



Historical Review

Arab and Persian Scientists' Contribution in Laying the Foundations for Modern Dental Medicine and Surgery

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Al Zahrawi, an Arab physician and surgeon, was the one responsible for making surgery as important as medicine in medieval times. He invented many surgical instruments which were later copied and used as standards in surgeries. He contributed to many fields of medicine, including neurology, surgery, orthopedics and gynecology. He recounted his 50 years of hard work in his book, *Al Tasreef*, which was translated into many languages later. Many of his inventions and surgical instruments have been described in his literature and later served as the foundations for the advanced instrumentation in medical and dental specialties. His immense contribution to dentistry cannot be overlooked. In this review, we attempt to collect and revisit his contributions.

In medieval times the Arab and Persian medicine and surgery was at its pinnacle providing deep foundations for modern medicine and surgery. Among the most popular Arab scientists, Al-Zahrawi was the one who made considerable contribution to dental medicine and surgery. As the names of most of the Arab world scientists were Latinized, such as Al-Zahrawi named "Albucasis" and Abubakr Rabi ibn Ahmad al-Akhawayni al-Bokhari as "Joveini", often their work and inventions are overlooked in the contemporary literature. This review highlights the need for the documentation of procedures and inventions especially in field of dentistry in modern literature.

An extensive search was done and 170 documents and a few books were found on databases as Scopus, Pubmed, Mendeley and Google Scholar with the keywords Albucasis, Al Zahrawi, dentistry, Persian medicine and scientists, ranging from years 1926–2026. A few of the documents were not traceable; for example, a 1987 article on dentistry by J.J. Hershfeld could not be retrieved. Other articles which were not in the English language or whose translations were not available, were also excluded. Articles and books dealing exclusively with dentistry are rare. We tried our best to include all the information we could on Albucasis' contribution to dentistry.

Campbell mentions in his book that the second part of volume 30 deals with dental surgery and other surgical procedures. He describes numerous surgical and dental procedures using Albucasis's own illustrations.

Keywords: Albucasis, Al-Zahrawi, Arab world, Dentistry, Instruments, Medicine, Medieval history, Surgical general surgery

Cite this article as: Khan MI, Khare A, Grover S, Shamim Khan S, Arif K. Arab and Persian scientists' contribution in laying the foundations for modern dental medicine and surgery. Arch Iran Med 2026;29(4): 267-272. doi:10.34172/aim.35751

Received: February 12, 2025, **Revised:** March 19, 2025, **Accepted:** March 26, 2025, **ePublished:** April 1, 2026

Introduction

Abu Al Qasim Al Zahrawi (Latinized, Albucasis), also known as Zahravius (93–1013 A.D) was an Arab physician and surgeon born in Al Zahraa in the Andalusia region of Cordoba, which is in modern day Spain. He was associated as a physician with Abd ar Rehman III, the Emir and the First Caliph of Cordoba. Dr. Donald Campbell in his book writes: 'The Arabic writers in western caliphate were small in number but their influence on Latin West was far reaching'. Albucasis was one of the four most eminent of these scholars. Campbell further states that 'Albucasis's chief influence on the West was his method of presentation and lucidity and he maintained a dominant position in Medical Europe for 500 years'.^{1,2} He wrote a 30-volume encyclopedia, *Al Tasreef Liman Ajaz Aan Al Taleef*, commonly referred to as *Al Tasreef*, which was translated five times and was used as a standard textbook in many European universities between 12th-17th century.³⁻⁵

None of the world's libraries have complete collections. Some volumes are in London, Baghdad, Cairo, Damascus, Turkey, and India, and in the Khuda Bakhsh Oriental Public Library in Patna.⁶ A lithographed Arabic version (1908) of the book (volume, 30) was also used by students from the Tibb Unani school in Lucknow, Uttar Pradesh, India.⁷ *Al Tasreef's* volume 30 treated surgeries as being distinct from medicine for the first time. That volume was divided into three sections, the second of which deals with extensive maxillofacial and dental surgical procedures.⁸ Another Albucasis book, *Liber Servitoris*, xxviii describes medicinal uses of plants and animals and discusses the use of chemistry in the practice of medicine.^{1,9}

Albucasis as Dentist

The term dentist was not recognized until 1759, although Albucasis can qualify to be called a dentist because of his significant contributions to dentistry. In a commemoration

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at the Fourth Arab Congress in Dental and Oral surgery in 1964, Syria issued a stamp portraying Albucasis,¹⁰ (Figure 1).¹¹

Instruments Used by Albucasis for Dental Procedures

Albucasis, along with numerous other instrument inventors, was the first to invent and use a retractable scalpel for various surgeries.¹²⁻¹⁴ He invented a number of instruments for surgical procedures and made specialized instruments for the treatment of dental diseases. His instruments were illustrated in the book *Periodontology* by Newman and Caranza,¹⁵ (Figures 2 & 3).

For gum diseases, he further states in his book that the deposits on the inner or outer surface of the tooth need to be cleaned, and he advocated even different instruments for different teeth, keeping in mind the individual morphology of each tooth.¹⁶⁻¹⁹ He conceived the idea of splinting loose teeth with wires of gold and silver; he preferred gold over silver for its better corrosion resistance. He was the first to suggest replanting a tooth avulsed as a result of trauma, and he offered instructions for dealing with partially luxated teeth and for holding them with gold wires for better results.²⁰ With his knowledge of chemistry and its applications to medicine, he introduced dentifrice for cleaning teeth by using a ground mixture of natural sodium carbonate, hydrosilicate of magnesium and common salt.²¹⁻²³

In *Al Tasreef*, he says 'Teeth should be saved by any trick, as tooth does not have a successor because its essence is of a noble origin'. This shows his depth of knowledge in understanding dental diseases and the treatments required. His topics also include the replacement of missing teeth with artificial ones using the bone of an ox.²⁴ He designed forceps and instruments for tongue depression and extraction of carious teeth and tooth roots. He had an entire step-by-step procedure recorded in his manuscript for tooth extraction, including the position of patient and operator, the right kind of instrument required and the amount of force needed for the procedure.^{6,9,25}

His idea of using light reflection during examinations

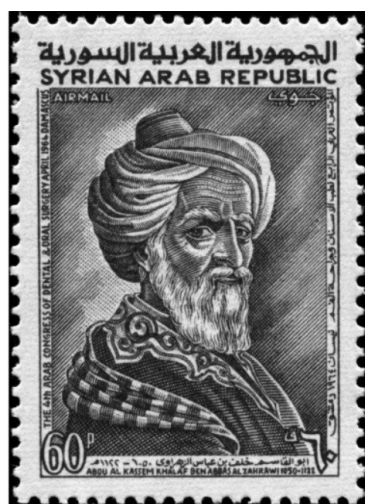


Figure 1. Albucasis's Portrait on a Syrian Postage Stamp.¹¹

led to Hoffman's head mirror design, which was further modified into Garcia's method of mirror laryngoscopy in 1854.^{26,27}

Invention of Anesthetic Sponge

Abu Al Qasim was the first to invent an anesthetic sponge. Before his invention, anesthetic compounds were given to patients in multiple doses. His idea was remarkable in the field of anesthesia. He used a sponge soaked in compounds prepared from water, hashish, opium, C-hyoscine and *zo'an* (wheat infusion). Then the sponge was dried. When it was needed for anesthesia, the sponge was moistened and applied to the lips and nostrils. The patient was anesthetized with the inhalation of aromatic compounds soaked in the sponge. This sponge was popularized in Europe as 'Arabian Nights'.^{28,29}

Management of Cleft Lip

Al Zahravi did extensive work on cauterization, and he advocated the same for the treatment of cleft lip (harelip), which would heal with fibrosis and scarring. He considered cleft lip to be a fissure and suggested that a small cautery similar to size of the defect should be heated and placed immediately on the fissure till it reached the depth of the fissure, and that the wound be covered with wax plaster

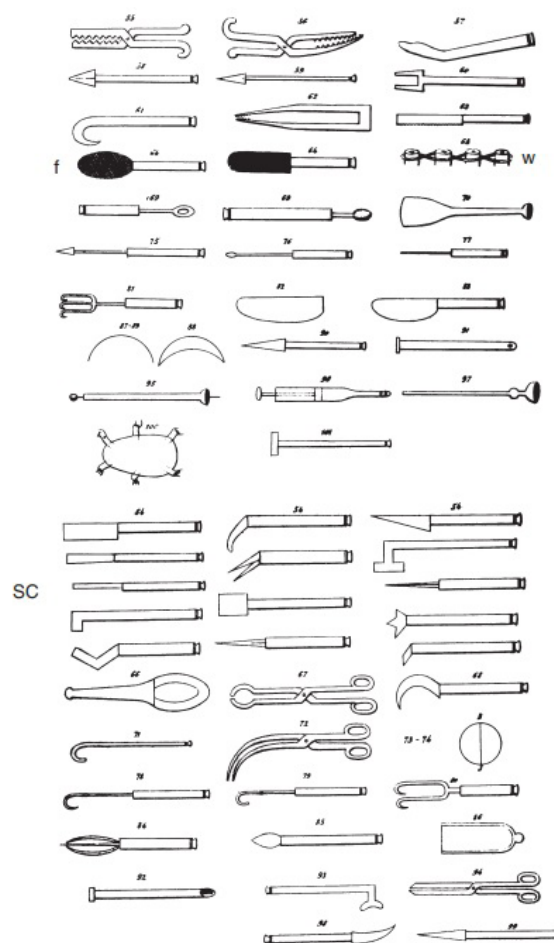


Figure 2. Illustrations of Albucasis's Periodontal Instruments: SC-Scalers, F-Files and W-Wiring of Teeth (image from Newman's and Caranza's *Clinical Periodontology*).¹⁵

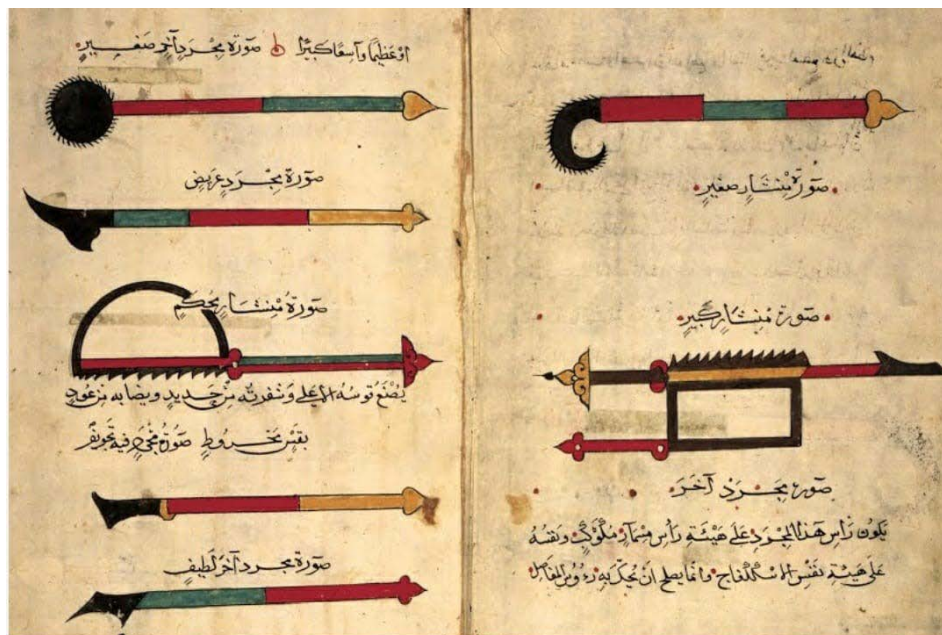


Figure 3. Illustration of Different Instruments of Al Zahrawi in his Arabic Treatise. In some other instrument illustrations, one can observe how finely he designed and described his instruments. (Image used from Google arts and culture)

to protect it.³⁰⁻³²

Maxillofacial Fractures

Al Zahrawi had adequate knowledge of human anatomy, and he discussed facial fractures including nasal and mandibular fractures. For mandibular fractures, he suggested a closed reduction of the fractured jaw, approximation of occlusion and wiring of the teeth with gold wires for stabilization of the occlusion. Further, he used leather bandages and pieces of wood for external stabilization of the jaw. For subluxation of the mandible, he followed the method similar to that used by Hippocrates and advised placing the thumb in the mouth and pushing the mandible backwards with fingers.

His inventions of modern plaster and adhesive bandages are still part of surgical treatments all over the world. He advised patients to rest and adopt a soft diet for at least three weeks. For nasal fractures, he used linen cloth twisted into the nostrils for positioning and approximating the fractured fragments. He stated that 'if one of the two upper parts are broken, you should pass your finger into the nostril and straighten out the fracture from inside. If the fracture is in the upper part of the nose and your fingers cannot reach, it should be evened with probes with some thickness to it'.^{30,33,34}

Al Zahrawi also treated many oral lesions like fibroma of the lip, ranula and defects like tongue ties. He had specialized instruments for removal of foreign bodies from the throat. He was the first to describe special instrumentation for tonsillectomy and wrote in detail about the procedure in his manuscript.³⁵⁻³⁷

Healing of Wounds and Hemorrhage Control

Albucasis was the first to use cotton in surgeries for hemorrhage control and dressings. He described multiple treatment modalities for ligation of blood vessels to control

bleeding and for cauterization of the bleeding vessel. He described all these procedures 600 years before Ambroise Pare.³⁸⁻⁴⁰

Apart from dentistry, Albucasis made extensive contributions to the field of pharmacology, gynecology, neurology, orthopedics, gastroenterology and ocular surgeries. With his thorough knowledge of human anatomy and physiology, he wrote his 30-volume book, which was followed for centuries in Europe and was the standard book for medical schools and references.

Discussion

Pietro d'Argellata an Italian surgeon, anatomist and translator of *Ibn Sina's* work (another famous Persian scientist) praised Al-Zahrawi saying, "Without a doubt, Albucasis was the chief of all surgeons". Before the Islamic revolution in medical and surgical field, surgeons were considered to be inferior to physicians and Al-Zahrawi was the one who not only highlighted the necessity of surgery but, as a result of his contributions, surgery was recognized as a distinct and valuable branch of medicine [29]. Arabs in the medieval times contributed at large to the field of medicine and surgery and the rulers (Caliphs) supported the cause with building hospitals and preserving and translating ancient Greek and Roman texts. Revolutionizing the medical education system, physicians were required to pass licensing examinations, contributing skilled medical professionals to the society.⁴¹ Many of Galen's claims were challenged by Arab scholars; for example, the claim that mandible has two bones was corrected by *Abd-el-latif-Al-Baghdadi* as human mandible comprises one single bone. Also, blood circulation having a pulmonary component was explained by *Ibn al-Nafis*, countering Galen's claim that the left and right sides of the heart are connected directly.^{42,43}

A scientist ahead of his time fits well for an Andalusian

scholar and scientist *Abū al-Qāsim Khalaf ibn al-'Abbās al-Zahrāwī al-Ansari*. His extensive work on surgery is so well known that the translation of his work *Al Tasrif* in Greek and Hebrew continued to the 15th to 18th century and was used throughout the European world as a standard textbook.^{44,45} Even in recent times, his work has a substantial impression and an English edition and translation of *Albucasis on Surgery and Instruments* was published by the University of California Press in 1973.³³ His study on surgical instrumentation was remarkable as he not only redesigned the thousand-year-old instruments, but also invented many new surgical instrumentations used in various surgical procedures. He described over 200 instruments with detailed drawings and descriptions in his book.^{46,47} Multiple titles were attributed to Al-Zahrawi as a scholar, surgeon, chemist, neurosurgeon, plastic surgeon, and obstetrician all because of his vast work in the fields of general surgery and specialized surgical procedures. He has written in detail about various surgical procedures like, from abdominal surgeries for hernia to retrieval of bladder stones in continuation with the Persian traditional medicine and designing instruments for the procedures, treating perianal fistulas, correction of genital anomalies.^{30,48-50} He had worked in detail in the field of obstetrics designing birth forceps and describing about the various complications of pregnancy like cord around the neck and dead fetus. He described in detail about parturition maneuvers, and the positions to facilitate child birth. The modern "Walcher position" for difficult child birth was described in his work at the time.⁵¹

His excellent anatomical knowledge helped him to perform his surgical procedures with such precision that he performed even cranial surgeries involving neurosurgical procedures like relieving intracranial pressure through trephination which involves drilling a hole in the skull and he was the first to develop and use non-sinking trephine and drills. His work clearly elaborates the treatment for skull and nasal fractures and wound healing.^{11,52} He was the first to use catgut for internal sutures and described thermal cauterization and arterial ligation for vascular bleeding.³⁹ He was also the first to do a thyroidectomy procedure which he described in detail.⁵³ Apart from all general surgical procedures and subspecialties, he contributed par excellence to the field of dentistry describing various oral and maxillofacial and periodontological procedures and instruments. In modern times, one cannot fail to notice his role in laying the foundations for modern dentistry and instrumentation.

Abubakr Rabi ibn Ahmad al-Akawayni al-Bokhari another famous Persian medicine scientist has also made considerable additions to dental surgery and medicine in his book, *Hidayat al-Mutallimin fi-al-Tibb* (Learner's Guide to Medicine). He lived in the 10th century and died in 983 AD. He dedicated two chapters to dental diseases and dental pain in his book. Oral diseases like gingivitis, tooth pain, bad breath and their remedies like extractions, natural mouth fresheners, extraction of aching tooth etc. were discussed by him in his book.⁵⁴

Conclusion

Albucasis contributed immensely to the medical science and surgery. During medieval times, his 50 years of hard work resulted in his translated manuscripts, serving not only as a standard textbook but also as a reference for new inventions and modifications of surgical instruments and procedures. His legacy in medical education continued for centuries throughout Europe. His multi-speciality approach in surgery, neurology, obstetrics, dental procedures, and orthopedics was outstanding. Apart from being a skilled surgeon, he served the society by being an educator and also a psychiatrist. The medieval era was a true Islamic golden age where many Arab and Persian scholars and scientists have contributed to the wells of knowledge and their contribution laid foundations for modern medicine and surgery.

Authors' Contribution

Conceptualization: Mohammad Imran Khan
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Methodology: Mohammad Imran Khan
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Competing Interests

We declare that we have no competing interests.

Ethical Approval

Not applicable.

Funding

This research received no external funding.

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