CORNEAL GRAFT REJECTION

Thesis
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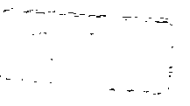

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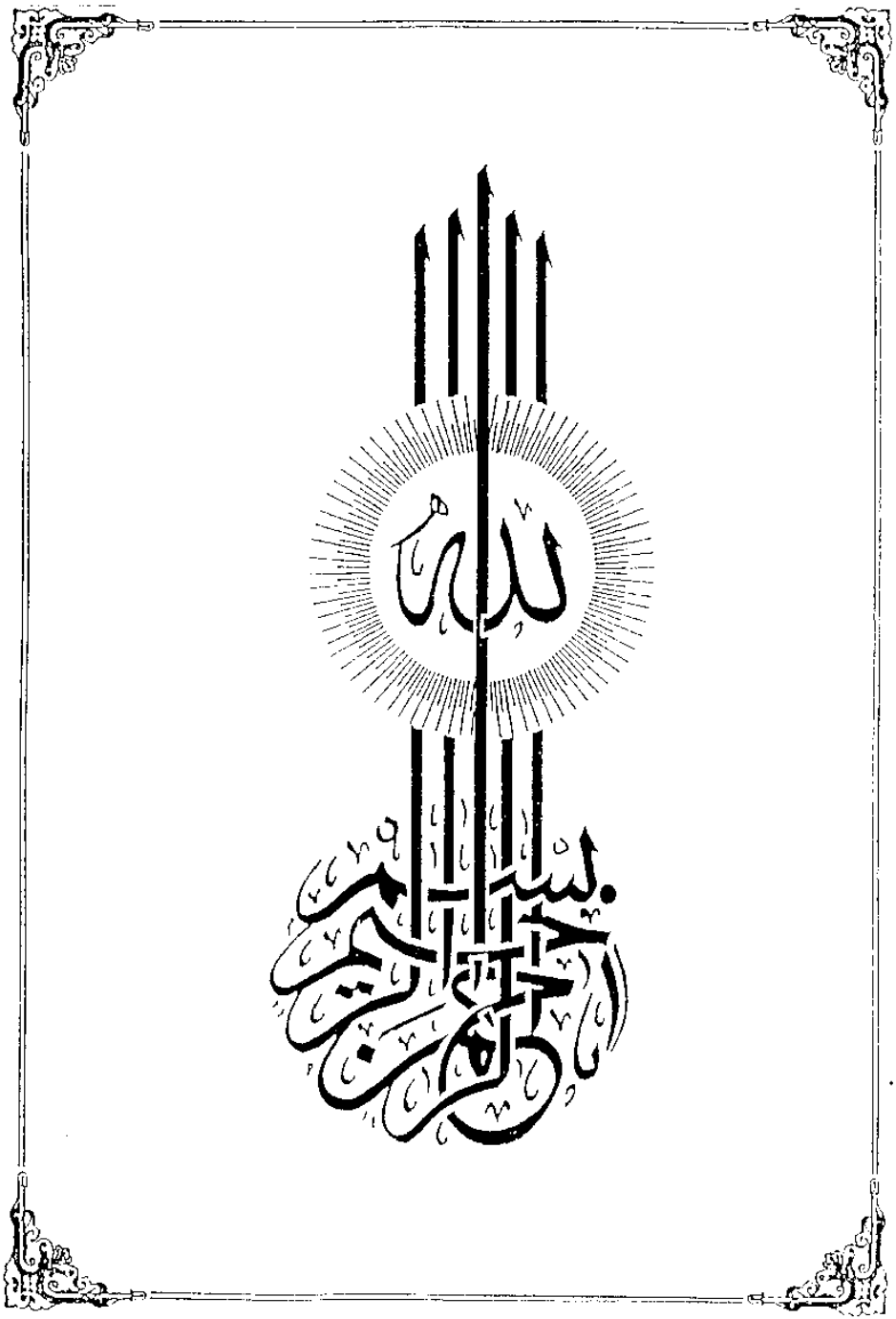

TO MY PARENTS

C O N T E N T S

INTRODUCTION

I N T R O D U C T I O N

At the beginning of the 20th century, the first successful total penetrating keratoplasty was achieved, using a human donor cornea.

Donor material for corneal transplantation has improved tremendously, in the last few years. The preservation of corneal material has made the planned scheduling of corneal transplantation possible. Donor material selection for corneal grafting became increasingly important. Recently, guidelines for the suitability of donor tissue have been established.

A good percentage of corneal grafts retains its transparency. With the advent of improved microsurgical techniques and the use of atraumatic needles with 10/0 monofilament nylon, the failures of corneal transplants on a technical basis are becoming less common.

However, opacification of transplants due to graft rejection still remains a major problem.

The corneal graft rejection was first described by the french ophthalmologists Paufique, Sourdille and Offret in 1948, as "maladie du greffon" (Maumenee; 1979). It is important to differentiate between graft failure as a general term & graft rejection as a specific immunologic process.

The so called"immunological privilege" of the cornea has stimulated researches about corneal transplantation immunology. By understanding the mechanisms of corneal graft rejection, we can manage properly corneal transplantation.

Our aim is to study methods of prevention and effective treatment of corneal graft rejection, as corneal transplantation is often tnreatened by the possibility of rejection.

Chapter 1

History of tissue grafting & corneal transplantation

HISTORY OF TISSUE GRAFTING AND CORNEAL TRANSPLANTATION

History of Tissue Grafting:

The idea of grafting parts of the body from one person to another started very early in the past and has inspired a number of legends. From a translation of a chinese document written about 300 B.C., the following quotation is taken: "A surgeon called Pien Ch'iao rendered two men unconscious by giving them a toxic drink. He operated, opened their stomachs, explored the heart and interchanged their organs". (Worshofsky, 1965). There is archeologic evidence that teeth were transplanted in man in Ancient Egypt, Greece, pre-Columbian North and South America. Also teeth transplantation was described by arabian writers around A.D. 1000 (Peer, 1955).

Ancient Hindu surgeons described methods for repairing defects of the nose and ears using grafting techniques.

The use of adjacent flaps to repair various facial defects was described in greco-roman writings of the first century A.D. (Worshofsky, 1965).

During the sixteenth century, the italian surgeon Tagliacozzi reconstructed the nose using a flap from the arm. Later in the eighteenth century, the scottish surgeon John Hunter revived the practice of transplantation of teeth. He reported success with autografts and allografts of chicken testes and other tissue transplantation experiments, (Calne, 1967). In 1770, Missa reported successful transplantation of the extensor tendon of the middle finger to

the extensor tendon of the index finger. In 1794, the english surgeons stationed in India, described nasal reconstruction as they had seen it performed by indian surgeons (Woodruff, 1960).

According to Woodruff's comprehensive review (1960), reports of the following kinds of grafts were first published during the nineteenth century: free grafts of skin, tendon, nerve, cartilage, cornea, adrenal, thyroid, parathyroid, ovary and adipose tissue; and pedicled grafts of muscle, tendon, nerve and portions of the gastrointestinal and urinary tracts. Some of these grafts were performed only in experimental animals but most were attempted with various degrees of success in man. Many of the developments in human transplantation were made possible by 2 developments during the last half of the 19^{th} century: the use of ether and other general anaesthetics and acceptance of Lister's principles of antiseptic surgery (Woodruff, 1960).

The first reports of reliable vascular anastomosis by suturing were those of Carrel and Guthrie between 1902 and 1912. They used this technique successfully in animal experiments in the transplantation of blood vessels and whole organs including heart, spleen, ovaries, endocrinal glands, extremities, (Peer, 1955).

History of Corneal Transplantation:

Because of its avascularity, the cornea is an ideal tissue for transplantation.

At the end of the 18th century, the french ophthalmologist Pellier do Quengsy had an idea of inserting a piece of transparent material (glass) in the centre of opaque cornea. At the beginning of 19th century, blindness due to corneal ulceration was a problem of increasing consequence specially after the Napoleonic Wars where high scores of soldiers and sailors were blinded by the Egyptian ophthalmia (Trevor - Roper, 1972).

The idea of corneal transplantation came from Karl Himly in 1813 but it was first applied by Frans Reisinger in 1817. Having watched Cooper performing the 1st successful free skin autograft in a human, Reisinger performed corneal grafts in chickens and rabbits during the period from 1817 to 1824. He proposed the replacement of opacified human cornea with transparent animal cornea, a procedure he called "keratoplasty", (Paton, 1955),(Trevor-Roper, 1972).

Following the publication of Reisinger's work, many ophthalmic surgeons tried total corneal grafting but their trials were threatened by sepsis, imperfect instruments and inadequate technique.

Stilling in 1833, cut an artificial pupil in the sclera and implanted in it a corneal graft of corresponding size.

In one case, the graft healed with slight clouding (Paton, 1955).

In 1837, Samuel Bigger published in Dublin, his report about successful clear homografts in a gazelle while he was a prisoner of the Egyptians bedwins, two years previously (Paton, 1955).

In 1844, Richard Kissam in New York attempted the first human keratoplasty suturing the cornea of a young pig into the place of a central leukoma of a blind man. The graft became opaque in a month. In the same year, Wutzer used a graft from sheep's cornea but failure was the result (Hefny, 1962), (Trevor-Roper, 1972).

Von Walther was the first to attempt lamellar keratoplasty in 1840. Mulhauer tried in the same year triangular lamellar grafts taken from sheep and implanted in human eyes. The results were bad (Roper-Hall, 1980). With those discouraging results, interest in keratoplasty was distinguished. Surgical attention was diverted from corneal tissue transplants to transparent inert prostheses. Nussbaum in 1856 inserted glass buttons into rabbit's corneas. Heusser, a swiss surgeon, in 1859 implanted a similar glass prostheses (small glass disc) in a 19 year old patient (Hefny and Rehim 1971).

In 1872, Henry Power renewed the interest to keratoplasty by his series of corneal grafting experiments on rabbits, dogs, cats and human beings. He attributed the

success of his corneal transplantations to the use of homoplastic tissue and suggested that donor material for human keratoplasty might be obtained from excised eyes as a result of disease but with healthy cornea (Trevor-Roper, 1972), (Shoukry et al., 1972).

Von Hipple in 1872 tried a glass prosthesis with a golden rim which can be cleared from time to time but the result was depressing. In 1877, Von Hipple described a partial penetrating keratoplasty in man which healed successfully but became cloudy. The donor material, was a dog cornea excised by his new clockwork automatic trephine (Paton, 1955).

In 1878, Von Hipple met a complication: panophthalmitis after homoplasty in man. He erroneously concluded that the homoplastic graft was the cause of that complication and hence he advocated heteroplasty (Shoukry et al., 1972).

No further homografts were done, until Von Hippel himself in 1887 recorded the first permanently successful lamellar graft in a girl using a full thickness rabbit graft with improvement of vision from counting fingers to 6/60 (Hefny, 1962) (Trevor-Roper, 1972). (Fig. 1).

Fuchs in 1894 reported a series of 30 partial penetrating grafts, half of them were homoplastic and the other half heteroplastic. He expressed a preference for human donor material in penetrating keratoplasty, (Paton, 1955).

Still at the end of the 19th century, there were few reports about prosthetic implants: Dimmer in 1889 used

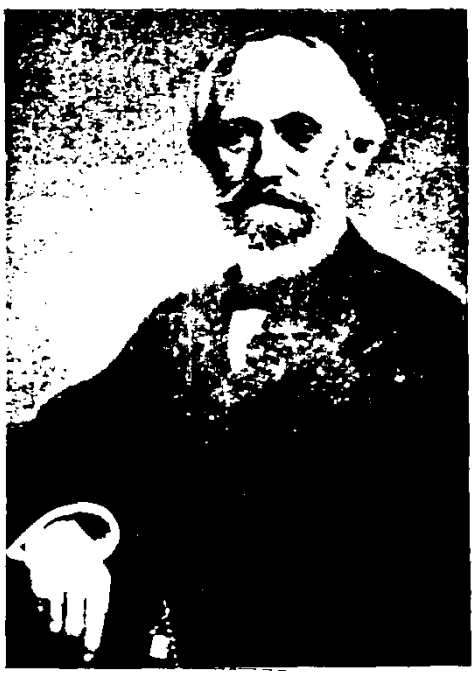

Fig. 1. : A. Von Hippel.

(From Casey T.A. (1972): Corneal grafting. Butterworths. London. P. 4 .).