

## LIGHT UP SUCH A CANDLE”

Al Mackay worked with the pioneers of Intraocular lens implants. His personal insights into the conflicts that existed at the time and his gratitude for the subsequent developments.

Each morning upon rising I see the world, I mean, I really see it in its glowing colours and grandeur and all as a result of the insight, perseverance and vision of one man, Sir Nicholas Harold Ridley. This is a personal story as I am the recipient of intra-ocular lenses and in a small, way a participant in the development of these marvellous surgical appliances. And it is to Harold Ridley (as he was known) that I am, and will remain, eternally grateful.

I first brushed shoulders with Ridley at a Royal Society Meeting in Wimpole Street, London during 1961. I was employed as ophthalmic registrar to the consultant ophthalmologist, Peter Choyce, at Southend Hospital. Choyce was Harold Ridley’s most devoted disciple, co-worker and fellow pioneer of intra-ocular implant surgery. Initially Choyce, as Ridley’s senior house surgeon at St Thomas’ Hospital, had assisted at the very first lens implant operation performed in the world.

My thoughts on the development of intra-ocular lenses were refreshed last year when I attended a Summer School in English Literature at Oxford. I stood at the memorial “iron cross” in Broad Street, the site of the burning at the stake of the Oxford Martyrs, Bishops Nicholas Ridley, Hugh Latimer and Thomas Cranmer in 1555-6. I had walked this very spot so many times during the last fifty years, but my recent eye surgery must have activated some sense of contact and empathy for all those who had been martyred, then and later, in pursuit of religious freedoms and the scientific advancements the fruits of which I was now enjoying. I realised that, during the late 20th century, Harold Ridley (and his disciple, Peter Choyce) were treated as outcasts in much the same way as

Bishops Ridley, Latimer and Cranmer were four hundred years before. Even though they were not executed, Ridley and Choyce suffered the scorn and ridicule of the Establishment.



As I stood there, I was aware that Bishop Nicholas Ridley was a collateral ancestor of Harold Ridley and both were alumni of Pembroke College, Cambridge. But the words of reassurance given by Latimer to Ridley on that fateful day in 1555 are poignant and could well be applied to the treatment given by the medical establishment to the pioneers of lens implant surgery during the twentieth century. As the flames licked their bodies,

Latimer was heard to say to his colleague, *“Be of good cheer, Master Ridley; and play the man. We shall this day, by God’s grace, light up such a candle in England, as, I trust, will never be put out.”* Harold Ridley, and my old boss Peter Choyce, were the men to take up that torch ignited so

long before and were to carry it through the 20th century turning darkness into light for so many untold millions of people throughout the world.

But to get to my story. Mr Harold Ridley was a consultant ophthalmologist at Moorfields Eye Hospital, London during the Second World War. He treated a Hurricane fighter plane pilot whose eyes were injured when his cockpit canopy was severely damaged causing him to sustain penetrating eye trauma from the particles. Squadron Leader Gordon “Mouse” Cleaver was shot down over Winchester, England during the Battle for Britain in 1940. He sustained facial and eye injuries and was transferred to Moorfields Eye Hospital, London where he came under the care of Mr Harold Ridley. The canopy of the fighter was composed of the synthetic polymer of methyl methacrylate, poly-methyl 2-methylpropenoate (PMMA) in distinction to the glass canopies of many other aircraft. Ridley observed that foreign bodies composed of PMMA, if they remained stationary in the eye, did not stimulate a foreign-body reaction.

As a result of this observation, he experimented with the design of lenses for insertion into the eye of aphakic patients. In November of 1949 at St Thomas’ Hospital, London Ridley performed the first intra-ocular lens implant although it was not until the February of 1950 that he left an acrylic lens in place permanently. Two years later Mr Ridley presented a paper on his new operation at the Oxford Ophthalmological Congress. He received criticism instead of praise. Immediately he ran afoul of the British ophthalmological establishment. This intense opposition of Ridley’s work was led by Sir Stewart Duke-Elder whose influence I believe set Britain back by more than two decades in the development and acceptance of this marvellous advance in cataract surgery. But not so in the rest of Europe, North America and the USSR where the development of implant surgery was taken up by many ophthalmologists.

Peter Choyce had been a clinical assistant at the Institute of Ophthalmology during the early parts of 1950s and, at that time, considered Duke-Elder to be his friend and mentor. He also had developed a disciple-like relationship with Harold Ridley and contributed to his experimentation with IOLs. This relationship was much to Duke-Elder’s displeasure as “the duke” had a strong dislike of Ridley.

During an interview with Ocular Surgical News in 1999 Choyce related his “sadness” of Duke-Elder’s reaction to his continuation with Ridley’s work. Duke-Elder told him that he would no longer help him in his career. In fact, he opposed his appointment within the National Health Service. Thus, his applications for consultant positions at University College Hospital, Guys and Edinburgh came to nothing. He was disheartened that Duke-Elder should allow his personal dislike of Ridley to block reason...” Such a pity” was his response during the interview.

Choyce had expressed similar sentiments to me thirty-eight years prior to this interview when he was my boss and still suffering the displeasure of Duke-Elder.

Let me give you a little background chemistry of this PMMA. In 1877 a German chemist, Wilhelm Fittig, discovered the polymerisation process that turns methyl methacrylate into the translucent polymethyl methacrylate in 1933, a German, Otto Rohm, patented a glass-like acrylic product known as Plexiglass. In 1936 Perspex was marketed by ICI as one of the few artificial solids that was transparent.

I met Peter Choyce during May of 1961. I was studying in London at the Institute of Ophthalmology and Moorfields Eye Hospital attending lectures given by many illustrious names of the day: Harold Ridley, Sir Stewart Duke-Elder, Stallard, Leigh and Trevor Roper were among my tutors.

One morning I visited the library of the Institute checking on a reference; remember that this is back in the days before computers, and one still used textbooks even though they were known to be out of date before they appeared on the library shelves. Journals were more reliable but word of mouth in the operating theatres still predominated. I perused a notice board on which was pinned various documents, mostly advertisements of coming events, exam dates and the like. Whilst I was thus engaged, a man in his early forties thumb-tacked a small card on the board. I read this addition. It was an advertisement for a locum eye registrar position at Southend General Hospital. I was a self-funded student supporting a wife and two children and had not worked for more than eight months, I was rather short of cash having travelled from



Australia. A paid position was of great interest to me. I had absolutely no idea where Southend was situated so I asked the chap what it was all about; he introduced himself as Peter Choyce and told me that he needed a locum for his registrar, Robert Boucherat, who was to be absent for a month or so but would likely be moving on to another hospital in the near future. The registrarship was to become permanent after Boucherat's departure.

This was my first contact with Mr Peter Choyce; he was to become my surgical mentor. I recalled his spectacles, his tousled fair hair, his slightly chubby face and impish smile. Little else of this first contact remains in my recall other than he gleaned from me that I had been an eye registrar in Australia, was looking for employment and that I should apply. I did and, after being interviewed at the hospital, I was accepted to start a few weeks later.

I rented a small house about one mile from the hospital, and, bundling my family into my tiny Austin A30, I moved to Southend. Thus began my association in the development of those acrylic lenses that would, fifty years later, magically restore my own eyesight. In 1961, apart from a minor mention of IOLs at the Institute, I had little knowledge of these appliances. During that year I purchased the then current textbook, "Eye Surgery" authored by H. B. Stallard. It was of 900 pages, and barely 6 pages were devoted to acrylic lens implants having noted that a complete evaluation of the techniques was not to hand.

Technical details of the surgery and the environment in which it was performed:

Choyce's lenses were produced by Rayners and manufactured from Perspex CQ. They were sterilised by placing them in caustic soda 10% for one hour then thoroughly flushed with sodium

bicarbonate and placed in a transportation container filled with a 0.1% solution of caustic soda. During these early days ethylene gas was considered to be too expensive in the UK.

Briefly the operation was as follows. In 1961-1962 Choyce was using his Mark V lenses

Firstly, the theatre: The gowns, drapes, masks and towels were of cotton and were all washed and sterilised after every procedure. The gloves were similarly washed, powdered with talc and sterilised for re-use. These gloves were of thick rubber and dexterity was reduced. Thus, eye surgeons did not wear gloves for any intra-ocular operations particularly as talc was known to be detrimental if introduced into an eye. It was only many years later that all manner of disposables (drapes, gowns, gloves, needle, syringes, packaged sterile water) became available in operating theatres. Most of our instruments, hypodermic syringes, surgical blades and surgical needles were cleaned and re-used. Graefe knives were tested for sharpness on a special kid-glove drum. When these blades were considered to be barbed or blunt, they were sent away for sharpening. Fine virgin silk, as well as black/white silk thread, was unwound from a cotton reel and carefully threaded into Grieshaber or other appropriate needles before sterilisation. Sometimes the scrub nurse would thread sutures during the operative procedure, but this became increasingly uncommon. The eye ward had its dedicated operating theatre and annex with a free-standing autoclave in which all the paraphernalia of surgery, including wash water, was sterilised. Products affected by heat, i.e., tubing, cautery leads etc., were soaked in a Zephiran solution. There was no central sterilisation unit and no wastage.

About one month before implant surgery an intracapsular lens extraction, using a Graefe knife, was performed. This allowed time for wound healing and the settling of any internal reaction to take place before the implant operation. An eye swab was taken two days before the second admission and was cultured for the growth of bacteria. A refraction was performed, the anterior chamber depth evaluated, the corneal diameter was measured, and a suitable lens ordered from Rayners. The patient with the now aphakic eye was re-admitted two days pre-operatively for a full medical assessment. The pupil was constricted by the administration of Pilocarpine 2% four hourly to facilitate the insertion of the implant. The lashes were cut, and the conjunctival sacs irrigated every two hours with Chloramphenicol antibiotic drops for one day. To lower intra-ocular pressure Acetazolamide was administered orally several hours before surgery and repeated with as an IV injection of 500mgms at induction.

General anaesthesia was preferred although local anaesthesia was used with very elderly patients. Anaesthesia was achieved with a premedication of Trimeprazine 50 mgs followed by induction with Chlorpromazine, promethazine and pethidine. Thiopentone and succinylcholine were administered prior to intubation. Anaesthesia was maintained with nitrous oxide and oxygen. Sometimes halothane (2-bromo-2-chloro-1,1,1-trifluoroethane) was used as a gaseous agent.

Choyce was always careful to check the available implants prior to operation. For safety, each pack contained two implants and were flushed clean of the storage solution.

Prior to commencement, Choyce would apply firm pressure to the eye to further lower the intra-ocular pressure. Magnification was achieved with loupes. The provision of a fully motorised operating microscope was still several years away. A lid speculum was used to expose the eye and a gonioscopic check of the angle performed as gonio-synechiae needed to be divided to clear the angle for proper insertion.

The corneal diameter again was measured and checked against the size of the implants. A temporal section, using a Graefe knife, was made so that there was no residual conjunctival flap. Sometimes, if there were a drawn-up pupil, a sphincterotomy was performed. The anterior chamber was

irrigated, the lens grasped with Ridley-Barrquer forceps and slid into the anterior chamber. Visco-elastic agents, such as Sodium hyaluronate- Healon, were not available until years later so there was an inherent danger of endothelial damage at this stage. The feet of the implant were then maneuvered into place one at a time. The insertion was sometimes facilitated by using a special needle inserted in a hole in the foot. Often Choyce would perform another iridectomy between the feet of the implant if there were any signs of iris bulging. Wound closure was achieved using two to four fine virgin silk sutures; 4% pilocarpine was instilled as miosis was desirable. The anterior chamber was reformed with an injection of air. At the conclusion of surgery, the pupil was constricted so as to keep the angle clear of iris. Subconjunctival penicillin was injected and systemic Achromycin administered.

commenced. At the first dressing next day, homatropine and neomycin were instilled and repeated for seven days after which the sutures were removed. It was only then that the patient was discharged from inpatient care. Atropine and hydrocortisone was instilled for the following several weeks and these drops were suspended only when the eye became quiet with no obvious anterior chamber reaction.

Choyce continued to experiment with several other implants whilst developing his own design. Among these were the Ridley tripod lens and the iris clip lenses of Binkhorst and Epstein. He also trialed coloured haptic in patients with subtotal aniridia, lenses for high myopia and Galilean telescopic lenses for macular degeneration.

Whilst compiling this document I became aware that I may have been the first Australian ophthalmologist to implant an IOL whilst working during the early '60s.

Recently I spoke with a lady who lives on the south coast of NSW; she is now 57 years old. I assisted Peter Choyce with her eye care in 1961; she was only four years old and had a traumatic cataract and had been referred to Choyce's care by her attending ophthalmologist in Canberra. I believe that she was the first Australian and possibly the youngest patient to receive an intra-ocular lens during those pioneering days of this procedure.

But what had these intraocular lenses replaced? Prior to lens implant surgery an intra-capsular cataract extraction (ICCE) was the treatment for cataract. The complication rates of ICCE was much greater than with the present-day implant surgery. These adverse outcomes included wound dehiscence, vascularity of the cornea, endothelial opacification, iris prolapse, secondary glaucoma, vitreous loss, retinal tears, expulsive hemorrhage and retinal detachments. These are but a few of the conditions accompanying this old-fashioned operation. As the complication rate was high patient selection chose those who were most incapacitated. Worse than 6/12 vision was thought a prerequisite.

When a cataract was removed, the eye became aphakic and completely out of focus. This refractive error was overcome by the prescription of thick, usually about +12.00, glass spectacle lenses. Sometimes contact lenses were ordered but these were of hard acrylic and most uncomfortable to wear. Thick lenses had many drawbacks. The image produced on the retina was magnified considerably introducing diplopia if both eyes were not similarly corrected, and if monocular, the



other eye needed patching. There was a “jack-in-the-box” effect as, on turning the eyes, images would jump in and out of focus as the viewing spot in the spectacles altered. The lenses were heavy, but the wearer was effectively blind without them.

This photograph is one of Peter Choyce, at the ward Christmas party; he was wearing a chef’s hat and carving a turkey. In those innocent days the chief consultant, and his entourage, always came into the hospital to preside over the inpatients’ Christmas lunch. As registrar, I had ordered several bottles of “hospital” brandy in the weeks prior to Christmas so a little alcohol was available courtesy of the NHS. It all helped to flame the pudding and maintain some of the fire in our blood.



Southend General Hospital serviced a population of 350,000 people and Choyce’s eye unit was the only one in that area. The unit consisted of 25 beds in female and male wards, a children’s ward, several private rooms and an out-patients department. Adjoining the wards were the operating theatre, the anaesthetic induction room and ancillary scrub/sterilising areas.

The heart of the operation was a small “cosy” room, the tearoom, the nerve centre of the entire operation. It was here that so many matters of momentous importance were deliberated.

A quote from Shakespeare’s Henry V seems appropriate.

*“In little room confining mighty men,  
Mangling by starts the full course of their glory.  
Small time, but in that small most greatly lived*

*This star of England...*”

To this tiny tearoom in the southeast of England came some of the most notable surgeons of the day. These doctors came, not from the British Isles, but from all over the European continent and North America. They observed and concluded that implant surgery would address world blindness, most certainly it was the way ahead. Many Americans who came to Southend then contacted Rayners for lens supplies and took the knowledge and the implants back to the USA. Eventually, Rayners could not supply the ever-increasing demand. At this time Peter Choyce had not patented his early developments being of the opinion that such medical innovations should be shared freely throughout the world. He thought that holding proprietary rights or making a profit would taint an idea. So, the Americans seized the initiative thus spawning the now enormous North American ophthalmological-based manufacturing industry. Choyce expressed his displeasure that the lenses were of his design yet bore a different patent.

So, who was this man, David Peter Choyce? He was the son of a prominent London general surgeon. He was born in 1919 and graduated from University College, London, in 1942. It was wartime and he, as a casualty officer at Lewisham Hospital, London, treated many victims injured during the Blitz. Subsequently he was posted as ship's surgeon on an armed merchant vessel plying the Atlantic with war supplies. The ship was forced to put into Norfolk, Virginia, USA, having been damaged during its passage across the ocean. Taking advantage of this stop-over, and having time on his hands, he visited New York to observe the master eye surgeon, Ramon Castroviejo, at work. He had previously decided upon a career in ophthalmology, but this visit cemented his resolve. During the latter part of the war, as he was the only German speaking member of the ship's crew, he acted as interpreter taking the surrender of a German submarine in the Mediterranean Sea. After the hostilities ceased, he became a house officer at Moorfields Eye Hospital in London, and it was there that he became Harold Ridley's assistant.

Choyce was an affable, honest and generous man but prone to express his mind quite openly. He confided in me of his doubts regarding the ability that his peer group possessed to dispassionately evaluate the true nature of his work. He was aware of the overbearing, almost God-like, influence that Duke-Elder exerted over his colleagues in British ophthalmology. Choyce was lauded in the USA and Europe but basically was an exile in his own country. As a Hunterian professor he had been accepted by the general surgical community but not by Duke-Elder.

I am now in my 82nd year and realise that if it were not for Ridley, Choyce and many others like him I would not be seeing well enough today to type this story. But it is not only to those two men of medicine that I owe so much.

My first encounter with medical doctors was at the age of four. I had been admitted as a desperately sick child to the Children's Hospital in Sydney. I realise that a defining moment occurred in that hospital whilst I was recovering from pneumonia. It was in the era before antibiotics and many bacterial infections were deadly. Recovery was not the outcome for my brother who had died several years before. I remember, in a sort of kaleidoscope of confused sequences, that night of my awakening. There was an occasional flash of a torch behind the screens of the bed opposite mine, human shadows danced on the ceiling, hushed voices mumbled incoherently, a trolley rumbled across the floor and the bed was empty in the morning. None of us asked where little Betty had gone; we didn't talk much about it, "*she must have gone to another ward*". This was my education into reality. It should not be considered unexpected that I became interested in doctoring about that time. Subsequently there were several other provocative inputs, the war being one of the most memorable. Primary school pupils were instructed in first aid to the injured as hostilities closed upon our shores and a St John's Ambulance officer came to demonstrate simple techniques of aid.

During my preclinical year at university in 1951 I listened enraptured to Charles Best as he talked of his work with Frederick Banting in their development of insulin. It was my first personal encounter with such men of science. In my early days of ophthalmic practice, I had the opportunity to cross consult with Sir Norman Gregg; in that time men of fame were never out of reach for consultative reassurance, always there on the telephone, quite unlike the professors of today who seem to migrate to some inaccessible place beyond. Gregg was but one of many “greats” that were to cross my path. When remembering the terrifying diseases that had surrounded me in my youth seeing all those children invalided with leg braces, chronic coughs, asthenia, and then seeing those diseases in the real life as a doctor reinforced the harsh reality of the times. Diphtheria, tuberculosis, whooping cough, measles, poliomyelitis and the devastation these conditions wrought upon my generation was omnipresent. My blood boils when I hear of those idiots who canvass parents not to have their children vaccinated or immunised.

And it is sad to recall that, upon my return to Australia in 1963, not one single Australian ophthalmologist expressed any interest in implant surgery nor asked of my experiences at Southend Hospital.

I am a product of all that has gone before and continue to benefit from the sacrifices made by our forefathers. Those martyrs of Broad Street, and their modern-day equivalents live on, and always will, in my perception. As a surgeon during the mid to late twentieth century, I resided in a land populated and nurtured by giants. It was a century of the most incredible medical advancement in all its fields, and I feel privileged to have contributed, albeit in a small way, to that continuing revolution trying to keep that candle flame burning brightly.

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Footnotes:

1. Some of the graphics were inspired and modified from those portrayed in Peter Choyce’s monograph “Intra-ocular Lenses and Implants” London H K Lewis 1964.
2. Harold Ridley was knighted in 2000, some fifty years after his first implant operation. Choyce played an active role in lobbying for this knighthood.
3. Peter Choyce never received the acknowledgement that I believe should have been awarded to him. He died aged 82.