

## Validated Manual 3-d med laparoscopic skills

### Introduction

The training course consists of six different exercises:

1. Post and Sleeve
2. Loops and Wire
3. Pea on a Peg
4. Wire Chaser (one hand)
5. Wire Chaser (two hands)
6. Zig-Zag Loop

The goal of the different tasks is to train hand-eye coordination, manual dexterity, depth perception and interaction of the dominant and non-dominant hand.

The overall score is based on time and precision which is calculated by adding the completion time to a penalty score. A lower score correlates with better performance.

The trainee should train to the expert level (page 5).

The exercises can be done in any laparoscopic box- or videotrainer. The exercises were validated in a 42 x 32 x 24 cm box trainer with a fixed camera (Covidien® Surgical Box). Two reusable laparoscopic graspers (Karl Storz®) were used to perform the exercises. A digital cooking timer was used to measure the time.

Below you find a description of the six different tasks separately

### Task 1: 'Post and Sleeve'

#### Goal: Moving the colored sleeves from side to side

#### Material:

- Six colored sleeves
- Pegboard with 12 pegs

#### Starting position:

- The board is placed in the box trainer with the peg rows in a vertical position (from left to right: 4 - 2 - 2 - 4)
- The six sleeves are positioned over the 6 pegs on the right side of the board.

#### Procedure:

- Start the time when the participant takes the first sleeve with the left hand
- Pass the sleeve to the right hand when it is taken from the peg
- Place the sleeve on the other side of the pegboard over the mirrored peg
- After the six sleeves have been moved successfully to the other side, the exercise is repeated in opposite direction, starting with the right hand.

#### Finishing position:

- The task is finished when all sleeves are again in the starting position

#### Penalty:

- Per dropped sleeve 10 penalty points are counted. When a sleeve falls from the pegboard it will not be used anymore and 20 penalty points are counted

#### Score:

- Time in seconds + penalty points



## Task 2: 'Loops and wire'

**Goal: Placing the pipe cleaners in a straight line through the loops.**

Material:

- Two pipe cleaners
- Pegboard with four rows of loops.

Starting position:

- The board is positioned with four loops in front, the pipes are lying in front.

Procedure:

- Start time when the first pipe cleaner is taken. Introduce the first pipe cleaner from the right; the next pipe cleaner from the left.
- Pass two pipe cleaners through the first two rows of four loops, changing hands as it progresses.

Finishing position:

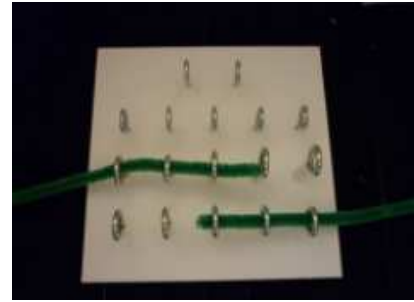
- The task is finished when both pipe cleaners are successfully placed through the two rows of loops.

Penalty:

- If the pipe cleaner is passed besides a loop during the procedure, 10 penalty points are counted.

Score:

- Time in seconds + penalty points



## Task 3: 'Pea on a peg'

**Goal: Put the beads on the 14 pegs**

Material:

- Pegboard with 14 pegs (different heights) and a cup with 25 wooden beads.

Starting position:

- The board is positioned with the cup containing the beads in front.

Procedure:

- Start time when the first bead is taken
- Take 14 wooden beads one by one out of the cup and place them on pegs of different height.
- The left side of the pegboard has to be done with the left hand, the right side with the right hand.

Finishing position:

- The task is finished when 14 beads are successfully placed on all pegs.

Penalty:

- Ten penalty points are counted when a bead is dropped; twenty penalty points are counted when a bead falls from the pegboard.
- When a bead is dropped besides the pegboard, it can not be used anymore
- When a bead falls on the pegboard it has to be picked up again to be successfully placed on a peg

Score:

- Time in seconds + penalty points

This exercise has a maximum time of 10 minutes



#### Task 4: 'Wire Chaser' one hand

**Goal: Moving the three rings from one side to the other side.**

Material:

- Wireboard (one hand)
- Three rings with decreasing diameter (increasing difficulty)

Starting position:

- The board is positioned with the text "one hand" in front.
- The rings are at the side of the dominant hand

Procedure:

- Start time when the first ring is taken
- Bring the three rings, with decreasing diameter, one by one to the other side of the wire using the dominant hand

Finishing position:

- The task is finished when the three rings are moved to the other side of the board

Penalty:

- If a ring is lost by the instrument, 10 penalty points are counted

Score:

- Time in seconds + penalty points



#### Task 5: 'Wire Chaser' two hands

**Goal: Moving the three rings from one side to the other side.**

Material:

- Wireboard (two hands)
- Three rings with decreasing diameter (increasing difficulty)

Starting position:

- The board is positioned with the text "two hands" in front.
- The rings are placed at the right side of the board

Procedure:

- Start time when the first ring is taken
- Bring the three rings, with decreasing diameter, one by one to the other side of the wire using the left and right hand alternately.
- Both hands are used and hands need to change after each curve in the ring.

Finishing position:

- The task is finished when the three rings are moved to the other side of the board

Penalty:

- If a ring is lost by the instrument, 10 penalty points are counted

Score:

- Time in seconds + penalty points



## Task 6: 'Zig-zag loop'

**Goal:** Passing the rope in a Zig-zag pattern through the loops.

**Material:**

- White rope with red end on one side
- Pegboard with four rows with loops.

**Starting position:**

- The board is positioned with four loops in front, the rope is lying in front.

**Procedure:**

- Start time when the rope is taken at the red side of the rope.
- Pass the rope alternately through the four loops of the first and second row of the loop-board, resulting in a zigzag pattern.
- Use both hands

**Finishing position:**

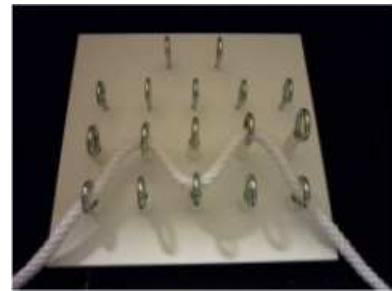
- The task is finished when the rope is passed through the last loop

**Penalty:**

- If the pipe cleaner is passed besides a loop during the procedure, 10 penalty points are counted.

**Score:**

- Time in seconds + penalty points



<b>Construct Validity (Total Time + Penalty points)</b>			
<b>Exercises</b>	<b>Group 1 Novices (n=18 )</b>	<b>Group 2 Intermediates (n=14)</b>	<b>Group 3 Experts (n=10)</b>
	<b>Mean score (range)</b>	<b>Mean score (range)</b>	<b>Mean score (range)</b>
<b>Post and sleeve</b>	299 (159-602)	161 (91-307)	120 (78-232)
<b>Loops and wire</b>	176 (111-298)	108 (59-176)	86 (61-121)
<b>Pea on a peg</b>	771 (345-1450)	404 (186-768)	313 (203-552)
<b>Wire chaser (one hand)</b>	195 (60-417)	113 (31-306)	69 (23-182)
<b>Wire chaser (two hands)</b>	317 (191-503)	166 (78-371)	127 (74-248)
<b>Zig-Zag loop</b>	134 (69-219)	70 (29-136)	48 (28-82)
<b>Overall Score</b>	1891 (1102-2683)	1022 (621-2030)	763 (523-1199)

## **Recommendations 3-d med laparoscopic skills**

Recommendations per task (materials):

- Task 1) 'Post and sleeve': no recommendation.
- Task 2) 'Loops and wire': no recommendation.
- Task 3) 'Pea on a peg': We recommend to use only wooden beads instead of the plastic, wooden and plush beads. The plastic beads are too smooth to catch in the instrument. The plush beads are too soft and are vulnerable. Thereby, this beads are not easily commercially available when replacement is needed.
- Task 4) 'Wire chaser-one hand': When the goal is not to touch the wire, the exercise is too difficult, even for laparoscopic experts. When it is allowed to touch the wire, sometimes much force is exerted on the wire. This seems not to be a very good simulation of reality.
- Task 5) 'Wire chaser-two hands': See task 4.
- Task 6) 'Zig-zag loop': the red band on the rope goes off the rope very soon during exercising. Thereby, the end of the rope will fray soon. We recommend to use a more fixed end of the rope.

Assessment:

- To assess the exercises we recommend to use the score (which includes both time and penalties) as described in the Manual.
- In the construct validity table the mean score of the Expert group can be used as a target score in developing a 3-d med laparoscopic skills curriculum.