



LEONARDO

**AUGMENTED REALITY
DENTAL SIMULATOR**





MULTI-TASK DENTAL SIMULATOR

- **It is more than just manual skills and cavity preparation**
- **It is more than just objective assessment of a separate skill**
- **It is a multi task AR simulator assessing clinical competencies integrated in a realistic environment with accurate 3D visualization**



REALISTIC ENVIRONMENT & MULTIDISCIPLINARY DEVICE

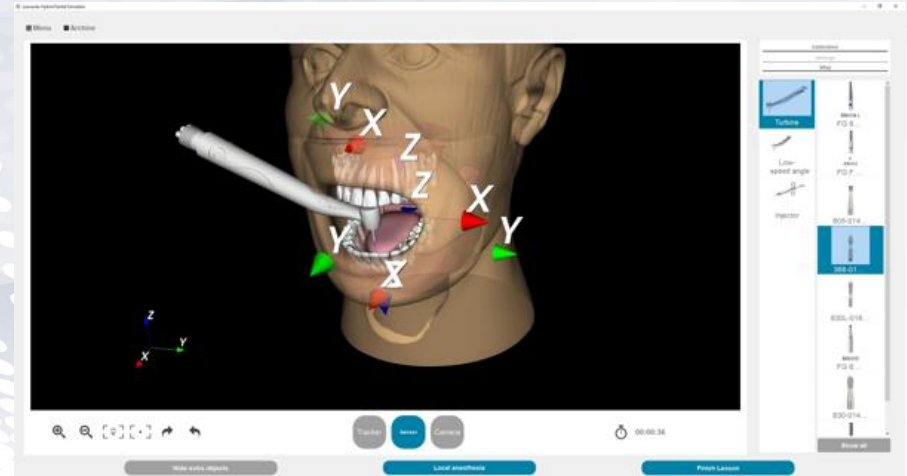
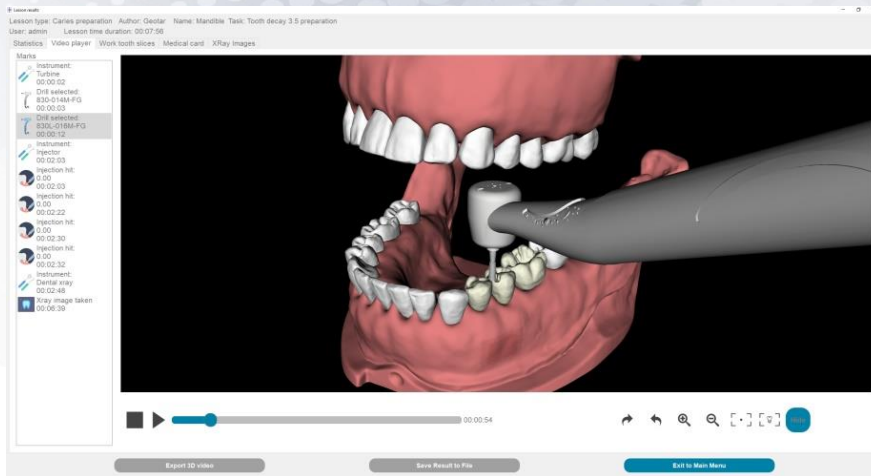
- Used tools are real HP and Typodont without any trackers
- No more heavy trackers attached to dental tools
- Simple and real automated calibration
- Integration with major brand of Typodont selected by the dental institution
- No more issue with smooth tracking system
- Cavity preparation procedures designed by dental instructors and integrated easily in the simulator
- Radiography Module
- Anesthesiology Module
- More in development (Hygiene Module)





REAL TIME 3D-VISUALIZATION

- AR is enabling the user to visualize his Handpiece positioning in real time
- Real time Feedback provided in 3D rendering similar to digital scanning
- Handpiece doesn't need a tracker so the user feels like he works with a regular Handpiece





UNIQUE LIBRARY OF CLINICAL CASES

- Cases on anesthesia
- Cases on cariology
- Cases on crown preparation
- Custom Cases from real patients

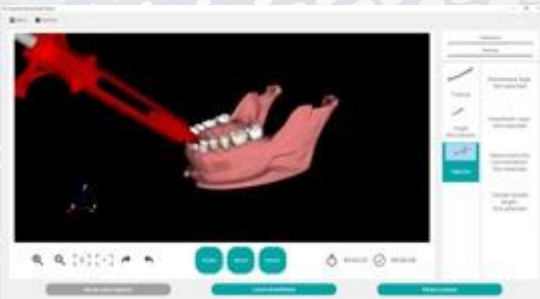
Leonardo Hybrid Dental Trainer

#	Author	Name	Task
2	Geotar	Maxilla	Anesthesia for tooth 1.7
6	Geotar	Mandible	Anesthesia for tooth 3.5
5	Geotar	Mandible	Anesthesia for tooth 4.2
8	Geotar	Mandible	Free drill mode
0	Geotar	Mandible	Tooth 3.2 Orthodontia
4	Geotar	Mandible	Tooth 4.4 Orthodontia
1	Geotar	Maxilla	Carious cavity preparation in tooth 1.7
7	Geotar	Mandible	Carious cavity preparation in tooth 3.5
3	Geotar	Mandible	Carious cavity preparation in tooth 4.2

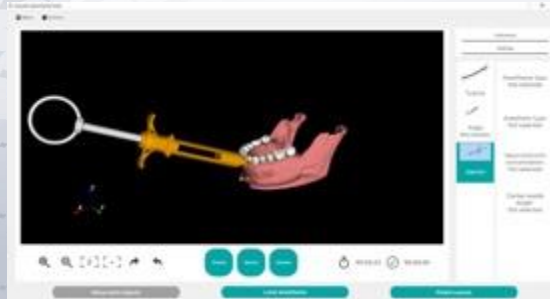


LESSON MODE

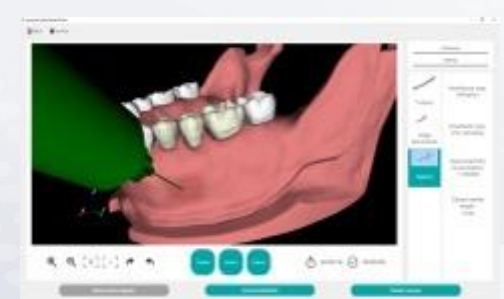
- In a lesson mode a color of the syringe changes from red to green depending on the needle position



Incorrect



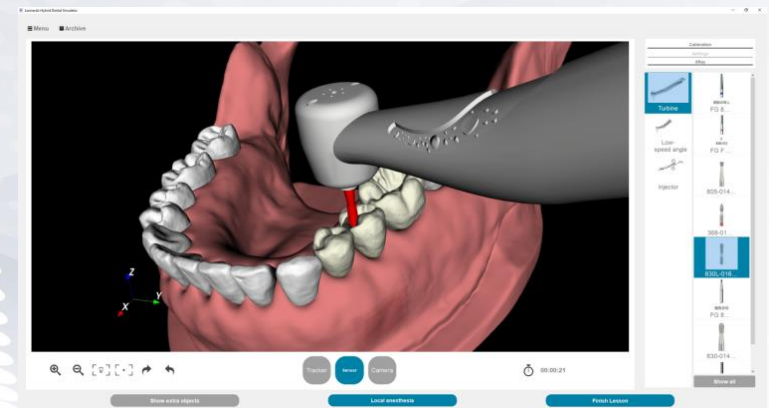
Nearly correct



Correct

- The gum is colored in 2 shades of grey for the injection

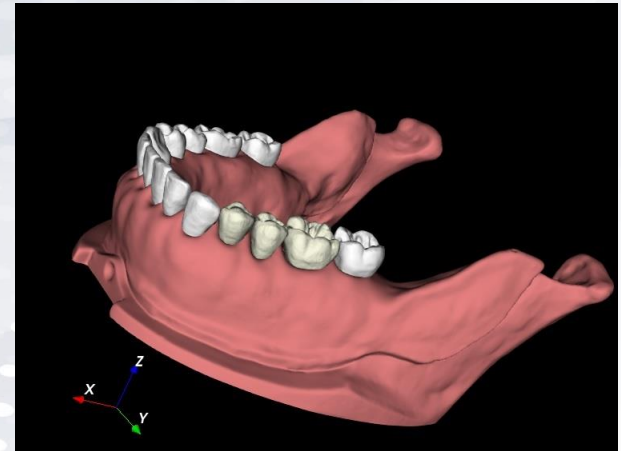
- The correct/incorrect angle of the bur is indicated by green or red color





EXAMINATION MODE

- A color of the syringe doesn't change depending on the needle position
- The gum isn't colored in shades of grey for the injection
- The correct/incorrect angle of the bur is not indicated by any color
- The teacher sets an exam's duration





LOCAL ANESTHESIA MODULE

- Available as a separate module or as a part of a Preparation case
- Each case contains a detailed description (complaints, patient history, data for an objective examination of oral cavity, X-rays, videos etc.)





PATIENT MANAGEMENT CASES

Student's operation with a patient: collecting a medical history, choosing the right anesthetic and correcting the vasoconstrictor's concentration based on a patient history. Then a procedure can be performed

The screenshot displays the Leonardo Hybrid Dental Trainer interface. At the top, there are two window titles: "Leonardo Hybrid Dental Trainer". The main area is divided into two columns: "Questions:" on the left and "Answer:" on the right. The "Questions:" column contains a list of medical history questions, with the third question, "Let's measure your blood pressure", highlighted in green. The "Answer:" column shows the response "130/85 mm Hg - optimal". Below the questions and answers, there are two buttons: "Add question to the medical card" (highlighted in green) and "Ask more questions" (greyed out). The "Medical card" section at the bottom left features a cartoon illustration of a female patient with brown hair. To the right of the illustration, the text "Added to the medical card questions number: 6" is displayed. Below this, a scrollable list shows the questions and answers from the current case: "Question: - Brain concussion Answer: - NO", "Question: - Varicose veins of the lower limbs, thrombophlebitis Answer: - NO", "Question: - Asthma Answer: - YES", and "Question: - Let's measure your blood pressure Answer: - 130/85 mm Hg - optimal". At the bottom of the interface, there are three buttons: "Back" (greyed out), "Local anesthesia" (highlighted in green), and "Start lesson" (highlighted in green).



ANESTHESIA SELECTION

According to the current case and patient's answers a student has to select:

- Anesthesia type
- Anesthetic type
- Vasoconstrictor concentration
- Length of the needle

Anesthesia type

Not selected
Infiltration
Intraseptal
Nerve block

Anesthetic type

Not selected
2% Lidocaine
3% Mepivacaine
4% Articaine

Vasoconstrictor concentration

Not selected
1:100000
1:200000
None

Dental needle length

Not selected
Medium
Long
Short

Back

Continue

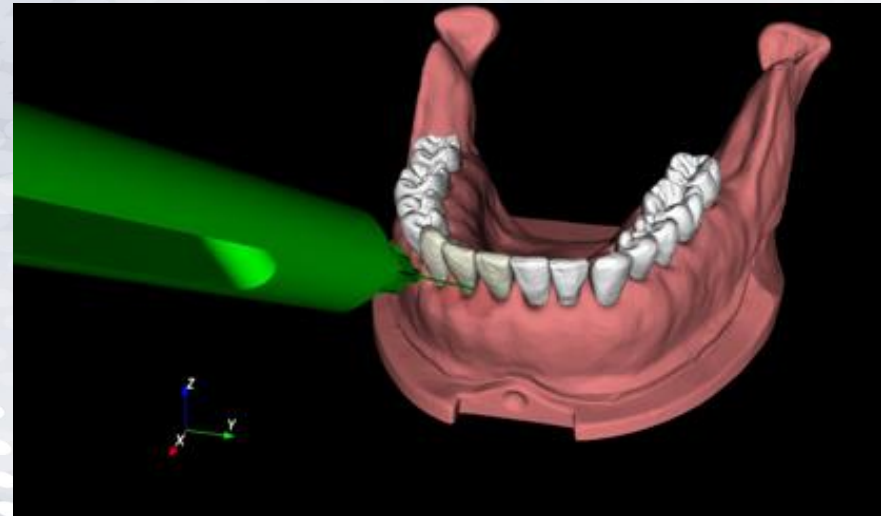


INJECTION

- There is an area for each case for making a correct injection on a virtual model using a real syringe and needle relevant to the procedure and medical history

SW tracks:

- Injection site
- Injection speed
- Injected anesthetic volume
- Number of attempts





OPERATIVE DENTISTRY

- Cases are based on a conservative preparation
- Each model contains a simulated cavity to remove
- Each case contains local anesthesia
- Burs added at the user discretion and not imposed by SW

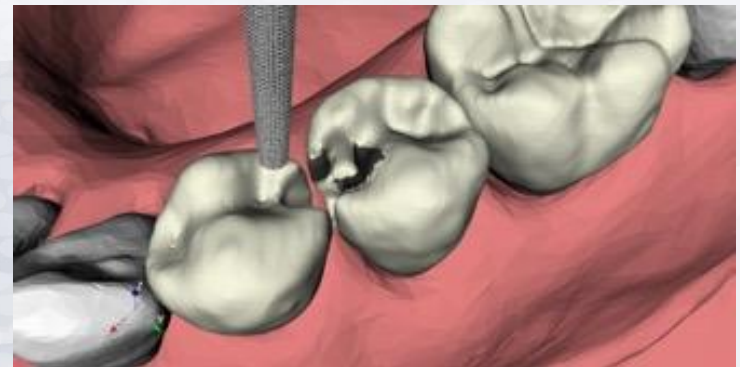




CARIOLOGY ASSESSMENT

At the end of the session a student will get a detailed report on a clinical criteria of preparation:

- Deleted carious tissue (%)
- Healthy tissue damaged (%)
- Pulp damage (%)
- Soft tissue damage
- Neighbour teeth damage
- Retention
- Outline shape





ANESTHESIOLOGY ASSESSMENT

Detailed report on local anesthesia:

- Anesthesia type
- Anesthetic type
- Vasoconstrictor concentration
- Dental needle length
- Injected Volume
- Speed of injection

Results

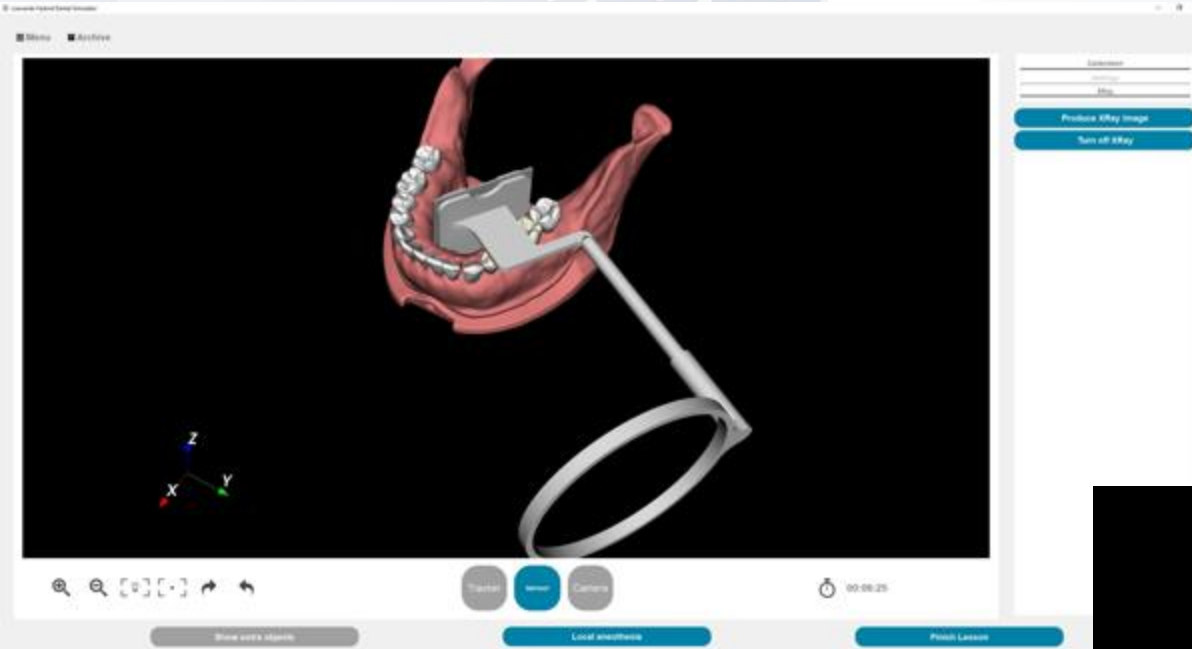
Deleted caries tissue	41.8%
Healthy tissue damage	1.2%
Pulp damage	0.4%
Efficient work time	44.0%
Injection accuracy	100.0%
Soft tissue damage	No
Neighbour teeth damage	No
Injected medicine volume	1.8 ml
Injected medicine speed	19.8 ml/min

Local anesthesia results

Anesthesia type	Intraseptal	OK
Anesthetic type	3% Mepivacaine	OK
Vasoconstrictor concentration	1:100000	Wrong
Dental needle length	Long	Wrong

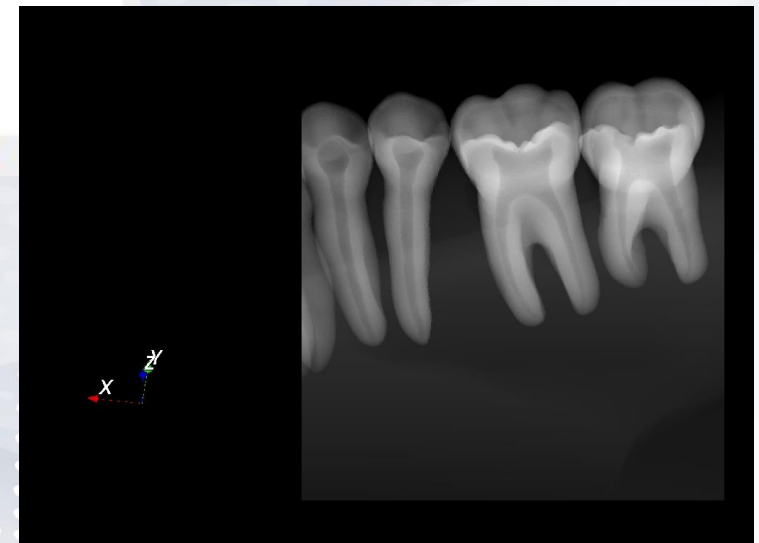


RADIOLOGY MODULE



X-ray image can be taken on low and upper jaws

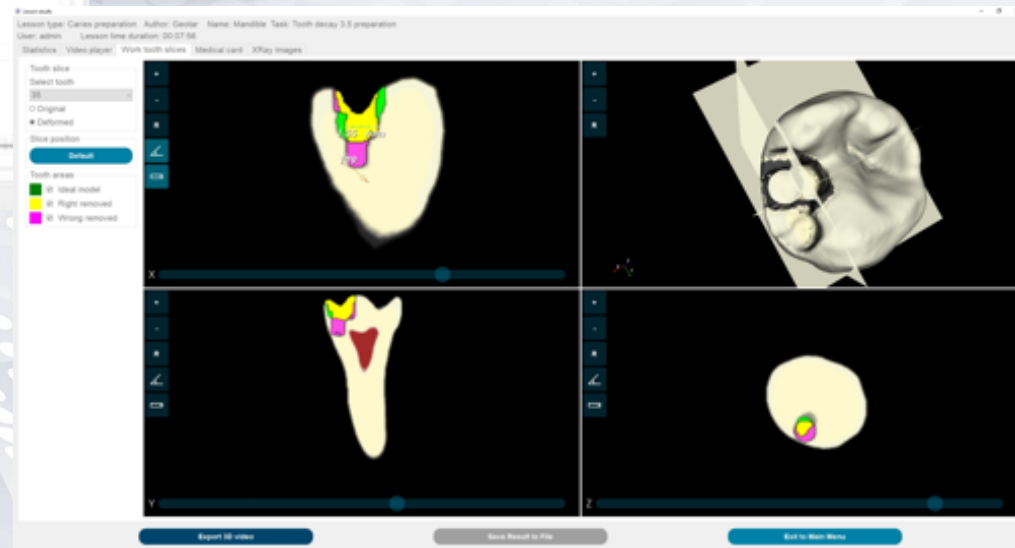
Every image is saved in a library and available for debriefing





ASSESSMENT

Report is generated according to a student's selection of relevant parameters depending on what student is tested on





PATIENT MANAGEMENT ASSESSMENT

A teacher can also review all questions and answers from medical history data collected to the procedure accomplished by the student

The screenshot displays a software window with the following content:

- Lesson type: Caries preparation mode
- Author: Geotar
- User: Standable
- Task: Carious cavity preparation in tooth 4.2
- User: admin
- Statistics: Video player Medical card
- Anamnesis score: 20
- Question: - History of a stroke
- Answer: - NO
- Question: - Varicose veins of the lower limbs, thrombophlebitis
- Answer: - NO
- Question: - Let's measure your blood pressure
- Answer: - 130/85 mm Hg - optimal
- Question: - Brain concussion
- Answer: - NO
- Question: - Asthma
- Answer: - YES
- Question: - For women: are you pregnant/are you a nursing mother?
- Answer: - NO

At the bottom of the window, there are two buttons: "Save Result to File" and "Exit to Main Menu". On the left side of the interface, there is a cartoon illustration of a female patient with dark hair and a light blue top.



DEBRIEFING OR SESSION REVIEW

- 3D-player with a zoom and rotation tool option
- Real video capture from the camera synchronized with 3D-player enabling the instructor to check ergonomic and posture
- Real Video capture eliminates issues of cheating during testing
- Real Video capture enables to control classroom environment remotely

Statistics | Video player | Medical card


Marks

- Instrument:Turbine 00:00:01
- Drill selected:FG 836/0 00:00:02
- Instrument:Injector 00:00:10
- Injection hit:33.00 00:00:13
- Instrument:Turbine 00:00:23
- Drill selected:FG 836/0 00:00:24
- Drill selected:FG 856/0 L00:00:25
- Instrument:Angle Micromotor00:00:48
- Drill selected:RA 57 00:00:49
- Instrument:Turbine 00:00:50
- Drill selected:FG 805/0 00:00:51



11-06-2017, Mon 15:19:51

Continue Stop 00:00:15





LEARNING MANAGEMENT SYSTEM



LEONARDO
Hybrid Dental Simulator

Login

Password

Log in

Exit

Use network mode

- **Allows to store all files locally on the simulator and on the server**
- **Review of the training progress by trainees, groups, courses**