Integration of New Technology

Change
Consideration (Why?)

• Purpose
  – Need
  – Desire
Consideration (Why?)

- **Purpose**
  - **Need**
    - Limited faculty
    - Limited time
    - Limited space
  - **Desire**
    - Improve instruction
    - Up to date
    - Set the curve
Questions

• Does it really work?
• Is it better than what we are currently using?
• Will it save me time?
• Will it save me money?
• Is it something we should be teaching?
Cost

- Expense (cost/benefit)
  - Initial
    - Equipment, supplies, training
  - Continued
    - Supplies, maintenance

- Budget
- Grants
Cost

We must be able to justify the expense!
Compatibility

- Philosophy/Direction
  - Administration/Faculty Buy-in
- Facility
  - Machinery
  - Associated materials (inventory)
- Logistics
  - Implementation
  - Transition
  - Sustainability
- IT
  - Security
  - Storage/Archive
  - Installation
Examples

Digital Records
Digital Radiographs
Intra-oral cameras
DentSim
CAD CAM
E-books
E-curriculum
Lasers
haptics
What is CAD CAM?

CAD CAM

Computer Aided Design

Computer Aided Manufacturing
How it Works

CAD CAM

DIU’s
Chair side CAD CAM
CAD CAM remote
DIU’s

- Itero (Cadent)
- Lava COS (3M ESPE)
  (chairside oral scanner)
Chair side CAD CAM

- CEREC (Sirona)
- E4D (D4D)
How it Works
How it Works
Questions

• Does it really work?
• Is it better than what we are currently using?
• Will it save me time?
• Will it save me money?
• Is it something we should be teaching?
Questions

• Does it really work?
• Is it better than what we are currently using?
• Will it save me time?
• Will it save me money?
• Is it something we should be teaching?
Does it really work?

- Fit, Marginal Integrity
- Esthetics
- Longevity
- Strength
- Wear Characteristics
- Post-Operative Sensitivity
REVIEW OF LITERATURE

CLINICAL Efficacy of CEREC 3 All-ceramic Restorations:
A 20-Year History of Peerless Performance

It is now nearly two decades after the market introduction of the CEREC System for the manufacture of all-ceramic dental restorations. CEREC can fabricate restorations for all single-unit clinical indications: inlays, onlays, partial crowns, crowns (posterior & anterior), and veneers. With over 7,000,000 restorations placed since the introduction of CEREC technology in 1987, CEREC is one of the most researched restorative systems on the market, with documented success rates of more than 90% after 10 years. Unlike other indirect processes, CEREC restorations are milled from solid, homogeneous blocks of all-ceramic material. The production process for CEREC blocks ensures optimal consistency with very little variation in strength or quality. Ceramics used for CEREC restorations display enamel wear characteristics more compatible to natural tooth enamel than other materials. CEREC materials, manufactured by Vita, Ivoclar, and 3M ESPE, are available in a wide array of shades and translucencies. The studies featured in this document highlight the exceptional clinical performance and longevity of CEREC all-ceramic restorations.

LONGEVITY

Many advances in dental technology have taken place since the introduction of CEREC in 1987. As CEREC has evolved, so have adhesive bonding techniques and methods. The studies below attest to the longevity of CEREC restorations. While these results attest to the longevity of CEREC, it is important to note that improvements in both CEREC technology and bonding techniques promise to produce even better results for restorations being placed today and in the future.

Longevity of 2328 chairside CEREC inlays and onlays.
Postle A, Kernbach T.

In a dental practice, 2328 ceramic inlays were placed in 704 patients. The restorations were manufactured chairside using CEREC technology and adherently inserted at the same appointment. The clinical performance of the restorations was evaluated with the Kaplan-Meier analysis. The probability of survival was 95.3% after 8 years; 31 CEREC restorations were judged as failures. The prognosis for success was not significantly influenced by restoration size, tooth vitality, treatment of caries remnants (CP), type of tooth treated, or whether the restoration was located in the maxilla or mandible. The most common type of failure was the extraction of a tooth. In a clinical follow-up light-microscopic examination of 44 randomly selected restorations, an average composite joint width of 236.3 microns was found. 43.1% of the restorations exhibited a perfect margin, and 47.9% of the investigatory joint sections showed underfilled margins.

Otsu T, De Nisco S.

PURPOSE: The objective of this follow-up study was to examine the performance of CEREC inlays and onlays in terms of clinical quality over a functional period of 10 years. MATERIALS AND METHODS: Of 300 CEREC inlays and onlays placed in a private practice between 1992 and early 1994, 187 restorations were observed over a period of 10 years. The restorations were fabricated chairside using the CEREC-1 computer-aided design/manufacturing (CAD/CAM) method and Vita MK 1 feldspathic ceramic. An adhesive technique and bonding composite resins were used for seating the restorations. After 10 years, the clinical performance of the restorations was evaluated using modified UPHS criteria. The results were used to classify success and failure. RESULTS: According to Kaplan-Meier analysis, the success rate of CEREC inlays and onlays dropped to 90.4% after 10 years. A total of 15 (8%) failures were found in 11 patients. Of these failures, 73% were caused by either ceramic fractures (53%) or tooth fractures (20%). The reasons for the remaining failures were caries (20%) and endodontic problems (7%). The three-surface CEREC reconstructions were found to have the most failures. CONCLUSION: The failure rate of 90% and the drop of the survival probability rate to 90.4% after 10 years of clinical service of CEREC-1 CAD/CAM restorations made of Vita MK 1 feldspathic ceramic appear to be acceptable in private practice. This is particularly true in light of the very high patient satisfaction.

Longevity of restorations in posterior teeth and reasons for failure.
Hickel R, Mombert J.
Clinical evaluation of self-adhesively placed CEREC endo-crowns after 2 years—preliminary results.

Brend A, Mjorland WH.

PURPOSE: Non-vital endodontically treated posterior teeth with complete loss of crown hard tissues were prepared with a circular equatorial cut and marginal and central retention cavity of the entire postspace (“endo-preparation”). Computer-generated ceramic-crown-rotorular restorations (CEREC endo-crowns) were bonded to these preparations. The purpose of this study was to evaluate the survival rate and the clinical quality of CAD/CAM endo-crowns after 2 years. MATERIALS AND METHODS: 19 CEREC endo-crowns (4 premolars and 15 molars) in 13 patients were examined using modified USPHS criteria at baseline and after an average of 26 months. The ratings of the two examinations were compared. RESULTS: The service time of the 19 endo-crowns was 14 to 35.5 months (mean ± SD 26.6 ± 6.8) months. One molar endo-crown failed after 28 months due to recurrent caries. CONCLUSION: The clinical quality of the CEREC endo-crowns was very good, and so far, the clinical concept appears feasible.


Clinical performance of CEREC ceramic inlays: a systematic review.

Martin N, Jedynakiewicz NM.

OBJECTIVE: The systematic review of trial data seeks to identify the clinical performance of inlay/onlay CEREC restorations placed with an adhesive composite technique. The focus of the review is to establish the survival rate of these restorations and to identify the factors that may influence their survival.

METHOD: A comprehensive literature search was undertaken, spanning from the year of introduction of the technology, 1986 to 1997. The review identifies all relevant studies comparing the clinical performance of inlay/onlay CEREC restorations placed with an adhesive composite technique. Throughout the critical appraisal, each individual study was evaluated to identify the amount of data available, the methodology used, and the results obtained. RESULTS: 29 clinical reports were identified in the search. The systematic analysis produced a figure of 15 studies. The data available established CEREC ceramic inlays as a clinically successful restorative method with a 97.4% survival rate over a period of 4.2 years. The review also highlights the reasons and the rates of failure for this type of restoration.


PURPOSE: To determine the fracture resistance of teeth, following treatment with various types of adhesive restorations. MATERIALS AND METHODS: 50 carious-free, extracted human molars were randomly divided into five groups consisting of 10 molars each. MOD cavities were prepared in 40 molars with a width of 30 µm in the facio-lingual direction of 5% of the occlusal depths. The cavities were filled with the following materials: CEREC or IPS Empress ceramic inlays, Anabak or Charisma F resin-based composite (RTC) restorations. The control group consisted of 10 sound, non-cavitated molars. All 50 teeth were loaded occlusally until fracture using a tensile testing machine. The statistical analysis included ANOVA, Kolmogorov–Smirnov test, Scheffe test, and Bonferroni.

RESULTS: There was no significant difference (P > 0.05) between the mean values of the sound teeth (2,102 N) and the teeth with the CEREC ceramic inlays (2,190 N). However, both groups demonstrated a significant difference (P < 0.05) when compared with the teeth with IPS Empress ceramic inlays (1,459 N) and Anabak RBC restorations (1,459 N).


Investigation of human enamel wear against four dental ceramics and gold.

Al-Hiyasat AS, Saunders WP, Sharkey SW, Smith GM, Gilmore WH.

OBJECTIVES: This in vitro study compared the wear of enamel against alumina porcelain, bonded porcelain, low-fusing hydrothermal ceramic, fieldspathic machinable ceramic, and cast gold. METHODS: Fifty pairs of tooth-material specimens were tested in a dental wear machine, under a standard load (40 N), rate (80 cycles min-1) and for 25,000 cycles in distilled water. The amount of wear was determined by measuring the weight loss of the tooth, and the depth of wear track of the restorative material. RESULTS: There was a significant difference in wear among the groups for both enamel and materials (P < 0.001). Follow-up comparisons (95% CI significance level) showed that gold caused significantly less enamel wear than all ceramics tested. The amount of enamel wear in the alumina and bonded porcelain groups was significantly higher than with the hydrothermal and machinable ceramic groups. There was no significant difference between the amount of enamel wear produced by the alumina and bonded porcelain groups nor between that produced by the hydrothermal and machinable ceramics. Furthermore, the wear of the alumina and bonded porcelain was significantly greater than that of the hydrothermal ceramic, the machinable ceramics and gold. No significant difference in wear was found between alumina and bonded porcelain, hydrothermal and machinable ceramics, or between machinable ceramic and gold. However, the hydrothermal ceramic had significantly greater wear than gold. CONCLUSION: It was concluded that the hydrothermal and the machinable ceramics were significantly less abrasive and more resistant to wear than the conventional aluminas and bonded porcelains. Gold was the least abrasive material and most resistant to wear, although the difference in wear between the machinable ceramic and gold was not statistically significant.

Post-operative Sensitivity

Patients report CEREC restorations for many reasons: long-lasting, single-appointment convenience, tooth-colored, biocompatibility, etc. Another benefit of CEREC materials is the documented lack of post-operative sensitivity. Satisfied patients provide quality referrals and are more likely to accept future treatment plans.


Post-op sensitivity related to type of restoration and material.

Data from 8 different CRA clinical studies conducted over 11 years were compiled in this study. Approximately 45 restorations for each 31 material benchmarks were placed by about 20 different dentists in each of the studies. CEREC inlay/onlay restorations machined from Vita Mark II fieldspathic porcelain showed 0% post-operative sensitivity.


Place the IOD wand in the patient’s mouth and then press the foot switch to scan.
Integration

• Freshman
  – Technology introduction
  – Dental anatomy
• Sophomore
  – Restorative Dentistry
• Junior
  – Crown & Bridge, Esthetics
• Senior
  – Clinical application
• Residents/Faculty
  – Clinical Productivity
Good morning all,

First, thank you for the time to demo this solution. This is really interesting technology and looks to be a great tool. We discussed and feel that the solution that we saw would work for a single environment. We are not supportive of this solution as an enterprise system. There are several reasons for this and if the vendor feels they can make adjustments to the product then we can evaluate any changes.

The reasons which do not support an enterprise roll out are as follows:
1) There is no authentication support. Basically anyone can obtain access to these images from any workstation.
2) There is no manageable storage method for these images. These images are stored on individual computers and no method to locate them on network or centralized device.
3) The imaging stations can point to any job server on a network with no naming standards to provide users with knowledge of where they are stored.
4) Anti-virus is not something the vendor truly supports running on these workstations.

Please let us know if there is any additional information surrounding this idea.
We would be happy to talk about this at anytime.

Thanks
Questions

- Does it really work?
- **Is it better than what we are currently using?**
- Will it save me time?
- Will it save me money?
- Is it something we should be teaching?
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment

• Better
  – Support current methods
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment

• Better
  – Support current methods
  - Evening sessions
  - “Immediate self-assessment”
Questions

• Does it really work?
• Is it better than what we are currently using?
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• Will it save me money?
• Is it something we should be teaching?
Questions

- Better
  - Adjunct
  - Accessibility
  - Assessment

- Save time
  - Practicals (reduce subjectivity)
  - Learning Curve
  - Teaching time

- Better
  - Support current methods
  - Evening sessions
  - “Immediate self-assessment”

- Save time
  - Scan models
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment

• Save time
  – Practicals (reduce subjectivity)
  – Learning Curve
  – Teaching time

• Better
  – Support current methods
  – Evening sessions
  – “Immediate self-assessment”

• Save time
  – Scan models
  - Yet to be seen
  - Less time grading
Questions

• Does it really work?
• Is it better than what we are currently using?
• Will it save me time?
• **Will it save me money?**
• Is it something we should be teaching?
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment

• Save time
  – Practicals (reduce subjectivity)
  – Learning Curve
  – Teaching time

• Save money
  – Faculty
  – Immediate return?

• Better
  – Support current methods
  – Evening sessions
  – “Immediate self-assessment”

• Save time
  – Scan models
  – Yet to be seen
  – Less time grading
Cost

We must be able to justify the expense!

Executive Decision Making System
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment

• Save time
  – Practicals (reduce subjectivity)
  – Learning Curve
  – Teaching time

• Save money
  – Faculty
  – Immediate return?

• Better
  – Support current methods
  – Evening sessions
  – “Immediate self-assessment”

• Save time
  – Scan models
  – Yet to be seen
  – Less time grading

• Save money
  – May require fewer faculty
Questions

• Better
  – Adjunct
  – Accessibility
  – Assessment

• Save time
  – Practicals (reduce subjectivity)
  – Learning Curve
  – Teaching time

• Save money
  – Faculty
  – Immediate return?

• Better
  – Support current methods
  – Evening sessions
  – “Immediate self-assessment”

• Save time
  – Scan models
  – Yet to be seen
  – Less time grading

• Save money
  – May require fewer faculty
  – Cost savings...
Potential Savings

- Impression Materials
- Trays
- Lab bills
- Fewer appointments
- Less time between appointments
- Reduce “Re-makes”
## Test Summary

The following table presents a summary of the results of this test.

<table>
<thead>
<tr>
<th>Subject</th>
<th>CEREC MCXL</th>
<th>E4D Dentist</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual Milling Time*</td>
<td>Shorter by an average of 39% (for both materials combined)</td>
<td>Longer</td>
</tr>
<tr>
<td>Displayed milling time</td>
<td>Actual milling time often not the same as displayed milling time</td>
<td>Accurate</td>
</tr>
</tbody>
</table>
| Material Removal Rate               | Variable: Decreases as bur wears  
Effects: 
- Fewer bur failures  
- Increased actual milling time  
- Increased variability in displayed milling time | Constant: Remains constant as bur wears  
Effects: 
- Increased bur failures  
- Actual milling time remained constant  
- Enabled consistent reporting of displayed milling time |
| Fast milling mode                   | • Reduced actual milling time by 23% over slow mode  
• Increased bur changes by 83% over slow mode | • Reduced milling time by 28% over slow mode  
• No significant increase in bur change/breaks over slow mode |
| Cost of milling per crown* (burs, coolant, and lost blocks†) | $2.33/crown  
($1.67, $0.66, $0) | $3.30/crown  
($1.81, $0.56, $0.93) |
| Slow milling of IPS e.max CAD       | E4D Dentist mill experienced 166% more bur breaks/changes over the CEREC MCXL |                                                                            |
| Slow milling of IPS Empress CAD     | E4D Dentist mill experienced 50% more bur breaks/changes over the CEREC MCXL |                                                                            |
| Fast milling of IPS Empress CAD     | CEREC MCXL mill experienced 38% more bur breaks/changes over the E4D Dentist mill |                                                                            |

*Average value based on milling 400 crowns on each mill  †When mill interruptions caused complete loss of ceramic block
Questions

• Does it really work?
• Is it better than what we are currently using?
• Will it save me time?
• Will it save me money?
• Is it something we should be teaching?
Is it something we should be teaching?

• Is this technology here to stay?
• How will this knowledge and skill help our students?
Comparison

Advantages
• Less faculty time
• More productive faculty time
• After hours assessment
• Shortened learning curve
• Less subjectivity
• Clinical savings
• Increase Graduates’ “Marketability”

Disadvantages
• Initial Cost
• Training/Learning Curve
• Maintenance
• Space
Questions

• Does it really work?
• Is it better than what we are currently using?
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• Is it something we should be teaching?
Questions

• Does it really work?
• Is it better than what we are currently using?
• Will it save me time?
• Will it save me money?
• Is it something we should be teaching?
• Do I really want to?
Success

- It must work
- It must have a real purpose
- It must be sustainable
- It must have a champion(s)
- It must be “thought through”
- Adequate training
- Quality Control
Thank You