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## REVISITING ORAL AND MAXILLOFACIAL SURGICAL VIEWS AS PRACTICED BY AL-ZAHRAWI: A REVIEW

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### Abstract

Al-Zahrawi - popularly acknowledged in the West by his Latin name Abulcasis - is considered as one of the greatest medieval surgeon in the Islamic world. His magnum opus "Al-Tasreef" is a thirty-volume encyclopaedia of medical practices. Al-Zahrawi is well recognized for his innovative methods in all the branches of surgery. A limited conceptual work has been done on his contribution in the field of oral and maxillofacial surgery. Through this review we intent to highlight oral and maxillofacial surgical views as practised by Al-Zahrawi.

**Keywords:** Al-Zahrawi – history - oral and maxillofacial surgery.

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## INNOVATIONS CHIRURGICALES ORALES ET MAXILLOFACIALES PRATIQUÉES PAR AL-ZAHRAWI: UNE REVUE DE LA LITTÉRATURE

### Résumé

Al-Zahrawi - populairement reconnu en Occident par son nom latin Abulcasis - est considéré comme l'un des plus grands chirurgiens médiévaux du monde islamique. Son livre «Al-Tasreef» est une encyclopédie des pratiques médicales. Al-Zahrawi est reconnu pour ses méthodes innovantes dans les domaines de la chirurgie.

Peu d'études ont cité sa contribution dans le domaine de la chirurgie buccale et maxillo-faciale. Grâce à cette revue, nous avons l'intention de mettre en évidence les innovations chirurgicales orales et maxillo-faciales telles que pratiquées par Al-Zahrawi.

**Mots-clés:** Al-Zahrawi – histoire – chirurgie maxillofaciale.

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## Introduction

The golden age of Arabic-Islamic era witnessed a progress in all fields of human intellectual activity including medical, technological, architectural and arabic culture. We come across many early Muslim surgeons who had contributed in the field of dentistry, and more specifically in oral and maxillofacial surgeries. Their work survived all through the ages in ancient books. Among them the most notable were Rhazees, Al Majusi, Al-Zahrawi and Avicenna [1, 2].

Among these pioneers of medical sciences, the name of 'Abu al-Qasim Khalaf ibn al-Abbas al-Zahrawi' is noteworthy. Al-Zahrawi was born in 936 AD in Al-Zahra', a suburb, six miles northwest of Cordoba, the capital of Muslim Spain. His ancestors were from the Al Ansar tribes of Al Madina Al Munawwarah which came from the Arabian Peninsula [3].

He was one of the greatest Muslim surgeons, well recognized for his innovative methods in surgery, ophthalmology, otolaryngology, orthopedics, urology, plastic surgery, obstetrics and gynecology [3 - 7]. A limited conceptual work has been done on his contribution in the field of oral and maxillofacial surgery. Hence the aim of the paper is to highlight the important contribution of Al-Zahrawi in the field of oral and maxillofacial surgeries.

## Materials and methods

The main source for this review was gathered under two headings: books and scholarly articles published in indexed journals. Reference and passage in relation to oral & maxillofacial surgeries as practiced / discussed / mentioned by Al-Zahrawi were identified from the below sources.

-Books: Accredited books written on "History of Dentistry" and "History of Arab Medicine":

Albucasis: On surgery and instruments: published by Wellcome Institute of the History of Medicine; London: 1973 [8].

Techniques for extraction of teeth [8].
Designing several dental instruments including dental forceps, elevators and tongue depressor [9] (Figs. 1, 2 & 3).
Treatment for partially luxated teeth due to fall or blow [8 – 10].
Reimplantation of avulsed teeth [8, 11].
Surgical removal of epulis [10].
Treatment procedure for ranula [9].
Endodontic surgeries using cauterization in cases of periapical abscess and fistula [12].
Fracture of jaw and nasal bones [9, 13].
Treatment of subluxation of the condyle [9].
Technique of preparing artificial teeth from Ox bone for replacing the extracted teeth [3, 14].
Surgical procedure for removal of salivary stone from sublingual duct [9].
Surgical procedure for the treatment of ankyloglossia [9, 10].
Surgical repair of cleft lip deformity [13].
Treatment of deformities of the mouth and the dental arches [2].
Discussion of the problem of nonaligned teeth and their treatment (Extraction of supernumerary tooth for esthetic reasons) [7, 8].

Table 1: Comments, passages and references regarding oral & maxillofacial surgery attributed to Al-Zahrawi.

The Different Aspects Of Islamic Culture (Vol. 4): Sciences and Technology in Islam (Part II), Technology and Applied Sciences published by UNESCO, Lebanon, 2001 [9].

Old Masters of Anatomy, Surgery and Medicine (XXI). Albucasis. Reprinted from the Annals of Anatomy and Surgery; Brooklyn, NY 1883 [10].

-Literature search: Within electronic database for scholarly articles published on Al Zahrawi. "Al-Zahrawi", "Albucasis", "Al-Tasrif", "Arabic Medicine" and "Dentistry" were used as search keywords.

## Results

These searches yielded a total of 127 articles, which were thoroughly reviewed to identify suitable articles.

The contribution of Al-Zahrawi as a dentist was tremendous. He described techniques for teeth extraction, with special emphasis on careful reflection of gingival tissue during extraction [8], as well as techniques for extraction of broken pieces of tooth and noted the

importance of extracting the whole root if the tooth gets fractured during extraction [8]. Also, he designed several dental instruments including dental forceps, elevators and tongue depressor [9]. He developed the technique of preparing artificial teeth from Ox bone for replacing the extracted teeth [3, 14]. Comments passages and references regarding oral & maxillofacial surgery attributed to Al-Zahrawi are listed in table 1.

Al-Zahrawi was also a great physician- surgeon. He provided precious services to

Humanity by introducing new ideas and making lot of researches and invention that helped laid the foundations of modern surgery.

He was the first to use catgut for internal sutures [15] and silk for cosmetic surgery [16]. He described ligation of blood vessels [3], promoted the use of antiseptic in wounds [13] and explained the primary and secondary wound closure [7, 13].

Other references regarding general surgery which are part of Oral & Maxillofacial surgery are listed in table 2.



Fig. 1: A copper spoon used as a medical implement to press down the tongue.

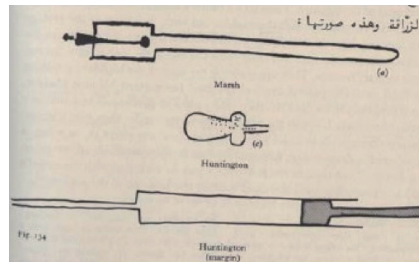


Fig. 2: Syringe.

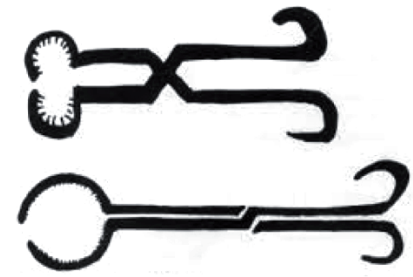


Fig. 3: Forceps designed by Al-Zahrawi.

Use of cotton in surgical dressings in the control of hemorrhage [7] in dentistry.
Used of wax & alcohol to stop bleeding from skull during cranial surgery [7].
Ligature of blood vessels [3].
Use of antiseptic in wounds [13].
Concept of primary and secondary wound closure and the importance of wound debridement before closure [7, 13].
Use of ink to mark the incisions in his patients preoperatively which became now a routine standard procedure [7, 133].
Creation of first illustration of surgical [3] and dental instruments [18].
Anaesthetic sponge [19].
Use of bandages similar to plaster of Paris [17].
Emphasize on the knowledge of anatomy [4, 7].

Table 2: Comments, passages and references regarding general surgery attributed to Al-Zahrawi.

## Discussion

The famous book of Al-Zahrawi, "Al Tasreef Liman 'Ajaz 'Aan Al-Taleef" (The clearance of medical sciences for those who cannot compile it) is a medical encyclopaedia, comprising 30 treatises and covers various aspects of medical knowledge. Stomatology and odontology are discussed in treatise XXI; treatise XXX covers the domain of surgery [20].

For tooth extraction, the entire step by step, from the position of the patients to the instrument selection, the amount of force needed are described. Al-Zahrawi also mentioned the surgical extraction of a badly carious teeth by separating the decayed tooth from the gums with the aid of a scalpel to avoid tooth fracture [8-10, 14, 21].

Even after 1,000 years, dental surgeons all over the world still practice

the surgical procedure of tooth extraction as introduced by Al-Zahrawi.

Al-Zahrawi was the first person to provide a written description of the successful replantation of avulsed teeth and also the treatment of partially luxated teeth due to blow or due to fall. He preferred gold wires over silver wires because silver corrodes fast [8-10, 14, 21].

The first cases of endodontic surgery are believed to be performed by Al-Zahrawi, by incising and draining an endodontic abscess [12]. Al-Zahrawi described the use of different instruments for cautery and the removal of soft tissues, such as epulis [21]. He treated epulis by ablation using a hook or forceps followed by the use of cautery or curette. He also used cautery for performing gingivectomies, as the modern electric scalpel is used today [21].

Incising the lingual frenum in case of ankyloglossia that impedes the proper speech was advocated by him [9, 10] as well as the removal of salivary calculi from the sublingual duct [9, 22].

He also described the treatment concept in case of mandible fractures: closed reduction by manually bringing the fractured ends together with fingers, giving consideration to occlusion of teeth, and suturing the teeth using a gold wire in order to stabilize the correct position of the mandible. After that, he noted the importance of stabilizing the jaw by bandaging it with a firm cloth and a piece of wood (which is shaped as a jaw). He advised the patient to eat soft diet and to keep the bandage for three weeks for proper healing. The use of leather bandages for jaw fractures was continued till the 13th century.

In case of inner nasal fractures, clothes shaped like wedge tents and made of twisted linen were applied in each nostril to keep the fractures in the correct position [13]. This concept in the management of fractures is still valid.

He also stated the reduction method in case of mandible subluxation, i.e., the surgeon placing his thumb in the mouth and fingers pushing the mandible backward and upward similar to Hippocratic method of reduction [9, 10].

The description of ranula as a swelling resembling a small frog occurring under the tongue, its causes and signs and surgical treatment is stated in his book Al Tasrif. "The frog sack" described by him for ranula is still in use.

The surgical treatment of ranula is very similar to the one used today [9].

For cleft lip repair, Al-Zahrawi preferred cauterization, followed by suturing the edges together. The same technique was still used until the 18th century.

He explained the concept of primary and secondary wound closure and laid the importance of wound debridement before the closure [7, 13].

Al-Zahrawi used anaesthetics sponge for inhalation of anaesthesia. He was the first to use a sponge that steeped in an aromatics soporific. At the time for anesthesia, the sponge was immersed in a boiled solution and passed on the patient's lips and nostrils. The ingredients were absorbed by the mucus membranes, causing deep sleep and pain control [19].

More than 200 surgical and dental instruments such as forceps, elevators like tooth-key for extraction of teeth, dental saw, dental file and forceps for extraction of roots were designed by him. He also used scalpels of diverse shape, cautery instruments, retractors, suture materials, osteotome, suture needles, several types of surgical scissors, tongue depressor, gold and silver wires for stabilizing luxated teeth and different kind of scalers to remove calculus from the teeth [1, 3, 23, 25]. The first drawings of elevators can be seen in the work of Al-Zahrawi [26]. This was first of its kind and a unique contribution to the history of surgery. He illustrated the use of surgical and dental instruments [17].

Al-Zahrawi suggested digital pressure, cautery, dry dressings (cotton or linen), or cold water to control bleeding [4]. He was the first to use cotton (which itself is derived from the Arabic word qutn) to control bleeding after extraction of teeth [27]. He described ligaturing blood vessels long before Amroise [7]. He also developed the plaster used for fractures, as well as the adhesive bandage used for simple injures [14, 21].

Marking of incisions on the patients pre-operatively using inks was introduced by Al-Zahrawi. It's

a routine standard procedure commonly applied these days [7, 13]. He laid great emphasis on the knowledge of anatomy. In the introduction to his book, Al-Zahrawi pointed out that good practice in surgery requires a sound knowledge of anatomy [4, 7]. He wrote: "He who devoted himself to surgery must be versed in the science of anatomy".

And lastly, a contribution worth mentioning but which is not in the scope of this review. He offered a perfect argument that tartar is the main cause of gum inflammation and recommends that it should be removed by a scraping and smoothening of the roots [1, 14]. He designed and described 14 scaling instruments for such purposes [21].

Some of the oral and maxillofacial surgical views have been described by Hippocrates (the famous Greek physician). Hippocrates advised to remove only loose teeth and cauterize those teeth that ached but were not loose. He also invented certain crude form of a dental forceps for extraction of teeth [22]. He used wires for stabilization of jaw fractures and binding of loose teeth. Reduction of temperomandibular joint dislocation by bimanual intra oral technique is still named after him.

There is no doubt that we find the influence of Hippocrate and Galen in his surgical views. He himself made note of this in the introduction of his book7. He wrote: "What ever I know, I owe solely to my assiduous reading of books of the ancients, to my desire to understand them and to appropriate this science; then I added the observation and experience of my whole life."

Al-Zahrawi raised the dignity of surgery as a specialty, which was very well accepted in the Islamic world. However, in Europe, the surgical work was accomplished by barber surgeons. The Council of Tours declared, in 1163: "Surgery is to be abandoned by all schools of medicine and by all decent physicians" [7].

### Al-Zahrawi's surgical views and their impact in the West

Al-Tasrif was first translated into Latin by Gerald of Cremona in 1187 [24], and later in other European languages [6]. It became a standard text book on surgery in many Universities of Europe until the end of the eighteenth century. The French surgeon Guy de Chauliac in his book 'chirurgicalia magna', quoted At-Tasrif over 200 times and closely followed Al-Zahrawi's surgical teachings [7]. John Channing published his *Albucasis de Chirurgia* in 1778; a copy of this is still housed in the British museum [24].

The treatment of mandibular fractures outlined by Theodoric (Italian surgeon wrote in his *Chirurgia* in Latin in 1267AD) and Guy de Chauliac are similar and have been copied directly from Arabic sources.

Many authors have discussed Al Zahrawi's contribution in the field of General Surgery along with his contribution in the field of Dentistry and dental surgery. We found very few articles exclusively written from the perspective of dentistry and only one article on oral surgery [14].

Oral and Maxillofacial Surgery is a recognized specialty of Dentistry that treats many diseases, injuries and defects in the head, neck, face, jaws and the hard and soft tissues of the oral and maxillofacial region. In the literature search, we found many innovative and original contribution of Al-Zahrawi on many aspect of oral and maxillofacial surgery.

### Conclusion

The contribution of Al-Zahrawi in the field of oral & maxillofacial surgery hardly got the recognition that it deserves. As we stand on the shoulders of our ancient giants who walked before us, it's our duty to recognize and honor their contribution. And lastly I would like to quote B.W. Weinberger from Dentistry: An Illustrated History: "A profession that is ignorant of its past experiences has lost a valuable asset because "it has missed its best guide to the future."

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