

# Learning Metrics using Dental Simulation



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# Study Design

- 50 pre dental students
  - 25 students used traditional methods
  - 25 students used advanced simulation
- Students were instructed how to prepare a class I mandibular preparation on tooth 36 and how to operate equipment.
- Each student was given 5 teeth to prepare.

# Study Design

- Students on DentSim were able to see the monitor during preparation procedures and switch to evaluation mode while preparing.
- The students without Dentsim used the Dentsim unit, but did not have access to the monitor.
- The same person provided all instructions to the students. Students could not use the units by themselves except for the experiments.
- All work was evaluated by DentSim for consistency.

# Determining Depth and Long Axis

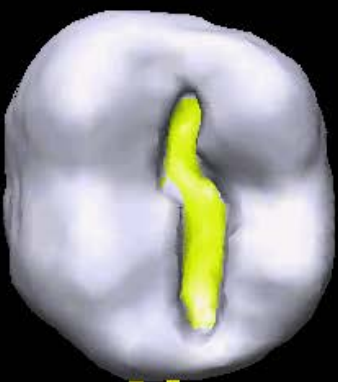
	DentSim	Non-DentSim
Depth Perception	3.5 hours	7 hours
Long Axis Determination	0.5 hours	2.5 hours
Long Axis Preparation	12 hours	30 hours

# Student Instructions

- Students prepare class I prep and evaluate work.
  - Compared how students complete preparations with access to feedback at any time vs when they have to ask for help.
  - Compare scores from preparations
  - Compare scores on complex concepts
    - Outline Shape
    - Retention
    - Wall angles
    - Floor smoothness
    - Wall smoothness

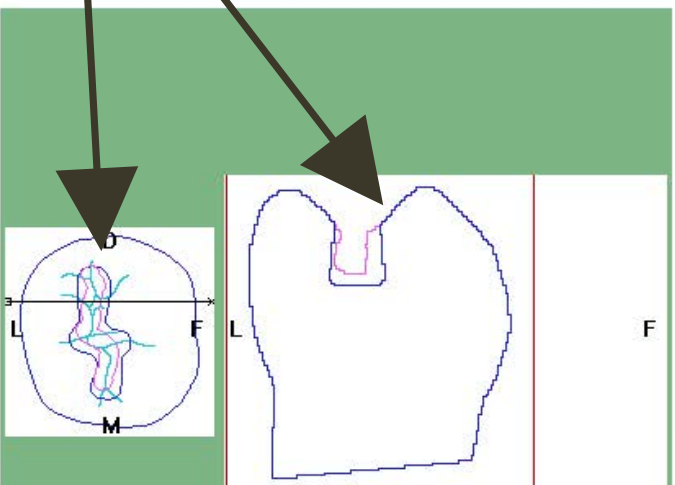
# Outline Form

**Image Navigation** Cavity Preparation: Class-I O 36 Beginners1V2 admin 2/22/2012 8:10:32 PM



**Details of Error**  
Revise extension to include mesial pit.  
Extend L groove.  
**Widen distal isthmus.**

Optimal: 1.7 mm (width of cavity at current section)  
Student's: 1.0 mm (width of cavity at current section)  
Deviation: -0.7 mm



**List of Messages**

1. Caries eliminated
2. Cross sections
3. **Outline Shape - 6**
4. Outline centralization - 0
5. Floor depth - 7
6. Walls angles - 3

— optimal  
— student's

**2**  
Points reduced

**Student's**

Grade 84

Session Time: 0:10:16


Main Menu Lesson mmHelper Quit

Start Done Reload

H245-008

# Outline Form

Image Navigation    Cavity Preparation: Class-I O 36 Beginners1V2    admin 2/22/2012 8:10:32 PM



**Details of Error**  
**Widen distal isthmus.**

↑

Optimal: 1.7 mm (width of cavity at current section)  
Student's: 1.2 mm (width of cavity at current section)  
Deviation: -0.6 mm

**List of Messages**

1. Caries eliminated - 0
2. Cross sections
3. Outline Shape - 2
4. Outline centralization - 0
5. Floor depth - 4

5 mm  
5 mm

optimal  
student's

2  
Points reduced

Student's

Grade 94

Start  
Done  
Reload

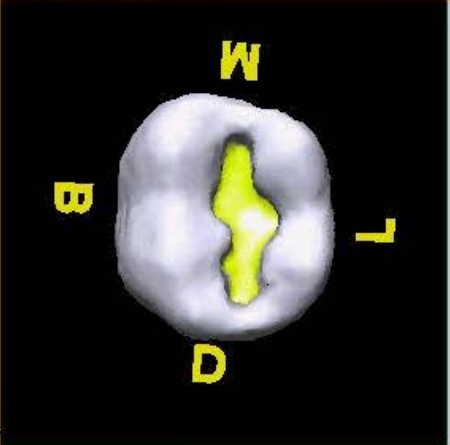
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Main Menu    Lesson    mmHelper    Quit



# Wall Incline Correction

Image Navigation Cavity Preparation: Class-I O 36 A2 admin 8/27/2012 4:45:03 PM



**Details of Error**  
L groove wall is not evaluated - wall is not smooth. ▲  
**B wall of D isthmus is excessively inclined buccally.**  
D marginal ridge wall is insufficiently inclined distally ▼

Optimal: -5 deg (wall inclination)  
Student's: -5 deg (wall inclination)  
Deviation: -10 deg

**List of Messages**

1. Caries eliminated
2. Cross sections
3. Outline Shape - 2
4. Floor depth - 2
5. Floor smoothness - 3
6. **Walls incline - 4**
7. Wall smoothness - 1
8. Retention - failed

1 Points reduced

Optimal

Student's

Grade 47

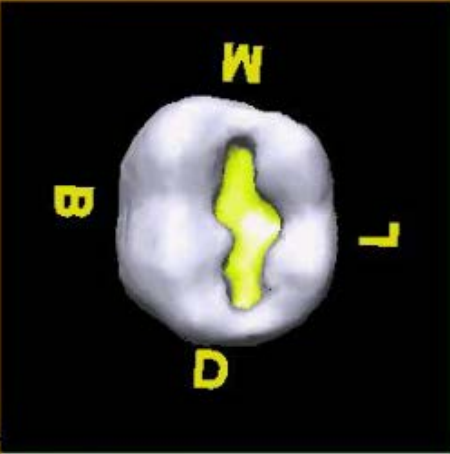
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Main Menu Lesson mmHelper Quit



# Wall Incline Correction

Image Navigation Cavity Preparation: Class-I O 36 A2 admin 8/27/2012 4:45:03 PM



**Details of Error**


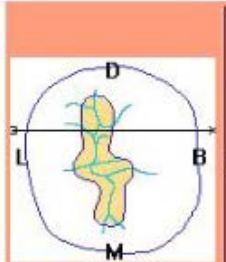
- D isthmus near B-L grooves Cross section
- D Isthmus Cross section**
- D area B-L Cross section

.5 mm .5 mm

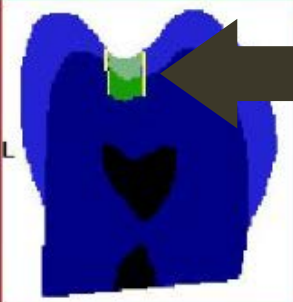
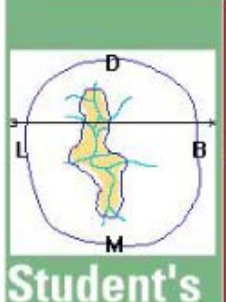
**List of Messages**

1. Caries eliminated - 0
- 2. Cross sections**
3. Outline Shape. - 2
4. Floor depth - 2
5. Floor smoothness - 3
6. Walls incline - 3
7. Wall smoothness - 1
8. Retention - failed

**Optimal**



**Student's**



H245-FG

Grade 48

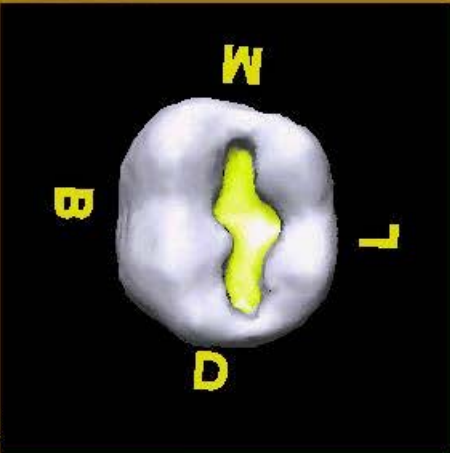
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Session Time: 0:06:14

Main Menu Lesson mmHelper Quit

# Wall Incline Correction

Image Navigation Cavity Preparation: Class-I O 36 A2 admin 8/27/2012 4:45:03 PM



Details of Error

- D isthmus near B-L grooves Cross section
- D Isthmus Cross section**
- D area B-L Cross section

0.5 mm 0.5 mm

List of Messages

1. Caries eliminated - 0
- 2. Cross sections**
3. Outline Shape. - 2
4. Floor depth - 2
5. Floor smoothness - 3
6. Walls incline - 3
7. Wall smoothness - 1
8. Retention - failed

Optimal

Student's

Grade 48

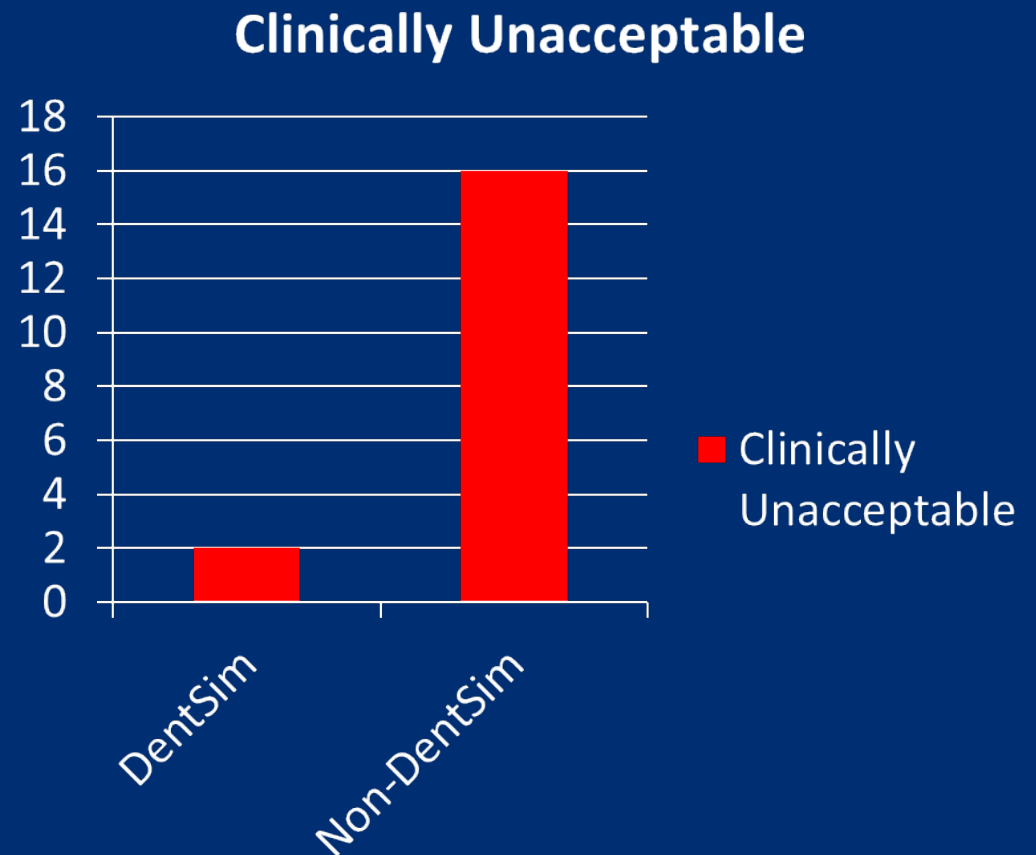
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Main Menu Lesson mmHelper Quit

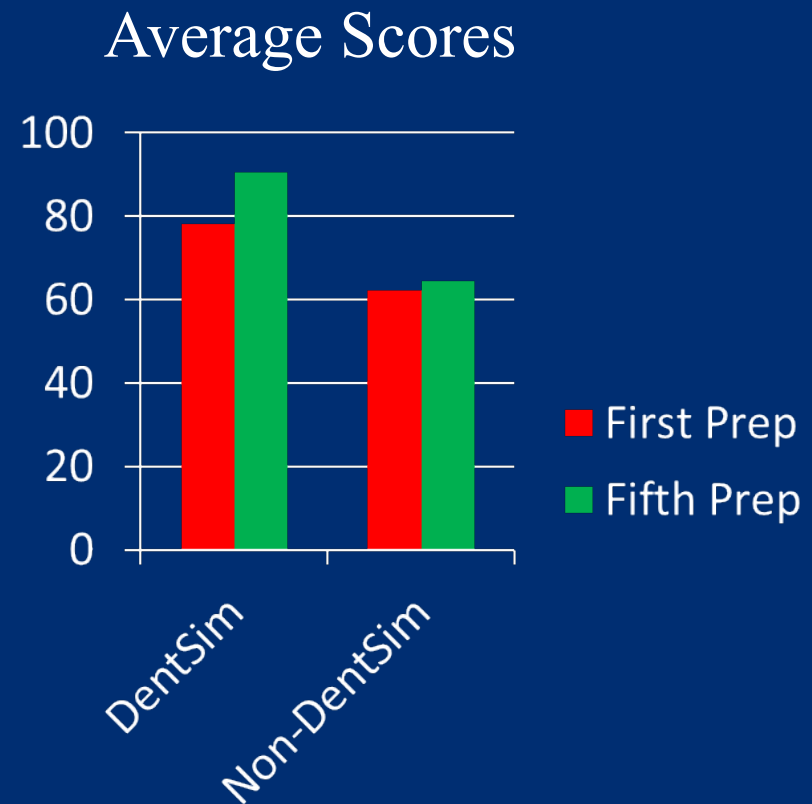
# Clinically Unacceptable Errors

Students using DentSim were able to evaluate their work until they had reduced their clinically unacceptable errors. Students without access to the evaluation mode made significantly more clinically unacceptable errors.



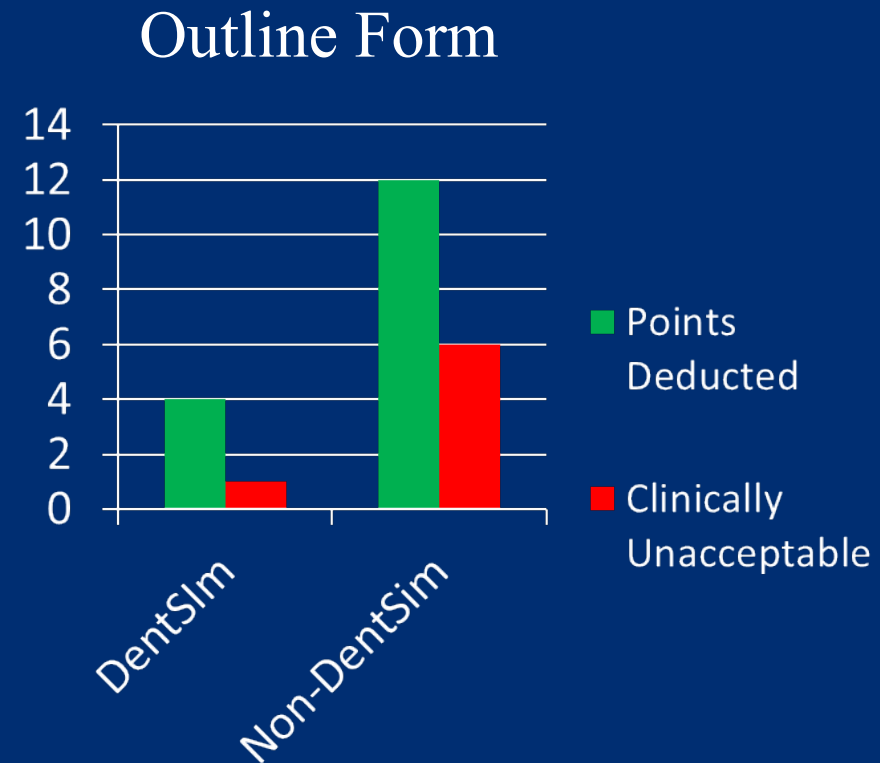
# Overall Scores on Preparations

- Students using DentSim improved their scores on average from 78.26 to 90.47 between their first and fifth attempts.
- Students not using DentSim saw approximately a 2 point average increase in their score between their first and fifth attempts at their preparation.



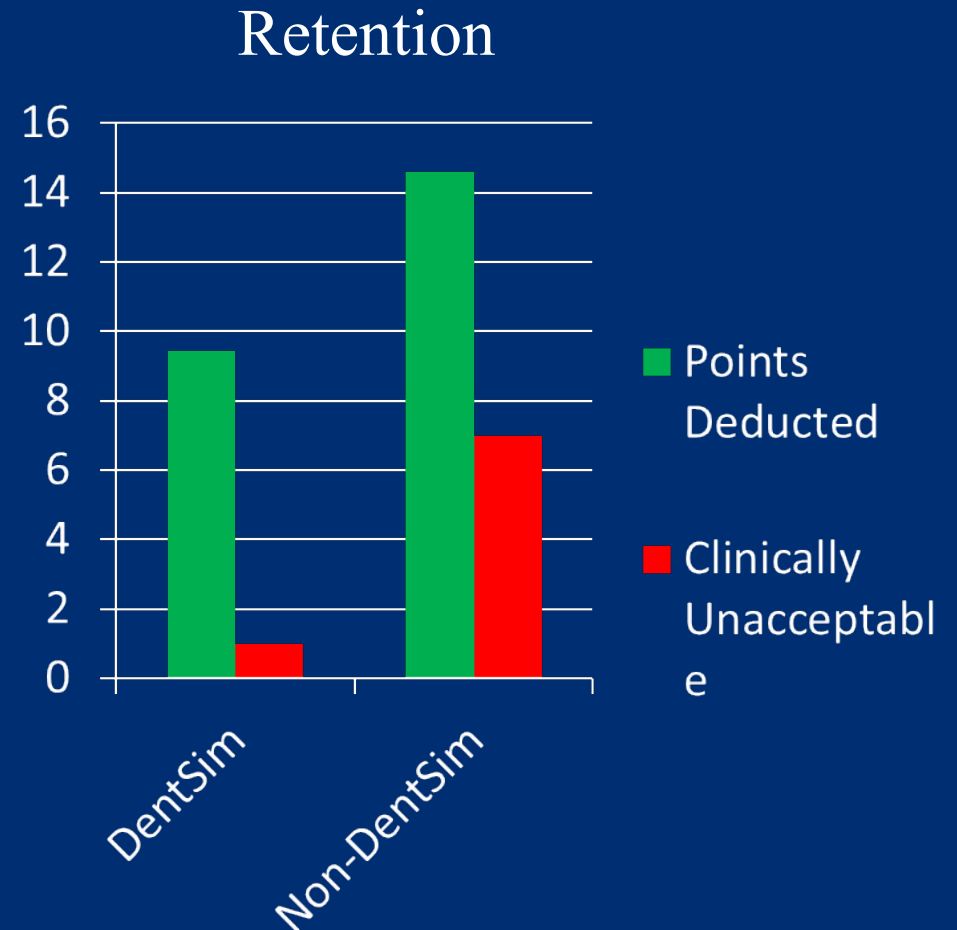
# Outline Form

- Students using the evaluation mode had fewer points deducted.
- Overall students with access to feedback had fewer clinically unacceptable errors in outline form.



# Wall Incline

- Students on DentSim had fewer points deducted for retention and had fewer clinically unacceptable errors compared to students who did not have access to the evaluation mode.





# Conclusions

- Students improved their learning using simulation.
- Students with access to unlimited feedback use this whenever they need to and are therefore able to reduce the amount of clinically unacceptable errors and improve their overall score.
- Provide the students constructive, objective feedback.

# Thank you

