INFLUENCE OF THE ENDOSCOPE'S STEREOSCOPIC BASIS ON PERFORMANCE OF STANDARDIZED LAPAROSCOPIC TASKS
A PROSPECTIVE RANDOMIZED CONTROLLED TRIAL

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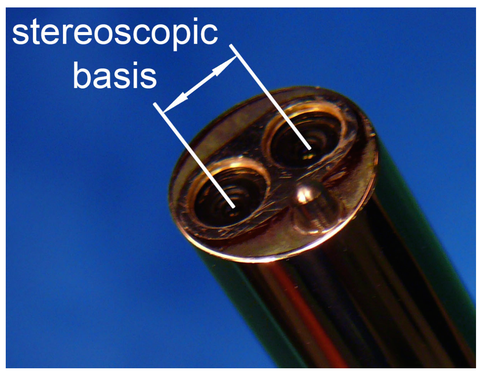
Background

Various optics and monitor systems from HD-technology through to 3D-technology are available in minimal invasive surgery.

There are studies already that have compared the 2D- with 3D-technology and demonstrated that 3D-technology improves time and learning curve of a surgical performance, but not its precision (Storz et al., 2012; Tanagho et al 2012; Bilgen et al. 2013).

Nevertheless, no study exists yet that deals with the influence of different plastic effects generated by the stereoscopic basis of a 3D-image during surgical performance.

The stereoscopic basis is defined as the distance of the two main points of a stereo optical system (see ILL 1). Its change results in a proportional change in three-dimensional effect (so called plastic effect).

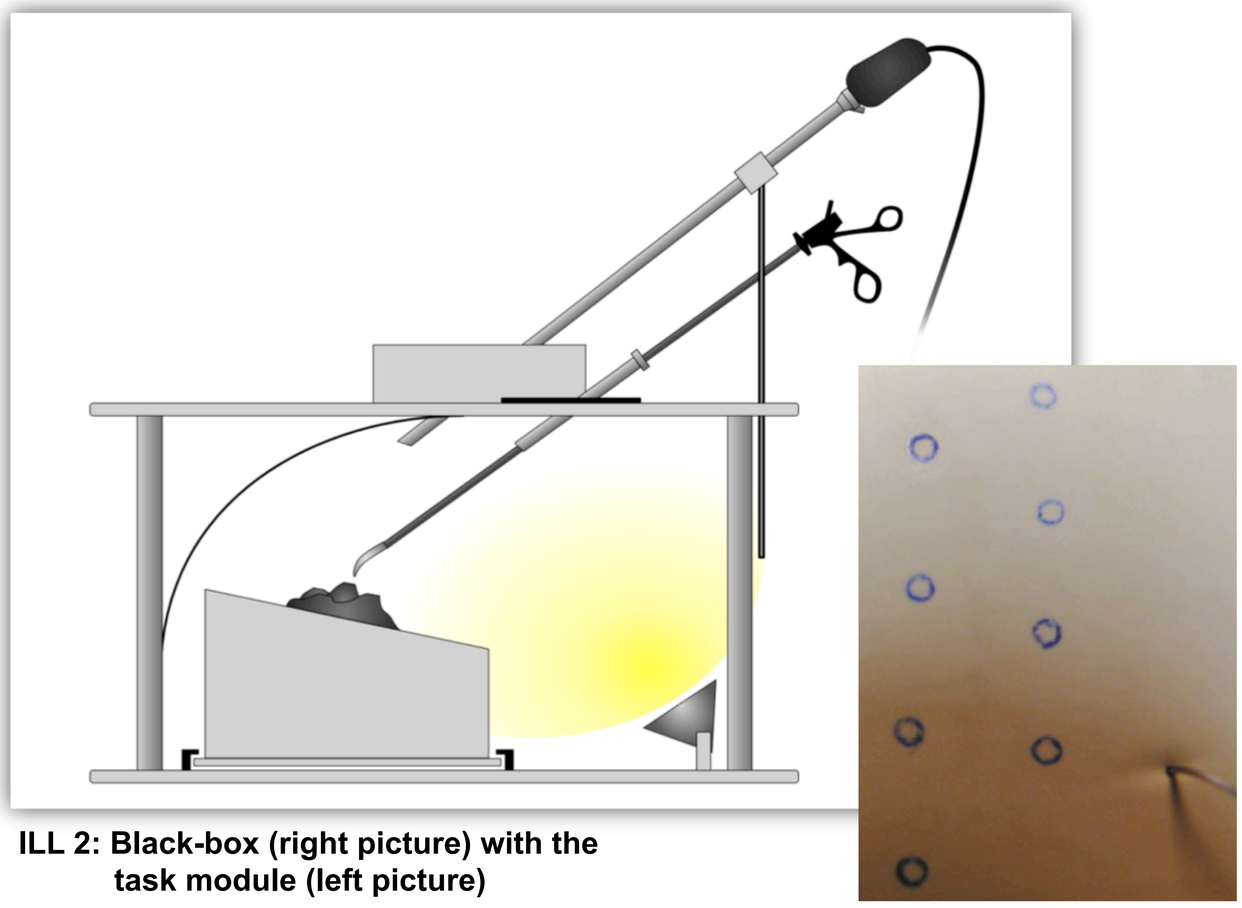


ILL 1: stereoscopic basis

Materials and methods

In our prospective randomized controlled trial we investigated the influence of the plastic effect caused by an altered stereoscopic basis on the performance of a standardized surgical task using the 3D-wavelength-division-multiplex-system (INFITEC GmbH, Ulm,Germany).

For this purpose n=20 medical students without laparoscopic prior knowledge were recruited and randomized in group 1 (n=10) with the setting-sequence b-a-c and group 2 (n=10) with the setting-sequence b-c-a.



ILL 2: Black-box (right picture) with the task module (left picture)

The settings were defined as follows:

Setting a: enlarged plastic effect
Setting b: typical plastic effect in laparoscopy
(5 mm stereoscopic basis 3D-system)
Setting c: reduced plastic effect

The study participants had to perform intracorporeal laparoscopic simple interrupted sutures (see ILL. 2). The guidance was based on an instruction video and a poster. After passing the stereo vision test by Julesz for testing their ability of perception of depth on study-day 1 they performed the suture till reaching the learning curve. On study-day 2 the participants had to absolve 3 study-sutures per setting (b-a-c vs. b-c-a) after a repetition of the suture exercise.

Results

The total time needed for the performance of an intracorporeal laparoscopic simple interrupted suture in setting a was median 73,6 s, in setting b 75,7 s and in setting c 93,3 s. The time needed for step 1, which describes the time for doing the incision from the right to the left circuit-mark, was 18,5 s in setting a, 19,0 s in setting b and 25,2 s in setting c. The precision assessed using a scoring system was 47 points in setting a and 51 points in setting b as well as in setting c.

Therefore, there is a significant difference in the total time needed as well as in the time needed for step 1 between setting b and c.

	Total Time [s]	Time Step I [s]	Precision [points]
Setting a (enlarged plastic effect)	73,6	18,5	47
Setting b (typical plastic effect in laparoscopy)	75,7	19,0	51
Setting c (reduced plastic effect)	93,3	25,2	51
p 1	0,66	0,57	0,48
p 2	0,0001	0,0265	0,85

TAB 1: Results (with p-values: p 1: setting b compared with setting a and p 2: setting b compared with setting c)

Conclusion

The present study demonstrates that the size of the stereoscopic basis of a laparoscopic 3D-system has an influence on the performance of standardized laparoscopic tasks. Even small changes in the size of the stereoscopic basis especially its reduction result in a significant difference in efficiency, less in precision. The 3D-image produced by a reduced stereoscopic basis causes a decreased visualization and as a consequence a significant worse efficiency.

Bilgen K. et al., (2013). „Comparison of 3D imaging and 2D imaging for performance time of laparoscopic cholecystectomy.“ Surg Laparosc Endosc Percutan Tech 23(2): 180-183
Storz P. et al., (2012). „3D HD versus 2D HD: surgical task efficiency in standardised phantom tasks.“ Surg Endosc 26(5): 1454-1460
Tanagho Y.S. et al., (2012). „2D versus 3D visualization: impact on laparoscopic proficiency using the fundamentals of laparoskopic surgery skill set.“ J Laparoendosc Adv Surg Tech A 22(9): 865-870

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