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OPHTHALMIC PINION

CME Ophthalmology Insights



- Pseudo-exfoliation syndrome: An old problem with an updated context
- The skill and art of planning LASIK: Trends in screening
- The role of the ocularist in patients who have lost an eye
- Living and working in New Zealand: A perspective

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Editorial

Dr Brian van Onselen

Ophthalmic Surgeon, Sandhurst Eye Centre, Sandhurst, Johannesburg
Past-president and board member of the South African Oculoplasty Society,
Editorial Board Member, MIMS Magazine

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Editor: Dr Brian van Onselen
Production Editors: Ann Lake Publications
Ann Lake,
Helen Gonçalves
Design: Jane Gouveia
Enquiries: Ann Lake Publications
Tel: 011 802 8847
Fax: 086 671 9397
Sponsor: Adcock Ingram Healthcare
Email: lakeann@mweb.co.za

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Greetings to friends and colleagues. For those who missed out, a very successful OSSA congress was held in March. It was wonderful to see familiar faces again. Listening to polished speakers and interesting topics seems to ignite the academic flames again in my jaded mind. I always come away feeling a little inferior in terms of my knowledge and this encourages me to start reading again.

In keeping with our theme of diversity, we have some excellent articles for you in this edition. The often vexing issue of pseudo-exfoliation is unpacked for us with some handy reminders of potential risks.

Modern-day LASIK surgery has evolved into a science and an art and this article deals with patient selection and new technology in a clear and concise way.

The loss of an eye is a devastating event for a patient. We approached an ophthalmologist to give some insights into the process of fitting a prosthesis and also how attention to our surgical technique can improve outcomes.

We hear from an old friend who has emigrated to New Zealand. He gives an excellent idea of the challenges and rewards associated with the move to Maori country. The future benefits for children must be weighed against leaving a successful practice behind to start again. Food for thought for those young enough to have choices!

I want to encourage you to contact me with ideas for articles, we want to cast the net wide! Have a blessed autumn.

Regards
Brian

Disclaimer

The content contained in this publication is provided in the interests of continuing medical education and is intended to stimulate and promote debate by disseminating informed opinions on the latest medical advances and treatments in ophthalmology. No suggested test or procedure should be carried out unless, in the reader's judgement, its risk is justified. Because of rapid advances in the medical sciences, we recommend that the independent verification of diagnoses and drug dosages should be made. Discussions, views, and recommendations as to medical procedures, products, choice of drugs, and drug dosages are the views of the authors. The views expressed by the editor or authors in this newsletter do not necessarily reflect those of the sponsors or publishers. The sponsors, publishers and editor will not be liable for any damages or injuries of any kind arising from the use or misuse of information provided in this publication and do not support the use of products for off label indications. The views and opinions expressed in these articles were in no way influenced by Adcock Ingram.

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Pseudo-exfoliation syndrome: An old problem with an updated context

Dr Johann Lamprecht
Ophthalmologist
Rosebank, Johannesburg

As with most fields within science and technology, ophthalmology continues to make steady progress in our awareness, understanding, detection and management of major eye diseases. This is also the case with pseudo-exfoliation syndrome (PES, often also referred to as PEX) and PES-related ocular pathology. The condition was described more than a century ago and given its current name more than 50 years ago. In addition, recent times have seen major advances in assessing the genetic and biochemical signatures of the condition. As someone with a particular interest in the overlap between complex anterior segment surgery and vitreoretinal procedures, I had to first ask myself whether anything truly useful could be said about this condition at this point? Perhaps starting with a contextual update will provide the necessary perspective.

THE CONTEXT

The past decade has once again seen additions to the ophthalmologist's diagnostic and treatment arsenal that have revolutionized the way eye patients are managed.

Firstly, the unique, no-touch, clear-view access one is granted to the interior of the eye with its multiple layers of intricately arranged optical, vascular and neurological tissue types, facilitates the continued development of non-invasive special investigations and imaging modalities such as optical coherence tomography (OCT) in order to better understand disease pathology, pathogenesis, functional impact as well as the application of possible remedies. These modalities are increasingly being investigated and incorporated with

artificial intelligence to screen for extraocular neurodegenerative disorders and vasculopathies.

Secondly, with increased years of age, the need for cataract surgery becomes almost universal. Considering the age-related nature of many of the other global contributors to visual impairment (including glaucoma and age-related macular degeneration), cataract surgery provides a unique opportunity for accessing intraocular fluid for research purposes. Biomarkers, once identified, can be compared to serum levels and analysed for genome localisation, providing the possibility of future diagnostic and treatment modalities.

In addition to the above, despite variation among cultures of the world, our eyes are considered by the majority of people to be the most valuable organ in terms of sensory perception, tasks of daily living and cognitive functions such as communication and memory formation. Of the studies performed on sensory memory until 2007, 68 % were on visual memory, more than double that done on all the other modalities combined. This has increased to more than 77 % in the past decade. Even if one wants to argue for some reason that we don't "live in a visual world" as the saying goes, we certainly relate to our world visually and we don't seem to plan on breaking up anytime soon. A much greater portion of each of our brains is engaged in processing visual information than in handling information from any of the other senses.¹

It seems therefore that ophthalmology as a specialty is both technology driven and a technology driver at a global level.

Technologies that received regulatory approval and/or became mainstream treatment modalities since the turn of the millennium include:

- Optical coherence tomography (OCT) with enhanced depth imaging, OCT, angiography, corneal epithelial mapping and intra-operative real-time imaging.
- Corneal cross-linking. (First performed in the late 1990's; FDA approved in 2016.)
- Femto-second laser assisted cataract surgery. (FDA approval 2010.)²
- Various modifications to implants and procedures for sutureless fixation of intraocular lenses to the sclera such as the Yamane Technique and Carlevalle IOL (Soleko).³
- Numerous devices in the minimally-invasive glaucoma surgery (MIGS) armamentarium.⁴
- Flexible, naturally coloured artificial iris implants such as those by Reper and HumanOptics.
- Widefield and/or 3D viewing systems with adaptive optics and digital tissue enhancement.
- Segmentation and delamination techniques for advanced diabetic eye disease via 23-, 25- and 27-gauge pars plana vitrectomy with improved fluidics, cutter and probe tip designs and cut rates.⁵
- Subretinal injections through 38-gauge and smaller cannuli and precision-controlled injectors.⁶
- Intra-arterial chemotherapy for retinoblastoma. (Although described half a century earlier, the modality has become a global standard more recently.)⁷

As surgeons attempt to incorporate and master new technologies and techniques, the boundaries between

the different subspecialties remain in flux. Better viewing systems with easier switching between anterior and posterior segment views, smaller incisions, shorter operating times per individual, funding limitations and other factors lead to the increased utilisation of combined techniques, where multiple anterior segment procedures or both anterior and posterior segment procedures are performed in a single sitting.

Having myself only qualified six years prior to writing this, there is of course my acute awareness that new ophthalmologists are added to the fold each year. A lingering passion for the Young Ophthalmologists of South Africa who face a learning curve that does not relent in steepness once our qualification is earned serves as final motivation for this update, as well as a call to readers to continue collaborating and contributing to eyecare and learning in South Africa.

THE OLD PROBLEM: PSEUDO-EXFOLIATION SYNDROME (PES)^{8,9,10}

Pseudo-exfoliation syndrome is an age-related, systemic disorder characterised by the deposition of light grey pseudoexfoliative material (PXM) in the eye, most notably the anterior segment, as well as in extraocular tissues. The abnormal deposits lead to reduced integrity of certain elastic tissues, especially within the eye and vessel walls, with secondary vascular dysregulation, ischemia, inflammation, atrophy and macroscopic structural changes.

PES was first described by John G. Lindberg in 1917 due to the characteristic findings in a large portion of his glaucoma patients, and to this day the condition is best known for its association with glaucoma, lens dislocation due to zonular dehiscence, and iris abnormalities. The term pseudo-exfoliation syndrome was coined in 1954 by the ocular pathologist Georgiana Dvorak-Theobald. It is the most important single risk factor in the development of secondary open angle glaucoma and, is regarded by some as the most important cause of secondary angle-closure glaucoma, and it is infamous for the trouble it causes during cataract surgery.



Figure 1. Eye with atrophied iris ruff, pigment and PXM on lens surface, and dense nuclear sclerosis.

DIAGNOSIS

Thorough clinical examination with the slit-lamp, including gonioscopy and pupillary dilation, remains the gold standard for diagnosing PES:

- The pathognomonic light grey fibrils and filaments can be seen adherent to virtually all ocular tissues including the corneal endothelium, iris/pupil edge, lens surface, trabecular meshwork, ciliary body, zonules and vitreous face. Their initial appearance is sparse and subtle. An obvious, dense distribution of fibrils with the typical three-zoned bull's eye pattern on the lens usually represents a late stage of the condition requiring extra attention to the search for associated complications.
- Secondary pigment dispersion occurs frequently due to iris atrophy and friction between the posterior iris and the roughed peripheral lens surface. Pseudo-uveitis or a true cellular reaction with mild flare are also common findings due to chronic disruption of the blood-aqueous barrier in PES eyes. These findings can be confused with pigment dispersion syndrome or Fuchs uveitis syndrome.
- Phagocytosed pigment granules and guttata within or underlying the corneal endothelium may be seen in cases of endothelial dysfunction, and specular reflection of the slit lamp beam may show pleomorphism and polymegathism. This should not be confused with Fuchs endothelial dystrophy.
- Iris atrophy is common, especially loss of the pupillary ruff, midperipheral transillumination, and poor pharmacological dilation. Iridodo-

nesis may be seen with saccades. Posterior synechiae and neovascularisation may also occur.

- Besides for the deposition of PXM and pigment in the anterior chamber angle, the angle depth and peripheral iris steepness may vary widely with different head positions or dynamic gonioscopy.
- Nuclear sclerotic and subcapsular cataracts tend to occur earlier in PES eyes than their normal counterparts, most likely due to relative anterior segment ischemia and lower levels of aqueous ascorbate.¹¹ Zonular weakness should be suspected where the anterior chamber depth is less than 2.5mm and phacodonesis should be elicited where present.
- The IOP can fluctuate significantly in any given patient. Measurements can be below normal due to the higher incidence of thin corneas in PES patients, inflammation and ciliary body ischemia with reduced aqueous production. Conversely the IOP can be very high to the point of being confused with Posner-Schlossman syndrome or angle closure, or due to actual acute angle closure. Marked IOP asymmetry is also more common.
- Although by no means a new test, there has been an increase recently in the utilisation of the water-drinking test (WDT), mainly to evaluate the outflow facility of patients in whom large diurnal fluctuations and IOP spikes are suspected. Home IOP monitoring with automated reporting and plotting via physician-managed software has become more accurate and accessible with devices such as the ICareONE.
- The increased speed and utilisation of anterior segment OCT as part of the commonly performed OCT suite or newer biometry equipment, makes repeat angle measurements and the identification of thin corneas (and therefore false low IOPs) easier. Improved optic nerve and retinal layer segmentation, enhanced depth imaging with accurate Bruch's membrane edge detection and growing databases with progression algorithms assist with earlier identification of glaucoma cases.
- High-resolution ultrasound biomi-

croscopy can aid in the early detection of PXM deposits on the zonules and posterior iris surface as well as abnormal antero-posterior movement of the lens-iris diaphragm.

- There are no clear guidelines on systemic screening for patients in whom PES has been diagnosed. However, being a common condition and one that presents most frequently in those aged 60 years and more, the diagnosis of PES should at least lead to patients determining baseline values for other vasculopathy risk factors if this had not yet been done. The necessary lifestyle adjustments sooner rather than later to minimise the general loss of blood vessel wall compliance, endothelial function and oxidative stress.

MANAGEMENT

Patients in whom pseudo-exfoliation syndrome has been diagnosed require life-long surveillance, particularly for the development of glaucoma. The exact screening interval required is unclear, but once glaucoma has been diagnosed, more frequent follow-ups are warranted. The subtle symptoms of raised IOP, corneal edema, pigment dispersion, uveitis and accommodative dysfunction can be explained to patients. Optometrists involved in co-management should be alerted to the presence of thin corneas and IOP fluctuations in order to not get a false sense of comfort from doing IOP measurements without funduscopy. In grossly asymmetric cases, an apparently normal opposite eye should not be neglected.

Cataract surgery^{9,12}

As long as it is performed non-traumatically, earlier cataract surgery is probably beneficial due to the role it plays in reducing iris friction, pigment dispersion, inflammation and angle closure risk, and also for the positive effect it has on angle width and outflow facility. Recent audits have shown that outcomes comparable to those in non-PES patients could be obtained when small-incision phacoemulsification cataract surgery was performed on eyes with PES.

Despite the potential for good outcomes, the diagnosis of PES in a cata-

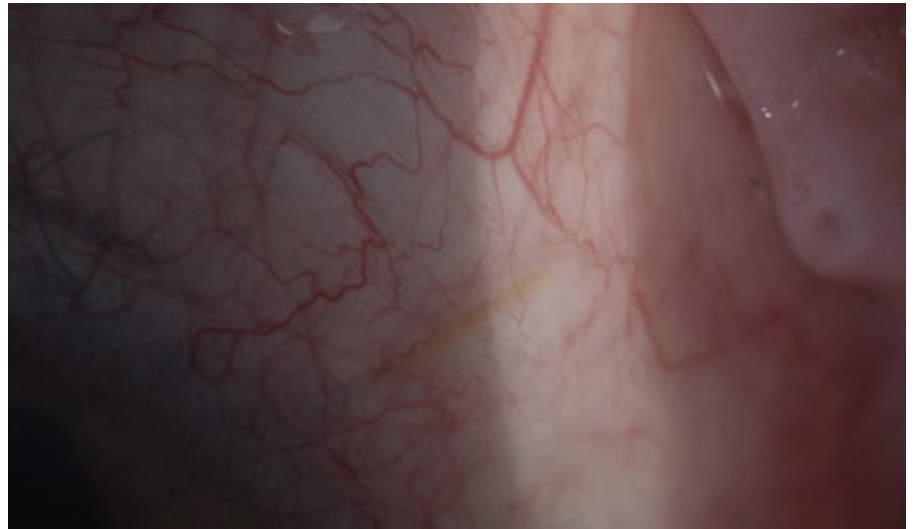


Figure 2. XEN45 stent in an eye with PEX glaucoma and Yamane-style scleral-fixed MA60AC IOL

ract patient should not be taken lightly and, in addition to the steps for safe standard cataract surgery, a few aspects warrant additional consideration:

- Pre-operative identification of complicating factors such as endothelial dysfunction, angle closure or aqueous misdirection, and zonular weakness should be achieved as far as possible in order to be best prepared.
- Although standard practice in many areas, the use of pre-operative non-steroidal anti-inflammatories should be emphasised for their positive effect on pupil dilation and for lowering the risk of post-operative inflammation and macular edema.
- Adequate pupil dilation should be achieved through a combination of intracameral agents and mechanical methods. Gentle force distribution such as that achieved with a Malyugin ring or visco-dilation tends to cause less haemorrhage and inflammation than localised stretching and tearing and may therefore be the superior approach.
- Anterior chamber stability during surgery should be aimed for by making appropriate sized wounds, optimising fluidics at more gentle parameters, and the generous use of viscoelastic devices. This reduces the risk of aqueous misdirection and damage to intraocular structures, especially the corneal endothelium, iris and posterior capsule.
- The creation of a perfect capsulorhexis is more critical than usual as it minimises localised stress to the zonules, facilitates the placement of capsule hooks or capsular tension rings, reduces the risk of vitreous prolapse, and aids in ideal placement and long-term stability of the preferred IOL.
- Gentle, bimanual manipulation of the nucleus and fragments should be performed and care should be taken to avoid placing stress on the zonules. Mechanical intracapsular horizontal chop and iris plane phacoemulsification have been suggested as good approaches.
- Cortex aspiration should once again be achieved with maximal anterior chamber stability. Hydrodissection with a syringe and cannula or a polishing bimanual irrigation tip as well as dry aspiration with a syringe and cannula are valuable tools to minimise stress to the capsule and zonules.
- Devices and instruments used for achieving additional capsular support and/or scleral fixation should be considered. These include capsule support segments, modified capsular tension rings with suture eyelets, IOLs with haptics that allow scleral fixation, and micro-forceps designed for the manipulation of these devices such as the sets manufactured by MicroSurgical Technology (MST).
- Small-gauge pars plana vitrectomy (PPV) is useful for the atraumatic removal of anterior vitreous prolapse

and the management of intra-operative aqueous misdirection. An anterior approach has a higher risk of causing damage to the cornea, iris, lens capsule and zonules.

- Post-operative monitoring for IOP spikes, inflammation and IOL centration and stability are important.

Glaucoma

PES has a multi-pronged impact on the ocular tissues in the way it predisposes to glaucoma. These include:

- Relative anterior segment ischemia
- Intermittent inflammation
- Reduced aqueous ascorbate levels with oxidative stress
- Dispersion of pigment and PXM with subsequent blockage of the juxtacanalicular trabecular meshwork
- Angle closure through pupil block with or without posterior synechiae, lens displacement, aqueous misdirection or even vitreous prolapse
- Endothelial dysfunction with involvement of trabecular meshwork cells and their basement membranes
- Reduced corneal stromal cell counts, thin pachymetry and possible reduced connective tissue support at the optic nerve head
- Reduced vascular compliance at the optic nerve head, and others.

As is characteristic of the field of glaucoma, there is room for debating the ideal process to follow to obtain adequate IOPs and prevent glaucoma progression. Salient points are:

- Selective laser trabeculoplasty (SLT) seems to be more effective in PES than in POAG, likely due to the mode of action on the increased trabecular meshwork pigmentation. However, careful monitoring is required to determine when the effect is wearing off, at which time repeat treatment or alternative therapy is required.
- In cases of PES with secondary open angle glaucoma, most medications will initially have a good IOP-lowering effect. However, in most cases the effect will wear off and eventually topical medical therapy will fail.
- Ab-interno procedures targeting the trabecular meshwork have their best effect earlier on in the disease

before collapse and atrophy of Schlemm's canal and the collector channels have occurred. Most of these procedures seem to lose their effect over time and often target IOPs are not achieved.

- Trabeculectomy with mitomycin C remains the gold standard procedure for achieving long term IOP control and minimise progression. IOPs achieved with trabeculectomy in PES eyes are statistically lower than in POAG, possibly due to ciliary body ischaemia and reduced aqueous production which are unmasked once the trabecular obstruction has been bypassed.
- Glaucoma drainage devices have good results as primary procedures or when trabeculectomies have failed. Smaller lumen or valved devices such as the Paul Glaucoma Implant and the XEN 45 Gel Stent may be better in the long term to reduce the risk of hypotony should ciliary body atrophy occur.

Other procedures

- Even when all foreseeable precautions have been taken, complications still occur. The possibility of having to retrieve nuclear fragments, an IOL or other devices from the posterior segment via PPV remains and should be planned for. Corneal clarity and pupil size once again plays a role in the ease with this can be performed.
- Due to the increased incidence of corneal endothelial dysfunction and iris atrophy, iris fixated IOLs, especially placed in the anterior chamber, may not be the best choice for correction of aphakia where no capsular support is present.
- Severe iris atrophy with transillumination or a large atonic pupil following surgical trauma may require the implantation of an iris prosthesis. Additional care needs to be taken to avoid endothelial damage and monitor for fibrinous reaction or IOP elevation.

CONCLUSION

Pseudoexfoliation syndrome is a well-known multisystem disorder of microfibril production and deposition which leads to significant ocular pathology, most notably the development of sec-

ondary glaucoma and more complex cataract surgery. Its prevalence, together with the continued development of diagnostic systems, lens implants, glaucoma procedures and microsurgical instruments, make PES as relevant as ever. With appropriate adoption of available technologies, good refractive results, stable IOPs with long-term optic nerve health and good vision can be achieved.

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The skill and art of planning LASIK: Trends in screening

Dr Lourens Coetzee, Cataract/Refractive Surgeon, Mediclinic Morningside, Sandton, Johannesburg
Dr Stacey Mallabone, Medical Officer in Ophthalmology, Sandton Eye Clinic, Mediclinic Morningside

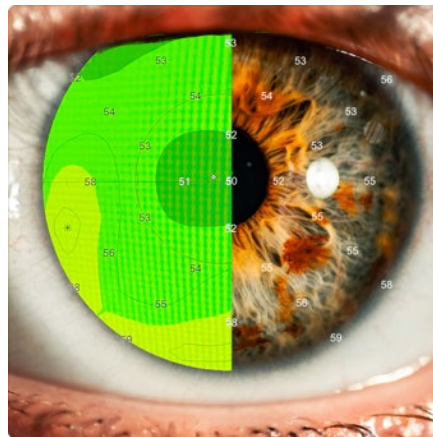
As our understanding of refractive errors evolves, so too does our ability to treat them. LASIK has become one of the safest and most effective methods for correcting refractive errors. This is in no small part due to the development of effective screening. Screening has evolved beyond being simply topography and measurement of corneal thickness. The average refractive surgeon now requires multiple tests to be done before planning for laser vision correction can even begin.

OCULUS Corvis® ST

It is generally accepted that the cornea's shape determines its refractive properties but more recently we have come to understand that the biomechanics of the cornea determine its shape and so in turn the biomechanics determine the refractive properties of the cornea. This gave way to the OCULUS Corvis® diagnostic machine which is a dynamic test that involves applying a force, in the form of a puff of air, to the cornea to measure its response to force which can be used to estimate its biomechanical properties. With this we now have an additional screening tool to safeguard against doing refractive procedures on patients who are at risk of developing ectasia after the procedure.



There is currently much room for interpretation when it comes to the results of a Corvis Biomechanical Index (CBI) and Topographic Biomechanical Index (TBI) that the OCULUS Corvis® gives us. Propitiously we are seeing rapid developments of approaches for interpretation that may soon allow us to have a more definite screening method. At this stage however the OCULUS Corvis® test results need to be looked at in the context of other test results to make decisions on the candidate's suitability for LASIK.



Epithelial mapping

The epithelium of a patient can be as unique as a fingerprint with each patient having their own specific areas of thinning and thickening. These differences necessitate an individualised plan for each patient undergoing refractive procedures. For more than 30 years epithelial mapping has been used to aid in the diagnosis of keratoconus. More recently it has been found clinically significant in vision correction screening and meticulous planning of laser vision correction. A cornea with epithelial irregularities and opacities makes it difficult to predict the visual outcomes after such a procedure. By mapping out these irregularities you can factor these into the planning of

the treatment. This allows for the excimer laser to have individualised treatment plans for each patient based not only on their topography and tomography but also more specifically their epithelium. Above and beyond planning purposes, it is possible to use the epithelial mapping to identify irregularities and perform a procedure aimed at regularising the epithelium.



InnovEyes ray tracing LASIK

Ray tracing is a method of calculating an ablation profile for laser vision correction that is computer-based. This method considers all optical surfaces of the eye and as a result produces the highest possible accuracy to improve the predictability of refractive outcomes. A device, the Sitemap®, and its artificial intelligence driven processor combine multiple tests. This is used to create custom profiles to be executed by an excimer laser. New proprietary software uses a laser-spot surface distribution and sequence that has been devised to address the shortcomings of the current wavefront guided excimer laser. This treatment is called InnovEyes and it aims to not only treat sphere and cylinder abnormalities but addresses higher order aberrations simultaneously. The software has been

programmed to consider the expected epithelial remodelling and predicted biomechanical changes that will occur because of the treatment, thereby increasing predictability and accuracy of the procedure allowing for more desirable outcomes.

Trends in presbyopia management

Presbyopia is as inevitable as death, taxes and even cataracts. As we get older, our lenses lose their ability to accommodate near and far vision and as a result we invariably find that our near vision is not what it used to be. In an ageing population it is becoming an increasingly common condition and it is estimated that nearly half of all Americans are affected by presbyopia. For a condition so common it is understandable that there would be multiple solutions. Many of them are relatively new. As our understanding of presbyopia develops so too does our ability to provide treatment for it.

Currently the mainstay of surgical management for presbyopia remains blended laser vision correction with an extended range of vision ablation profile or a lens exchange with a multifocal IOL. Both procedures have their own drawbacks and so the world looks to new and innovative solutions in order to improve the vision of those over the age of 45.

VUITY™ drops

VUITY™ drops are a pilocarpine HCl ophthalmic solution 1.25% aimed at treating presbyopia without the need for surgery. It is a drop that is used once daily and has an onset of action of around 15 minutes and lasts for around 6 hours. Its mechanism of action relies on the pupil's own ability to constrict and improve near vision without negatively impacting distance vision. VUITY™ drops provide a non-surgical approach to presbyopia and have shown promising results. Two clinical trials have been conducted, namely Gemini 1 and Gemini 2, to get FDA approval. In both trials a statistically significant portion of the trial population gained 3 lines of near vision when measured on day 30. This gain did not result in any lines being lost from distance vision. The prospect of

having a solution to presbyopia that is non-surgical is very exciting and a testament to how far we've come in the understanding and management of presbyopia.

Allotex Inlays

Corneal inlays have long been used to change the shape of the cornea to a more prolate form thereby increasing extended focus by increasing negative spherical aberration. While not a new concept, an overhaul in their design has taken place - specifically the material that they are made from. Allotex lenticules are made from donor corneal tissue instead of being made from synthetic material as was traditionally done. The lenticule is then inserted into a small pocket made with a femtosecond laser and this lenticule changes the shape of the cornea to provide improved vision. As it is not made of synthetic material it allows an unfettered flow of nutrients and oxygen to the cornea and it decreases the risk of inflammatory reactions and will integrate into the cornea more easily. It decreases risks of processes relating to disturbances within the cornea such as corneal melt. While there have not been many large studies completed one small study looked at the outcomes of 14 treated eyes. In this study 10 eyes (71.4%) had spherical equivalent within ± 1.00 D. So while the technology may be new, and the data still limited the outcomes available do show a lot of promise.



Presbyopic laser vision correction

There is a common misconception held by the public at large that laser vision

correction cannot treat presbyopia in the older population. With constant advances being made we now have various presbyopic laser vision correction options when it comes to providing independence from reading and multifocal glasses. PresbyMAX® is a treatment module that has been developed by Schwind. It involves the excimer laser creating a bi-aspheric profile on the cornea which allows for a hyperpositive zone centrally which allows for near vision and a gradual aspheric taper in the periphery which provides distance vision in the same eye. This treatment module comes in three forms namely: PresbyMAX®-symmetric module, PresbyMAX® μ -Mono-vision and PresbyMAX® hybrid. In the symmetric version, both eyes are treated with the same profile while mono vision provides the patient with a dominant eye for distance vision and a different profile for the opposite eye to provide for near vision while the hybrid version provides an intermediate between the other two methods. This method is compatible with both LASIK and PRK procedures. A binocular UDVA of 20/25 or better and a UNVA of J3 or better can be expected based on a review article that looked at the results of PresbyMAX® treatment across multiple studies.

Conclusion

In a world where we have many technologies like cell phones and computers that are constantly changing and progressing, technical advances in refractive surgery have been rapid. It is important to keep up with these ever-improving options we as doctors can offer to our patients. These are really exciting times to be in the field of refractive surgery. We are seeing constant innovation resulting in the possibility to not only offer our patients a better quality of life, but also improved safety during the procedure.

References available on request.

The role of the ocularist in patients who have lost an eye

Beryl Carvalho

OASA-registered Ocularist
Randburg, Johannesburg

The ocularist's domain is the eye socket and blinded phthysical eye. An ocularist manufactures and fits ocular prosthetics for a patient who has lost an eye or eyes through evisceration or enucleation as well as fitting a scleral shell prosthesis over the blind phthysical eye or a blinded eye with an irregular cornea where a coloured contact lens wouldn't fit effectively. Our eyes are hand-painted and sculpted to fit the socket/eye by taking an impression of the socket and working on a copy of this shape with adjustments to the front surface and into the fornices to manipulate the soft tissue in the socket and lids to enable the best final shape, size, comfort and movement possible. We also utilise prefabricated stock eyes only in dark brown iris shades as the blues and greens are much too expensive to import for the South African market.

Background to the manufacture process

We utilise PMMA to manufacture our eye prostheses, using a high-quality material made specifically for the ocularistry market, and not simply a dental-grade material, where the material is a rougher grade. These materials need longer curing times and staged curing temperatures over the soak time, and therefore, an eye prosthesis takes long to manufacture as each stage is cured for long hours in pressurised moulds in the specially designed curing unit for ocular prosthetic times and temperature ramping. I would have manufactured and fitted an eye prosthesis many years ago in a day. Polymer chemists, however, suggest lengthening the times and slowly ramping the temperatures in manufacture. This prevents the emittance of excess or free monomer bleeding out into the patient's socket

or blinded eye. Some of the dry eyes or discharge problems associated with prosthetic eyewear can be alleviated after fitting an eye prosthesis of which the material is ocular grade, where slower curing temperatures and longer soak times are strictly adhered to. In the dental industry, additives are often used in monomers, which can cause untold problems for an ocular prosthetic patient. The strictest protocols advised by manufacturers of the ocular-grade polymers and monomers must be adhered to. For more information regarding the curing of acrylics, please visit <https://www.eyesalive.co.za/more-info/free-monomer-in-ocular-prosthetics-after-curing-the-prosthesis/>

There are very few suppliers worldwide. This is such a small field that less than ten OASA registered ocularists practice in South Africa. The Ocularists Association of Southern Africa (OASA) is the SAQA recognised professional body for ocularists.

Considerations based on patient conditions

Suppose a patient is sensitive, or just had surgery a month or so prior. In that case, they can often have oedema when we start working on their socket, and this can cause the process of manufacture and fitting to be lengthened because it is no use making a product that should last five years while the patient has an oedematous socket. If this occurs, I like to wait a few days to ensure a good fit for better long-term cosmesis.

The importance of the patient's mental health and expectations

Patients come to the ocularist with a need to feel better about their psyche due to their facial disfigurement, disfigurement of the eye or an

unsightly eye. The ophthalmologist has referred them with this expectation, but in reality, we can never replace what they have lost. The eye prosthesis can only ever be a distant second prize. Realistic expectations have to be brought across, either by the ophthalmologist or the ocularist and ideally both. Some of the most realistic patients I've worked with have been referred for trauma counselling by the ophthalmologist at the date of booking surgery for evisceration or enucleation. This counselling is very beneficial to the final outcome of fitting a first eye prosthesis, and I highly recommend the ophthalmologist adds this to their patient protocol for our patients. For more information regarding what to expect when manufacturing an eye at our practice, please visit <https://www.eyesalive.co.za/more-info/your-new-ocular-prosthesis-the-fittings-involved/>

Four to six weeks post operatively we will begin the physical work of manufacturing and fitting the ocular prosthesis. This can be a very time consuming process, depending on the socket and orbital differences as well as the sensitivity of the phthysical eye or the eye socket.

The oncology ophthalmology patients who have recently been through chemo or radiation are the most time consuming as their sockets tend to swell very easily when being worked on. They also tend to have changes in the socket shape and size over the first 6-8 months, and their first eye prosthesis is often a temporary prosthetic eye. It's best if the patient is well prepared that this is a process.

Once we begin work on the shape, size, comfort, and movement of the eye prosthesis in the socket, we can begin to get a more accurate idea of

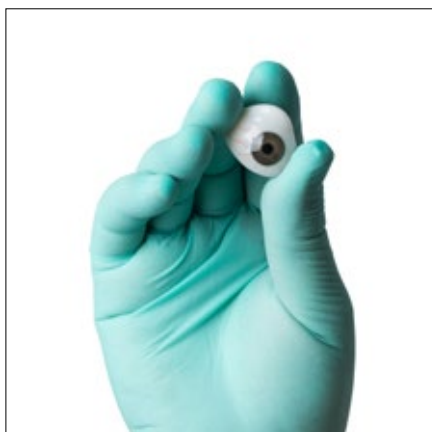
the extent of the differences between what they have lost and this new “eye”. At this stage, we will discuss reasonable expectations and results in our practice. If the patient is not able to come to terms with the differences in symmetry, then we will discuss surgical options and time-frames with the patient.

A few of the most common problems we face that patients feel they just can't live with can be sunken sulcus, a lower lid ectropion or drag on that lower lid and an empty socket, or a too-full socket. Of course, this is an oversimplification, but these are what I struggle with daily.

Preserving the damaged eye for the best outcome

The most important information I can impart is that where it is not medically necessary, always preserve the damaged eye or as much of it as possible. The hollowing in the upper sulcus, the lax lower lid, and the movement are far better when the eye is still in situ. Then the next best option for the ocularist is an evisceration rather than an enucleation. Of course, we are fully aware of the need for more invasive procedures where necessary and will always defer to the ophthalmologist. When working with patients with an eye that's been removed surgically, an implant can make all the difference. An ideal socket for us has about 4-5mm space to work with. If the socket is emptier than this, then the weight of the eye prosthesis, which often rests solely on the lower lid in these larger eyes, causes slackening of the lower lid muscles. This is worsened in the older patient, who loses all that volume with enucleation, the upper sulcus is so sunken but the prosthesis can't be enlarged enough to compensate because the lower lid is too lax.

Inversely, if the eye socket is too full, the eye prosthesis needs to be that much thinner, and the iris colour doesn't have enough depth for a life-like appearance. The less clear acrylate in front of the hand-painted iris allows for less magnification, and we start to lose the life-like quality or the sparkle in the eye.



As an eye prosthesis is held in situ mainly by the lids, and to a much lesser extent, the implant, it is important for us as ocularists to have good fornices for an eye prosthesis so that we don't cause further lid laxity or entropion.

The Fornices

As an eye prosthesis is held in situ mainly by the lids, and to a much lesser extent, the implant, it is important for us as ocularists to have good fornices for an eye prosthesis so that we don't cause further lid laxity and/or ectropion or entropion. When we have a shallow lower fornix, we often have to slot a very thin-edged prosthesis to bring the lower lid up enough, but this can cause entropion, so the ocularist cannot always do this with the eye prosthesis and maintain comfort. The discomfort from entropion is often far worse for most patients than a lid with ectropion because of the involvement of the lower lashes into the upper lid margin. Since the eye prosthesis is a foreign object, it is already prone to dryness and or mucosal discharge problems and entropion with the constant rubbing on the other lid margin exacerbates these problems. There have been various implants over the years that have encouraged the prosthesis to rest more on the implant through the use of pegs or indents in the implants, but these have their own complications that, when occurring,

as they do with fair regularity, then these implant complications are far worse than a relatively simple shallow fornix. A good old mucosal graft works well, unless your patient is a smoker, of course.

Maintenance and care of the prosthetic eye

When a patient presents to a medical practitioner with irritation that mimics a mild infection, while on a course of antibiotic drops or ointment, it naturally clears, they present to the GP, then the prescribing optometrist and the ophthalmologist repeatedly for this, it can often just be time for the prosthesis to be replaced. The material has a limited lifespan, and frequently, when they present with repeated irritation to the socket, it's the material that has deteriorated. Also, if medications are contra indicated to gas permeable contact lenses, then the prosthetic eye needs to be removed for the course duration. Nothing deteriorates the material quicker than some ophthalmic ointments.

An eye prosthesis needs polishing annually, often best done around the end of winter/beginning spring in the Gauteng area, as this is our dry season with the highest dust particles in the air, and then the high pollen count begins and exacerbates the problem. Using high-speed polishing and buffing compounds will relieve the irritation. Remember, too, that these are slippery little beasts when washing and, in some cases, are dropped more often than the patients can count. They really need their annual polish, as when those rough surfaces come into contact with external factors, it's an ideal grasping point for the pollen, protein and calcium deposits to begin grabbing hold.

I absolutely love being an ocularist and am always available for discussion with the ophthalmologist, optometrist, plastic surgeon and other eye care professional towards the best outcome for our patient.

Living and working in New Zealand: A perspective

Dr Malcolm Carey
Ophthalmologist

Leaving SA, even for a short period, is not easy as it will always be home. I am not going to delve into the reasons one moves one's entire family to the other side of the world leaving behind beloved family, friends and colleagues - suffice to say it is not easy. We left for a great opportunity in another system, but I still miss home, and, as with most major decisions, there is always doubt and opportunity for late night rumination.

New Zealand is a lovely country with a population just over 5 million and is literally on the other side of the world. Kiwis are an outdoor, active people with a strong focus on quality of life and wellness, with leisure time being highly prized. The conservation ethic is very strong and, whilst few places can match the biodiversity of Africa, New Zealand has incredible natural wilderness areas, and the rivers and waterways are pristine. We have the option of surfing, paddling, mountain bike trails, waterski, snowboarding/ skiing and superb trout and sea fishing all within 90 mins drive.

The two main islands making up the country are separated by the Cook straits with capital city Wellington and major hub Auckland both on the North Island. It is 2046 kms by road from Cape Reinga in the North to Bluff in the South. The Maori people first arrived as Polynesian settlers in 13th and 14th centuries and have formed a distinct culture with deep affinity to the land. Europeans arrived in 1642 with Abel Tasman and in 1842 the treaty of Waitangi was signed giving Maori status as British subjects and allowing NZ to become part of the British Empire. There is no specific independence date as NZ has always had the right to self-govern. Despite there being a history of conflict as to the terms of the treaty, there is currently a

strong focus on the on Maori culture, health and wellbeing with the aim of optimising health and social equity.

Working in NZ

There are multiple local District Health Boards (DHB) – 21 in fact, and they provide healthcare to clearly defined areas. This leads to an element of 'postcode lottery' with the richer DHBs funding a wider range of treatments, for example toric intraocular lenses for lower degrees of astigmatism, less stringent criteria for surgery and shorter waiting lists. Public hospitals provide the bulk of the community care, and most specialists are involved in this system even if only on a sessional basis. Private practice is usually provided in separate units although there are examples where the public work is contracted to a private practice. There are approximately 157 ophthalmologists registered in NZ and about 1.4 million New Zealanders have health insurance. A lot of private practice work is also self-funded by patients. Whilst

frustrations are present in all systems, they are certainly less than I found in SA. For example, renewing authorisation for Aflibercept involves ticking 3 boxes and a dated signature.

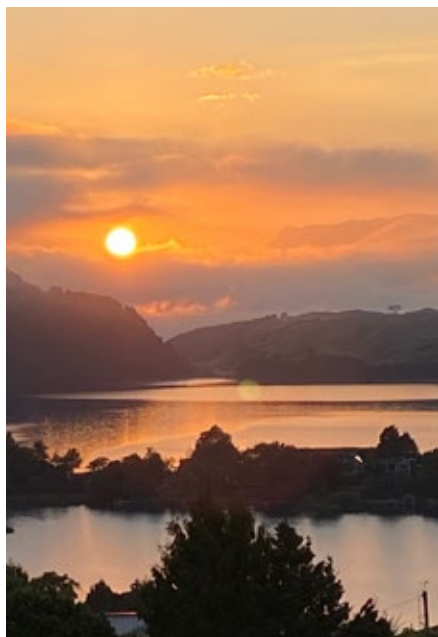
Medical registration

To practice in New Zealand, you must be registered with the New Zealand Medical Council (NZMC) in the vocational scope of ophthalmology. There are various registration pathways depending on your qualifications, training, experience and whether you intend to work in New Zealand permanently or just for a short time for a specific purpose. Published on the NZMC website: KA Morris Coles medical practice in New Zealand 2021 provides excellent insights.

It is important to note here that the registration is different to Australia which is under the auspices of the Australian Medical Council. The link between the two countries is the Royal Australian and New Zealand College of Ophthal-



Arrival in New Zealand in 2021 – escape after 2 weeks in MIQ. No masks for a year but now in the thick of the COVID wave. Vaccination percentage is over 97% for residents over 12.



Sunrise over Lake Okareka from the verandah of our home with the brooding presence of Mount Tarawera in the background. In 1886 a violent eruption occurred which was the largest in 500 years changing the regional landscape forever.



My colleague from the Eye Clinic, Derrell Meyer and myself on White Island in 2019. This was a helicopter trip whilst on a fact finding mission to NZ and was 2 days before it erupted killing 22 tourists. It was incredible to see the steaming hissing sulphur vents and bubbling caldera. New Zealand has significant geothermal activity due to high heat flow in the crust along the Pacific-Australian tectonic plate boundary. An eye-opener coming from SA but amazing hot springs and pools!

mologists (RANZCO) which is the medical college responsible for the training and professional development of ophthalmologists in Australia and New Zealand. This includes maintaining a Continuing Professional Development (CPD) system, a Vocational Training Program (VTP) and organising scientific congresses and meetings. The NZMC in its process of assessing an international medical graduate (IMG) enlists the opinion of RANZCO but retains the final say in the registration process. The assessment pathway is clearly outlined on their website. A provisional assessment will be made by council on advice of RANZCO as to whether a graduate is 'equivalent to' or 'as satisfactory as' or 'neither'. The candidate may then be invited to an interview.

The candidate will then be assessed during an in-depth interview with a RANZCO panel and the outcome of this detailed review will be shared with NZMC who will then make a final decision. The following is an excerpt from the RANZCO information pack.

"This interview is an opportunity for the RANZCO to obtain detailed information about your training, qualifications and experience so that the Council can be advised about your suitability for reg-

istration within a vocational scope of practice that, if granted, would allow you to practise independently in New Zealand. The interview is not an examination. The interview will be conducted by an interviewing panel, usually three people, and will last for about one hour. You will be invited to ask questions of the interviewers also. During the interview you will be asked about:

- components of your training, and the assessments and examinations you have undertaken
- your experience as a consultant since completing your specialist training
- some general questions relevant to the branch of medicine in which you have trained and want to practise, including questions about clinical practices
- your continuing professional development, including peer review and audit activities
- cultural and ethical issues relevant to the practice of medicine in New Zealand, including the Treaty of Waitangi." It is important to prepare well for this interview.

There are countries with reciprocal recognition of training and qualifications but for a number of reasons, South Africa is not one of them. A major issue is the perceived poor performance and

leadership of the HPCSA as well as the (post graduate) limited international interaction and governance of the Colleges of Medicine outside of the role of being purely an examining body (for example in the role of high level CPD and ongoing peer review). This leads to an 'unknown factor' in terms of individuals who may excel in every sphere or fall short in a number of ways. The fact that South Africa does not have a formal year of post graduate Fellowship training also counts against us.

The best-case scenario would be to be assessed as 'equivalent' with a period of provisional vocational registration for 12 months during which time the IMG would work under supervision with quarterly reports to the NZMC. These review all aspects of practice and are discussed prior to submission. The IMG would be strictly linked to a specific unit and supervisor. The main aim of this period is to allow adjustment to the unique medical structure in New Zealand and to become familiar with policy decisions such as directed by Pharmac, the organisational structure within the DHBs (District Health Boards), the existence of ACC (Accident Compensation Corporation, which provides full cover to all accidental injuries in New Zealand), the role of the Health and Disability office, the

Treaty of Waitangi, accessing RANZCO CPD programme and teaching, which all differ from SA.

Subsequent to the 12 months supervision, application can be made for Vocational Registration in Ophthalmology which allows independent practice in NZ with conditions including adherence to an appropriate and formal CPD programme.

Important considerations

- Registration in NZ does not allow you to work in Australia. It also does not automatically give you RANZCO fellowship. It is considered poor form to use the registration pathway in NZ as a 'stepping-stone' to Australia. I will not discuss registration in Australia further - suffice to say detailed information is available on the websites of RANZCO and individual State medical registration boards. Please also be aware of limitations in private practice for variable periods depending on the rural nature of your place of work. Australia is lovely but there is a reason why people gravitate to certain areas!
- As noted above, there is no guaranteed outcome to an application for registration for a South African trained ophthalmologist. This is moderately depressing but unfortunately true for us regarding most first world countries. The application will be assessed entirely on an individual basis as an IMG (International Medical Graduate) by the NZMC and RANZCO.
- It is highly recommended that new graduates consider an International Fellowship and at the same time



My first decent Kingfish off the Alderman Islands. The fish resources are well managed and bountiful.



Morning flyfish on Lake Rotorua for spawning trout seeking the cooler water of feeder streams in summer. The trout fishing is incredible in river and lakes.

sit RACE or FRCS exams whilst everything is fresh in your memory - it doesn't get easier when you are older! This does not guarantee registration or even a pathway in that country but gives exposure to another medical system and subspecialty interest gives one an edge in SA practice. Make an effort to develop skills and interests resulting in specialist referrals from colleagues. Visiting Fellows also often get insights not offered to local hotshots that may be competition in future. This holds true everywhere, if you want to learn LASIK ask the unit furthest away from your practice!

- Keep your surgical logbooks up to date. Do a surgical audit every few years for example 50 consecutive cataract cases for refractive outcome and complications. Audit templates are available online.
- Keep an updated CV live on your desktop and add to it all the time e.g., if you attend or present at a Congress or get training/ accreditation for a new skillset.
- Try to formalise your CPD. I am aware HPCSA online platform has

had issues but keep all records of CPD on multiple levels. Congress attendance, especially at international congresses, is invaluable. Try and present as often as possible at meetings or even local journal clubs.

- If you haven't already, consider getting at least two publications to your name – you can't do this at the last minute if an opportunity comes up or you need to move in a hurry
- Doing the MMed Ophth that is offered by most departments is an excellent addition to your CV.
- No one cares about your big house and wonderful life in South Africa. No one owes you anything, but you will be welcomed everywhere with hard work and humility.

In summary, there are no easy or correct paths you may choose to follow. There is a big, wonderful world out there. You have already won the lottery in selecting ophthalmology but never underestimate your connection to your home country. Although the grass may be safer on the other side, it is not necessarily greener!



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* CME=Continued Medical Education, SAMA= South African Medical Association, HPCSA= Health Professions Council of South Africa

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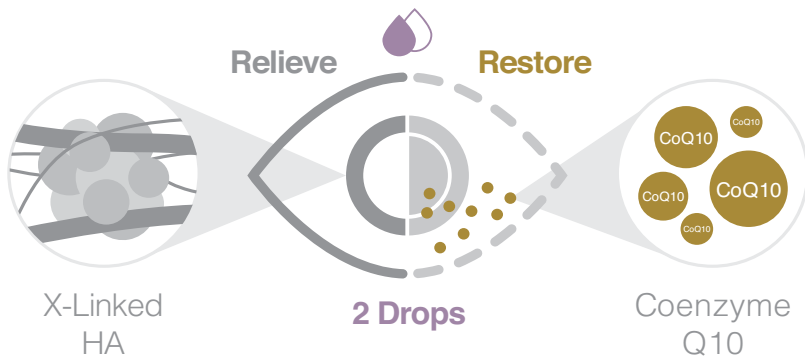
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