

A BRIEF HISTORY OF PROSTHETIC EYES

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2900–2800 BC

The earliest known prosthetic eye was found buried with a woman in Shahr-I Sokhta, Iran. It was probably made of bitumen paste which was covered with a thin layer of gold, engraved with a central iris from which lines radiated out like the rays of the sun.



Professor Mansur Sayyed-Sajadi supervised the excavation.



World's oldest prosthetic eye, as found.

<http://www.kavehfarrokh.com/iranica/maps-of-iran-5000-bc-651-ad/the-worlds-oldest-known-artificial-eye/>

500 BC

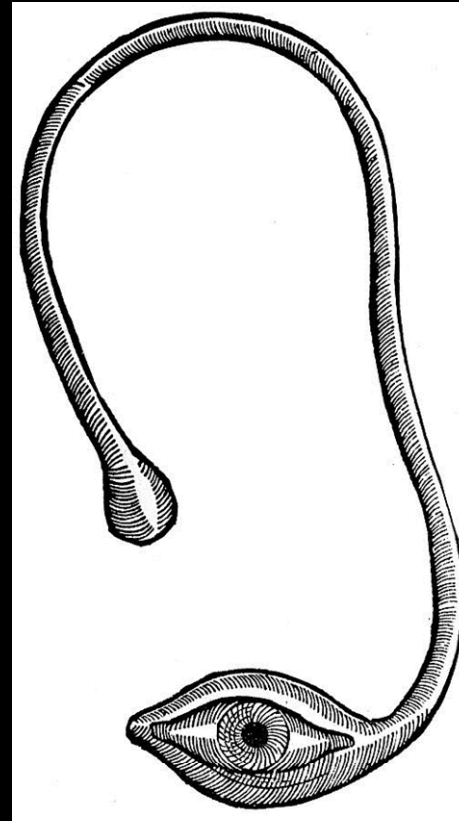
Further evidence of the earliest prosthetic eyes being worn outside the socket comes from Egyptian and Roman priests who were making prosthetic eyes from painted clay attached to a cloth in the fifth century BC. The Greek term for this type of prosthesis was 'ekblepharon'.



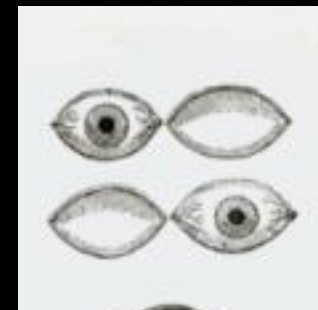
Painted clay prostheses.

16th Century

Frenchman Ambroise Paré (1510-1590) described a prosthetic eye that was fastened to the end of a metal rod which bent around the back of the head to hold the eye in place. This prosthesis was illustrated in Paré's 1614 book which was published after his death. Ambroise Paré was also associated with the first prosthetic eyes worn inside the socket (termed 'hypoblepharae') although an hypoblephara (undated) in a private British collection, made from wood and ivory suggests that the idea was not new. The 16th century prosthetic eyes worn inside the socket were made from gold or silver, with coloured enamel coatings.



Eklepharon.



Hypoblepharae.

17th Century

By the late 16th century, Venetian glass blowers were making more realistic prosthetic eyes from glass. These early glass eyes were fragile and easily broken. They were made by skilled glassblowers and lens makers who belonged to trade guilds. Glass eyes were also produced in Augsburg near Munich which was also an historic optical manufacturing centre until the 30 Years War (1618 to 1648) which destroyed many German states.



Assortment of glass eyes.

There were few British glass eye manufacturers, however, an advertisement for prosthetic eyes appearing in 'Merlin's Ephemeris' 1681 proclaimed William Boyse of London as:

'the only English operator in glass and the most expert in making artificial eyes so exact as not to be distinguished from the natural, they are of enamel with colour mixt the same, without either paint or lead, and worn with much ease, and so curious that they have the motion of the natural eye, being exactly made to the colour or bigness of the same which renders them very ornamental and commodious, the like was never made in England.'



In about 1710 William Boyse was succeeded by his son-in-law, James Smith, seen here holding a glass eye.

18th Century

For a brief period in the 1700s, the centre of manufacture for artificial eyes was Paris where, for example, Auguste Boissenneau's prostheses could be purchased by mail order or by appointment in Paris. His thin enamel shells were designed to be worn over an atrophied eye. Dr Heister of Nuremberg, in 1752 recorded that he would prefer glass eyes to metal eyes because metal eyes repelled tear fluid and lost their brightness.

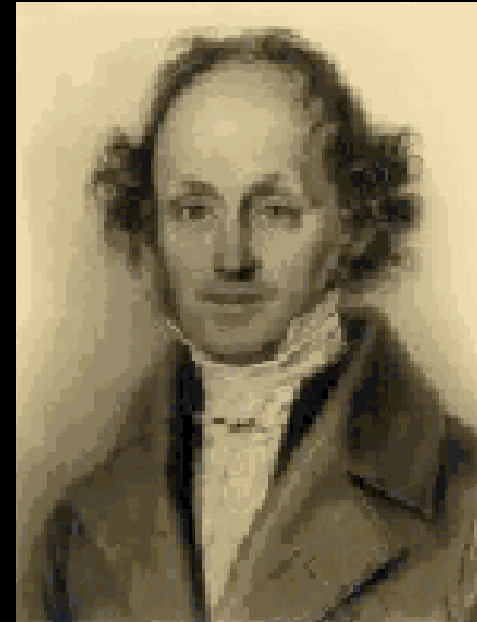


Dr Heister of Nuremberg. Preferred glass eyes over metal.

19th Century

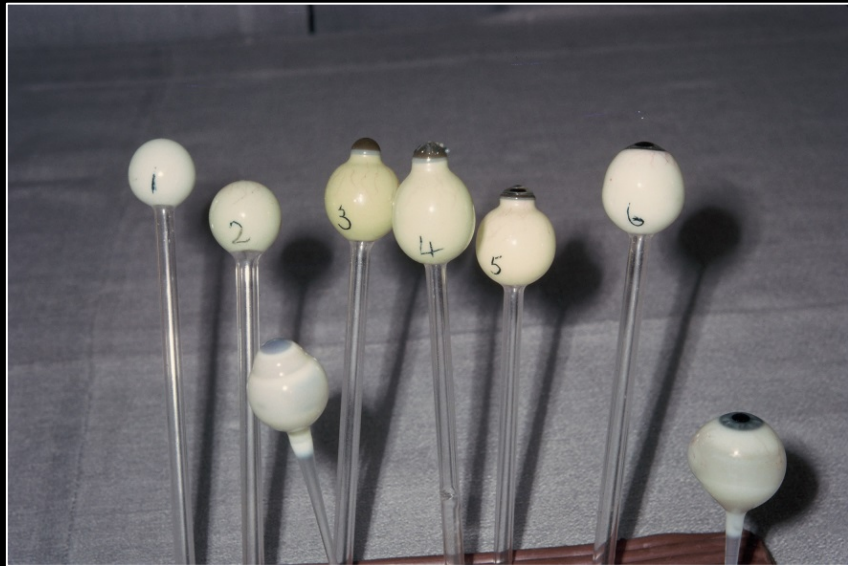
Friedrich Phillip Ritterich (1787 to 1866), a doctor and teacher at the University of Leipzig was appalled at the cost of artificial eyes from Paris and advocated for the establishment of a glass eye industry in Germany.

Ritterich encouraged German glassblowers to make glass eyes and even organised classes in glassblowing technique. He also established a free glass eye service at the Leipzig Eye Institute where glass eyes were custom manufactured for individual patients. This was the first time that the supply and fitting of glass eyes was seen as a service and where glass eyes were no longer a commodity to be purchased from stock.

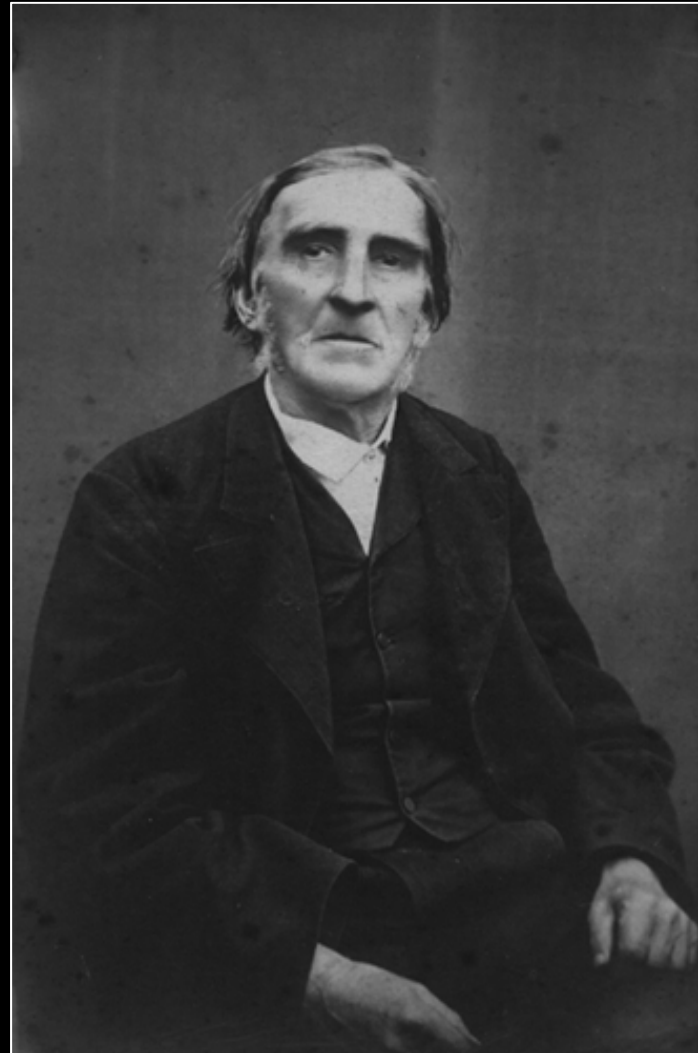


Friedrich Phillip Ritterich.
Established the glass eye
industry in Germany.

By the mid 19th century, the centre for glass eye manufacture had moved to Germany and in 1832 Ludwig Müller-Ur, a glassblower who made dolls eyes at the famous Lauscha Glass factory in Sonneberg, developed the cryolite glass eye which was more durable than previous glass eyes.



Steps in glass eye manufacture.



Ludwig Müller-Ur. Developed the cryolite glass eye.

In 1880, Hermann Snellen a Dutch eye surgeon, developed the 'Reform' eye in response to an increase in the number of enucleations being carried out following the introduction of anaesthesia and asepsis. The Snellen invention was a hollow glass eye with rounded edges. This was more full than the earlier shell-like glass eyes and facilitated the restoration of socket volume and improved wearing comfort.



This broken 'Reform' eye illustrates its form.

In 1885 an English doctor, Phillip Henry Mules implanted a glass sphere into the scleral cavity of an eye following evisceration. Prior to this, the prosthetic eye was the only component involved in the restoration of the eye. The implant restored lost orbital volume and gave more movement to the overlying prosthetic eye.

OBITUARY.

PHILIP HENRY MULES, M.R.C.S., M.B.,

Ophthalmic Surgeon, Wrexham Infirmary; formerly Surgeon to the Royal Eye Hospital, Manchester.

WE regret to announce the death at the age of 62 of Dr. Mules at his residence, the Old Parsonage, Gresford, Denbighshire, on September 1st. Dr. Mules received part of his medical training at St. George's Hospital, London, and part in Edinburgh, where he took the degree of M.B. in 1870. After devoting some years to general practice, Dr. Mules began to specialize in eye diseases, and attained great distinction as an ophthalmic surgeon, for his reputation extended beyond England. In 1884 he gained the Prize Medal of the International Society for the Amelioration of the Condition of the Blind, awarded by the Paris Society. While in Manchester Mr. Mules was Surgeon to the Manchester Royal Eye Hospital and Altrincham General Hospital. In Altrincham, where he was Chairman of the Gas Committee, he practised for many years. On leaving Manchester he took up his residence in Gresford, and his practice extended to Chester and Wrexham. About five years ago Dr. Mules succeeded the late Dr. Charnley as Ophthalmic Surgeon at the Wrexham Infirmary. In his quiet and picturesque home he devoted much of his spare time to gardening. His garden at Gresford was quite unique in its way.

Dr. Mules made many contributions to the literature of his subject, and added some useful operations. His best known contributions to medical literature were papers on evisceration of the globe and the introduction of an artificial vitreous (1885) and on ptosis (1894). Dr. Mules also wrote on tubercle of the organs of vision, septic ophthalmitis, and the lymphatic system of the eyeball in relation to Graves's disease. Dr. Mules leaves a widow, two sons, and four daughters.

Cryolite glass eyes from the Lauscha Glass factory were exported all over the world.

GLASS EYES.

Aitchison, the greatest manufacturer and dealer in glass eyes in Europe, was recently interviewed. He says that England alone consumes some 50,000 glass eyes annually. A good English glass eye will last about a year and costs £1. Glass eyes of French and German make are cheaper, but will not stand wear as long as the English. The greatest destroyer of the glass eye is the salt in the tears; its caustic action upon the glass has up to this time baffled all human invention. He says that there are some people who wear two glass eyes—but not in order to see—as the interviewer inadvertently asked—but to keep the lids in place and in good condition and particularly in order to look more attractive.

Bruce Herald, Volume XXXI, Issue 46, 13 June 1905,

GLASS EYES.

Two miners, not far from Harton, were one day sitting drinking, when one of them who had lately lost his right eye, said, "Bill, aa feel badly off withoot ma eye." "Wey, lad," said the other, "aa've hard of folk gitten glass eyes put in, and likely that'll be the best thing for thoo." So Geordie went to the doctor's and ordered a glass eye, which he got put in safe and sound. But when he cast a glance round—at the same time shutting the natural eye—he exclaimed, "Had away wiv your glass eyes; aa can see ne better noo than aa could afore aa gat it put in!"

Star, Issue 4848, 13 November 1883,

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ARTIFICIAL HUMAN EYES.

(Prize Medals Awarded.)

PACHE & SON,

MANUFACTURERS
to the
BIRMINGHAM EYE
HOSPITAL.
Also to the Principal
Hospitals in the
United Kingdom.



71, Station St. (Corner of Hill St.), Birmingham.
Makers of the new thickened artificial eye as recommended
by Professor Snellen.

20th Century

A GLASS-EYE CRISIS

When Germany in 1933 prohibited the export of raw materials, the special glass from which glass eyes are made was included in the ban. Now, when supplies for this purpose were falling very low, British scientists have produced a glass as good if not better, than that made by the Germans' secret process. Thousands of artificial glass eyes of different colours and sizes used to be stocked in drawers in premises belonging to the Ministry of Pensions at Acton, London. They were sent, chiefly by post, at the rate of about 4000 a year, to ex-servicemen who lost one or both eyes in the war. Recently the supplies had fallen very low, following the German prohibition. Dr. Harry Moore, Director of Research of the British Scientific Instrument Research Association, said that to make the white of the eye look as natural as possible the glass had to have an opal, creamy, or even a blue hue, according to the age of the wearer, as distinct from the colouring of the pupil and the iris. The glass also had to have fine veins in it as in the human eye. All these effects have been obtained, and the new artificial glass eyes, now being distributed from Acton by the Ministry, are a wonderful imitation of the human eye.

Evening Post , Issue 49, 26 August 1936.

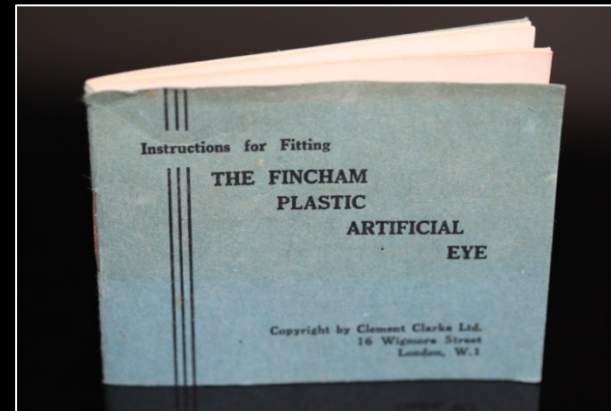


Early 20th century stock glass eyes.



Late 20th century custom made PMMA eye.

A new material, Poly (methyl methacrylate) (PMMA) was introduced by ICI in 1930. A medical grade PMMA was quickly adopted by dentists as a superior alternative to vulcanite rubber from which denture bases were made at the time. When German glass eyes became unavailable at the start of WW2, British Royal Navy dental technicians investigated the use of PMMA for prosthetic eyes. Fritz W. Jardon, a German dental technician who immigrated to the United States in 1932 and the Royal Navy technicians developed PMMA prosthetic eyes at about the same time



An ordering kit for plastic artificial eyes

PMMA proved to be a more durable material than glass. Its working properties also enabled prosthetic eyes to be custom made for the first time from an impression of the patient's socket. In the latter half of the 20th century PMMA eyes supplanted the 350-year-old glass eye industry although a small number of glass eye manufacturers still exist in Europe. Until the introduction of PMMA all glass prosthetic eyes and shells were made and fitted by members of the optometry profession but dental technicians were more familiar with the new PMMA technology when it was introduced. Over the next 70 years (at least in the UK) dental technicians increasingly dominated and extended the field within a new discipline called maxillofacial prosthetics.

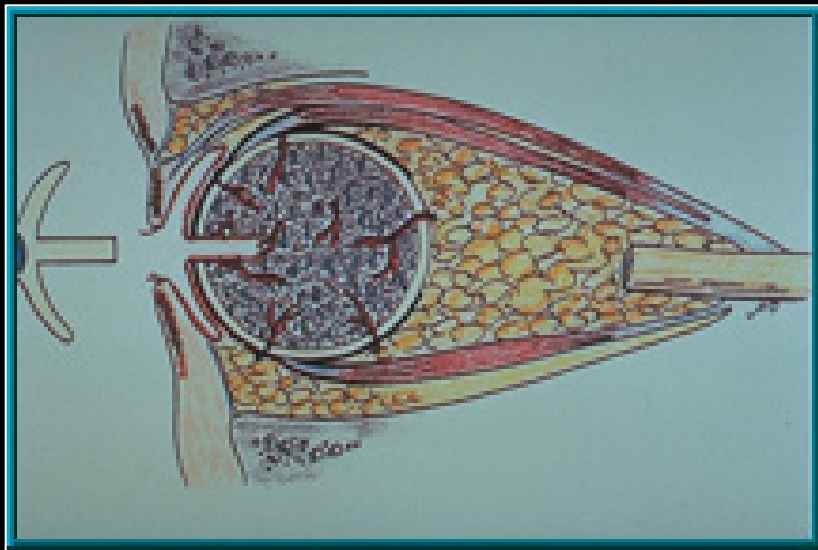


Artificial eyes formed with red denture wax and invested in a denture flask.

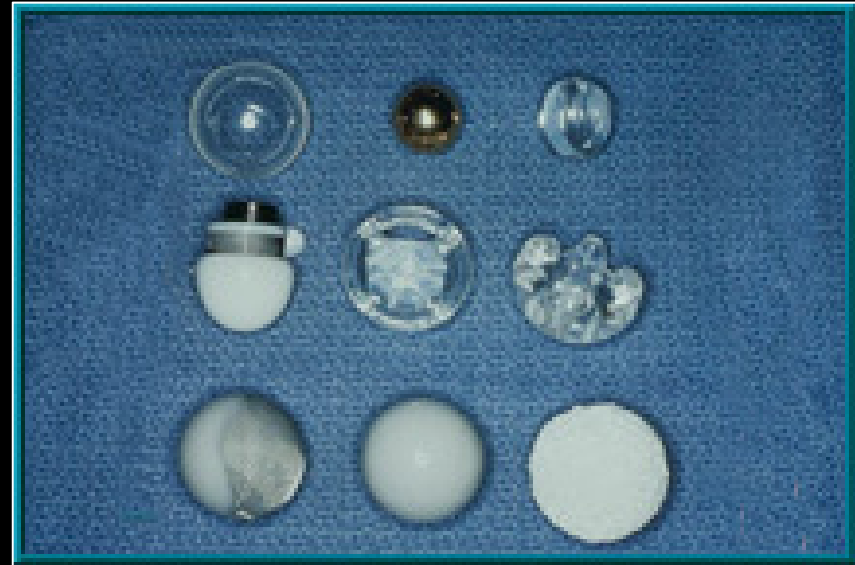


Iris tinting using oil paints.

Custom made PMMA prostheses created opportunity for further development of orbital implants. An implant made of hydroxyapatite was implanted in 1985, by Dr. Arthur Perry. A hole drilled into the implant epithelialised and sealed itself against infection enabling a peg to provide direct mechanical linkage to an overlying prosthetic eye.



Pegged hydroxyapatite implant



Implants of various materials and designs range from a hollow glass sphere used by Mules in 1885 (top left) to a hydroxyapatite orbital implant introduced by Dr Arthur Perry a hundred years later (bottom right). A Troutman implant (middle left) used a magnet to hold the prosthesis while the Castroviejo (middle) and the Allen (middle right) implants were made of poly (methyl methacrylate). Spheres of gold (middle top), silicone (middle bottom) and acrylic (bottom left) have also been used.

21st Century

The search for better implant materials and designs continues as the pegged implant fell out of favour.

Since WW2, the origins of PMMA eyes have resulted in two main schools for training ocularists. The US school centred on the American Society of Ocularists and the English school which is rooted in dental technology. As training and practising standards improve, more research into ocular prosthetics is taking place. It is through this means that the evolution of prosthetic eyes will continue into the future.



The wettability of a prosthetic eye being measured with a goniometer.