Guidelines for using the ABC system on the Elekta for Respiratory Gating Treatment

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Introduction

The ABC or Active breathing coordinator system is the respiratory gating system used with the Elekta treatment machine. Unlike the Varian, this system uses a spirometer to track the patients actual lung volume. Consists of 3 main parts: ABC cart, laptop interface, mouthpiece w/ flow meter and valve.

Intended use and function of the Equipment

i.   ABC is used when there is a need to reduce the anatomical movement in the thorax and abdomen caused by breathing and cardiac motion.

ii.   Intended use is for breath-hold treatments in simulation and XRT.

iii.   Specifically used for left breast treatments to spare dose to heart, lung and other thoracic cancers to reduce tumor target margins, SRS thorax treatments, and certain liver and pancreatic tumors.

iv.   Patient can hold and maintain an accurate breath-hold to a specific lung volume that can be monitored in the treatment room by that patient. The therapist monitors the breathing on a laptop in the treatment area.

v.   A patient controlled balloon valve lets the patient do breath-hold treatments at the same lung volume for each field (Figures 1 & 2).
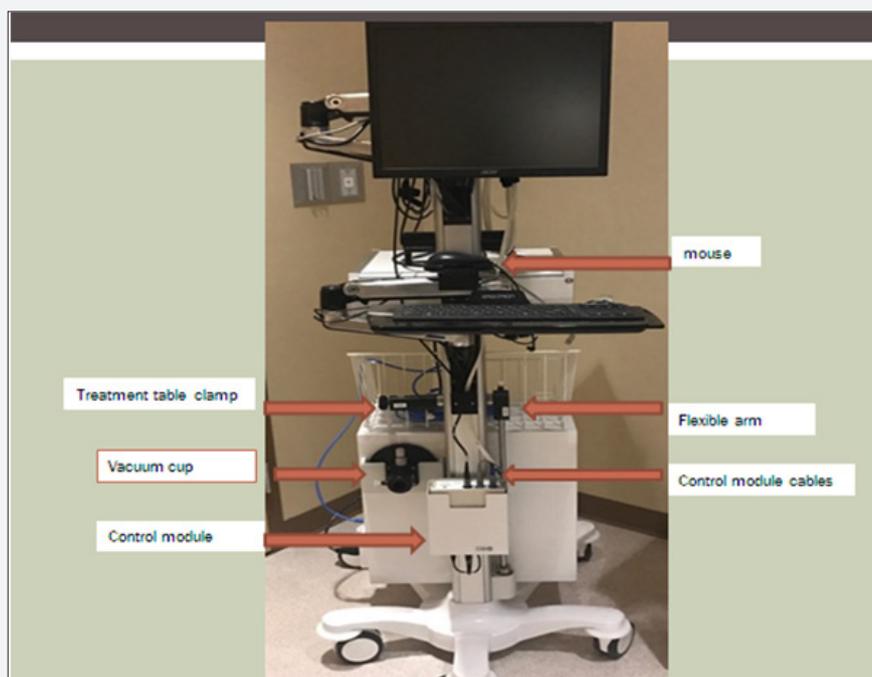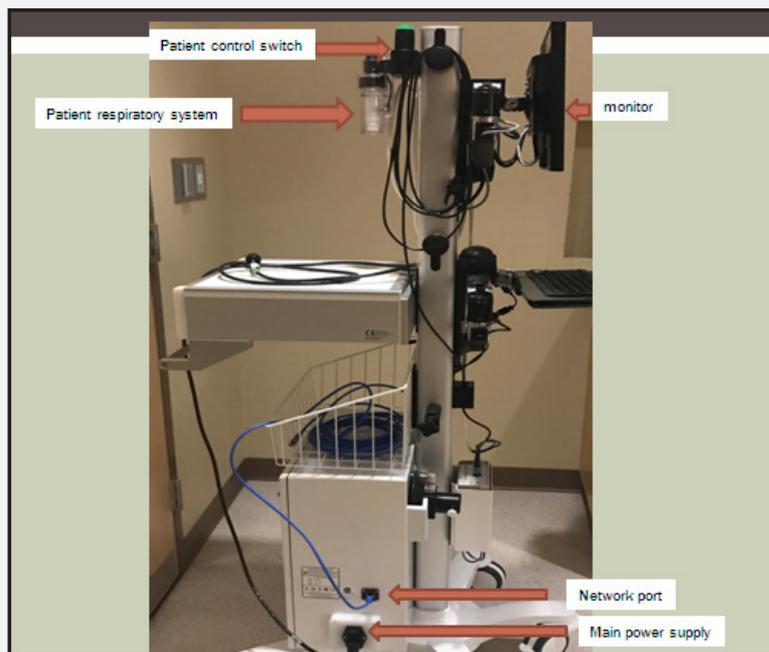

Figure 1: Trolley.

Figure 2 : Patient control switch: Patient presses the button during treatment and only releases it to stop the breathold. When the button is released the balloon valve is deflated. If the patient presses the button twice is one second it will send a distress signal that will show up on the laptop screen.

Patient control switch

Patient presses the button during treatment and only releases it to stop the breathold. When the button is released the balloon valve is deflated. If the patient presses the button twice is one second it will send a distress signal that will show up on the laptop screen (Figure 3).
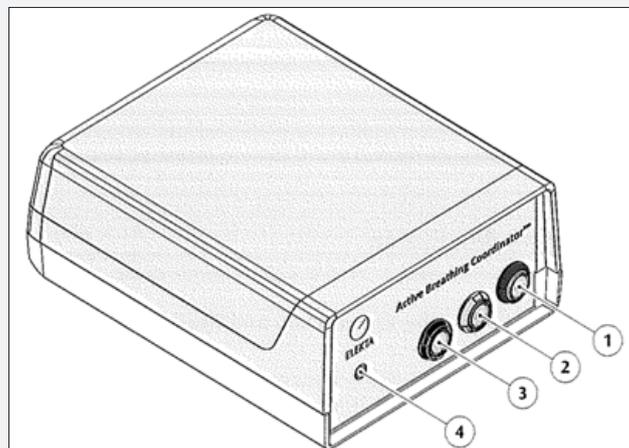

Figure 3: ABC Control Module.
1.   Balloon valve port.
2.   Transducer port.
3.   Patient control switches port.
4.   Power indicator.
Communicates with the other system parts. It includes a pneumatic pump which controls the balloon valve causing it to inflate and deflate.

Patient Respiratory System (Figure 4)

a.   Sensor pneumatics cable assembly: measures the amount of air the patient breathes that is then sent to the ABC control module

b.   Balloon valve: inflates to prevent air flow through the spirometer when a breathold starts. It deflates when the breathold is completed or interrupted.

c.   Balloon valve tube: how the ABC control module controls the balloon jalve.

d.   Mechanical connector: attaches to the flexible arm socket

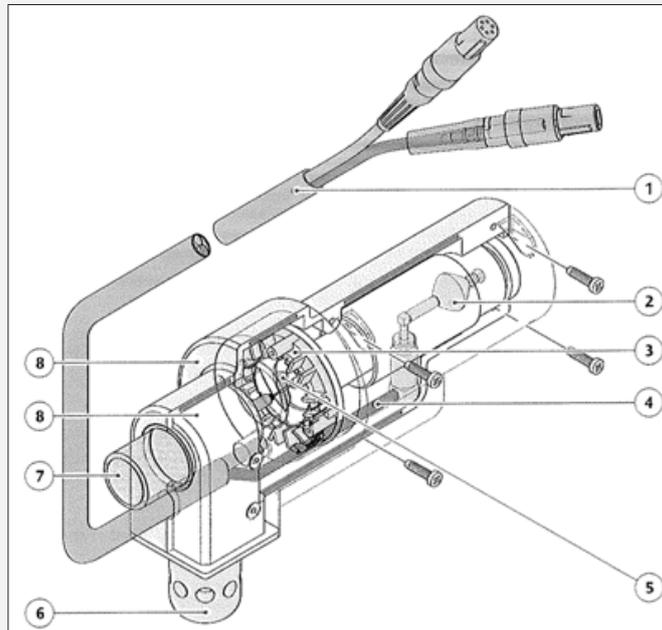e.   Filter adapter: mouthpiece and filter kit attaches to this (Figures 5 & 6).

Figure 4 : Patient respiratory system.

Figure 5 : Filter adapter.

Figure 6 : Measures the quantity of air a patient breathes through the ABC system**.**

ABC Response Control Box (Figure 7)

Figure 7 : ABC Response control Box.

i.   The response control box enables/disables the response gating control system.

ii.   Green lights on USB connect, Relay module, Gating on/ off, Gating enabled/fault will allow for the patient loaded into ABC system to be treated. Any red lights and system will not allow treating.

iii.   Gating enable button: enables/disables gating of the accelerator when pressed continuously for 3 seconds. Also used to change from a fault mode to gating enabled mode.

Introduction

Recommended cleaning for the ABC is as follows:

Clean surfaces using a mild detergent solution then dry with a clean, lint free cloth

Figure 8 : Laptop Connection to ABC cart using the network cable.

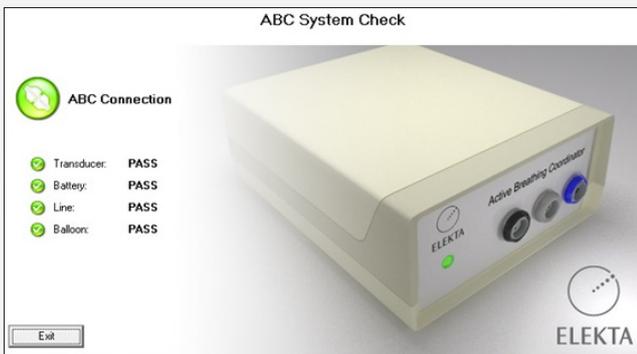**Figure 9 :** Connection of the cart to a power outlet and turn the power to the cart ON.

Figure 10 : Turn the Active Breathing Coordinator box ON (green light should be present.)

a. Morning QA

i. Connect laptop to ABC cart using the network cable. Cable runs from laptop to cart network port located next to ON/OFF switch.

ii. Ensure that all cords are firmly attached (Figures 8-10).

iii. Turn the Active Breathing Coordinator box ON (green light should be present).

iv. Turn on laptop (Figure 11).
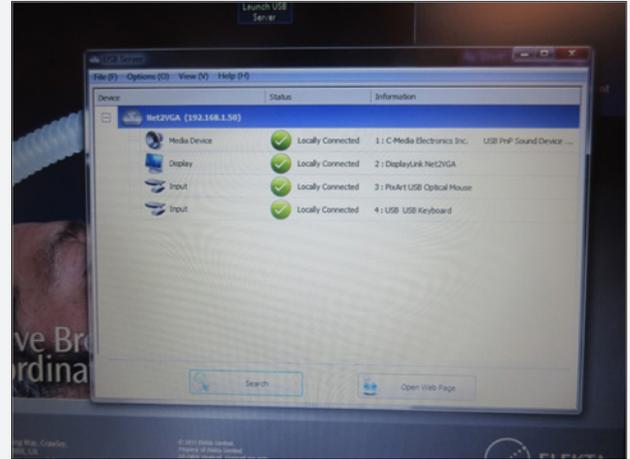
Figure 11 : Turn on laptop.

v. Login to ABC computer (Password: abc lowercase) (Figure 12).
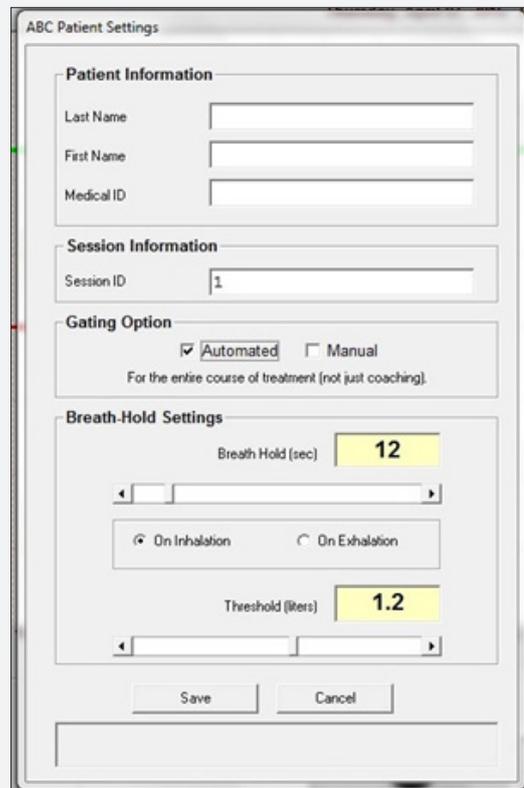

Figure 12 : Login to ABC computer (Password: abc lowercase.)

vi. Double click on ABC icon.

vii. ABC System Check should all be green (connected.)

viii. At this time, the laptop should have connected to the mouse and monitor on the cart.

ix. ABC will prompt user to load an existing patient. Select the morning QA patient.

x. A QA patient should be created by the physicist for daily QA.

xi. Once the QA patient is loaded, put in the current date under session ID.

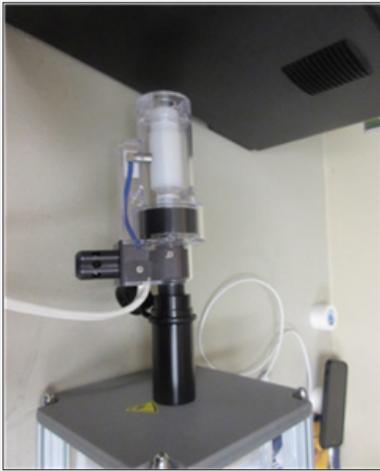xii. Connect the spirometer to the automated morning QA device (Figure 13).

Figure 13 : Connect the spirometer to the automated morning QA device.

xiii. Scroll down to "Self test "option on the LCD screen of the morning QA device (Figure 14).

Figure 14 : Scroll down to "Self test "option on the LCD screen of the morning QA device.

xiv. Press the play button to initiate test.

xv. The QA device will run tests and a prompt will come up and tell you if the test has passed or failed (Figure 15).

xvi. Record if passed or failed on the daily QA sheet

Figure 15 : The QA device will run tests and a prompt will come up and tell you if the test has passed or failed.

xvii. Once the "automatic test" passes, scroll through the LCD menu to find the manual option (Figure 16).

Figure 16 : Once the "automatic test" passes, scroll through the LCD menu to find the manual option.

xviii. This setting will give you 3 inhale and exhale cycles for testing.

xix. Press the play button each time for an inhale and exhale.

xx. This will be done 6 times for 3 inhales and 3 exhales.

xxi. Record inhale and exhale volume values on the daily QA sheet.

CT Simulation using ABC (Figure 17)

a. Turn on computer.

b. Take ABC cart into Tx room and connect network cable from the laptop into cart.

c. Plug in cart unit to nearest outlet.

d. Turn on control module power switch.

e. Remove table clamp from cart and attach to superior/top of table.
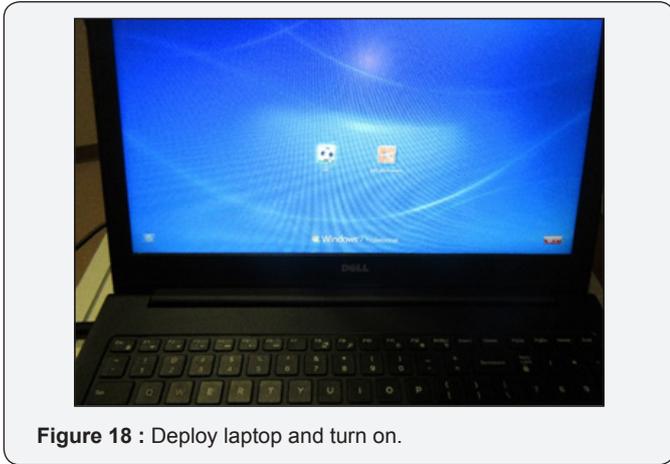
Figure 17 : CT Simulation using abc.

Figure 18 : Deploy laptop and turn on.

f. Deploy laptop and turn on (Figure 18).

g. Log into ABC.

h. Select Create New.

Populate Patient Data (Figure 19)

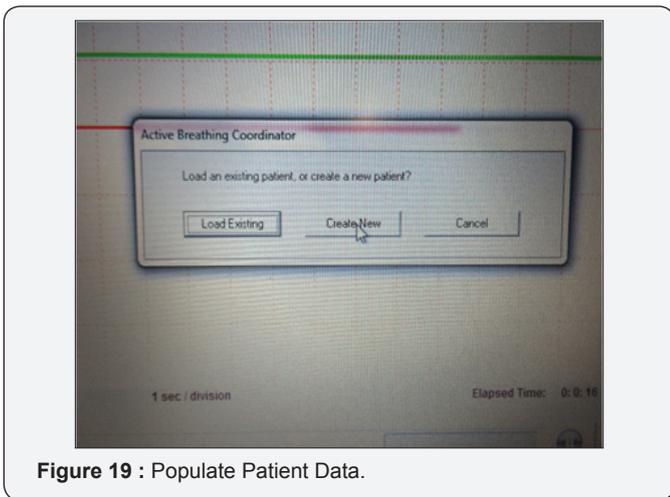**Figure 19 :** Populate Patient Data.

i. Patient and session Information

ii. Session ID is CT Sim

iii. Gating Option – Manual

iv. Select Breath hold

v. 30 seconds for full scan

vi. Treshold defaults at 1.2L

vii. Inhalation

viii. Save.

Modification to set up can be made by selecting Patient Settings and clicking and entering desired levels (Figures 20). Physics will provide instructions to the patient explaining the steps to the ABC procedure (Figure 21). Position mouth piece, nose clamp and patient control switch. Ask patient to take in a big breath and take note as to how many liters are inspired. Repeat 3 times and adjust threshold to approximately 80% of maximum volume. Activate System by pressing space bar once. Have patient depress green button and take in a big breath. System will cut up breath upon reaching the preselected volume. Have them let go of the button and breath normally. After patient tumor loc and marking, attach flexible arm to table top. Insert balloon device and lock in place.
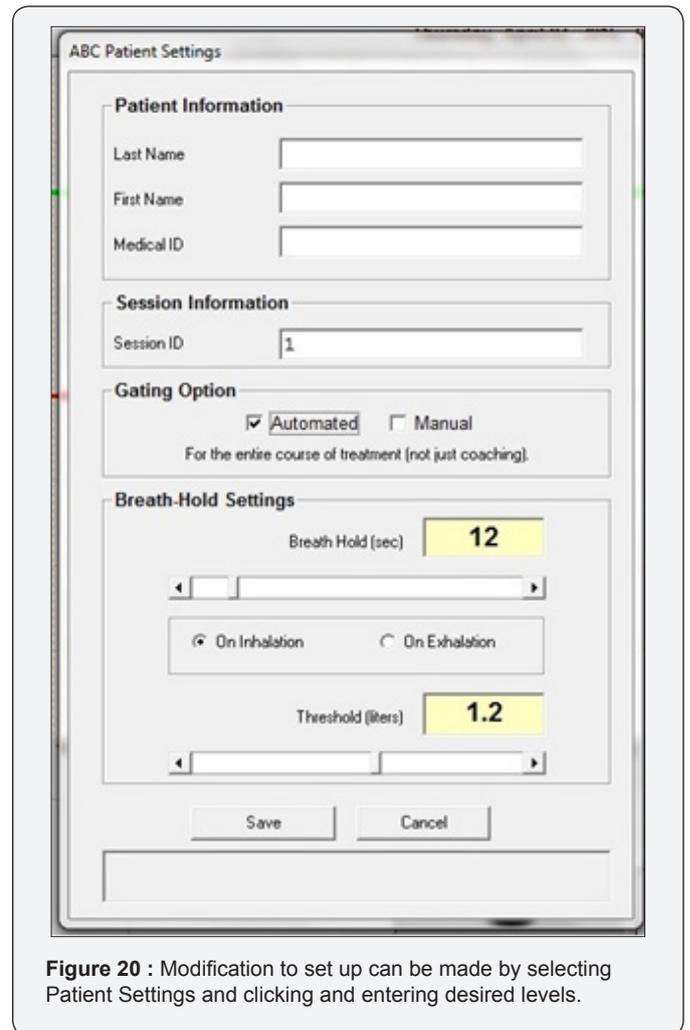

Figure 20 : Modification to set up can be made by selecting Patient Settings and clicking and entering desired levels.
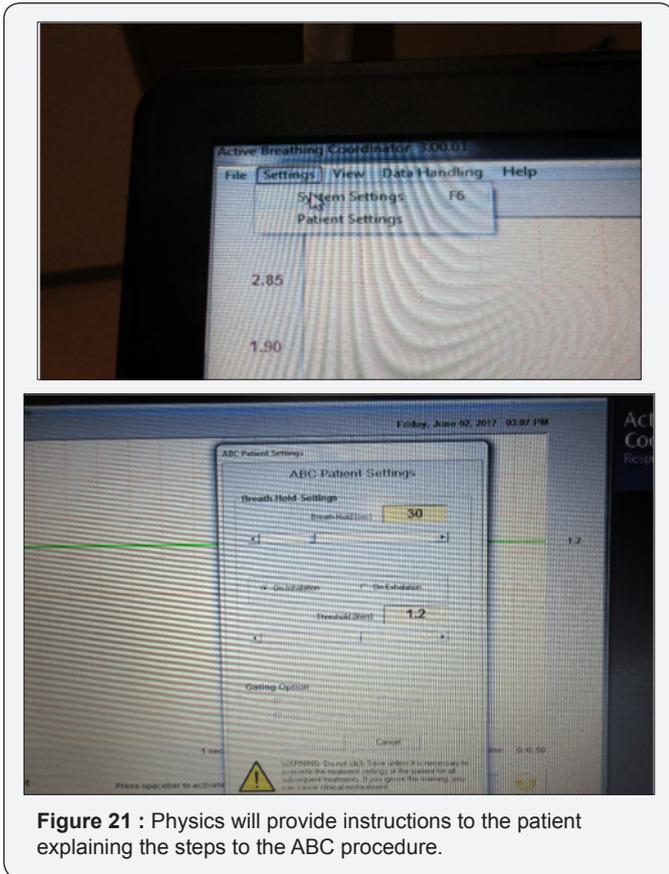
Figure 21 : Physics will provide instructions to the patient explaining the steps to the ABC procedure.
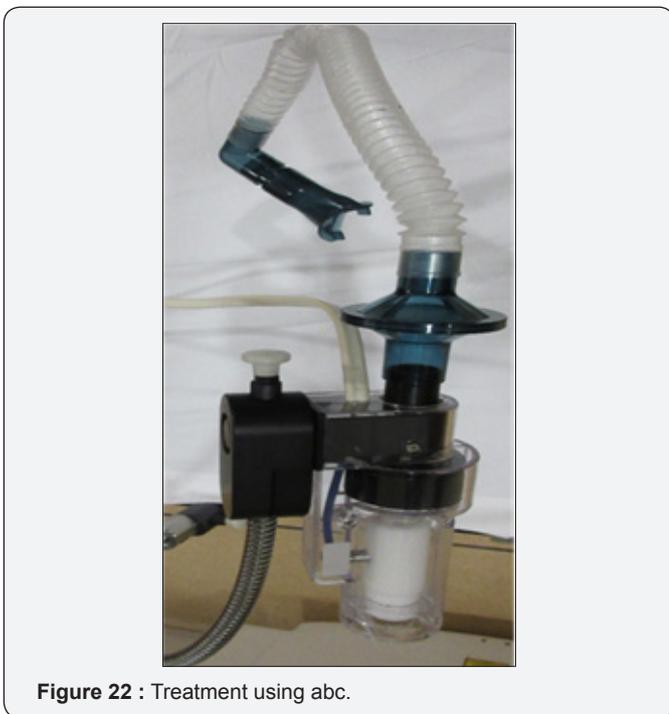
Treatment using ABC (Figure 22).

Figure 22 : Treatment using abc.

Remove Laptop from cart and place on counter. Connect computer to Elekta Response Box and network cable. Turn on Response Box on (hold down until green light appears) (Figure

23). Turn on computer. Take ABC cart into Tx room and connect network cable into cart (Figure 24). Plug in cart unit to nearest outlet. Turn on control module power switch. Remove table clamp from cart and attach to superior/top of table. Insert flexible arm into table clamp. Attach patient respiratory device to flexible arm along with mouth piece (Figure 25). Login to ABC computer (Password: abc lowercase). Double click on ABC icon. ABC System Check should all be green (connected) (Figure 26). Trouble shooting (if needed). Load existing patient. Click on ABC patient data (Upper left corner). Select correct patient from existing list. Highlight patient for treatment. Select – open patient (Figure 27). ABC patient setting Box will appear (Figure 28). Under session record today's date. Click DONE (lower left). Load Patient information (plan) on linac. Highlight field and add pre-port film (must image daily).
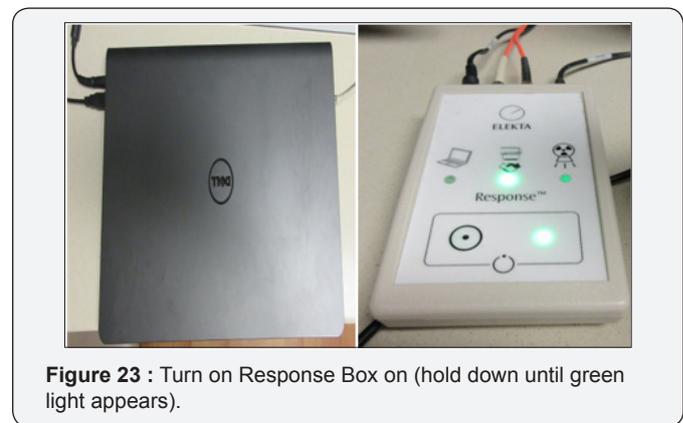

Figure 23 : Turn on Response Box on (hold down until green light appears).

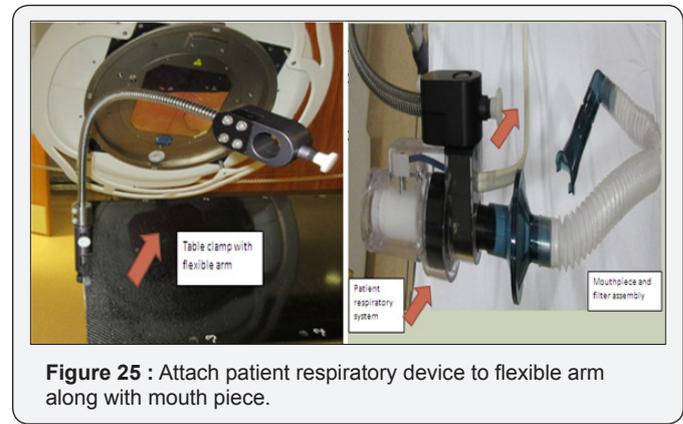**Figure 24 :** Take ABC cart into Tx room and connect network cable into cart.

Figure 25 : Attach patient respiratory device to flexible arm along with mouth piece.

Figure 26 : ABC System Check should all be green (connected).
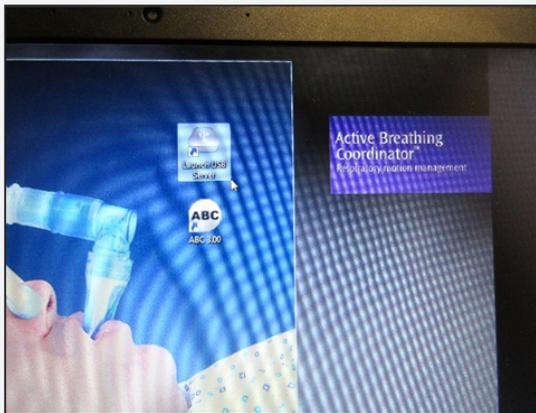

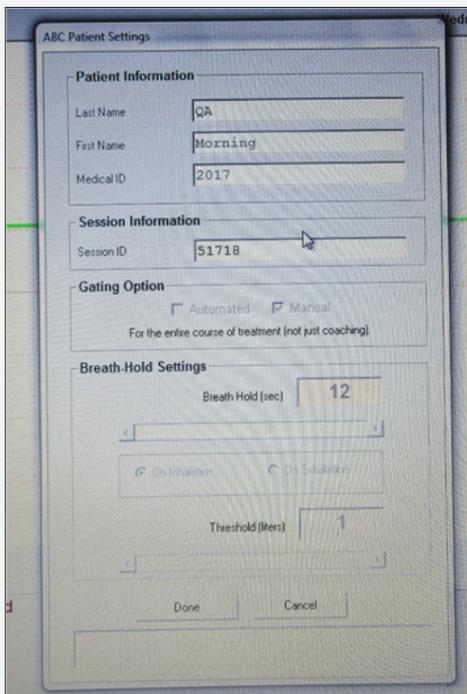**Figure 27 :** Highlight patient for treatment.

Figure 28 : ABC patient setting Box will appear.

Select port needed. Instruct patient to hold control switch (Figures 29-31). 2nd therapist should be providing patient with breathing instructions over intercom. Patient instructed to release green button as needed with breathing crisis, (release of button will necessitate 2nd therapist to hit space bar to reactivate ABC control) Hit space bar to activate breath control with linac. ABC control is represented by green bar. Instruct patient to gently take in a deep breath. ABC control will prevent patient from normal breathing once dose delivery threshold is reached. Treatment delivery achieved within countdown window (Figure 32).

Figure 29 : Instruct patient to hold control switch.

Figure 30 : Red Line Indicates control Switch is not depressed.

Figure 31 : Blue line indicates control switch is depressed.
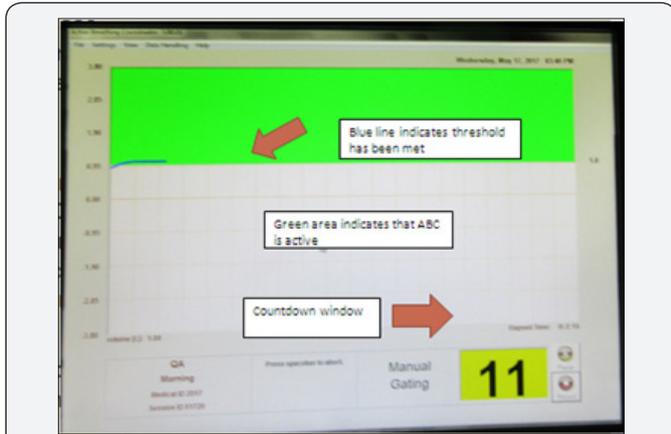
Figure 32 : Treatment delivery achieved within countdown window.
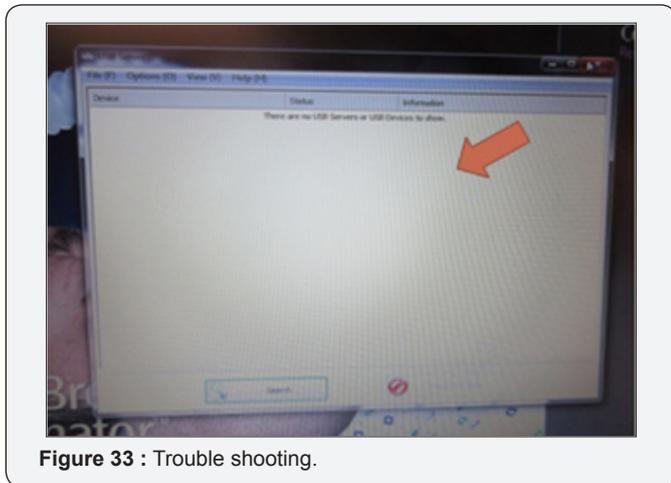
Trouble Shooting (Figure 33)

Figure 33 : Trouble shooting.

Most common problem when launching ABC software is that no USB connections are identified.

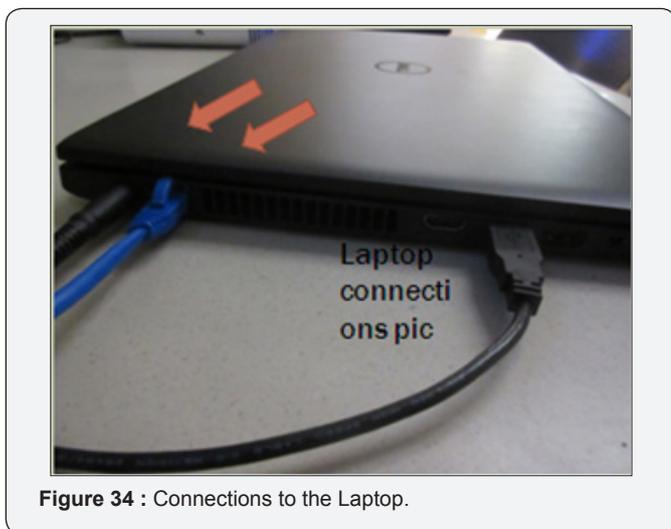i. Begin by checking connections on the laptop, ABC cart, and network connections.

Figure 34 : Connections to the Laptop.

ii. These are the laptop connections (Figure 34).

iii. These are the ABC cart connections.

iv. Micro USB cable connected on the bottom left is often the culprit as it works loose with gravity (Figure 35).
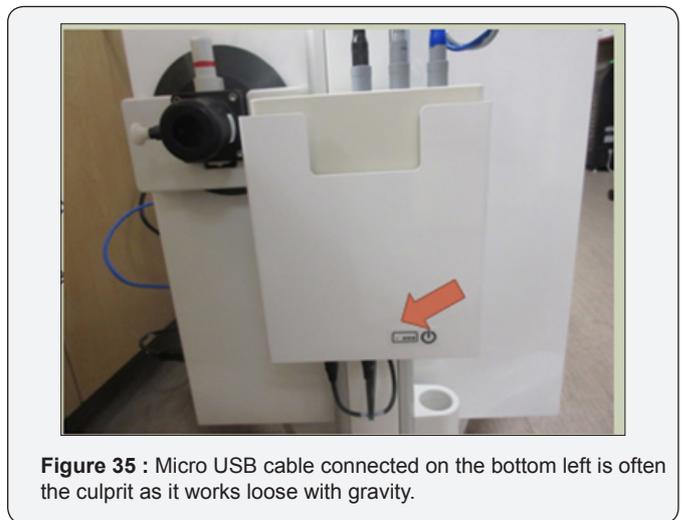
Figure 35 : Micro USB cable connected on the bottom left is often the culprit as it works loose with gravity.

v. This is also where the power switch for the control module is located (Figure 36).
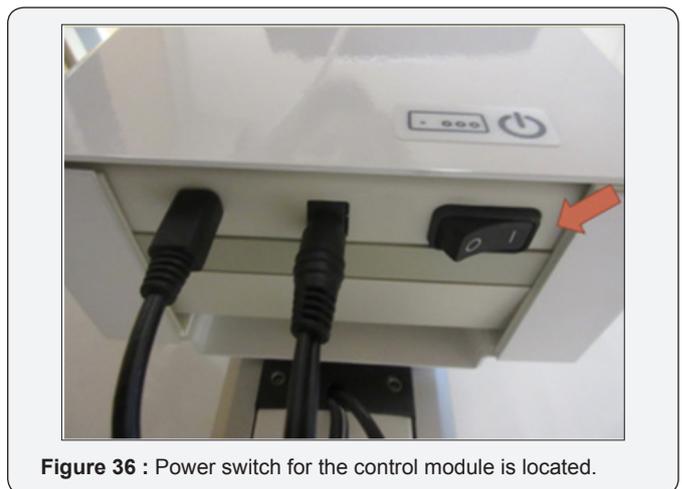
Figure 36 : Power switch for the control module is located.

vi. Green light on top indicates power to the module and control unit are on (Figure 37).

Figure 37 : Green light on top indicates power to the module and control unit are on.

vii. Red light on top along with audible alarm indicates power switch to the module and control unit are off (Figure 38).
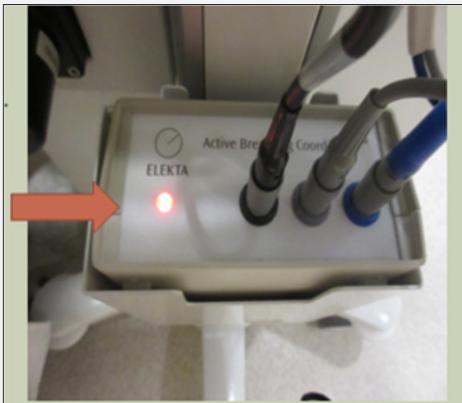

Figure 38 : Red light on top along with audible alarm indicates power switch to the module and control unit are off..

viii. Power switch for the ABC control cart is located on the side of the unit along with the network connector (Figure 39).

Figure 39 : Power switch for the ABC control cart is located on the side of the unit along with the network connector.

Figure 40 : Check that the network cable is plugged securely into the correct jack.

ix. Lastly check that the network cable is plugged securely into the correct jack (Figure 40).
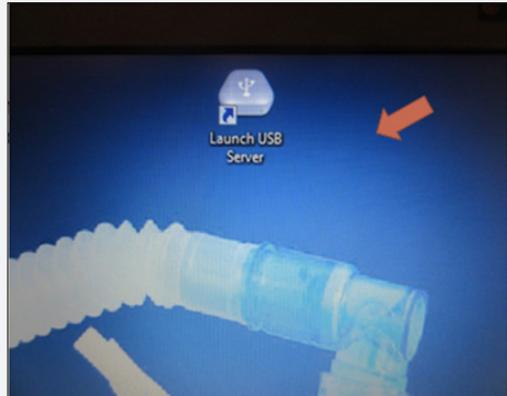
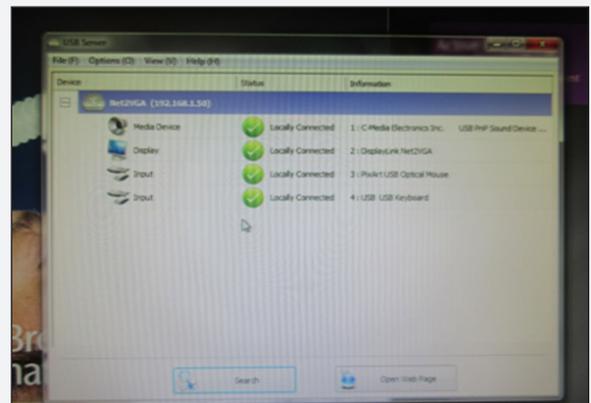**Figure 41 :** If all connections are securely plugged try to re-launch the USB server from the control laptop.

Figure 42 : All green lights indicate ABC is in the correct state for treatment.

Figure 43 : Make sure patient is holding the patient control button down. This will change the respiratory indicator line blue.

If all connections are securely plugged try to re-launch the USB server from the control laptop (Figure 41). All green lights indicate ABC is in the correct state for treatment (Figure 42). While delivering treatment you find that the space bar

will not activate the system. Make sure patient is holding the patient control button down (Figure 43). This will change the respiratory indicator line bl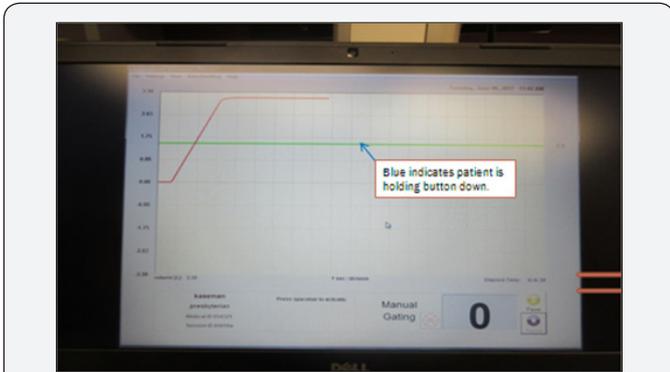ue. If line is blue and space bar still does not work then press pause then record to re-activate syste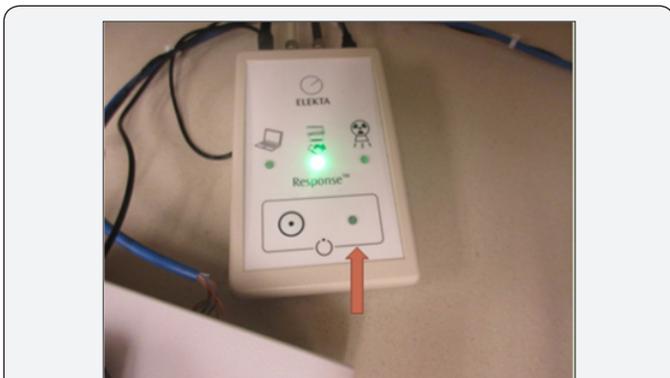m (Figure 44). This is the correct activated treatment state (Figure 45). If beam will not deliver check that the response box is active

(Figure 46). Press and hold power switch till light turns green. If light is red, press and hold till light turns off then turn it back on. This is what the response box should look like when ready to deliver beam. If beam will not deliver check that the response box is active. Press and hold power switch till light turns green.

Figure 44 : If line is blue and space bar still does not work then press pause then record to re-activate system.

Figure 45 : This is the correct activated treatment state.

Acknowledgement

Figure 46 : If beam will not deliver check that the response box is active. Press and hold power switch till light turns green.