Learning Metrics using Dental Simulation

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Study Design

• 50 predental 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

<table>
<thead>
<tr>
<th></th>
<th>DentSim</th>
<th>Non-DentSim</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth Perception</td>
<td>3.5 hours</td>
<td>7 hours</td>
</tr>
<tr>
<td>Long Axis Determination</td>
<td>0.5 hours</td>
<td>2.5 hours</td>
</tr>
<tr>
<td>Long Axis Preparation</td>
<td>12 hours</td>
<td>30 hours</td>
</tr>
</tbody>
</table>
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

Cavity Preparation:
Class-I: 0.36 Beginners/V2

Details of Error
Widen distal isthmus

Optimal: 1.7 mm (width of cavity at current section)
Student: 1.2 mm (width of cavity at current section)
Deviation: -0.5 mm

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

Student's

Points reduced

Session Time: 0:24:32
Wall Incline Correction

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

Grade: 7
Wall Incline Correction
Wall Incline Correction
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.
• Students using the evaluation mode had fewer points deducted.
• Overall students with access to feedback had fewer clinically unacceptable errors in outline form.
• 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