Developments in Ophthalmology

OCULAR MICROSURGERY

Editor: A. S. M. Lim

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Ocular Microsurgery

Volume Editors
A.S.M. Lim, L.C.Y. Khoo, and L.B.C. Ang,
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Preface

Each year numerous meetings are held, and hundreds of articles appear, on microsurgery. More recently a journal on microsurgery was started. However, a perplexing dilemma persists, for despite a proliferation of articles, teaching workshops and promotion by firms for better microscopes and better microinstruments, only 30% of ophthalmic surgeons in developed countries and 10% in developing countries use the operating microscope.

Most teaching centres in developing countries do not possess a microscope, and even when one is available surgeons still do not take full advantage of its use. This situation also prevails in developed countries.

Interestingly, despite its established advantages, the operating microscope is cast aside or underused, even in large hospitals and large teaching centres where microscopes are available.

An urgent move should be undertaken to educate and persuade these surgeons to either attend courses or learn from colleagues familiar with the operating microscope, since its use will not only enable surgeon to operate with precision but also enhance the professional satisfaction of the surgeons concerned. With this in mind, the World Convention on Microsurgery was planned to help overcome some of the fundamental difficulties which surgeons experience, with the hope that increasing numbers will attain better surgical results with the precision and accuracy gained through good magnification.

This is a selection of articles and discussions on new, basic or practical concept of microsurgery presented at the convention. The Editorial Board considers that they will be of value to readers who did not have the opportunity to attend the meeting.

Arthur S. M. Lim

Contents

Dev. Ophthal., vol. 1, pp. 1–3 (Karger, Basel 1981)

Opening Address

D. Sutherland

President of the Royal Australasian College of Surgeons

The Council of the Royal Australasian College of Surgeons and I are sure the Fellows of the College as a whole are very happy to be associated in name with this important occasion. The College has come to recognise from past experience that ventures of this sort in Singapore, when led by yourself, Mr. Honorable Speaker, combined with the masterly efforts of *Arthur Lim*, have always justified their ambitious planning. I am quite sure this week will be no exception.

The last 15 years have witnessed incredible advances in the whole field of microsurgery. As recently as 10 years ago few surgeons, let alone the medical profession as a whole, could have contemplated the impact of microsurgical techniques on so many facets of surgical treatment and rehabilitation.

There is probably no surgical specialty or subspecialty which has not been improved upon by learning and applying the techniques which will be discussed and demonstrated this week. While we are thinking of our part in all this, let us not forget the vital part that pure technological advancement has played.

In my own field of cardiac surgery we would be absolutely nowhere without modern heart lung machines, medical electronics, oxygenaters, modern suture materials, grafting materials and modern instruments.

In microsurgery you would be nowhere without the help of those who have developed the microscopes, the suture materials, and the instruments to be used with them. It is also well to remember the dedicated nursing and rehabilitation teams working alongside the surgeons to complete the job

started with those long and exacting operations. Such are the requiremenst of this whole field that established professional barriers have to be broken down and rebuilt. This often means new attitudes by administrators and those controlling hospital staff to create new team structures and working conditions so that the achievements now known to be possible can be attained.

We are by nature a conservative profession and those sort of adjustments, which may seem so simple to the outsider, are not so easily achieved in fact. The necessary adjustments for the best results require the sort of direction and leadership which will come as a by-product of meetings such as this.

It would be unrealistic of me to attempt to cover even in a superficial way the range of topics to be covered this week and the skills to be learnt in the workshop. As a quasi-layman in this area, the emotional (all-be-it practical) appeal comes in the field of trauma.

Injuries of the hand are the commonest of all industrial accidents. Only the presence of an adequate number of trained microsurgeons combined with appropriate ancillary services will lower the appalling economic loss currently going on, to the communities of the world. A recent report from the USA has revealed that 16 million work days are lost in that country alone in one year from upper extremity injuries, and in the State of Victoria in Australia 25% of all workers compensated for accidents sustained in 1977 involved hand injuries.

What of the future? Unquestionably there will be a consolidation of the advances of the last two decades into the 80s and 90s. Improved training and services will evolve. Community education will be required and likewise an increased awareness by governments of the importance of microsurgery will be necessary, so that the required services can be developed in appropriate regions.

Fellows of any college fall broadly into two categories – those who see the college diploma as the hall-mark of surgery; they work to this end, and then sit back. Hopefully, some of them apply the principles and skills they have learnt in their professional careers. A small but very essential group do just that, but they also work actively for their college and what it stands for. *Arthur Lim* is right at the top of the second category, as he has shown over and over again, not only in his work for this marvellously successful week in the name of the college, but during the previous two years as well.

The Royal Australasian College of Surgeons will always remember *Arthur Lim*'s major contribution to the General Scientific Meeting held here in Singapore in 1973, for which he was the Chairman of the Organising

Committee, masterminding the biggest and most successful meeting of its type the college had ever held.

Arthur Lim's *curriculum vitae* covers 12 pages of foolscap – mine easily fills three pages. You should know that he is a Fellow of the English College and a DO London, both of which he obtained by examination. By election he is a Fellow of the Royal Australasian College of Ophthalmology and a Member of the Academy of Medicine of Singapore. Some may think that election is the easy way to such recognition, but this is far from the truth because with 'election' it is a matter of 'by their works ye shall know them'.

Amongst these 12 pages I find that *Arthur Lim* is also a member of 13 medical associations and numerous non-medical societies and clubs. He has given lectures all over the world. He has received eight academic awards, published nine books and written 72 articles and papers for medical journals and for major medical meetings – and so it goes on.

There are other snippets of information in this *curriculum vitae*, such as two national tennis championships and other tennis and table tennis achievements over the years – yet, believe it or not, this human dynamo, this paragon of medical virtue also practises very successfully as an ophthalmic surgeon, and is blessed with a marvellous wife and family who must be a great support to him. Without any of this information, all of us have known *Arthur Lim* to be a pleasant and charming man, respected widely far beyond his chosen discipline, both inside and outside medicine.

On behalf of the President and Council of the Royal Australasian College of Surgeons, it gives me very great pleasure to present to *Arthur Lim Siew Ming* the RACS Medal which is given for outstanding service to the College, and through the College to surgery in its widest sense.

Hopefully this Congress will be a real step forward in every way, and I wish you well.

Dr. H. D. Sutherland, President, Royal Australasian College of Surgeons

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Dr. H. D. Sutherland, President, Royal Australasian College of Surgeons

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Extended Use of Microsurgery in Ophthalmology

M. J. Roper-Hall

Introduction

The microscope has now such an established place in ophthalmic surgery that it is difficult to realize that the first meeting at which microsurgery was discussed internationally was as recent as 1966. At that time all the ophthalmic surgeons who were known to have an interest in microsurgery were invited. There were 35 surgeons at that meeting and it may well be true that this represented the very small proportion of surgeons who were making use of microsurgery. The majority of eye surgeons took the view that it was not necessary and that they could manage perfectly well without it. These views were generally voiced by ophthalmologists who had not attempted to use the method, or perhaps had only tried on one or two occasions.

Early Models

The refinement of the Zeiss operating microscope in 1953 had led to this microscope being used by a few ophthalmic surgeons although it had been designed for use by gynaecologists. *Harms* wrote of its possible use in 1953, *Barraquer* and *Becker* in 1956. I saw the microscope being used by *Barraquer* in Barcelona and started to use it in 1958.

Operating Spectacles

This, however, does not represent the beginning of the use of magnification for eye surgery. Operating spectacles were first used in the middle of the last century. They gave some magnification by using an increased back vertex distance and they usually incorporated base–in prisms. Compound lens systems were introduced about 1880. The binocular erect microscope became available in 1920 and within a year or so was being used in ear surgery. Within the same time it was being used in ophthalmology as a slit-lamp microscope so it seems extraordinary that it took another 30 years before it became applied to eye surgery. If we look at some of these microscopes the reason may be more apparent. The earlier models had a very small field of view, only 6–12 mm diameter until 1938; they were unsteadily supported and had poor illumination. When we look at the Zeiss OpMi 1 with some of its near contemporaries in 1953 it is easy to see what a great advance was made by this instrument.

Use of Microscope Extended

It is useful to reconsider the ways in which the use of the microscope has been extended in eye surgery. Some of the advances were predictable but others were not.

Littmann [1954] who designed the Zeiss microscope foresaw the need for more delicate surgical instruments. Finer needles and suture materials naturally followed.

A review of the use of the operating microscope in ophthalmology in 1964 [*Roper-Hall*, 1967] showed that apart from its direct surgical use it was being advocated as a means of controlling foreign material in the operative field. Those who did not use it for surgery accepted that it was helpful in the operating theatre for immediate pre- and postoperative examination and especially for gonioscopy.

Advantages

The advantages in relation to the surgery of individual tissues were as follows:

Lids and Lacrimal Apparatus: In epilation of fine lashes, the identification of torn ends of canaliculi and for suturing of flaps in the DCR operation.

Conjunctiva. Dissection could be in separate layers and avoid potential bleeding points.

Cornea. In determining the exact depth of incisions; the repair of lacerations; in keratoplasty especially in deep lamellar grafts; for the removal of foreign bodies; for the placement and removal of sutures; for the assessment of the accuracy of wound apposition; for the examination of the corneal endothelium. In glaucoma surgery the canal of Schlemm could be identified, goniotomy could be safer and more accurate.

Anterior chamber. The depth and regularity could be established.

Iris. The stroma could be picked up accurately when partly covered by a thin corneal shelf. Synechiae could be separated and sphincterotomy performed without damage to the lens capsule.

Lens. For discission, the removal of fragments of lens matter and capsule.

Vitreous. The position of the vitreous face could be seen after extraction and at subsequent operations. The position of a ruptured vitreous face could be seen, making it possible to replace it and avoid incarceration in the wound.

Sclera and Uvea. Trap-door approaches could be made for operations on uveal tumours and for the removal of foreign bodies.

All these claimed advantages referred to the greater accuracy which was made possible by the use of the microscope. As an example of this it was suggested that an accurancy of 1/6th mm is possible with simple magnification, but an accuracy of 1/50th mm can be obtained under 16 times magnification. That was the position as it was 10 years after the introduction of microsurgery in ophthalmology.

The application started with corneal surgery in the repair of lacerations and in keratoplasty. It then spread into more general anterior segment use in cataract and glaucoma surgery. It should be possible to ensure that there is

no part of the iris stroma at risk of incarceration in the corneal wound, the iris diaphragm can be repaired as well as irido-dialysis. In glaucoma surgery it is possible to be more specific, to identify and expose the canal of Schlemm, and to open it into the anterior chamber or externally. Thus, new operations for glaucoma have been introduced as microsurgical procedures and the orthodox operations can be performed with greater precision.

Double flap scleral trapdoors can be dissected giving greater security when operating for tumours or to remove posteriorly placed foreign bodies. In vitreous surgery, either through the anterior segment or through the pars plana, the microscope is essential.In the anterior chamber the use of sponge vitrectomy or infusion-suction cutters has recently led to a far better control of the problem of vitreous prolapse so that not only is the vitreous prevented from becoming incarcerated in the wound, but it is effectively removed from the whole anterior chamber including the surface of the iris. It is not possible to see the thin layer of vitreous on the iris surface without the microscope.

Through the pars plana, vitreous surgical instruments are seen through the pupil. They can be placed with great accuracy so that the suction cutter is safely visible when in use. The care in setting up the apparatus and dismantling afterwards takes time but it is fascinating to see the way in which these fine instruments work so swiftly and effectively in the posterior parts of the eye. In the procedures which I have observed and performed myself the time spent operating within the eye is quite short. A vitreous haemorrhage can be removed so that the retina and posterior pole of the eye are clearly seen within 10–15 min. The instrument is performing three separate tasks at the same time, each of these tasks would require a surgeon's two hands but most often he is only using one for a six-handed function. Two-instrument techniques are introducing further intra-vitreal refinements.

These small highly developed instruments are taking microsurgery into parts of the eye where surgeons feared to venture until very recently and we are now able to remove vitreous opacity, clear membranes, nibble away new blood vessels and control bleeding. Infective membranes and exudates can be removed as well as foreign bodies. Some cases of traction detachment are effectively cured.

This was an unexpected development of microsurgery and it shows how difficult it must be to make any predictions of future developments. Nevertheless, this may well be an indication that we shall find ourselves using microsurgical control for more instruments which are so miniturized that they are performing much finer work than we could possibly manage with two thumbs and eight fingers.

Extra-Ocular Procedures

Surveying the expansion of the use of microsurgery it is generally true that this has been an anatomical progression from the front to the back of the eye. There has been little said of the use of the microscope for extra-ocular procedures. Even microsurgeons have said that they see no particular advantage, but this may be only because they have not tried it out.

In descriptions of the DCR operation non-microsurgeons have pointed out the value of coaxial light. There seems to be no good reason for using such lighting which is so readily available on the operating microscope without using the microscope itself. Similar advantage is gained in orbital surgery, for example, in blow-out fractures, in operations on the lacrimal gland and in decompression of the optic nerve. Such use is similar to the approach to the pituitary gland, which has proved so effective in the hands of ear, nose, throat and neurosurgeons.

Why should the microscope not be used more widely for strabismus? I find it helpful in squint surgery and have used it for over 15 years. It is easier to complete the operation without bleeding and this saves time. The operation is not made longer by the use of the microscope; once the theatre staff is used to setting it into position and the surgeon is used to using the microscope, operating time is if anything reduced. It is a particularly safe way of training eye surgeons in the use of the microscope, so it should have the advantage of improving their early results with intra-ocular conditions.

Apart from the routine procedures on the lateral recti, on which surgeons may have their reservations regarding the value of the microscope, most would be prepared to agree that it would have an advantage in the approach to the oblique muscles and in re-operations, especially when a muscle has slipped from its surgical insertion and reattached itself elsewhere.

The Future

What are the possibilities for the future? The division of vitreous adhesions and traction bands, with vitreous replacement and internal tamponage is already being developed. It is sometimes possible to seal retinal breaks including giant tears whilst holding them in position. It seems likely that more complete procedures for retinal detachment will be performed from within the eye.

Will it be possible to do retinal vascular surgery? At present the smallest vessels being operated upon are of 1 mm diameter and anastomosis is made to the small vessel by end-to-side attachment of a larger vessel. The temporal artery is quite conveniently placed to bring into the orbit. Might we learn of it being used to provide the retinal circulation at some future time?

It is difficult to predict future developments. Looking back many of those which have already taken place were not predicted. I think, however, that there is a fairly clear indication that we shall see a rapid introduction of further instruments for use in the posterior segment and that these will need to be controlled by the surgeon under microscopic control. Operations can be expected to be performed through smaller incisions with shorter hospital stay and quicker turnover of patients. Since the surgeon is using both hands and he wishes to make adjustments and applications while operating, we have seen the development of more sophisticated foot controls. These have now reached their limit. On the Moller surgeon's chair there are 16 controls on 12 pedals and on the Zeiss chair I have 13 controls on 4 pedals. These give focus, magnification, X–Y movement, slit-lamp position or height of surgeon's seat and cryo-application. I have no provision at present for the control of bipolar cautery. There is no control for the Ocutome or Phako-emulsifier, which at present have more sophisticated foot-pedals.

The limit of foot and hand control has been reached for many surgeons, but for most of us there are still other possibilities of direct control. The head has been used to operate servo-switches. There is a nose operated X-Y control available on the Zeiss microscope and a tongue controlled switch has also been used.

There is no doubt that the use of the microscope will be extended in ophthalmic surgery. Most microsurgeons extend its use with experience, follow the advances made by others and perhaps themselves lead to new advances.

It is difficult to understand why ophthalmology was so slow to use the microscope for surgery when adequate out-patient work is not possible without a slit-lamp microscope. The introduction of the slit-lamp into ophthalmology about 50 years ago was slow and met with resistance. The parallels are interesting. *Harrison-Butler's Guide to the Slit-Lamp* was published in 1927. In that book he said: 'The difficulty of slit-lamp technique has been exaggerated, especially by some authors who have suggested that the use of the slit-lamp is the province of a few super specialists. The slit-lamp is not more difficult to use than the ophthalmoscope, the intelligent use of either instrument is the result of careful instruction and considerable