.org/10.18502/jmehm.v19i16.22904

Copyright © 2026 Tehran University of Medical Sciences.
This work is licensed under a Creative Commons Attribution-Non-Commercial 4.0 International license https://creativecommons.org/licenses/by-nc/4.0/).
Non-commercial uses of the work are permitted, provided the original work is properly cited.

Introduction

Rhazes (865–925) and Avicenna (980–1037), two distinguished figures in medicine of the Islamic era, are notable not only as prominent physicians of their time but also as authorities whose comprehensive works significantly influenced medical thought in subsequent centuries. In the principal works of both physicians, extensive information is provided on the etiology, clinical progression, and treatment of diseases; within this framework, their observations on oral and dental health occupy a noteworthy position in the medical paradigms of their period. Rhazes was born in the city of Ray in Persia, near present-day Tehran, the capital of Iran (1). Avicenna was born in Afshana, near Bukhara, the capital of the Samanid dynasty in the tenth century (2). The medical works of both physicians were deeply embedded in the humoral tradition that shaped the theoretical and practical foundations of medicine in the Islamic era.

In medieval Islamic medicine, the explanation and treatment of diseases were primarily structured by the theory of humoral medicine. This approach was inherited from ancient Greek medicine and adopted in the medical tradition of the Islamic era by Rhazes and Avicenna (1,3). According to humoral doctrine, bodily health was contingent upon the balance of the four humors—blood, phlegm, yellow bile, and black bile- and imbalances in the humors could lead to disease. These humors were characterized by qualities such as hot/cold and moist/dry, and diseases were classified according to the predominant humor and associated qualities. Therapeutic interventions involved the administration of drugs with qualities opposite to those of the excessive or imbalanced humor, aimed at restoring equilibrium. Additionally, procedures such as bloodletting, emesis, purgation, and induced sweating were employed to eliminate excess humors from the body, complemented by dietary regulations and other lifestyle interventions designed to re-establish humoral balance (4). Within this framework, the emergence and management of oral lesions were likewise assessed in the context of humoral theory, with particular emphasis on concepts such as heat, moisture, and putrefaction in explaining conditions such as oral thrush and

ulcerative lesions. A review of the available literature reveals that no comparative study has yet examined in detail the diagnostic categories, etiological explanations, and therapeutic approaches to oral lesions in the medieval Islamic world, where dentistry had not yet evolved into a distinct discipline, including *Liber Continens* and *The Canon of Medicine*. This gap constitutes the primary motivation for the present study. The scope of this study encompasses approaches to diagnosis, etiology, and treatment in both texts, as well as their structural features, modes of knowledge transmission, and terminological characteristics. Given the approximately one-hundred-year gap between Rhazes and Avicenna, the therapeutic substances common to both physicians may be regarded as the product of a long process of refinement rather than mere coincidence. The fact that these shared substances continue to attract scholarly attention in modern pharmacological research, despite a fundamental shift in the medical paradigm, constitutes further motivation for the present study. In this context, the central research question of the study is: How did these two eminent physicians of different eras approach the diagnosis and treatment of oral lesions, and to what extent can their shared therapeutic repertoire serve as a source of inspiration for modern dental practice?"

Methods

Although aspects of dentistry and oral health in medieval Islamic medicine have been discussed in previous studies, research focusing specifically on oral lesions remains limited (5). Moreover, no comparative study examining the therapeutic substances recommended for oral lesions in both *Liber Continens* and *The Canon of Medicine* has been identified. Given the approximately one-century interval between the two works, searching for shared therapeutic substances may provide insight into the continuity and transmission of medical knowledge within the humoral tradition. In this context, these two texts were selected based on several key criteria. The selection of oral lesions as the focus of this study is grounded in several considerations. In the history of medicine literature, studies on diseases and treatments based on humoral pathology predominantly address systemic conditions. Topics directly relevant to dentistry, such as toothache, dental caries, and oral lesions, remain comparatively underrepresented in this literature. The first

author's background as a dentist was a determining factor in directing scholarly attention to how oral lesions were conceptualized and treated within the humoral-pathological paradigm. These two texts were selected based on the following criteria: First, both rank among the most comprehensive medical encyclopedias of their respective periods and represent the two most mature expressions of the humoral medical tradition. Second, the approximately one-hundred-year gap between the two texts allows for tracing how the accumulated body of knowledge concerning the same disease category was transformed over time. Finally, the availability of modern editions and translations of both texts renders them accessible for scholarly analysis.

This study employed a comparative qualitative analysis. For the examination of *Liber Continens*, the authors used the Arabic edition, revised by Muḥammad Ismāʿīl and published by Dār al-Kutub al-ʿIlmiyya (Beirut, Lebanon) under the Muḥammad ʿAlī Bayḍūn Publications in 2000 (6). The study focuses on the section in the first volume, pages 509–521, which addresses "Lesions such as ulcers and oral thrush occurring from the entire mouth down to the throat" (6). This section was analyzed in the original Arabic, and statements concerning diagnosis, etiology, and treatment were evaluated through philological examination, conceptual analysis, and thematic content analysis. For Avicenna's *Canon of Medicine*, the present study was based on the Ottoman Turkish translation (i.e., Turkish written in the old Arabic script) entitled *Taḥbīz al-Maṭḥūn*; this work was composed by Tokadî Muṣṭafā Efendi in the 18th century, and the authors used the 2018 edition published by the Turkish Manuscripts Institution (7,8). In the first volume (*Kulliyāt*), the analysis focuses on the third section, specifically Chapter 3, titled "On Diseases Occurring in Children," which covers pages 766–767 (7). In the third volume (*Tashrīḥāt-ı Evvel*), the analysis focuses on the sixth section on "Diseases of the Mouth and Tongue and Their Treatments," specifically Chapter 15, entitled "On Oral Thrush and Other Malignant Lesions Occurring in the Mouth," covering pages 486–489 (8). Both texts were compared with respect to terminology, conceptual structure, disease classification, etiological explanations, and therapeutic approaches. In the course of the analysis, the core concepts of humoral pathology (phlegm, bile, black bile, and blood) and the relationship

between lesion color and diagnosis were examined. In addition, the drugs and compound formulations mentioned in both works were extracted and tabulated separately, and the common herbal components in these tables were identified. Comparison of simple and compound remedies was conducted within a semi-quantitative framework, grounded in the distribution of therapeutic examples across the texts; on account of the recurrence of the same remedies in different contexts and the presence of formulation variants, no attempt was made to provide an exact numerical inventory. Finally, the drugs mentioned in these historical texts were examined through thematic matching with the modern pharmacology and dentistry literature. It must be noted that *Liber Continens* was examined in the original Arabic, but the analysis of *The Canon of Medicine* relied on an Ottoman Turkish translation; therefore, minor semantic variations cannot be entirely excluded, as is the case with any translated historical text.

Results

In this section, the approaches of Rhazes and Avicenna to oral lesions are presented and discussed separately. The aim is to outline in detail the diagnostic categories, etiology, treatments, and clinical observations related to oral lesions in the works of both authors.

Oral Lesions in Liber Continens

Rhazes explains the emergence of oral ulcers (*quruḥ*) in terms of excessive moisture and the associated processes of putrefaction and mold (*al-ʿufn*) (6). In his view, the oral mucosa has a looser, softer structure than the skin covering the rest of the body. For this reason, under conditions of increased heat and moisture, lesions on the oral mucosa are easily altered and tend to putrefy. At the same time, Rhazes notes that the temperaments (*mizāj*) of the intraoral organs differ. He expresses this by stating that “the gums are dry, except for the tongue.” Thus, although the oral mucosa is loose and soft, it is drier than the tongue (6). Because the tongue has a more humid nature and is continuously exposed to heat and moisture, it is, in his view, more prone to molding than other intraoral organs. Accordingly, he recommends stronger desiccant drugs for the treatment of mold-like lesions on the tongue, and, citing Galen, emphasizes that this should not be regarded as a contradiction (6). According to Rhazes, another cause of intraoral lesions is an excess of bile. In cases of severe oral ulcers with a poor prognosis, or those that are painful and

accompanied by fever, in addition to using "desiccant and astringent" formulations, he advises employment of procedures such as bloodletting, cauterization, or purgation (6). Furthermore, owing to the loose and soft structure of the mucosa, he warns that drugs intended for local application in the oral cavity may inadvertently descend into the throat and cause harm. Rhazes draws a clear distinction between ulcers and oral thrush (*qulāʿ*), which he particularly associates with childhood (6). He believes that when thrush deteriorates and progresses, it is no longer "thrush" but rather "putrefied ulcer" (*qurūḥ ʿafina*) (6). In children, thrush is generally easy to treat and can be alleviated with moderately astringent remedies. In some cases, however, it follows a more severe course and requires stronger medications. The "black thrush," a grave form with a poor prognosis that Rhazes describes with reference to Galen, appears to occur predominantly in adults rather than in children (6). In addition to these observations, Rhazes also includes herpetic eruptions (*al-buthūr*) among intraoral lesions, describing their manifestations on the tongue and palate (6). Within the therapeutic principles that prioritise desiccant and astringent drugs, Rhazes's repertoire is remarkably extensive. In the treatment of oral ulcers, he makes use of numerous remedies of plant, mineral, and animal origin. These drugs are sometimes administered as single agents and sometimes formulated into various compound preparations, applied either topically within the oral cavity or as mouth rinses and gargles. Rhazes also regards dietary regulation and the selection of appropriate foods as fundamental elements supporting the therapeutic process (6). The *materia medica* employed by Rhazes in the treatment of oral lesions is presented in Table 1.

Table 1. *Materia Medica* repertoire in *Liber Continens*

Category	Drugs/Substances	Usage/Methods
	Rose seed and water (*Rosa spp.*), pomegranate flower and juice (*Punica granatum*; flos, juice), sumac (*Rhus spp.*), mastic (*Pistacia lentiscus* resin), acacia (*Acacia spp.*; gum), lentil (*Lens culinaris*), purslane and its seed (*Portulaca oleracea*; herb, seeds), goat's thorn (*Alhagi spp.*), coriander (*Coriandrum sativum*), quince (*Cydonia oblonga*), apple (*Malus domestica*), pear (*Pyrus communis*), sorrel (*Rumex spp.*), mulberry (*Morus spp.*), raspberry (*Rubus spp.*), tarragon (*Artemisia dracunculus*), barley (*Hordeum vulgare*), fenugreek (*Trigonella foenum-graecum*), chicory (*Cichorium intybus*), marjoram (*Origanum spp.*), lettuce (*Lactuca sativa*), Makkah henna (*Lawsonia inermis*), yellow poppy (*Glaucium spp.*),	Most are employed for their cooling, astringent, or desiccant properties; some are recommended as mouthwashes, while others are applied as ointments.

Herbal	chamomile (*Matricaria spp*.), mountain marjoram (*Origanum spp*.), anchusa (*Anchusa spp*.), nerve herb (*Verbena spp*.), star anise (*Illicium verum*), grape (*Vitis vinifera*), mastic gum (*Pistacia lentiscus* resin)	
Mineral/ Metal	Vitriol (copper sulfate), sulfur, chalk, arsenic, lime, copper patina (verdigris), copper, kaolin, Armenian clay, myrrh	These are mainly used in severe cases, such as malignant thrush and deep ulcers, and have a cauterizing and drying effect.
Animal	Turtle's gallbladder, calf's bone marrow, donkey's milk, honey, yogurt	These are recommended for thrush and severe ulcers in children.

In Rhazes's work, there are descriptions of single remedies as well as numerous compound preparations (*adwiya murakkaba*) composed of multiple drugs, and these vary according to the type and severity of the disease. In severe cases, in addition to cauterization, vinegar- and salt-based gargle solutions are recommended to prevent mold formation and putrefaction. Another noteworthy aspect of Rhazes's treatise is that, while he maintains the tradition of transmitting the knowledge of earlier physicians, he at times explicitly distinguishes his own experience by using the word "mine" (*liyy*) (6). He presents examples of applications involving mastic gum and tarragon as based on personal observation.

Oral Lesions in The Canon of Medicine

In *The Canon of Medicine*, in the sixth section of the third volume on diseases of the mouth and tongue, Avicenna discusses oral lesions within the framework of humoral pathology, distinguishing between oral thrush (*qulāʿ*) and other malignant ulcers (*qurūḥ khabītha*). In his view, oral thrush on the surface of the mouth and tongue arises from the predominance of one of the four humors, and the color of the lesion indicates which humor is dominant. Accordingly, white thrush corresponds to an excess of phlegm, yellow thrush to bile, red thrush to blood, and black thrush to black bile. In Chapter 3 of the first volume of *The Canon*, Avicenna explains that white and red thrush generally follow a milder course, yellow thrush presents with the most intense inflammation, and black thrush is the most severe, with the worst prognosis and a potentially fatal outcome. In addition, he divides thrush into two types based on whether the erosion and gangrene are severe or mild. Finally, he notes that thrush may also be classified according to whether it is accompanied by swelling (*waram*) (8). Avicenna emphasizes that oral lesions occur more frequently in children,

particularly when caused by milk or undigested substances in the stomach. In *The Canon of Medicine*, specifically in the third section of the first volume on diseases occurring in children, he attributes the frequent occurrence of these lesions in childhood to two factors: the extreme softness of the oral and lingual surfaces in children, and the tendency of milk, especially in breastfed infants, to occlude bodily pores. He further explains that when milk comes into direct contact with the oral mucosa, it can irritate the mouth and cause thrush (7). In *The Canon of Medicine*, specifically in the sixth section of the third volume, Avicenna draws on Galen to distinguish between thrush and other malignant ulcers. He states that as long as a lesion has not undergone putrefaction and has not deepened, it is to be called thrush; once it becomes putrefied and deep, however, it should no longer be termed thrush but rather a malignant ulcer (*qurūḥ khabītha*). In the treatment of thrush, he notes that, unlike malignant ulcers, there is no need for very potent drugs. Avicenna also notes the influence of environmental conditions, observing that thrush occurs more frequently in rainy weather and often accompanies febrile states arising from inflammation. In treatment, the primary objective is to reduce and rebalance the predominant humor responsible for thrush. If a particular humor is thought to be dominant throughout the entire body, it must be drained, which can be achieved by bloodletting from the veins located under the jaw, especially those referred to as "*chahārek*" (8). Local treatments, by contrast, vary according to the severity and temperament of the lesion: purulent, highly inflamed, and excessively moist forms of thrush require stronger drugs, but in children, milder, gentler remedies are recommended. Avicenna further notes that oils (including olive oil) should be avoided in the treatment of thrush. He also specifies the pharmaceutical forms to be used based on the lesion's colour: When thrush appears red, astringent and cooling agents should be employed in the early stages of the disease, followed by resolvent remedies in the later course. For yellow or yellowish-red forms of thrush, drugs with predominantly cooling qualities are prescribed. In other forms of thrush, moderately desiccant and cleansing remedies are used at the beginning of treatment, whereas in later stages, more potent desiccant and resolvent drugs should be employed. A common principle across all these therapeutic approaches is the need to carefully consider the patient's age. Indeed, in the treatment of children, weaker

remedies and drugs aimed at improving the quality of breast milk are recommended. For infants who can receive supplementary foods, certain items believed to be beneficial for thrush may be directly incorporated into the child's diet. In infants nourished exclusively with breast milk, by contrast, intervention is directed not at the infant but at regulating the quality of the mother's milk through adjustments in the mother's diet (8).

In the first volume of the Canon, Avicenna recommends a specific compound for managing severe, deep-seated thrush. This formulation includes ʿ*urūq*, pomegranate peel, pomegranate blossom, sumac, gallnut, and Yemeni alum. All ingredients are to be ground and sieved in the specified proportions (six, four, and two dirhams, respectively), then sprinkled directly onto the lesion (8). However, Tokadî notes that in many manuscripts of the Canon, Avicenna does not clarify the identity of the plant ʿ*urūq*, and that this omission is also found in the commentarial tradition; with explicit reference to Shīrāzī, he emphasises this point by stating that "even the great scholar *(allāme)* has not explained it" (7). Some of the drugs recommended in *The Canon* for various types of oral lesions are presented in Table 2.

Table 2. Substances recommended by Avicenna for oral lesions and the ingredients used in their preparation

Category	Drugs/Substances	Usage/Methods
Herbal	Rose (*Rosa spp*.), pomegranate flower (*Punica granatum;* flos), pomegranate peel (*Punica granatum*; pericarp), sumac (*Rhus spp*.), lentil (*Lens culinaris*), quince (*Cydonia oblonga*), apple (*Malus domestica*), loquat (*Eriobotrya japonica*), lettuce (*Lactuca sativa*), purslane (*Portulaca oleracea*), wild mustard (*Sinapis spp*.), mallow (*Malva spp*.), bamboo root powder (*Bambusa spp*.), and camphor (*Cinnamomum camphora*)	These possess cooling, astringent, and soothing properties; some are used as ointment or gargle.
Mineral/Metal	Sulfur, ferrous sulfate, copper rust (verdigris), copper solution	In more resistant or malignant ulcers, desiccant and cauterizing treatments are employed.
Animal	Deer's pelvis, honey, calf's pelvis, turtle's gallbladder	These are reserved especially formelancholic (black) ulcers.

Discussion

Although Rhazes and Avicenna's accounts of oral lesions are grounded in the humoral pathology paradigm, they offer complementary approaches in method, style, and therapeutic planning. Both explain lesions as resulting from humoral imbalance, using lesion color as a diagnostic indicator, as described in the Results section. In both works, childhood thrush is primarily associated with milk; milk that is qualitatively impaired or inadequately digested is said to give rise to thrush on the thin, delicate mucosa of the child. Rhazes links thrush closely to childhood, and Avicenna concurs. However, Avicenna further underscores the particular thinness of the oral mucosa in children, attributing the formation of thrush to this anatomical delicacy alongside the humoral factors. Rhazes, by contrast, points out the tendency of the loose oral mucosa to retain moisture and develop mold, presenting this not only as a cause specific to children but as a more general explanation for thrush. This shared explanatory framework suggests that both texts are shaped not only by theoretical constructs but also by clinical observation. Rhazes's anatomical emphasis on the oral mucosa being looser and softer than the skin of the body, and Avicenna's reference to the softness (or fragility) of the child's mucosa, thus appear as mutually reinforcing perspectives. In Rhazes's account, a clear distinction is drawn between thrush and ulcer. When thrush progresses due to putrefaction and tissue decay, it is no longer considered thrush and is instead termed "putrefied ulcer" (*qurūḥ ʿafina*). Moreover, Rhazes conceptualizes thrush along a spectrum ranging from mild childhood forms to severe adult types, such as black thrush. His texts also address not only thrush and ulcers but also herpetic eruptions, which he classifies by color into white, red, yellow, and black. This approach shows that he does not confine oral lesions to a single diagnostic category, but rather evaluates other intraoral and perioral lesions that share similar manifestations within a common framework. By contrast, Avicenna primarily treats intraoral lesions under the headings of thrush and malignant ulcers arising in the course of thrush, and does not discuss more superficial lesions such as the herpetic eruptions described by Rhazes. Nonetheless, he does mention

abscesses and pustules (*buthūr*) occurring on the gums of children, for which he recommends single drugs in connection with the treatment of thrush. In this respect, although both physicians describe intraoral lesions within a broadly similar clinical picture, Avicenna's use of the term *buthūr* for abscesses and pustules of the gingiva in children suggests a terminological distinction compared with Rhazes. Avicenna discusses oral thrush in two separate sections of *The Canon of Medicine*: in the first volume, under the heading "On Diseases Occurring in Children," and in the third volume, under the heading "Diseases of the Mouth and Tongue and Their Treatments."

Against this background, a comparison of the writing styles of Rhazes and Avicenna helps to clarify how their respective methodological approaches shaped the presentation of oral diseases. In *Liber Continens*, Rhazes presents diseases of the mouth in a highly complex manner, interweaving quotations from various physicians with his own observations. This suggests that Rhazes conceived his work not as a monographic treatise systematically organized around a single topic but as an encyclopedic compendium in which diverse observations and experiences are assembled cumulatively. In addition to classifying diseases, he records, based on his observations, the effects and modes of drug use, thereby building a practical reservoir of therapeutic knowledge in *Liber Continens*. This encyclopedic character is likewise reflected in his writing style. As he expands his text with quotations from physicians of different periods, he labels citations of unknown origin as "anonymous (*majhūl*)" and records his own contributions with the phrase "mine" (*liyy*) (6). This style not only imparts a vivid and rich character to his work but also illustrates how experiential medical knowledge was incorporated into the written tradition. By contrast, Avicenna's text is more classificatory in nature: he offers conceptual explanations within a framework of cause-and-effect relationships and presents therapeutic principles in a systematic order. His decision to treat the same topic in two different volumes and in two distinct contexts reflects a style that privileges theoretical organization.

This distinction is also reflected in their therapeutic repertoires, particularly when viewed from the perspective of modern dentistry. In the treatment of oral ulcers, Rhazes stands out for the breadth of his therapeutic repertoire: astringent/drying plants (rose, sumac, galls, pomegranate blossom, etc.), cooling and

soothing components (lentil, purslane, etc.), potent mineral- and metal-derived agents (vitriol/iron sulfate, alum, verdigris, lime, etc.), and animal-based substances (honey, marrow, etc.) (6). By contrast, Avicenna's treatment of oral thrush and related oral lesions relies on a more limited repertoire, consisting primarily of simple drugs (*mufrad dawāʾ*), while compound drugs (*murakkab dawāʾ*) appear within a narrower framework. In Rhazes's work, both simple and compound drugs are more widely distributed, in terms of both the number and the diversity of formulations (6). In modern dentistry, the use of some of the highly caustic and desiccating substances described by Rhazes (such as arsenic and copper derivatives) is incompatible with contemporary clinical practice (9–11). Even in humoral pathology, these substances had only limited indications. Rhazes, in particular, warns against their potential to burn tissues and the risk of ingestion, and adopts a cautious stance regarding their use. For this reason, prescriptions in classical medical texts should not be transferred directly into modern clinical practice, but should instead be understood within their own epistemological context and approached as potential sources of inspiration for current pharmacological research.

When evaluated in this way, it becomes apparent why several drugs mentioned in both *Liber Continens* and *The Canon of Medicine* have attracted renewed scholarly attention in contemporary pharmacological research. For example, pomegranate (Punica granatum) preparations have been evaluated in clinical research for gingival inflammation and investigated as a mouth rinse formulation (12). Rose (Rosa damascena) extracts have been reported in modern literature to possess a range of pharmacological applications and benefits, including anti-HIV, antibacterial, antioxidant, antitussive, hypnotic, antidiabetic, and tracheal muscle relaxant effects (13). Similarly, the resin of mastic (Pistacia lentiscus) has attracted attention for its potential to maintain oral mucosal health and its possible effects on biological processes associated with oral cancer (14). Studies on plantain (Plantago major) suggest that this plant may support the healing of intraoral ulcers (15). It can therefore be deduced that classical physicians possessed not only theoretical knowledge but also a practical corpus grounded in empirical observation.

Comparing the herbal drugs and therapeutic formulations in *Liber Continens* and *The Canon of Medicine* is therefore important for

understanding how this empirical orientation was concretized through two different methodological approaches. In this study, the diagnostic and therapeutic approaches of Rhazes and Avicenna to oral ulcers were compared based on their texts, and the drugs that appear in both works were identified. This approach not only juxtaposes the therapeutic concepts of two major physicians but also enables tracing therapeutic traditions that represent medicine of the Islamic era. In this way, it establishes a shared ground in both historical continuity and potential pharmacological foundations. To make these comparisons more concrete, the drugs that occur in both works and their counterparts in modern literature are presented systematically in Table 3 (16–30). Studies of the substances listed in Table 3 are based predominantly on in vitro or animal models and are not intended to serve as clinical evidence of therapeutic efficacy or to create confirmation bias toward their use. The broader literature on several of these substances includes findings that remain inconclusive or warrant further investigation, including results from controlled trials conducted on human volunteers (31–33). Additionally, for some substances such as Rosa spp., existing reviews have noted significant heterogeneity across study designs, underscoring the need for standardized clinical protocols (34).

In this respect, the modes of application attested in classical medical texts can also inform contemporary thinking on pharmaceutical formulation. These include vinegar or wine, topical pastes kneaded with honey or oils, aqueous infusions, and lozenges. These formulation strategies could serve as starting points for future experimental research, including the development of standardized preparations for controlled clinical evaluation. By comparing the treatments of oral ulcers in *Liber Continens* and *The Canon of Medicine*, this study has delineated two different interpretive models, composed at different historical moments yet situated within the same humoral medical paradigm. While observation-based knowledge production is a shared feature of both physicians, Rhazes tends to present his observations without consistently subsuming them under a systematic framework, whereas Avicenna integrates observational material into a more rigorously ordered structure. The drugs and formulations shared by these two works illustrate dimensions of historical medical knowledge that can inform modern pharmacological assessment. The shared therapeutic substances that appear in

the repertoires of both Rhazes and Avicenna are presented in Table 3, and several have attracted particular attention in contemporary pharmacological research. Pomegranate (Punica granatum) is among substances that have been investigated in a double-blind, randomized controlled trial as a mouthwash to reduce gingival inflammation (12). Oak galls (Quercus galls), with their high tannin content, have demonstrated antibacterial, antifungal, and anticariogenic properties in preclinical studies, warranting further investigation for oral health (28). Honey has been proposed for further investigation in the context of oral mucosal lesions due to its reported antimicrobial and wound-healing properties (29). Rose (Rosa spp.) and purslane (Portulaca oleracea) have also been reported to exhibit anti-inflammatory and antioxidant activities in recent studies, but the clinical relevance of these effects in the context of oral mucosal conditions remains to be established (24,27). (Table 3)

Table 3. Drugs common to *Liber Continens* and *The Canon of Medicine* and their reported antimicrobial, anti-inflammatory, and disinfectant effects in modern pharmacological literature

Drugs	Recent Findings and Sources
Blackberry (*Rubus spp*.) (the leaf in Avicenna's writings)	Antimicrobial and anti-inflammatory (16)
Pomegranate (*Punica granatum*) (the peel in Avicenna's writings)	Antifungal and antibacterial (17)
Grape (*Vitis vinifera*)	Antioxidant and antibacterial (18)
Mulberry (*Morus spp*.)	Anti-inflammatory and antimicrobial (19)
Quince (*Cydonia oblonga*)	Antioxidant and antimicrobial (20)
Apple (*Malus domestica*)	Antioxidant and antibacterial (21)
Pear (*Pyrus communis*)	Antioxidant and antimicrobial (22)
Hawthorn (*Crataegus spp*.)	Antibacterial and antioxidant (23)
Rose (*Rosa spp*.)	Anti-inflammatory and antioxidant (24)
Saffron (*Crocus sativus*)	Antibacterial and antifungal (25)
Lettuce (*Lactuca sativa*)	Antimicrobial (26)
Purslane (*Portulaca oleracea*)	Anti-inflammatory, antimicrobial and antioxidant (27)
Oak galls (*Quercus* galls)	Tannin-based astringent, antibacterial, anticariogenic, and antifungal (28)
Honey	Antimicrobial, anti-inflammatory (29)
Vinegar	Antimicrobial and disinfectant (mediated by acetic acid) (30)

The convergence of classical attestation and contemporary pharmacological interest in these substances suggests that they may constitute a meaningful starting point for future systematic

research. Most modern pharmacological studies cited in this context rely on in vitro experiments or animal models, and robust clinical evidence from human trials remains limited. This constitutes an important limitation in evaluating the clinical potential of these substances. Controlled clinical trials involving human volunteers are needed before any of these promising substances can be considered for integration into modern dental practice, and the present study aims to make this need more visible.

Conclusion

By comparing the accounts of oral ulcers in *Liber Continens* and *The Canon of Medicine*, this study has identified two distinct modes of elaborating a shared humoral framework. Taken together, Rhazes's narrative, shaped by observation and a pronounced practical orientation, and Avicenna's more conceptually ordered and systematic exposition shed light on the structure of knowledge production and therapeutic reasoning in the medical tradition of the Islamic era. The drugs and prescriptions common to both works indicate that the historical medical tradition rested not merely on theoretical explanations but also on an accumulated trove of experience derived from medical practice.

Ethics Approval

Ethics approval was not required for this study as it involved historical textual analysis of published sources and did not include human or animal subjects.

Acknowledgments

The authors received no specific funding and have no acknowledgments to declare.

References

1. Edriss H, Rosales BN, Nugent C, Conrad C, Nugent K. Islamic medicine in the Middle Ages. Am J Med Sci 2017; 354(3): 223–229.
2. Gutas D. "Ibn Sina [Avicenna]", The Stanford Encyclopedia of Philosophy (Winter 2025 Edition), Edward N. Zalta & Uri Nodelman (eds.), URL = https://plato.stanford.edu/archives/win2025/entries/ibn-sina/.
3. Boylan M. Galen: on blood, the pulse, and the arteries. J Hist Biol 2007; 40(2): 207–230.
4. Jackson WA. A short guide to humoral medicine. Trends Pharmacol Sci. 2001; 22(9): 487–489.

5. Derakhshan AR. Natural treatments for fissure in ano used by traditional Persian scholars, Razi (Rhazes) and Ibn Sina (Avicenna). JEBCAM 2017; 22(2): 324-333.
6. Abū Bakr al-Rāzī. *al-Ḥāwī fī al-Ṭibb*. Vol. 1. Ismāʿīl M, editor. Beirut: Dār al-Kutub al-ʿIlmiyya; Muḥammad ʿAlī Bayḍūn Publications 2000; 509–521.
7. Ibn Sīnā. *al-Qānūn fī al-Ṭibb*. Vol. 1. Tokadî Muṣṭafā Efendi, translator. Istanbul: Türkiye Yazma Eserler Kurumu Başkanlığı 2018; 766-767.
8. Ibn Sīnā. *al-Qānūn fī al-Ṭibb*. Vol. 3. Tokadî Muṣṭafā Efendi, translator. Istanbul: Türkiye Yazma Eserler Kurumu Başkanlığı 2018; 486–487.
9. International Programme on Chemical Safety. Arsenic and arsenic compounds. INCHEM [Internet]. n.d. Available from: https://www.inchem.org
10. Agency for Toxic Substances and Disease Registry. Toxicological profile for arsenic. Atlanta (GA): U.S. Department of Health and Human Services; n.d. Available from: https://www.atsdr.cdc.gov/toxprofiles/tp2.html
11. World Health Organization. Arsenic. Fact sheet [Internet]. n.d. Available from: https://www.who.int
12. Sedigh-Rahimabadi M, Fani M, Rostami-Chijan M, Zarshenas MM, Shams M. A traditional mouthwash (*Punica granatum* var. *pleniflora*) for controlling gingivitis of diabetic patients: a double-blind randomized controlled clinical trial. J Evid Based Complementary Altern Med 2017; 22(1): 59–67.
13. Boskabady MH, Shafei MN, Saberi Z, Amini S. Pharmacological effects of *Rosa damascena*. Iran J Basic Med Sci 2011; 14(4): 295–307.
14. Alwadi MAM, Sidhu A, Boumédiène Khaled M, Aboul-Enein BH. Mastic (*Pistacia lentiscus*) gum and oral health: a state-of-the-art review of the literature. J Nat Med 2023; 77(3): 430–445.
15. Jahanimoghadam F, Javidan A, Ranjbar M, Torabi M, Kakooei S, Sharififar F. The healing effect of nano-emulsified *Plantago major* L. extract on oral ulcers: a Wistar rat model study. BMC Complement Med Ther 2024; 24(1): 327.
16. Yiğit D, Yiğit N. Rubus fruticosus meyvesinin antibakteriyel aktivitesi. Erzincan Univ Fen Bilimleri Enst Derg 2015; 7(2), 267-74.

17. Vasconcelos LCS, Sampaio FC, Sampaio MCC, et al. Minimum inhibitory concentration of adherence of Punica granatum Linn (pomegranate) gel against S. mutans, S. mitis and C. albicans. Brazilian Dental Journal 2006; 17(3): 223-227.
18. Karkuzhali K. Antimicrobial activity of crude metabolites of *Vitis vinifera* against pathogenic microorganisms. J Pharm Bioallied Sci 2024; 16(Suppl 2): S1186-S1190.
19. Batiha GE, Al-Snafi AE, Thuwaini MM, et al. Morus alba: a comprehensive phytochemical and pharmacological review. Naunyn Schmiedebergs Arch Pharmacol 2023; 396(7): 1399–1413.
20. Kadıoğlu Dalkılıç L. Investigation of antioxidant, antimicrobial and cytotoxic activity of *Cydonia oblonga* leaf on breast cancer (MCF-7) and liver cancer (HepG2) cell lines. Turk J Sci Technol 2024; 19(1): 13–23.
21. Yanagida A, Kanda T, Tanabe M, et al. Inhibitory effects of apple polyphenols and related compounds on cariogenic factors of mutans streptococci. Journal of Agricultural and Food Chemistry 2000; 48(11): 5666-5671.
22. Ribeiro D, Silva V, Igrejas G, Barros L, Heleno SA, Reis FS, Poeta P. Phenolic compounds from *Pyrus communis* residues: mechanisms of antibacterial action and therapeutic applications. Antibiotics 2025; 14(3): 280.
23. Nam SH. Antimicrobial activity of *Crataegi fructus* extract used for potential application in the prevention and treatment of oral diseases. Medicina (Kaunas) 2023; 60(1): 13.
24. Verešová A, Vukić MD, Vuković NL, et al. Chemical composition, biological activity, and application of *Rosa damascena* essential oil as an antimicrobial agent in minimally processed eggplant inoculated with *Salmonella enterica*. Foods 2024; 13(22): 3579.
25. Primavilla S, Pagano C, Roila R, Branciari R, Ranucci D, Valiani A, Ricci M, Perioli L. Antibacterial activity of *Crocus sativus* l. petals extracts against foodborne pathogenic and spoilage microorganisms, with a special focus on *Clostridia*. Life 2023; 13(1): 60.
26. Al-khazraji SM, Rasheed EM. Investigation of antimicrobial activities of Lactuca sativa (L.) extracts against clinical pathogens, Al-Nisour Journal for Medical Sciences 2019; 1(2), 302-310.

27. Baradaran Rahimi V, Rakhshandeh H, Raucci F, Buono B, Shirazinia R, Samzadeh Kermani A, Maione F, Mascolo N, Askari VR. Anti-Inflammatory and anti-oxidant activity of *Portulaca oleracea* extract on LPS-induced rat lung injury. Molecules. 2019; 24(1): 139.
28. Mehri Ardestani M, Aliahmadi A, Toliat T. Antimicrobial activity of *Quercus infectoria* gall and its active constituent, gallic acid, against vaginal pathogens. Traditional & Integrative Medicine 2019; 4(1), 12–21.
29. Ogwu MC, Izah SC. Honey as a natural antimicrobial. Antibiotics 2025; 14(3): 255.
30. Baldas B, Altuner EM. The antimicrobial activity of apple cider vinegar and grape vinegar, which are used as a traditional surface disinfectant for fruits and vegetables. Communications Faculty of Sciences University of Ankara Series C: Biology 2018; 27(1), 1–10.
31. Morvaridzadeh M, Sepidarkish M, Daneshzad E, Akbari A, Mobini GR, Heshmati J. The effect of pomegranate on oxidative stress parameters: a systematic review and meta-analysis. Complementary Therapies İn Medicine 2020; *48*, 102252.
32. Tang Y, Lihong C, Xingwu R. Efficacy and safety of honey dressings in the management of chronic wounds: An updated systematic review and meta-analysis. Nutrients 2024; 16(15), 2455.
33. Amilah WAWWN, Mohamad AN, Noor Izani NJ, Arizam MF. Antimicrobial activities of Quercus infectoria gall extracts: a scoping review. Journal of Herbal Medicine 2022; 32, 100543.
34. Lalovski I, Krasteva M, Yordanov E, Hristov E, Dimitrov M, Parvova I. Safety of active substances derived from Rosa damascena and their potential biological activity in humans: a systematic review. Pharmacia 2025; 72. 1–10.