



The Royal Academy
of Engineering

The
**Royal Society
of Edinburgh**

Optos: The design challenges and business tribulations

Lecture at the Royal Society of Edinburgh (RSE)

Mr Douglas Anderson, Founder, Optos plc

Monday 10 March 2008





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The talk will encompass product specification and design, project planning and commercialisation of Optomap®.

Optomap® is a totally new (and disruptive) eye imaging technology aimed to improve preventative diagnosis of eye and general health problems. Based upon his personal experience of observing difficult manual eye exams undertaken on his five year old son, Douglas Anderson will describe the history and the secrets of the whole Optos story from sceptics originally saying "it is impossible and not needed anyway" right through the 15 year innovation and entrepreneurial processes.

Today Optos (now LSE list plc) have 3000 users and over 13 million patients have benefited from this new type of eye exam.

The views expressed in this report do not necessarily represent the views of the RSE Fellowship and The Royal Academy of Engineering.

Background to Retinal Examination in the UK context.

Examination of the retina is normally conducted manually in one of two ways. Either without dilating the pupil - this is normally the standard in primary eyecare (optometry) or after dilating the pupil - in the UK this is normally only done within the hospital setting by an ophthalmologist.

Un-dilated retinal exams are by their nature of low sensitivity causing a large number of patients to be referred unnecessarily (60%) into secondary care at considerable inconvenience and cost to all concerned (cost per initial referral to the PCT typically £100+). The high level of false positive referrals adds very significantly to waiting lists which can be in excess of 22 weeks for non urgent cases. Equally because of the low sensitivity of un-dilated manual exams many cases of clinical significance go undetected until the patient's vision is badly affected. Late detection and referral in many cases eg Diabetic Retinopathy (DR), Age Related Macular Degeneration (AMD), Inter Ocular tumours etc. will often result in poor outcomes for the patients with high quality of life impact and cost to the community. In many other developed healthcare systems eg US and Germany dilated exams are the norm for practitioners in the primary care setting. Today there are many emerging advances in treatment possibilities (some driven by Optos technology) that use new pharmacological (eg anti - VEGF) or less dramatic surgical interventions (focal laser). These treatment possibilities are most effective when the condition is identified early.

Optos technology makes it possible for a practitioner in primary eye care to consistently and comprehensively capture early indicators of retinal and systemic diseases evidenced in the retina (without the need to dilate the patient's pupil) at a level of sensitivity that would normally only be accessible to a fully skilled ophthalmologist or retinal specialist conducting an advanced (dilated) manual examination.

For Optos technology to be used to its greatest effectiveness clinically (and cost benefit to the NHS) in detecting early disease and reducing false referral rates its output (known as an Optomap - essentially a high detailed picture of 80%+ of the total retinal surface), it needs adequate interpretation skills to be available. Sometimes these are present in the primary eyecare location and sometimes not. Where the skills are not adequate an internet link to the secondary care ophthalmology setting is hugely effective in obtaining fast diagnostic support examples which might be to a) send the patient for urgent attention or b) hold the patient and examine again in six months or c) release the patient finding of no clinical significance. It is worth noting that diagnostic skills of Optomap users accelerate quickly and clear referral thresholds are greatly helped when practitioners have on-screen image content to work with. There is an unjustified fear from some UK ophthalmologists that Optomap technology will actually increase referrals. While early users find much more pathology they quickly learn those of low clinical significance (Optos provides online and other diagnostic support for this purpose). In a limited trial in the Scottish borders the rate of physical referral was down 40%.

Optomap technology is intended to be placed in primary eyecare locations (high street opticians, Diabetic screening centres) where patients have easy access either as walk-ins with symptoms or because they are referred by GPs or because most often because they are going for routine annual Optomap exams as part of Optos' partners' 'Wellness' programme. Under Optos' protocol of annual retinal exam practitioners look for early eye and general health disease indicators. When significant pathology is found the patient may be referred immediately (electronically) for a second opinion from a local or geographically remote secondary care specialist and a decision made as to the necessity and urgency of physical referral. The second opinion can generally be

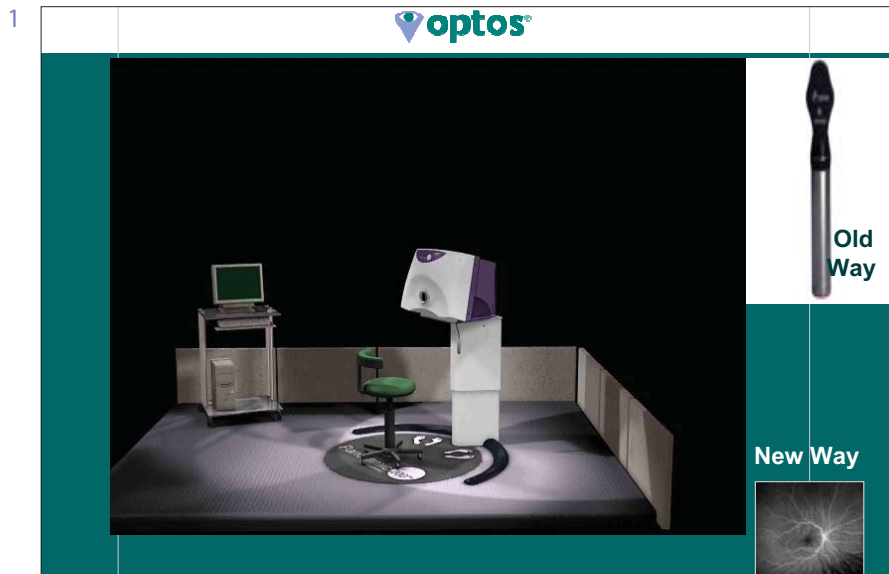
Optos: The design challenges and business tribulations

obtained the same day. This compares with the conventional route via a letter posted to their GP often containing little diagnostic information requesting referral to a consultant ophthalmologist that may result in a protracted waiting period for the patient to be seen.

Keeping Adults and Children Well:

The Optomap retinal exam is designed to be fast and very patient-friendly experience even for young children. It is capable of detecting a huge range of eye and systemic diseases that present indicators in the eye often while the disease is otherwise totally asymptomatic. These include Diabetic Retinopathy, AMD, Glaucoma, Hypertension, Cardiovascular disease, Bowel Cancer, Inter Ocular tumours, Leukaemia, Stroke Risk and many others.

Because the Optomap Retinal Exam is accessible, fast, non intrusive and does not require pupil dilation, annual compliance is high. It is part of the annual Wellness protocol that clinicians also invest time in educating patients using the on screen Optomap image the consequences of the disease they may have or the fact that they are in fact healthy. This educational experience is universally embraced by patients and greatly improves their sense of being well cared for. The fact that the practitioner also has a datum for future comparison is hugely helpful for long term patient management.



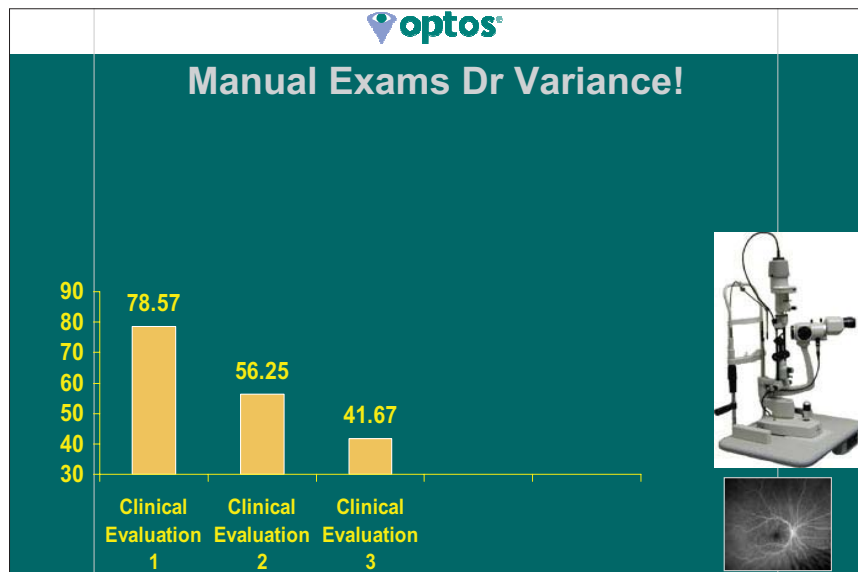
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Optos Beginnings 1992

- My son age 5yrs lost sight
- Contributory factors: inadequate screening & poor patient education
- Desire to establish a technology that would improve detection and understanding

The slide features a list of three bullet points on the left and a photograph of a young child sitting on a rocky, snowy mountain peak on the right. The Optos logo is in the top right corner.

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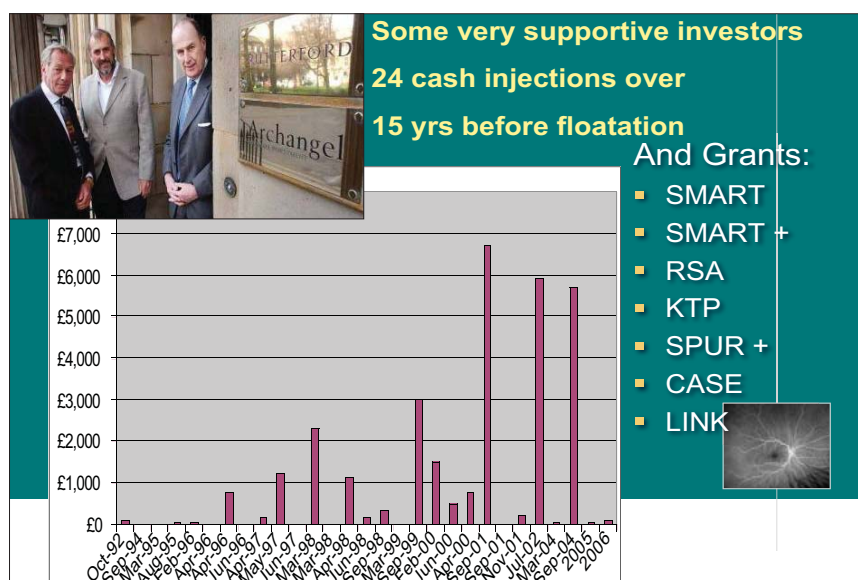
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optos®

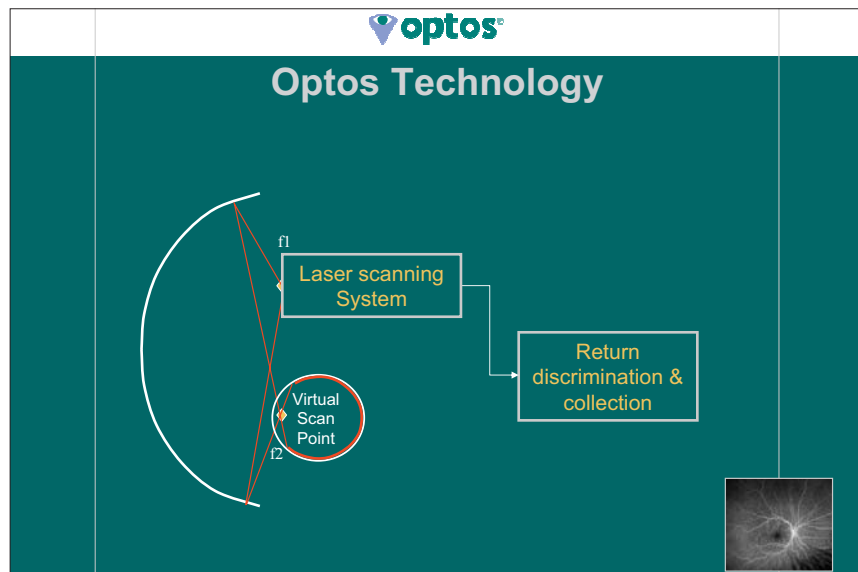
Starting from a low base.....

- No engineers
- No manufacturing
- No Marketing
- No \$\$\$
- Judged
 - Impossible
 - Unnecessary
- Strong belief in the potential Value
- Strong desire to make accessible to all

5



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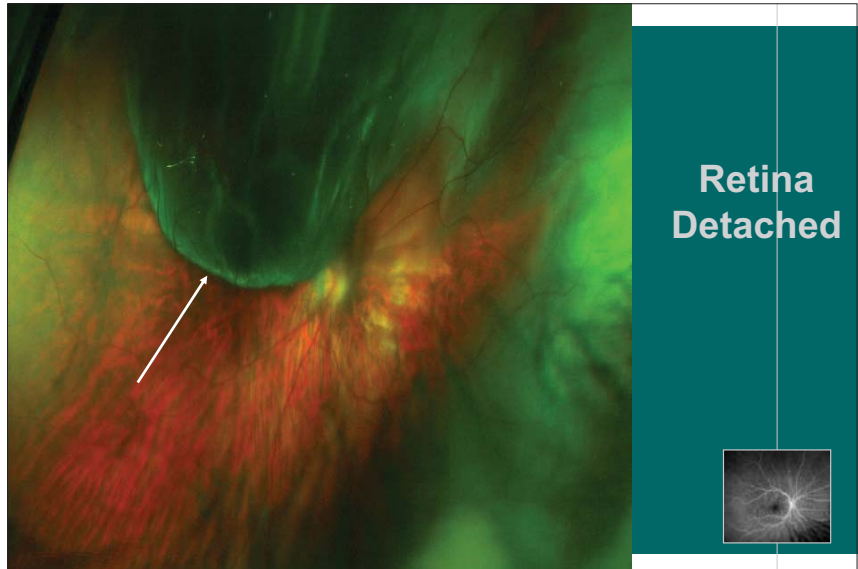
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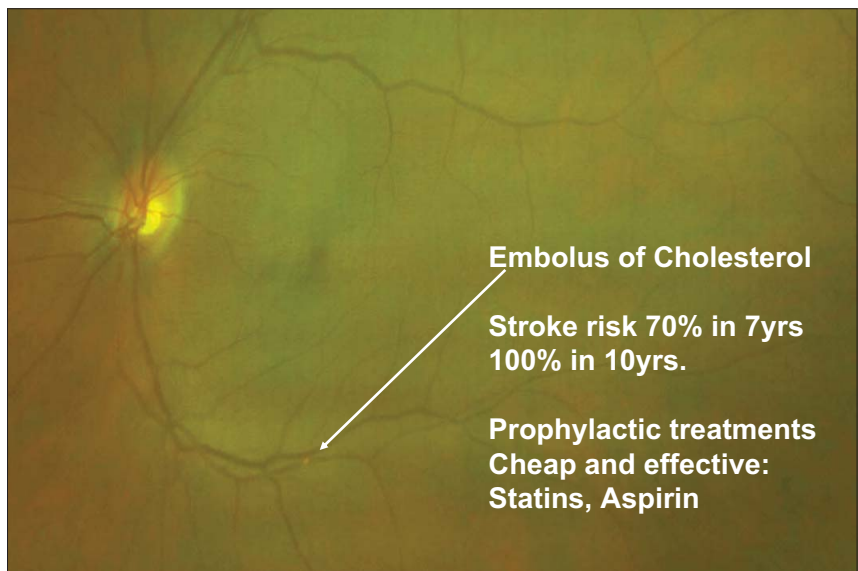
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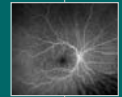
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R&D Fulfils our “Evergreen” Commitment



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European Service Centre Refurbishes and places old units back in the market



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Optos Academy Meeting in Napa Valley



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Optos Partners Visit Scotland

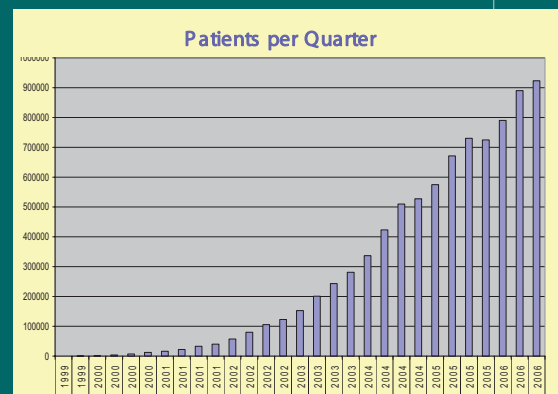


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Where are We Now?

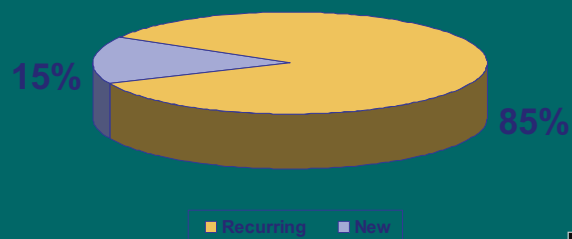
- 14M Exams
- 3000+ sites
- Active in
 - US
 - UK
 - Canada
 - Germany
- Profitable



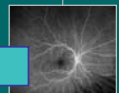
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Recurring Revenue vs New Sales



Reliable Growth – Sustainable Margin Expansion



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The Royal Society of Edinburgh

The Royal Society of Edinburgh (RSE) is an educational charity, registered in Scotland. Independent and non-party-political, our wide-ranging educational activities include:

- Organising lectures, debates and conferences
- Conducting major independent inquiries
- Providing educational activities for school students throughout Scotland
- Distributing over £1.7 million to top researchers and entrepreneurs
- Showcasing to the World the best of our research and development
- Increasing two-way international exchange
- Encouraging, promoting and rewarding excellence
- Offering state-of-the-art conference facilities
- Publishing internationally respected learned journals

The RSE was founded in 1783 by Royal Charter for the 'Advancement of Learning and Useful Knowledge'. It is regarded as Scotland's National Academy of Science and Letters. Today it has around 1400 Fellows whose expertise encompasses the full spectrum of the sciences, medicine, engineering and technology, education, law, the arts, humanities, social sciences, business, industry, the professions and public service. This multi-disciplinary perspective makes the RSE unique amongst the United Kingdom's learned societies. It is funded by a range of carefully selected charitable, public and private bodies. Its mission today is providing public benefit through the advancement of learning and useful knowledge.

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The Royal Academy of Engineering

As Britain's national academy for engineering, we bring together the country's most eminent engineers from all disciplines to promote excellence in the science, art and practice of engineering. Our strategic priorities are to enhance the UK's engineering capabilities, to celebrate excellence and inspire the next generation, and to lead debate by guiding informed thinking and influencing public policy.

The Academy's work programmes are driven by three strategic priorities, each of which provides a key contribution to a strong and vibrant engineering sector and to the health and wealth of society.

Enhancing national capabilities

As a priority, we encourage, support and facilitate links between academia and industry. Through targeted national and international programmes, we enhance – and reflect abroad – the UK's performance in the application of science, technology transfer, and the promotion and exploitation of innovation. We support high quality engineering research, encourage an interdisciplinary ethos, facilitate international exchange and provide a means of determining and disseminating best practice. In particular, our activities focus on complex and multidisciplinary areas of rapid development.

Recognising excellence and inspiring the next generation

Excellence breeds excellence. We celebrate engineering excellence and use it to inspire, support and challenge tomorrow's engineering leaders. We focus our initiatives to develop excellence and, through creative and collaborative activity, we demonstrate to the young, and those who influence them, the relevance of engineering to society.

Leading debate

Using the leadership and expertise of our Fellowship, we guide informed thinking, influence public policy making, provide a forum for the mutual exchange of ideas, and pursue effective engagement with society on matters within our competence. The Academy advocates progressive, forward-looking solutions based on impartial advice and quality foundations, and works to enhance appreciation of the positive role of engineering and its contribution to the economic strength of the nation.



The Royal Academy of Engineering promotes excellence in the science, art and practice of engineering.

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The Royal Academy of Engineering
3 Carlton House Terrace, London SW1Y 5DG

Tel: 020 7766 0600

Fax: 020 7930 1549

www.raeng.org.uk