

Personal experience with varioscropy in orthopaedic surgery

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I have personally tested the first head-mounted operating microscope Varioscope® AF3 by Life Optics since October 2000. First of all as a trial and then as a definite provision and assessed it according to the evaluation forms during the first six months. This assessment of the Varioscope® AF3 was the first such evaluation pertaining to the application of this new medical product class to the field of orthopaedics world-wide.

The Varioscope® AF3 is an operating microscope, which is mounted on the head. The distance to the object can be automatically focused at a working distance of 30–60 cm and it is also possible to control the parallax of the Varioscope®'s two tubes in a different working area. It is thus possible to have a 3D image at every stage and by using the pedal, which is attached to the head set by a cable, the magnifying power can be varied from 3.6× to 7.2×. The auto focus can also be switched off by a pedal in order to set a fixed working distance. Individual defective vision is taken into consideration and one can correct astigmatism, myopia or long-sightedness by attaching a pair of glasses to the Varioscope® to align vision. When the Varioscope® is automatically focused, one can also see objects above and below the Varioscope®'s line of vision, as well as other objects in the distance, such as x-ray photographs or a general view of the operation area. Apart from the freedom of movement provided by the headset, one is also independent of large, immobile microscopes as the Varioscope® can be taken into any operating theatre.

As a result of my personal experience with the headset, the weight of the control system at the back of the headset has been reduced and padding has been added to the headset, in order to improve comfort during long operations.

Since October 2000, various selective operations have been carried out at the Department of Orthopaedics in Vienna (Fig. 1).

We were able to operate with the Varioscope®'s auto focus using a magnification of 3.6× to 7.2× without any further source of light. For orthopaedic operations we

usually used the smallest magnification, namely 3.6× and we nearly always used the auto focus function. Only operations involving deeper levels would the focusing be turned to manual, so as to avoid any disturbing effects in the change of focal length due to the edges of the wound or the long instruments. This is where the Varioscope®'s luminous intensity stood the test, as there was never a problem with the lighting.

Spine operations, which were to be carried out in a dorsal prone position, were not undertaken using the Varioscope® AF3, as the vertical view angle was not possible with the first model, meaning that these operations would have had to be carried out in a lateral position. As a spine operation in the lateral position is difficult, it was decided not to use a Varioscope® AF3 for this type of operation anymore. Auto focus was nearly always used in superficial cases, such as children's feet and hands and in these cases, a greater magnification could be employed when dissecting nerves and vessels.

At the University Clinic of Orthopaedics, the Varioscope®'s main operational area was magnification during tumour operations. It concerned primary tumours of the extremities, which had to be resected and had to be treated with preservation of the extremities by using prosthesis or bones. The principle of the treatment of bone and soft tissue tumours consists of wide resection, this means to restore health wide resection is carried out, so that the



Fig. 1. Since October 2000, various selective operations have been carried out at the Department of Orthopaedics in Vienna

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area of the wound cannot be contaminated by an insemination of tumour cells. Here problems arose with the Varioscope®. Namely, the distance to the tumour, which cannot easily be detected, but which is observed through a layer of healthy tissue, was proportionately close when using 3.6× magnification in dissection. This observation is an apparent consequence of the fact that considerable experience is needed to exactly gauge real distances at each and every magnification factor of the Varioscope®. As the instrument provides excellent vision of the field of operation, the surgeon tends to dissect at closer margins. An analysis of the specimens then showed that apparently the magnification showed a larger visibility, but that in total the margin of the tumour to the healthy covering amounted to less than 1 cm. As the definition “wide resection” means in the case of intra-compartmental dissection of muscles and bones of at least 1 cm, the apparent safety area shown by the Varioscope® AF3 was no longer warranted and in the histology assessments the resections were indicated as being marginal, because the covering of the tumour was thinner. No detriments were found in the follow-up examinations and none of the patients had a local recurrence, but the operation techniques had to be changed. The soft tissue and bone tumour operations were started and concluded without the use of the Varioscope® AF3 and the instrument was only used during the critical part of the operation, namely when the vessels and nerves were being dissected or during the resection of the vessels and their suturing, taking special

consideration not to exceed the limits of “wide resection” while using the Varioscope®. Therefore, the Varioscope® proved to be a useful accessory during major and difficult tumour operations, especially when critical structures such as vessels and nerves had to be dissected, separated or restored in order to ensure that the radical operation turned out to be positive. Future experience gathered and subsequent discussion will show whether the current safety limits of “wide resection” can be adjusted to the new possibilities that are made available by varioscopy.

Because of the recent change in the construction of the Varioscope® M5, which I, personally, have also tested, there is now the possibility to set the angle, so that a patient can now be operated on the spine in a prone position, as well as being able to incorporate the use of a further, integrated and fully co-axial, source of light, so as to have an even better visibility of the structures, especially at deeper levels and under narrow conditions. Another function integrated into the Varioscope® M5 offers new perspectives in terms of teaching, demonstration, and documentation: the newly added product line Varioscope® M5 incorporates a miniature video system that for the first time offers truly identical ancillary vision for head-mounted vision aids. The laboratories of Life Optics® are now working on the next generation of head-mounted miniaturised vision systems to use photo dynamic vision and augmented reality to offer additional system features, this as a result of customer advice and experience.