LASER REFRACTIVE SURGERY AT
MOORFIELDS EYE HOSPITAL OVER THE PAST 20 YEARS

by

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It is just over 21 years (November 1989) since I performed the very first UK excimer laser photorefractive keratectomy (PRK) procedure at St Thomas’ Hospital, London (when working with Malcolm Kerr Muir and John Marshall) and it is 20 years this very month since the first Moorfields PRK treatment was carried out by Arthur Steele in December 1990. Both hospitals were using prototype Summit Technology lasers at the time and results were, to say the least, ‘mixed’. The early lasers had relatively inhomogeneous ‘broad beams’ with no tracking/guidance and we were only able to treat modest amounts of simple myopia. Astigmatic, hypermetropic and wavefront-guided treatments were still several years away! Since the maximum circular ablation diameter that could be treated was only 5mm, patients regularly experienced halos and other night vision issues when their pupils exceeded this value. Regression, with corneal haze and concomitant loss of best corrected visual acuity, was common but since those early days excimer laser refractive surgery has evolved beyond all recognition into its present highly successful and safe iteration.

Around the mid 1990’s Professor Ion Pallikaris from the University of Crete introduced the concept of ‘LASIK’ which relies on the generation (using a microkeratome) of a thin superficial corneal flap which is then reflected to one side to allow the excimer laser treatment to be applied to the underlying, exposed corneal stromal bed. This virtually eliminated post-op pain, haze, regression and loss of best visual acuity but brought with it its own problems – often related to the generation of the corneal flap (incomplete or damaged flaps, flap dislocation, slippage, striae, inflammation, infection and even corneal weakening leading to ectasia). With modern techniques these complications are now extremely rare. Mechanical microkeratomes were used to create corneal flaps up until around 2005/2006 when they were rapidly superseded by femtosecond laser technology. This infra-red laser (working at a similar wavelength to the YAG laser) can produce corneal flaps to much higher tolerances than microkeratomes and we now commonly utilise flap thicknesses of around only 100 microns with an average 8.5mm diameter. Previously flaps were much thicker and tolerances much less with the risk of corneal ectasia therefore being much greater.

Around 2000/2001 wavefront technology was introduced in an attempt to measure and treat not only basic refractive error (1st order aberration) but, in addition, other more subtle optical problems (higher order aberrations). Tracking systems evolved rapidly and we now have excimer lasers capable of dynamic rotational tracking – adjusting the position of a high frequency (100Hz) small ‘flying spot’ laser beam in order to compensate almost instantaneously for patient eye movement during the actual excimer laser exposure. Iris recognition which identifies as many as 3000 features on the patient’s iris – as used in passport control at airports - ensures that it is impossible to treat the wrong patient, or even the wrong eye of the correct patient (!), and is used mainly in tandem with dynamic rotational eye tracking (DRET) to ensure that the laser energy is applied to exactly the correct area of the cornea. This has obvious benefits when treating, for example, astigmatism where accurate and dynamically maintained alignment of the axis of treatment is vitally important.
At Moorfields Eye Hospital over the past several years we have carried out, on average, 4,200 laser treatments per annum. This year we are ‘on track’ to perform around 4,500 procedures generating well over £3 million for The Trust. Approximately 90% of our treatments are wavefront guided IntraLASIK, 10% LASEK (i.e. surface laser treatments similar in many ways to PRK), 93% of treatments are private and 7% are carried out within the National Health Service. Patients who are eligible for National Health Service excimer laser refractive treatment include those with refractive surprises following cataract surgery, corneal graft astigmatism, clinically significant anisometropia with intolerance to contact lenses, and patients with neurological and other disabilities which impact on the ability to wear spectacles and/or contact lenses.

Almost 2 years ago our new Refractive Laser Unit was opened on the 4th floor at Moorfields at a cost to The Trust of around £800,000. This is a customised laser unit with excellent patient examination and nursing facilities and 2 laser treatment rooms containing, in the first, an AMO-Abbott Star S4 excimer and, in the second, the latest Technolas Perfect Vision (TPV - formerly the refractive arm of Bausch & Lomb) Z100 excimer laser with dynamic rotational eye tracking (DRET). Each room also contains the latest femtosecond laser from AMO-Abbott (the ‘iFS’). This is in addition to our research laser room on the 1st floor which presently houses a solid state refractive laser undergoing evaluation (the CustomVis) and a third femtosecond laser (the TPV 520F) installed primarily for corneal graft surgery (and therefore close to theatres!).

From the very early days when Arthur Steele performed the first Moorfields Eye Hospital PRK treatment we have come a very long way indeed and there are now a total of 9 Moorfields Eye Hospital Consultants using the above facilities (see below) two of whom have actually had LASIK themselves! Results are excellent with complications at a minimum (for example infection is quoted at around 1 in 4000 treatments which is a lower incidence than that of soft contact lenses – said to be 1 in 2000) and accuracy of refractive outcome has improved greatly. For example, to quote comparative figures (the FDA uses myopia up to -6.00 as a yardstick) patients have a 93% chance approximately of being within +/- 0.50 dioptre of emmetropia (or target refraction) and a 95% chance of being 6/6 or better unaided. Halos and ghosting are virtually a thing of the past and even troublesome (usually temporary) dry eye symptoms have been much reduced with femtosecond flap creation (because of thinner, smaller flaps with less damage to superficial corneal nerves). The only problem we have now is, of course, the ever increasing expectations of our patients!

David Gartry,
Moorfields Eye Hospital, December 2010

The Refractive Service at Moorfields (in strict alphabetical order!) comprises:

Bruce Allan
Linda Ficker
David Gartry (Refractive Service Director)
Alex Ionides
Vincenzo Maurino
Valerie Saw
Julian Stevens
Steve Tuft
Mark Wilkins