MedVision

USER MANUAL

Simulator for laparoscopy

LapVision Standard

Contents

Introduction **3**

1 Safety precautions **4**

2 Startup and Shutdown **7**

2.1 Simulator startup 7

2.2 Simulator shutdown 7

3 Authentication **8**

3.1 Existing user selection 8

3.2 New user registration 9

3.3 New group creation 10

4 Exercises **11**

4.1 Exercises end and exit 14

5 Imitators of the laparoscopic instruments **15**

5.1 Instruments battery charge 17

5.2 Imitators freeze 17

5.3 Imitator of endocamera 18

5.4 Imitators of trocars 19

6 Exercise menu elements **20**

6.1 Control panel 20

6.2 Control elements 24

6.2.1 Powered instruments controls 24

6.2.2 Irrigator-Aspirator controls 25
6.2.3 Cutting controls 25
6.2.4 Uterine manipulator 27
6.2.5 Endocamera controls 28
6.2.6 Virtual port 29

7 Statistics **30**

8 Training courses **35**

9 Acknowledgement table **40**

Introduction

Surgery simulator LapVision Standard is a training complex consisted of laparoscopic ports (trocars), laparoscopic instruments, computing unit and visualization system.

Training complex is designed for studying of basics and specifics of laparoscopy. All interventions are being performed in virtual but realistic anatomic environment, with use of real laparoscopic instruments imitators as well as imitators of trocars and other surgical equipment. It eliminate any risk to the health and life of the real patient unlike in many classic training programs.

This user manual explains principles of working with simulator hardware and instruments operations as well as features of its educational software (performing of laparoscopic interventions, training courses, instruments calibrations etc.).

Please note: all laparoscopic instruments and medical equipment used in the simulator are only imitations of the real ones and can not be used outside simulator's environment.

1 Safety precautions

Always check condition of simulator body, connection wires and monitors brackets before work. Look for twisted wires, breaks or cracks, loose fastening of bracket etc. In case of any damage or serious defects - all work should be postponed until repair is completed.

Following things are **forbidden:**
- Exert a force upon the instrument;
- Hold instruments nearby metal surfaces/place instruments onto them;
- Hold instruments nearby each other (the instruments rod will attract to each other due to the strong magnet and can be deformed afterwards;
- Dismantle the instruments handles;
- Expose simulator to the high temperatures (over 30 °C) in a continuous manner;

Always retract the instruments imitators of the ports (imitators of trocars) after exercise completion. **Do not leave the instrument in the trocar imitator, always hold it.** Leaving instrument leads to the disruption of feedback function (if one is present) and can case a traumatic situation for the user as well.

It's also forbidden to use simulator in a rooms with high humidity conditions, there condensation may form on the electronic and mechanical components. Vapours of acids, alkalies and other aggressive substances should not be present in the air. Air condition must meet the sanitary

standards: maximum single amount of dust in the air space no more than - 0.5 mg/m^3, average - 0.15 mg/m^3.

Warning labels on the simulator body:
- «High voltage warning» (W08) (Figure 1.1) ;
- «Ground» (W08) (Figure 1.2)

Figure 1.1.High voltage warning

Figure 1.2.Ground

Simulator also marked with label mark containing the information on product's name and nominal specifications (such as power consumption, frequency and voltage of the power supply).

Other dangers

Collisions with the simulator's body can lead to its falling. Do not hold or hang on the monitor bracket . If simulator falls onto you, call for help, before trying to free yourself. After being freed make sure to visit your doctor even if there are no visible signs of injury.

Power cords, cables and wires should not be placed in the passages, it's can cause stumbling and falling as well.

Do not stumble, insert or put any of the laparoscopic instruments imitators into the cavity of the human body or anywhere else except for trocars imitators.

Please note: all laparoscopic instruments and medical equipment used in the simulator are only imitations of the real ones and can not be used outside simulator's environment.

2 Startup and Shutdown

2.1 Simulator startup

Startup algorithm is shown below:

- Connect simulator body to the surge protector/power outlet;
- Press **«Start»** button on the side panel of the simulator to turn its on.

2.2 Simulator shutdown

Shutdown algorithm is shown below:

- Close exercise and return to the Main menu;
- Retract out instruments from the laparoscopic ports (trocars);
- Log in as Administrator (see «Authentication as an Administrator» section for details);

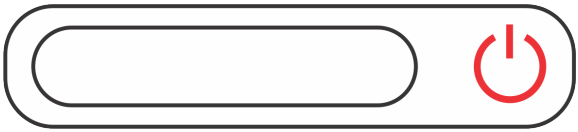

Figure 2.1.«Start» button

3 Authentication

Authentication menu (Figure 3.1) is available immediately after medical simulator program loading. In the menu you can select between «Select the existing user» or «Create a new one».

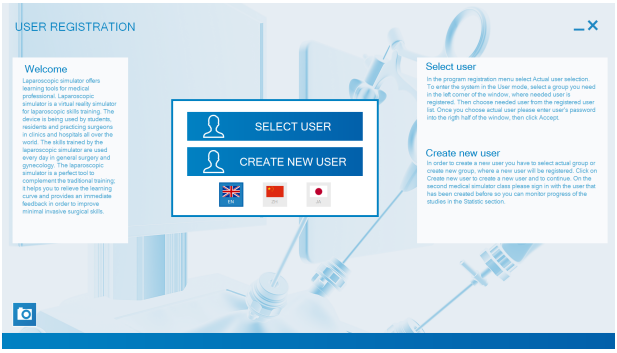

Figure 3.1.Authentication menu

3.1 Existing user selection

Press «Select existing user» button in the menu.

Each user (cadet) affiliate to a study group, which she/he selects when registering. User name is displayed only in his group. All study groups are listed on the left (Figure 3.2) of the screen. Choose group by clicking its name and choose user name in the middle. Then type the password in the password field and press «Accept».

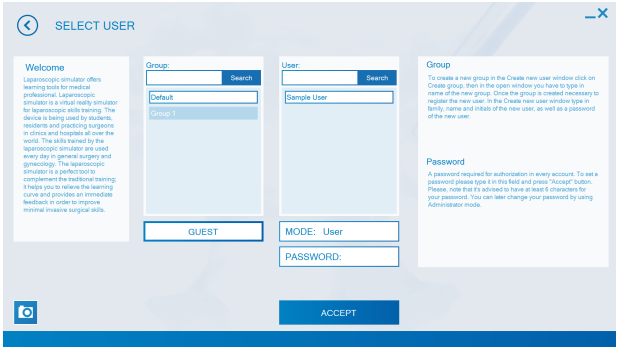

Figure 3.2.Authentication process

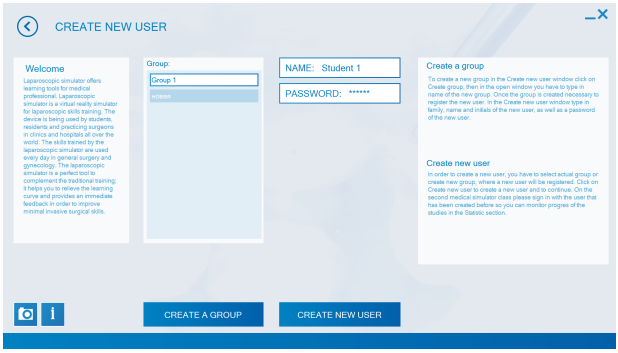

Figure 3.3.User registration form

3.2 New user registration

Press «Create user» button in the menu (Figure 3.3) . New user can be added to existing group or to a new one. In second case you'll need

to create any group first (see «New group creation» section for more details).

To add a new user into one of already existing groups follow the instruction below:

- Choose group name from the list on the left (Figure 3.3) ;
- Type user full name in the «Full name» field;
- Type password in the «Password» field;
- Press «Create new user» button;

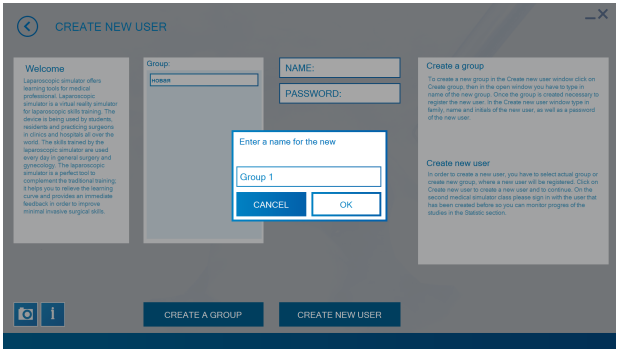

Figure 3.4.New group creation

3.3 New group creation

In order to create a new study group click «Create a group» button in the registration menu. Type name of the group in the new window (Figure 3.4) and press «Accept».

4 Exercises

Before starting the exercise:

- Read step-by-step exercises manuals;
- View video course of the selected exercise (within the exercise);
- Turn on with Video tips;

The simulator is based on complete set of training modules:
- training and education exercise for basics of laparoscopic instruments functions;
- control of the camera with a viewing angle of 0 °, 30 ° and 45 °;
- coordination of instruments in space;
- clipping and seizure of vessels;
- coordination and capture objects by instruments in space;
- use of endoscopic scissors;
- use of electrocoagulation;
- moving and rotating objects in space;
- studying of real operations videos;
- studying of three-dimensional virtual anatomical atlas;
- trocars and laparoscopic instruments calibrations;
- endoclip applier use;
- training and education for suturing and knotting;
- relief of acute operation complications;

«Endosurgery» section comprises all exercises available for this simulator. They are compiled as follows sections: «Basic skills in endoscopic

surgery», «Certain important skills in laparoscopy», «Complex of training tasks on suturing and knotting», «Skills in gynecological surgery», «Execution of total hysterectomy», «Skills in laparoscopic cholecystectomy», «Execution of laparoscopic appendectomy» and etc. Press «Back» to return to the main menu.

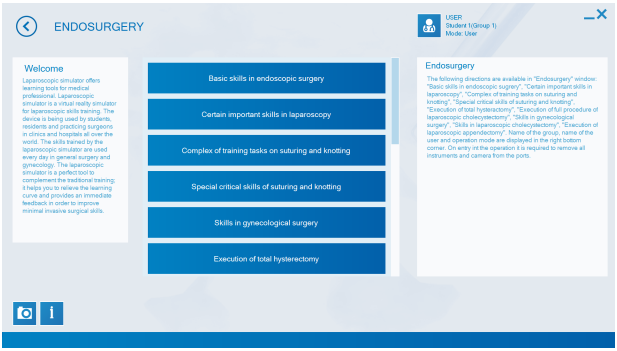

Figure 4.5.«Endosurgery» section

To access the exercise click the «Endosurgery» button in the main menu (Figure 4.5) and choose study section. List of the available exercises will display on the screen. All exercises have three levels of complexity: easy, normal and hard. Click the «Complexity» button to set the required level.

Level of complexity determines the changes in the exercise features such as:

- time limit;
- blood loss limit;
- speed of blood loss;
- length of the left instrument motion trajectory;
- length of the right instrument motion trajectory;
- total length of camera motion trajectory;
- square of coagulated surface e.t.c.

Choose exercise by clicking its name. Exercise description will display on the right of the window. Press «Next» to proceed.

4.1 Exercises end and exit

For the «Basic skills in endoscopic surgery», «Certain important skills in laparoscopy», «Complex of training tasks on suturing and knotting» and «Special critical skills of suturing and knotting» sections the exercise exit is being performed automatically after all the stages completion.

For the «Skills in gynecological surgery», «Execution of total hysterectomy», «Skills in laparoscopic cholecystectomy», «Execution of laparoscopic appendectomy» sections first you must retract all imitators of laparoscopic instruments from the trocars . After that «Finish» button will appear, click it to exit the exercise. In case if the button has not appeared, not all the stages were performed (final cavity examination wasn't performed, washing waters weren't aspirated etc.). Every exercise has a forced exit. For that press «Exit» button.

5 Imitators of the laparoscopic instruments

Imitators of many laparoscopic instruments are being used imitated in the simulator. Instruments imitators are inserted in the trocar imitators - simulator's ports.

Instruments are wireless and run on battery power. Work time of fully charged instrument is about 8 hours.

If instrument imitator is ON, but has not been used for some time, it goes to «sleep mode». It happens when the imitators are:

- Retracted out form port and are not being moved - «sleep mode» activates after 2 minutes;
- Inserted into the port and are not being moved - «sleep mode» activates after 10 minutes;

Each laparoscopic instruments imitator has an indicator (LED on a button) which determining its status:

- Two blinking lights - the instrument is ON, is recognized by base station (wireless server) but not inserted in port;
- Single blinking lights - the instrument is ON, is recognized by base station and is inserted in the port;
- Repeatedly blinking lights (15-20 seconds after simulator start-up) - the instrument is autocalibration;
- Repeatedly blinking lights - the instrument is discharged;

To awake the instrument quickly press LED button on the handle and wait for a long flash. As long as the instrument is sleeping, LED won't flash. To force turn the instrument OFF hold LED button until three short flashes.

There are two possible ways to change instrument type in the program:

- **First**, if set includes a large number of instruments imitators with variety of unique tips and handles, change is done automatically - choose of the required instrument, press button on the handle to turn it on and insert it in the port (trocar).

- **Second**, if set includes 2-4 laparoscopic instrument imitators:
  - Retract instrument out of the port;
  - **Option 1**: Press LED button - list of all available instruments will appear on the screen (Figure 5.1) ;
  - **Option 2**: Open and close instrument handle to summon instruments icons (Figure 5.1) ;
  - Choose between instruments by turning the wheel on the instrument handle;
  - **Option 1**: Press LED button to confirm choice;
  - **Option 2**: Open and close instrument handle to confirm instrument choice;
  - Insert imitator back in the port to confirm the choice;

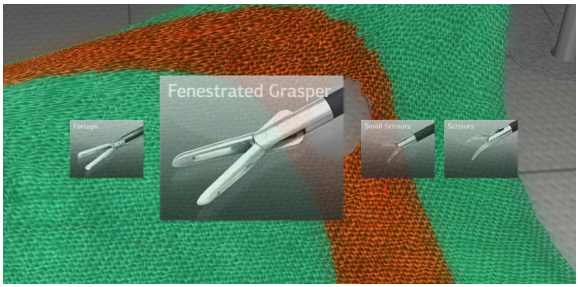

Figure 5.1.Instruments icons

5.1 Instruments battery charge

To charge wireless laparoscopic instrument imitator connect it to the USB-port using special adapter cable (is part of the standard equipment package). Instruments can be charged from any PC, including one used in the simulator. Charging process takes about 2 hours. Each wireless laparoscopic instrument imitator has power jack of 5V.

5.2 Imitators freeze

In some exercise instrument imitators can be «frozen» by pressing on instrument icon or «freeze» button under it. Frozen instrument will keep it position regardless of its imitator movements, which can be convenient in some of the exercises, there is required to work with assistant instrument. To «unfreeze» instrument press button under his icon on screen.

5.3 Imitator of endocamera

Instrument imitator is presented on the figure

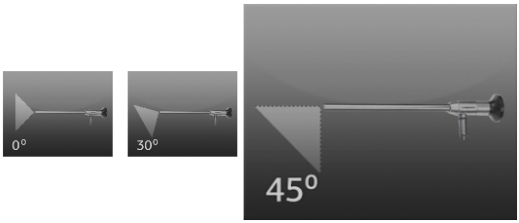

Figure 5.2.Viewing angles

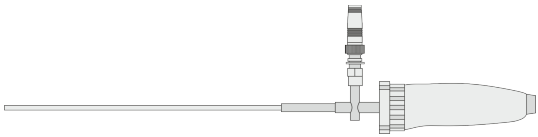

Figure 5.3.Imitator of endocamera

Camera view can be «frozen» i.e. it won't change regardless from the instrument position and movement. In that case «freeze» inscription will appear at the camera icon on the screen. Press the middle button on the instrument handle while imitator of endocamera in the port to its camera view .

Camera view can be «frozen» i.e. it won't change regardless from the instrument position and movement. Press the middle button on the instrument handle while imitator of endocamera in the port to freeze its

view . In that case «freeze» inscription will appear at the camera icon on the screen. Press the middle button again to «unfreeze» camera view.

ATTENTION: Hold imitator of endocamena **only by the handle and never by the lightpipe**. Otherwise, it is possible to block the LED located in the lightpipe and lose image in the program.

5.4 Imitators of trocars

Imitators of trocars serve for insertion of the laparoscopic instruments imitators. If needed, trocars also can be equipped with a feedback system (except one for endocamera), which is used for simulation of organs resistance towards impact of laparoscopic instruments.

6 Exercise menu elements

6.1 Control panel

Control panel becomes active during exercise performance. Functions change from exercise to exercise depending on its type, some are unavailable during basic trainings, some are not supposed for this exercise (for example, video courses or step-by-step instruction). Main functions are «Virtual tips», «Video course», «Descriptions and instructions», «Video course», «Anatomical atlas». «Descriptions and instructions» also contains «Ports placement», «Step by step instructions» and «Exercise description».

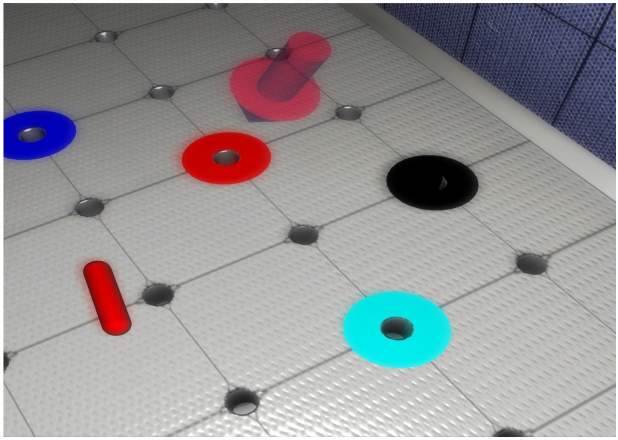

Figure 6.1.Virtual tips. Pointer

Clicking the «Virtual tips» button will activate performance hints,

such shown on figure 6.1 - Pointer direct to the appropriate ring is supposed to be put in stick, on figure 6.3 semi-transparent needle shows the correct trajectory, blue line onto figure 6.2 define dissections and coagulation places. Each tip is also followed up with a text message on the top of the screen.

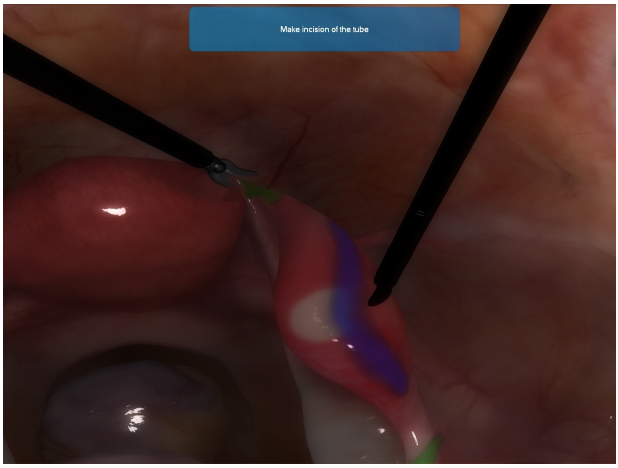

Figure 6.2.Virtual tips. Place of dissection

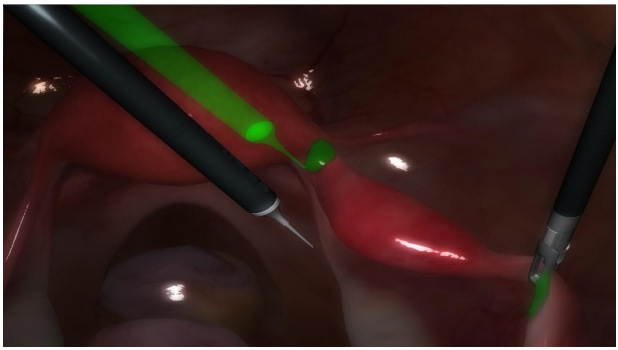

Figure 6.3.Virtual tips. Place of injection

Figure 6.4.Descriptions and instructions buttons

To watch the video course click the button «Video Course».

New window will open inside the exercise. Video can be played, paused, moved forward or back. Remember that video course is not present in all exercises.

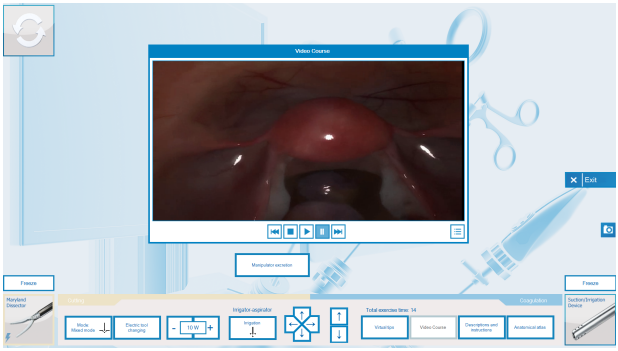

Figure 6.5.Fullscreen video course player

Click «Anatomical atlas» button in order to open it (Figure 6.6) .

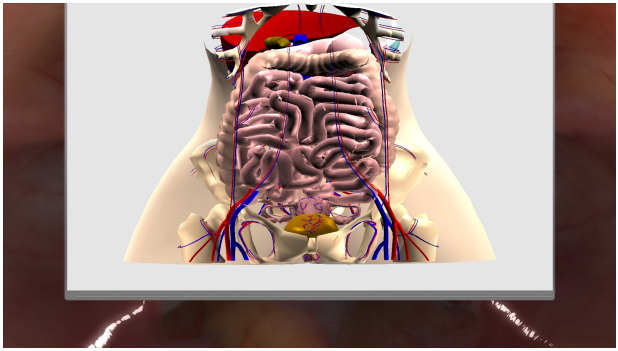

Figure 6.6.Anatomical atlas

Atlas allows to take a look onto different anatomical environment of the body such as: skeleton, lung, colon, uterus, arteries and others.

6.2 Control elements

6.2.1 Powered instruments controls

Electricity powered surgical instruments are being used in all surgical exercises and controlled via indicators and buttons on the control panel (Figure 6.8) .

Figure 6.7.Powered surgical instrument

Description of the control panel's function listed is given below:
- «Mode» indicator. Two working mode are available: «electro-dissection» and «coagulation». Working mode is set automatically and depends on the key pressed on the 2-key pedal is pressed. As long as either of keys is pressed you will hear a loud beep sound, indicator of the active work mode will be display on the control panel and instrument icon will blink repeatedly;

Figure 6.8.Control panel

- «Electric tool changing» button. Clicking this button changes the powered instrument (if used instruments can be powered). Powered instrument is marked with lightning icon (Figure 6.7) ;
- Power buttons. Click «+» to increase electricity power and click «-» to decrease it. ;

6.2.2 Irrigator-Aspirator controls

Controls for irrigation and aspiration modes present onto «Mode» button, located on the fig. 6.8. Current work mode displays on the button and can be changed by clicking. Aspiration/irrigation mode activation method depends on the simulator type - clasp together scissors-shaped handles of the instruments.

6.2.3 Cutting controls

Cutting is allowed only in certain areas differing in every exercises. Cutting area (Figure 6.9) is being highlighted by blue colour if hints have been activated.

Free cutting in other areas is forbidden and impossible. However it is possible to penetrate organs and cause an internal bleeding that can

be stopped by electro coagulation.

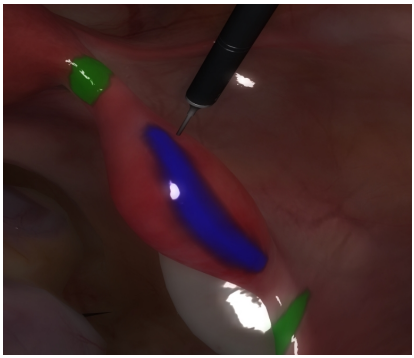

Figure 6.9.Cutting area

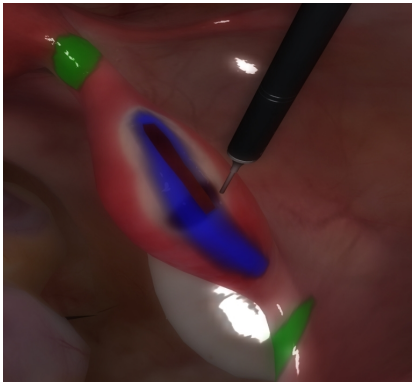

Figure 6.10.Cutting by line

Cutting is allowed only in certain areas differing in every exercises.

Cutting area (Figure 6.9) is being highlighted by blue colour if hints have been activated.

6.2.4 Uterine manipulator

Uterine manipulator is used for uterus position change in the most of the gynecological operations. To move the uterus press the buttons:

1. up;
2. left;
3. down;
4. right;
5. forward;
6. back;

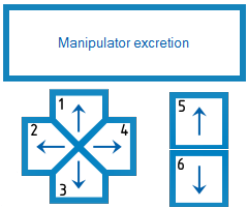

Figure 6.11.Uterine manipulator

«Manipulator excretion» button is in charge of uterus removal in hysterectomy exercise. After cutting the uterus off press the button to complete the removal process.

6.2.5 Endocamera controls

Endoscope camera helps to display the operative field during the exercise. It's required to adjust endoscope camera focus at the start of exercise by rotating blue rubbed ring on the instrument imitator handle. Endoscope (endocamera) instrument handle has three buttons. When the endocamera is not inserted in the port, the triangle-shaped buttons used for change of camera view angle and middle button are being used for confirmation. Possible viewing angles are - 0 °, 30 ° and 45 °.

While imitator of endocamera is in the imitator trocar, it is possible to «Freeze» it, i.e. to stop camera view from changing regardless of the endoscope position and movements.

Figure 6.12.Freezed endocamera icon

During the exercise (imitator must be inserted in the trocar at this moment) press the nearest to the lightpipe button to make a screenshot

of the operative field. Screenshots can be viewed later on the Statistics screen (see «Statistics» section for more details).
Use of coagulation or electro-dissection during the exercise may cause camera view blurring, leading to visibility deterioration. It can be clean by wiping camera tip of the organs (rub it against the organ).

6.2.6 Virtual port

Some exercises require a work with extra ports (trocar imitators). The fourth port is marked as an «assistant» and can be activated by pressing at «Change to assistant port» button the control panel. After that left port will start acting as an assistant's, and inscription button will change to «Change to left port».

Instrument inserted into a left port can be used as any one. It also can be freeze in order to keep position. Port affiliation can be change but instrument position will not change.

Assistant's instrument remains in a position in which it has been left. At the end of the exercise, in order to remove all the tools from patient body you'll need to switch back to the assistant port and remove (but do not retract it completely from port) any remaining instruments.

7 Statistics

Statistic results are being formed after completion of the exercise. It is individual and tied to the user's profile. It is very important to log-in into the system using correct name and password. In any other case it may lead to the serious mistakes in the grade estimation.

To access statistics section click the button with the same name in the main menu.

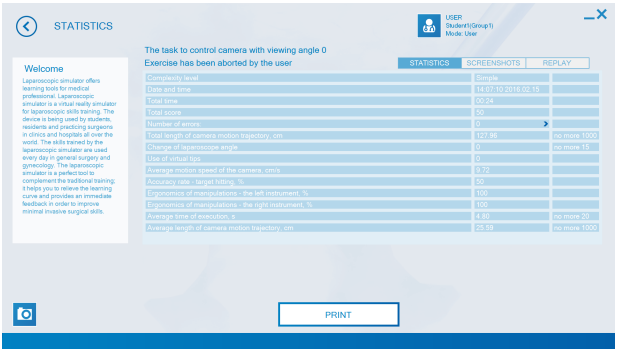

Figure 7.1.Statistics window

Statistics displays all exercises performed by a current user. Choose one by clicking its name and press «Results of the selected exercise» button. In the newly open window statistics parameters will be displayed alongside with two columns of the numeric values - first actual numbers from the exercise, second - permissible numbers from the exercise settings (mainly determined by the level of complexity). Grade of the

exercise is define by «Total score» (ranged from 0 to 100 points, where 100 is max). Points are being added or took off depending on the performance quality, performance time, quantity and the character of the mistakes made.

«Replay» button opens a new window where a video record of chosen exercise (Figure 7.3) can be viewed.Screenshots also can be viewed in this window (if have been taken during exercise) (see «Endocamera controls» section for more details). Press «ScreenShots» button to shift from video to screenshots. Press «Statistics table» to return back to the statistics window.

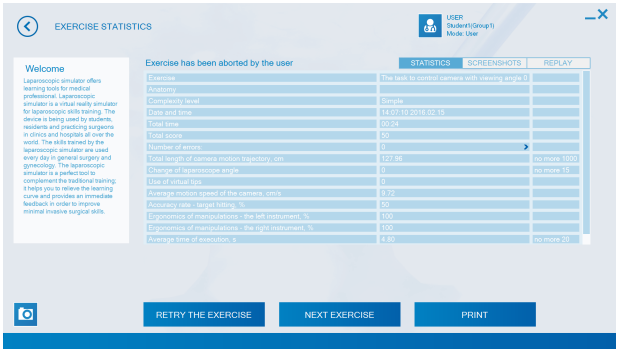

Figure 7.2.Exercise statistics

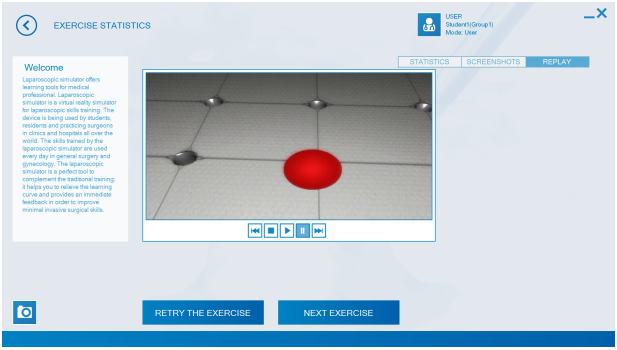

Figure 7.3.Statistics. Replay

It is possible to compare results of the same exercises: choose the required exercise from the main list and press «Compare results statistics» button. Statistic window will display exercises parameters numeric values in the columns. Press «Graphical display» to show comparison as graphics scales as well. Remember it's not possible to compare results of more than 3 exercises at the same time. It's not possible to compare results of exercises from the exercise end form.

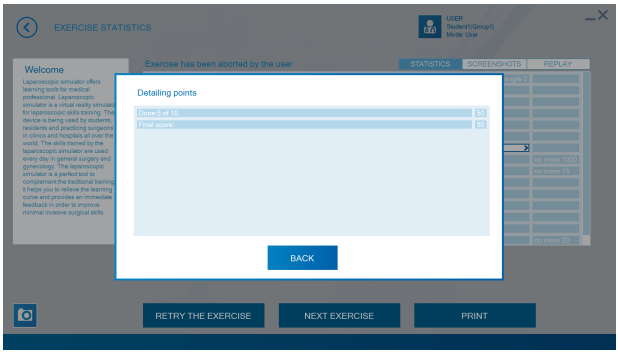

Figure 7.4.Detailing points

Statistics window also appears after completion or interruption (forced exit) of exercise.

This window display statistic information for the current exercise.Buttons «Replay», «Print», «Next Exercise», «Retry the exercise» located on the right side of the window.

Click > mark in the field «Total score» in order to see detailed elaboration of the score.

Detailing point is a precise elaboration of the final score, including points received on correct exercise performance and took off in case of mistakes.

Pressing the «Replay» button will open new window in which video record of the exercise can be viewed. Buttons «Play», «Pause» and «Replay from the start» are located in the lower left corner . There also

video slider which can be moved manually to find a particular part of the record.

If screenshots were taken during the exercise, «ScreenShots» button will be available in the «Replay» window (Figure 7.5) . Upon pressing it new window will open in where screenshots can be viewed.

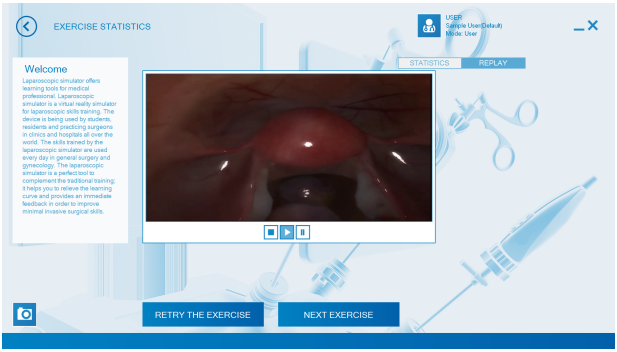

Figure 7.5.Exercise end form. Replay window

Press «Statistics Table» in order to return to exercise end form.

8 Training courses

Training courses are a sequence of exercises, with number of requirements including: line of performance, minimal passing score, complexity level etc.

Exercises in the course are being performed successive, in line, there is no possibility to jump ahead toward one exercise without completing previous one first. Already completed exercise can be repeated for obtaining of a better score. While one of training courses is being actively performed, section «Endosurgery» and other courses will be unavailable until chosen course is completed or cancelled.

If one of courses already started, section will display its statistics if not - list of all available training courses (Figure 8.1) will be shown.

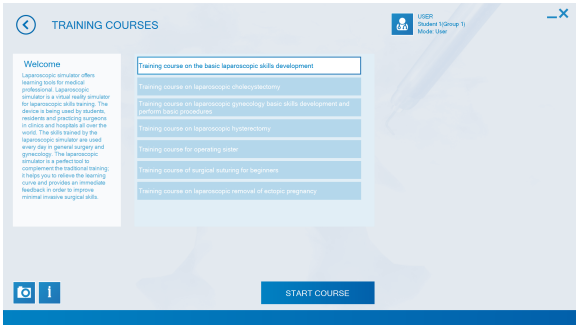

Figure 8.1.List of training courses

Following courses are available:
- «Training course on the basic laparoscopic skills development»
- «Training course on laparoscopic cholecystectomy»
- «Training course on laparoscopic gynecology basic skills development and perform basic procedures.»
- «Training course on laparoscopic hysterectomy»
- «Training course for operating sister»
- «Training course of surgical suturing for beginners»
- «Training course on laparoscopic removal of ectopic pregnancy»

Administrator mode allows creating of new training courses or edit and delete already existing ones (see «Administrator» section for more details).

To start course choose it from the list and click «Start training course» button (Figure 8.1) . Next menu - statistics - will display contents of the course as well as performance results (Figure 8.2) .

Status icons of the exercises display at the statistic window (Figure 8.3) with the following meaning:
1 - completed exercises;
2 - repeat completed exercises;
3 - non-performed exercises;
4 - current exercise;

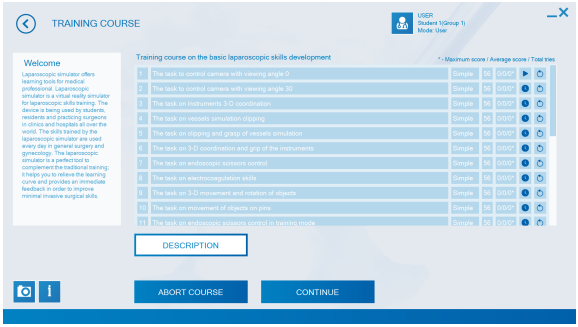

Figure 8.2.Course contents

Figure 8.3.Exercise status icons

Numbers near status icons display progress of performing: maximum score/average score/number of tries. The following buttons are located at the bottom «Back», «Course description», «Abort the course», «Continue». Press «Back» in order to return to the previous window. Press «Course description» to see general information about chosen course.

In order to start or continue the course press «Continue». After that course exercise start window will open. Please note, you can not choose or change complexity level of the exercise and change its passing score (Figure 8.4) . Press «Start exercise» to begin.

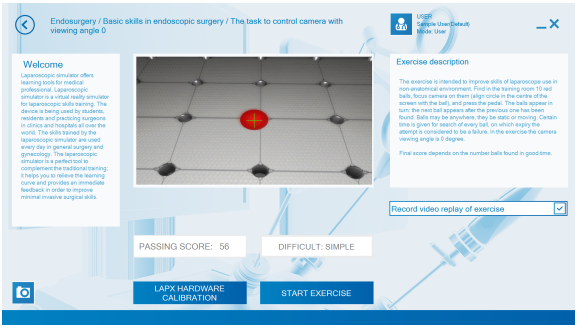

Figure 8.4.Exercise in the course

Performing of the course can be cancelled by pressing «Abort the course» button in the «Training courses» menu. Press the button that confirm («Accept») or decline («Cancel») your choice in the pop-up window (Figure 8.5) .

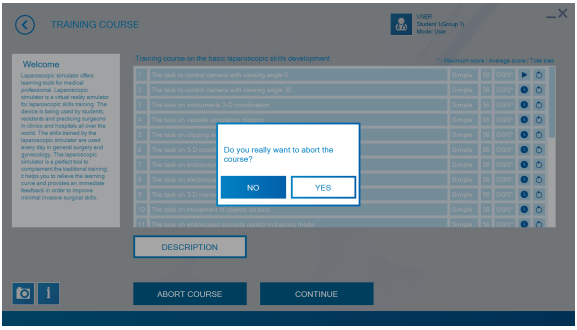

Figure 8.5.Abort the course

After completing of the exercise its statistics window will open. User

can watch replay of the exercise, print its statistics, return to the main menu, view course results or continue with it.

To proceed with further with course performance press «Continue exercises of the course». If cadet's score is lower than required passing score «Retry the last exercise» button will appear instead of «Continue exercises of the course». It's not possible to continue with others exercises until pass the require score.

After completing of all exercises in the course its statistics window will open automatically.

9 Acknowledgement table

I have read and understood the manual:

Table 1.Acknowledgement table

Date	Name	Signature