Abstract

When using video endoscopes in the context of minimally invasive surgery significant difficulties arise when assessing spatial proportions, estimating distances of lengths or when comparing those distances with real objects. It is, therefore, not possible to accurately evaluate the proportions of intraoperative findings. The included wide angle lens causes a considerable change in size of the object's image in relation to the distance from the object to the lens.

In the present work, a measurement system is proposed which compensates this disadvantage by mapping the area of operation in real scale to an external monitor. This allows an objective diagnostic evaluation and the use of tailor-made implants (e.g. meshes in hernia surgery). For security reasons, the live video stream must remain unaffected and needs to be continuously available in real time.

After a number of pilot tests the idea emerged to determine the local scale by using a geometrical reference: it was decided to use as reference the intersection of the optical axis of the endoscope optics with the object and the point of incidence of a defined laser beam to the optical axis. This defines – independently from the distance to the object – an orthogonal distance from which the scale of the object can be determined.

To realize such a measuring system a laboratory setup has been created. This included a computer program which allows to detect the laser mark in the video image signal and to extract the local scale information. This information is then used to display the video at the present scale or to include the visualization of distance markings in the video feed. The *chip-on-the-tip* endoscope technology helped to prove the technical feasibility of the presented measurement method.