

Plaster of Paris – The fading art

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The treatment of fractures has gone through a drastic change since its inception. With development of modern orthopaedics and technological advancements, non-operative treatment is escaping out of armamentarium of orthopaedic surgeons. As the number of plaster of treatments have gone down drastically the residents in the teaching hospitals are not getting exposure to the art and science of plaster treatment.

One of the earliest descriptions of casting material was by Hippocrates in 350 BC. He wrote about wrapping injured limbs in bandages soaked in wax and resin [1]. Egyptians were using self-setting bandages, probably derived from those used by the embalmers [2]. Arab physician Rhazes Athuriscus. El Zahrawi (960-1013 AD), described the use of both clay gum mixtures and flour and egg white as casting materials. Starch based casts appear to have been the standard treatment with only minor changes until the beginning of the 19th century with only a few minor changes [3]. In the 18th century, Henri François Le Dran used to soak his bandages with egg white, vinegar and clay powder or plaster [4]. Larrey's modification was adopted from Don Eugenio de la Penna who bandaged the fracture with linen that had first been moistened with Camphor spirit, egg whites and lead-acetate [5]. Baron Louis Joseph G Seutin (1793-1862) became famous for inventing starch bandages known as "La Bandage Immobile" or "L'Appareil Amidonnee" that consisted of strips of linen or bandages and carton splints, soaked in starch and wrapped around the limb [5,6].

Plaster of Paris is produced by removing the impurities from the mined gypsum and then heating it under controlled conditions to reduce the amount of water of crystallization [7]. There are various accounts describing the origin for the name plaster of Paris. One account mentions King Henry III who visited Paris in 1254 and was so impressed by fine white walls

that he introduced similar plastering in England where it became known as plaster of Paris. The first use of plaster of Paris as a cast for injured limbs took place through a technique known as plâtre coulé that became popular in Europe at the beginning of 19th century. This technique involved pouring plaster of Paris around injured limbs encased in a wooden construct. Due to the weight of the construct, the patient was largely confined to bed during the period of fracture healing [1].

In 1839, Lafargue of St. Emilion used fresh warm starch paste mixed with plaster of Paris powder applied to layers of linen strips. That dressing had the advantage of hardening much quicker, reducing setting time down to six hours [8].

The Dutch military surgeon Anthonius Mathijssen while working at the military hospital in Haarlem discovered that bandages soaked in water and plaster of Paris were becoming hard within minutes providing sufficient casting for injured limbs. He published his monograph in 1852 in a medical magazine called Repertorium. His plaster bandage was based on the principles of Seutin, who 10 years earlier introduced starched bandages known as bandage amidonnee [1, 8].

Nikolay Ivanovich Pirogov conceived his idea to use plaster splints around 1852 while observing the work of a sculptor who used strips of linen soaked in liquid plaster to make models. After the war he refined his method by cutting coarse sail cloth to a defined pattern shaped to fit a part of body and soaking it in plaster before application [2].

Use of plaster of Paris bandages for fracture casts became widespread after Mathijssen's death and replaced most other forms of splintage. Early plaster bandages used at hospitals were made by nursing staff. They were usually freshly made from plaster powder kept in air tight containers that was applied on to the woven bandage or strips of cloths. Care was required while soaking dry bandage in water to

prevent the plaster coming off the bandages and dissolving in water. In the early 1930's, the first commercially manufactured bandages were available in Germany. They were made by spreading plaster mixed with minute quantities of volatile liquids on soft cloth.

In 1906, Meisenbach outlined the four essential properties of plaster dressings to include strength, quick set, light weight and ventilation, summarizing that ideal plaster dressing should be thin and strong [9].

It usually sets in few minutes, but needs between 36-72 hours to completely dry. Leg plasters can bear weight after 48 hours. Completely dry casts when tapped with knuckles will sound crisp and clear whereas wet casts emit a dull sound. Cast should only be dried by natural methods. No artificially generated heat is recommended [10].

When plaster of Paris dries off it becomes porous which helps to maintain patient's skin free from moisture. It is radiolucent which makes

X-ray examination possible. The strength of the plaster cast is determined by the quality of plaster, water to gypsum ratio, product age and storage conditions [11].

A fiberglass cast is a newer synthetic alternative to plaster of Paris. Fiberglass cast is a lightweight and extremely strong material. Fiberglass cast is used for fracture management but is not applied in the acute settings because it is less accommodating to swelling and does not allow moulding.

The success of non-operative treatment of fractures relies on a clear understanding of fracture healing and the proper use of stabilizing techniques, good knowledge of anatomy and pathology. Plaster of Paris is unique and remains the favoured casting material. It is cheap, non-toxic, and can easily be moulded to the desired shapes and contours of the body. Skin irritation and allergy is extremely rare.

Plaster of Paris has stood the test of time and is still commonly used.

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