Keratoprosthesis

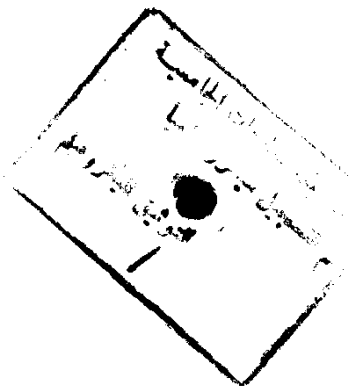
Essay

Submitted for Partial Fulfillment of

M.S. Degree

In

Ophthalmology



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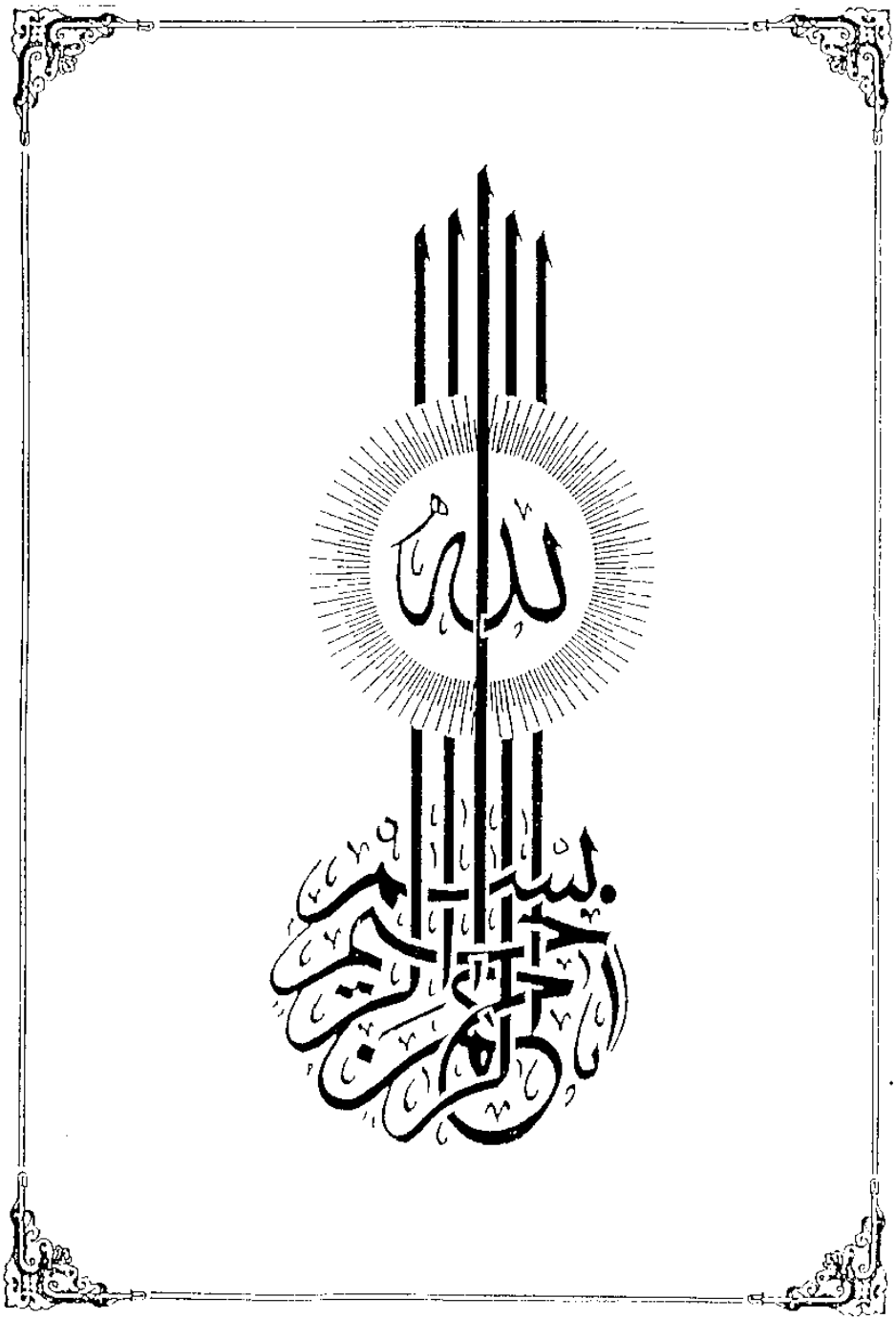

بسم الله الرحمن الرحيم

قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا مَا عَلَّمْتَنَا إِنَّكَ أَنْتَ
الْعَلِيمُ الْحَكِيمُ (٣٢)

سورة البقرة

صدق الله العظيم

TO MY FATHER AND MOTHER

ACKNOWLEDGEMENT

I would like to express my deepest gratitude and respect to Professor Dr. Amira Mounir Professor of ophthalmology, Ain Shams University, for her valuable guidance and support. Without her constant encouragement and her enthusiastic spirit this work would not be accomplished

All my appreciation, utmost respect to Assistant Professor Dr. Madgi El Barbary, Assistant Professor of Ophthalmology, Ain Shams University, for his kind supervision and fruitful suggestions.

I wish also to extend my sincere thanks to all my senior staff in the ophthalmology department , Ain Shams University for their warm help and their constant concern throughout this work.

Lastly I would like to express my special regards to my parents for their love, their patience and their understanding .

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1.	3	Vanisek, in Fig. 1.	Vanysek
2.	87,88	Skipped	
3.	91	Fig 31	Fig31 a b / c d / e f
4.	97	7.0 Prolyene, in No. 10	7.0 Prolene
5.	97	Propylene, 8 in No. 11	Prolene 8.0
6.	118	Application, in first line	Applicator
7.	122	Eye lid infection, in no. 9.	Eyelid infection
8.	131	(Heimke, Polack), in fourth paragraph	(Heimke and Polack)
9.	142	eye lid, in first line	eyelid

Introduction

Introduction

It was reported, by *Girard, 1983* and by *Renard, 1992*, that there are 20 million cases of corneal opacities all over the world, 25% of these cases are poor candidates for penetrating keratoplasty.

According to the literature, the French ophthalmologist Pellier de Quengsy in 1771 was the first to suggest the concept of an artificial cornea in treatment of corneal blindness, by thinking of inserting an artificial glass window. It took almost another hundred years before the first implantation of a glass plate in a rabbit cornea was done by Nussbaum in 1853. It was maintained successfully for 3 years *(Cardona, 1962)*. Fig. (1)

The first implantation of a glass disc into a human cornea was done by Heusser in 1859, a Swiss surgeon, who implanted a small glass disc in the cornea of a 19-year-old patient. Several trials were further conducted by many investigators like Von Hippel in 1877, Salzer in 1898 using glass discs in animal studies, and Dimmer in 1891 using a celluloid plate instead of glass *(Cardona, 1962)*.

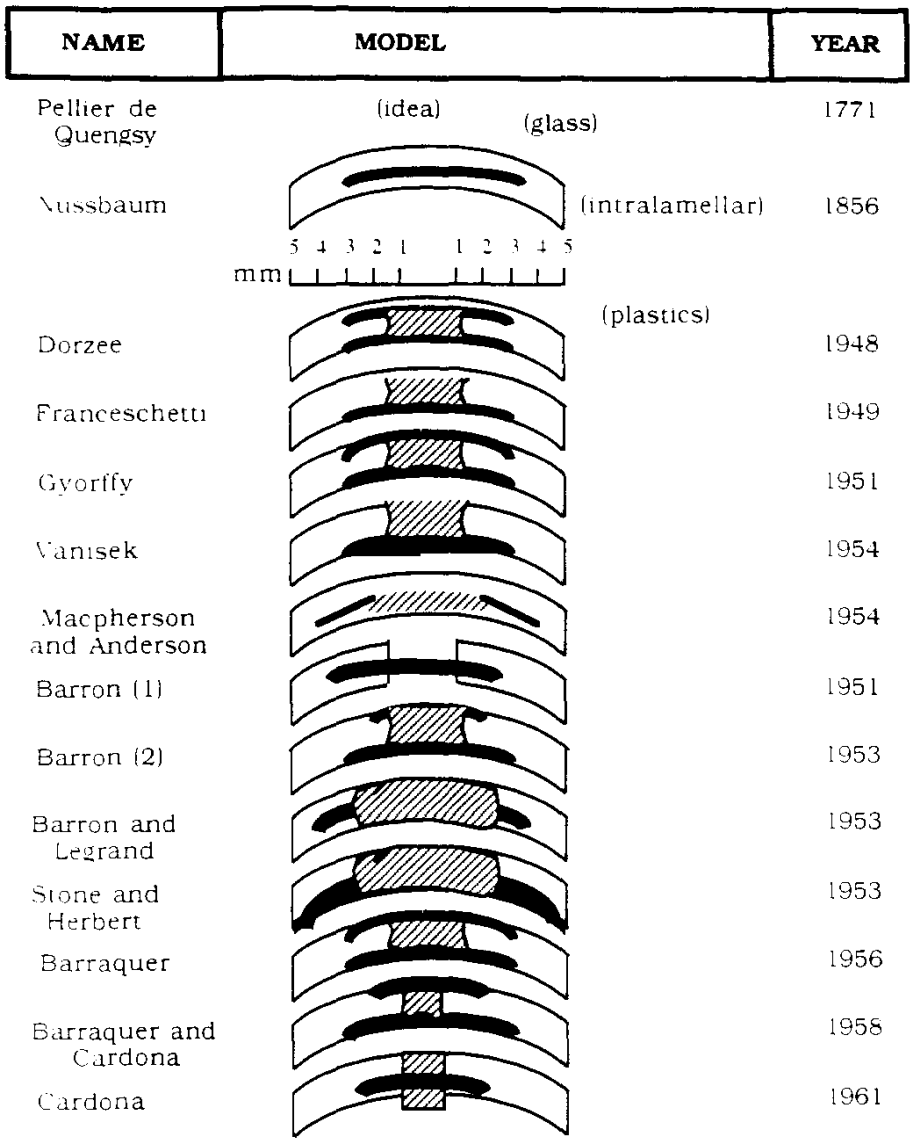

Fig. (1): Evolution of principal keratoprostheses *(Cardona, 1962).*

After 1906, when the first successful human to human corneal graft was performed, there was loss of interest in artificial cornea *(Barnham and Roper-Hall, 1983)*. In the early to mid-1900s, several advances were made in the surgical techniques of penetrating keratoplasty that further increased the success of this procedure. The concept of treating blindness due to corneal opacities was shifted from using artificial cornea, to the use of human corneal graft which became the more logic approach *(Barron, 1988)*.

After World War II, Stone and Herbert in 1950 noticed that polymethylmethacrylate (P.M.M.A.) splinters embedded in the cornea, the anterior chamber and even the vitreous of World War II pilots were well tolerated with practically no adverse reaction. This observation led to the conclusion that P.M.M.A. would be a good substitute for glass, and triggered the pioneer animal experiments of Stone and his associates *(Stone and Herbert, 1953)*.

The modern era of keratoprosthesis surgery began in the nineteen sixties with the introduction of this synthetic plastic polymer of low toxicity and good optical quality. Failure of keratoplasty in chronically edematous and vascularized cornea, with regrafting which may be repeated several times hopelessly, revived the concept of an artificial cornea *(Barnham and Roper-Hall, 1983)*.

The principal problem with implantation of a kerato-prosthesis is obtaining adherence between an inert material and living eye tissues. The failure of the diseased cornea to permanently incorporate a keratoprosthesis (Kp) by early cicatricial formation, led many investigators to try to prevent extrusion of the implant through design modification. One of the first implants used was a biplate model, joined in the center, designed by Dorzee in 1945. Also, Wünsche in 1947 and Kuwabara in 1956 tried different types of acrylic implants in rabbit and human eyes. Franceschetti modified the Dorzee model in 1949, giving it the form of a diabolo *(**Cardona, 1962**)*.

Györffy designed a two-piece implant in 1951, consisting of a threaded base with the optical section and an outer piece that screwed onto the inner *(**Györffy, 1951**)*. Trying to retain the implant in human host cornea, Macpherson and Anderson in 1953 used an intralamellar implant with radial peripheral extensions *(**Macpherson and Anderson, 1953**)*. Legrand designed a thinner model in 1958 with 10 holes in the periphery for the passage of what he termed "anatomic suture" of nylon *(**Cardona, 1962**)*.

The keratoprosthesis fixed to the cornea through an intralamellar supporting plate was designed by Vanysek in 1954. This was latter modified to include fenestrations by Stone in 1958,

which he hoped would decrease the tendency of extrusion of the implant by scar tissue proliferation through them, thus creating adherence between living tissue and plastic *(Barnham and RoperHall, 1983)*.

Barraquer used a pulley shaped implant, similar to, but smaller than that designed by Dorzee. Results were not too encouraging because of the high rate of extrusion. In 1958, Barraquer used the Barraquer-Cardona implant in several human eyes with satisfactory results *(**Cardona, 1962**)*.

Modifications to the supporting structures, were subsequently introduced with the use of tooth and cartilage by Strampelli and Casey *(**Barnham and RoperHall, 1983**)*, ceramics by Polack and Heimke *(**Polack and Heimke, 1980**)*, and polyethylene terephthate (Terylene Dacron) by Cardona *(**Cardona, 1967**)* and Girard *(**Girard et al, 1977**)*.

Odontokeratoprosthesis proved unsatisfactory in experimental studies since it leads to pronounced corneal infiltration, vascularization, corneal abscess formation and extrusion of the implant. This procedure is considerably more complicated and traumatizing not only to the eye but also to the mouth and does not appear to offer any advantages. The

extrusion rate of odontokeratoprosthesis is higher than the rate for prosthesis made of pure P.M.M.A. *(Castroviejo et al., 1969)*.

A two-piece implant was designed by Stone in 1967 in which the central component is changed at a second operation. This central component could also be removed for cleaning retroprosthetic membranes, Fig. (2). Choyce described and used his two-piece keratoprosthesis in the same year *(Barnham and Roper-Hall, 1983)*.

A new two-piece penetrating keratoprosthesis was designed by Cardona *(Cardona, 1969)*. Cardona designed many models of keratoprostheses since then, like:

1- The through and through keratoprosthesis with an interlamellar supporting plate.
2- Buried mushroom keratoprosthesis.
3- Nut and bolt keratoprosthesis. Fig. (3)

Although several hundred of such implantations have been done throughout the world, this field of ophthalmic surgery is still in an experimental stage *(Sletteberg et al, 1990)*.