Keeping Up With the Technology of Restorative Dentistry

Next time you hear someone say technology is making us anti-social, show them this picture.
Technology to stay in touch and educate your patients:

magappapp.com

www.drsmanda.com
Keeping Up With the Technology of Restorative Dentistry

- Training (*learning curve*) and continued education
- Accuracy of digital scanning and quality of Cad/Cam restorations
- Efficiency of digital intraoral scanning (technique and dental lab communication)
- Cost analysis of single visit Cad/Cam restorations
- Work flow utilizing CBCT and Intraoral scanning/Cad/Cam technology
Training (learning curve) and Continued Education

Cad/Cam Training for All Level of Users

CEREC CURRICULUM COURSE FLOW

LEVEL 1
CEREC ACCEPT OFFERED THROUGH PATTERSON

LEVEL 2
CEREC MASTERY – RAPID INTEGRATION INTO YOUR PRACTICE

LEVEL 3
ADVANCED POSTERIOR QUADRANTS AND TOOTH REPLACEMENT

LEVEL 4
MASTERING CEREC ANTERIORS

LEVEL 5
CEREC INLAB PROFICIENCY

LEVEL 6
FUNDAMENTALS OF CEREC AND GALILEOS INTEGRATION
Training *(learning curve)* and Continued Education
Training (*learning curve*) and Continued Education
Training (*learning curve*) and Continued Education

Many ways to continue learning and advance skill level
Training (*learning curve*) and Continued Education

A *learning curve*
Excessive powdering of preparation

Training (learning curve) and Continued Education

- Tooth Preparation
- Site Management
  - Dental arch isolation
  - Heme control
  - Gingival retraction
- Intraoral Imaging with Scanner
- CAD/CAM software
Training (learning curve) and Continued Education

Circa 1993

Cad/Cam Scanner/Milling Chamber

Milling Chamber

Excessive powdering of preparation
Training (learning curve) and Continued Education

Circa 1993

Monitor screen view of scan

Virtual view of restoration
Training *(learning curve)* and Continued Education

In 1993 there was a steeper learning curve due to limitations of the software and milling capabilities.
Training (*learning curve*) and Continued Education
Cad/Cam Crown with inadequate adaptation

Emax/Cad Crown with excellent adaptation

Conventional PFM Crown with inadequate adaptation

Conventional PFM Crown with excellent adaptation
Training (*learning curve*) and Continued Education

Tooth Preparation

Visible, clean and smooth margins
Residual lipping of gingival margin

Milling chamber cannot mill entire defect accurately

Leads to defective margin

Need a complete understanding of milling chambers capabilities

Training (learning curve) and Continued Education
Wide isthmus width for lingual extension

Visible transition at cavosurface margins

Poor transition at cavosurface margins

Training (learning curve) and Continued Education

Wide isthmus width for lingual extension
Inadequate isthmus width for lingual extension increases the probability of porcelain fracture. Training (\textit{learning curve}) and continued education are essential for preventing such issues.
Occlusal surfaces of crown preparations need not be accentuated.

Training \textit{(learning curve)} and Continued Education

Accentuated occlusal surface

Correct reduction for porcelain crown

Occlusal surfaces of crown preparations need not be accentuate
Minor gingivectomy to increase crown margin visibility
Make certain not to leave tissue tags visible to scanner

Syringed clay based retraction/hemostatic agent

Retraction cord must be placed below crown margin...no fuzz above margin
Training (*learning curve*) and Continued Education
Dental (Rubber) Dam

Optimum barrier against crevicular fluids and oral cavity humidly

Training (*learning curve*) and Continued Education
Attaches to HVE
Isolates maxillary and mandibular arch at same time
Autoclavable base and HVE tube
Attaches to HVE
Disposable cheek/tongue shield and bite guard
Isolates maxillary and mandibular arch at same time

Training (learning curve) and Continued Education

Alternative Isolation
Training (*learning curve*) and Continued Education

Alternative Isolation

Excellent Isolation for anterior segments
Training (learning curve) and Continued Education

Types of Intraoral Cameras

1) Static Camera Systems
   - have a steeper handling learning Curve
   - slower imaging speed
   - camera angle criteria must be followed for accuracy

Static Intraoral Camera Imaging
Training (learning curve) and Continued Education

Static Intraoral Camera Imaging

Poor Static Intraoral Camera Image
2) Continuous Capture Color Streaming Systems

- featuring an ergonomic handpiece and special optics, the Omnicam camera has Color Streaming to allow for continuous capture of the oral cavity as well as displaying 3D data in full color. The system is completely powder-free.

- the slim, rounded camera tube provides for easy rotation of the camera in the intraoral space. The small camera tip makes it easy to best position the lens anywhere in the mouth. The camera captures images in 2D and 3D and can rapidly capture half-arch and full-arch impressions.
Intraoral Camera

Training (*learning curve*) and Continued Education

Full Arch Impression Demonstration
Training *(learning curve)* and Continued Education
Training (*learning curve*) and Continued Education

Software

- Task Bar prompts user to next step
- Click tooth number
- Select restoration type
Software

Training *(learning curve)* and Continued Education

Recurrent Caries

Scanning criteria met

- Crevicular fluids at bay
- Intra oral "graduex" cleansed from preparation surface
- Gingival margins visible to camera
Click on the draw margin function

Mark gingival margins of #29 and #30

Training (*learning curve*) and Continued Education

Software

Trim Area  Draw Margin  Define Insertion Axis
Training (*learning curve*) and Continued Education

Click on the Tools function

Click on the Move function
Move function allows user to reposition virtual crown within the arch

Training (*learning curve*) and Continued Education
Use Shape Tool to modify occlusal and interproximal contacts
Training (*learning curve*) and Continued Education

Color intensity relates to contact strength
Crystalized and Glazed Lithium Disilicate Crowns

Crowns cemented with the Maximized Adhesive Dentistry Technique

Post operative radiograph

Training (*learning curve*) and Continued Education
Training *(learning curve)* and Continued Education

Software

Software work flow with clinical case

Patient complaint of tooth pain at teeth #’s 28,29

Radiographic and clinical exam revealed acute periapical periodontitis and irreversible pulpitis

Software
Training (*learning curve*) and Continued Education

**Software**

Can duplicate full contour build ups or diagnostic wax up for morphology and occlusion

- Intraoral scan of existing morphology
- Intraoral scan of centric bite
- Intraoral scan opposing arch
Endodontic treatment completed

Scanning criteria met

Training (*learning curve*) and Continued Education

Scanned image of prepared teeth #’s 28 and 29
Training (*learning curve*) and Continued Education

Software

Superimposed image of original morphology onto the preparations

Software editing of the virtual crowns
Training (learning curve) and Continued Education

Crystalized and Glazed Lithium Disilicate Crowns

Crowns cemented with the Maximized Adhesive Dentistry Technique

Post operative radiograph
Quality of Cad/Cam Restorations

We offer three kinds of service:
GOOD - CHEAP - FAST
You can pick any two
GOOD service CHEAP won’t be FAST
GOOD service FAST won’t be CHEAP
FAST service CHEAP won’t be GOOD
With current intraoral scanning systems, full arch dental impressions are possible with high accuracy.
Quality of Cad/Cam Restorations

Clinical evaluation of all-ceramic crowns fabricated from intraoral digital impressions based on the principle of active wavefront sampling.
Syrek A, Reich G, Ranftl D, Klein C, Cerny B, Brodesser J.

Abstract
OBJECTIVES: The aim of the present study was to compare the fit of all-ceramic crowns fabricated from intraoral digital impressions with the fit of all-ceramic crowns fabricated from silicone impressions.

METHODS: Twenty patients agreed to take part in the study to receive two Lava crowns each for the same preparation. One crown was fabricated from intraoral scans using the Lava Chairside Oral Scanner (Lava C.O.S.), and the other crown from a two-step silicone impression. Prior to cementation the fit of both crowns was clinically evaluated by two calibrated and blinded examiners; the marginal fit was also scored from replicas. Data from the replica scores were analysed by Anderson-Darling test, Levene’s test and Mann-Whitney test. All tests were performed with alpha-level of 0.05.

RESULTS: Median marginal gap in the conventional impression group was 71microm (Q1:45microm; Q3:98microm), and in the digital impression group 49microm (Q1:32microm; Q3:65microm). Mann-Whitney test revealed a significant difference between the groups (p<0.05). No differences were found regarding the occlusion, and there was a trend for better interproximal fit for the digitally fabricated crowns.

CONCLUSIONS: 1. Crowns from intraoral scans revealed significantly better marginal fit than crowns from silicone impressions. 2. Marginal discrepancies in both groups were within the limits of clinical acceptability. 3. Crowns from intraoral scans tended to show better interproximal contact area quality. 4. Crowns from both groups performed equally well with regard to occlusion.
A comparison of fixed prostheses generated from conventional vs digitally scanned dental impressions.

Henkel GL.

Abstract
For many years, mechanical and laser-based scanning technology has been used with computer-aided design and computer-aided manufacturing applications in the field of dentistry, but most have been limited to the dental laboratory. For the past 20 years, only 1 intraoral scanning device has been available to the dentist for in-office use. Recently, a new kind of intraoral scanning technology was introduced to the dental market. This technology, based on a laser scanning protocol called "parallel confocal," allows the dentist to take electronic impressions intraorally. This technology is coupled with traditional laboratory protocol for the construction of fixed dental restorations, providing the dentist with an accurate and efficient system to produce high-quality fixed dental restorations of all types. In a blind study, crowns developed using this technology were preferred over crowns generated using conventional impressions and criteria of marginal fit, contacts, occlusion, and time of adjustment in nearly 70% of cases. This article introduces scanning technology including a discussion of its clinical applications and an overview of the benefits.
Quality of Cad/Cam restorations

Marginal fit of anterior 3-unit fixed partial zirconia restorations using different CAD/CAM systems

Tae-Jin Song, DDS, MSD, PhD,1,† Taek-Ka Kwon, DDS, MSD, PhD,2,† Jae-Ho Yang, DDS, MSD, PhD,3 Jung-Suk Han, DDS, MSD, PhD,3 Jai-Bong Lee, DDS, MSD, PhD,3 Sung-Hun Kim, DDS, PhD,3 and In-Sung Yeo, DDS, MSD, PhD

Abstract

PURPOSE
Few studies have investigated the marginal accuracy of 3-unit zirconia fixed partial dentures (FPDs) fabricated by computer-aided design/computer-aided manufacturing (CAD/CAM) system. The purpose of this study was to compare the marginal fit of zirconia FPDs made using two CAD/CAM systems with that of metal-ceramic FPDs.

MATERIALS AND METHODS
Artificial resin maxillary central and lateral incisors were prepared for 3-unit FPDs and fixed in yellow stone. This model was duplicated to epoxy resin die. On the resin die, 15 three-unit FPDs were fabricated per group (45 in total): Group A, zirconia 3-unit FPDs made with the Everest system; Group B, zirconia 3-unit FPDs made with the Lava system; and Group C, metal-ceramic 3-unit FPDs. They were cemented to resin dies with resin cement. After removal of pontic, each retainer was separated and observed under a microscope (Presetize 440C). Marginal gaps of experimental groups were analyzed using one-way ANOVA and Duncan test.

RESULTS
Mean marginal gaps of 3-unit FPDs were 60.46 μm for the Everest group, 78.71 μm for the Lava group, and 81.32 μm for the metal-ceramic group. The Everest group demonstrated significantly smaller marginal gap than the Lava and the metal-ceramic groups (P<.05). The marginal gap did not significantly differ between the Lava and the metal-ceramic groups (P>.05).

CONCLUSION
The marginal gaps of anterior 3-unit zirconia FPD differed according to CAD/CAM systems, but still fell within clinically acceptable ranges compared with conventional metal-ceramic restoration.
Efficiency of Digital Impressioning

Digital vs. conventional implant impressions: efficiency outcomes.
Lee SJ*, Gallucci GO.

Abstract
OBJECTIVES: The aim of this pilot study was to evaluate the efficiency, difficulty and operator’s preference of a digital impression compared with a conventional impression for single implant restorations.

MATERIALS AND METHODS: Thirty HSDM second year dental students performed conventional and digital implant impressions on a customized model presenting a single implant. The outcome of the impressions was evaluated under an acceptance criteria and the need for retake/rescan was decided. The efficiency of both impression techniques was evaluated by measuring the preparation, working, and retake/rescan time (m/s) and the number of retakes/rescans. Participants’ perception on the level of difficulty for the both impressions was assessed with a visual analogue scale (VAS) questionnaire. Multiple questionnaires were obtained to assess the participants’ perception on preference, effectiveness and proficiency.

RESULTS: Mean total treatment time was of 24:42 m/s for conventional and 12:29 m/s for digital impressions (P < 0.001). Mean preparation time was of 4:42 m/s for conventional and 3:35 m/s for digital impressions (P < 0.001). Mean working time including retakes/rescans demanded 20:00 m/s for conventional vs. 8.54 m/s for digital impression (P < 0.001). On a 0-100 VAS scale, the participants scored a mean difficulty level of 43.12 (±18.46) for conventional impression technique and 30.63 (±17.57) for digital impression technique (P = 0.006). Sixty percent of the participants preferred the digital impression, 7% the conventional impression technique and 33% preferred either technique.

CONCLUSIONS: Digital impressions resulted in a more efficient technique than conventional impressions. Longer preparation, working, and retake time were consumed to complete an acceptable conventional impression. Difficulty was lower for the digital impression compared with the conventional ones when performed by inexperienced second year dental students.
Combining intraoral scanning with today's CAD/CAM technology allows for proficiency in the dental operatory.
Efficiency of Digital Intraoral Scanning (Chairside and Dental Lab communication)
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Existing Amalgam Restoration with recurrent caries and vertical fractures

Tooth Preparation with Scanning criteria met

Lithium Disilicate Crown with Crystallization and Stain and Glaze Cemented with the Maximized Adhesive Dentistry Technique
Efficiency of Digital Intraoral Scanning (Chairside and Dental Lab communication)

Existing Restorations with recurrent caries

Tooth Preparation with Scanning criteria met

Lithium Disilicate onlays cemented with the Maximized Adhesive Dentistry Technique
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Recurrent caries and vertical fractures

Lithium Disilicate onlays cemented with the Maximized Adhesive Technique
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Existing amalgam restorations with interproximal recurrent caries

Lithium Disilicate Crown*

Lithium Disilicate Onlays*

*Cemented with the Maximized Adhesive Technique
Efficiency of Digital Intraoral Scanning (Chairside and Dental Lab communication)

Existing PFM Crowns

Empress Cad BL3 Crowns with stain and glaze

Note Maximized Adhesion Technique facial resin
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Existing Amalgam with recurrent caries

Zirconia Restoration cemented with Glass Ionomer
Efficiency of Digital Intraoral Scanning (Chairside and Dental Lab communication)

Zirconia Custom Abutment

Pre-Stained Empress Cad Implant Supported Crown

Stained and Glazed Crown cemented with the Maximized Adhesive Technique
ZIRCONIA CUSTOM ABUTMENTS

Have we placed all Zirconia abutments?

Fractured Zirconia abutment at fixture level

Would I do it again?

Friction and abrasion marks
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Hybrid Custom Abutments

- Provides precise implant location transfer
- Prefabricated rotation locks in zirconium block and on Ti-Base
- Metal to metal screw connection
Hybrid Custom Abutments

- Orientation Notch
- Orientation Recess
- Ti-Base
- Scan Body
Hybrid Custom Abutments

- Zirconia Blocks
- Screw Access Hole

Orientation Recess

Magnified View of Intaglio Surface of Milled Zirconia Crown
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Hybrid Custom Abutments

Custom Healing Abutment

Gingival Emergence at Implant Fixture Level

Custom Healing Abutment removed
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Ti-Base* inserted at fixture level

Scan Body* inserted over Ti-Base

*Ti-Base is the fixture level connection to the implant body

*Scan Body is the orientation marker for the software
After cementation need to polish gingival 1/3

Abutment Crown crystalized and glazed cemented onto Ti-Base

Occlusal View
Efficiency of Digital Intraoral Scanning
(Chairside and Dental Lab communication)

Zirconia Hybrid Custom Screw Retained Implant Crown

Natural Emergence Profile
Cost analysis of single visit Cad/Cam restorations

Ya its awesome but........................
The Real Cost of Producing a Cerec Crown

Through research we have seen many discussions on the cost and savings of producing a Cerec crown. The figures given have had a wide disparity amongst them. What we have found is that there is a cost a what are the real savings? Are they worth it?

Here is a break down of what the basic costs are:

<table>
<thead>
<tr>
<th>Cost Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost of Cerec machine</td>
<td>$100,000 on a 5yr (60mth) lease, 5% interest</td>
</tr>
<tr>
<td>Average amount of units produced per month</td>
<td>$47.50 p/unit</td>
</tr>
<tr>
<td>Average cost of material for Cerec unit</td>
<td>$20.00 p/unit</td>
</tr>
<tr>
<td>Average time to produce a unit</td>
<td>20 min</td>
</tr>
<tr>
<td>(this takes in to account no learning curve)</td>
<td></td>
</tr>
<tr>
<td>Average dentist hourly rate</td>
<td>$342</td>
</tr>
<tr>
<td>Base cost of producing 1 Cerec unit</td>
<td>$181.50</td>
</tr>
</tbody>
</table>
Tooth Prep and Impression
- anesthesia $.52
- syringe $.11
- Burs $1.80
- Retraction cord $.29
- Impression material $10.83
- Impression tips $2.89 (coe syringe tip, heavy and light body
- Impression tray $.90

Grand Total $14.45

$336.62 per crown
Cost analysis of single visit Cad/Cam restorations

What a conventional 2 visit crown really cost

Laboratory and Final Cementation
- Lab Fee $200
- Permanent Cement $5.46

Grand Total $205.46

Miscellaneous Cost
- Employee Salaries $37
- Square footage cost $10.27
- Room turn over $50

Grand Total $97.27
What a single visit Cad/Cam crown really cost

Digital Crown with milling chamber Cost
- anesthesia $.52
- syringe $.11
- Burs $1.80
- retraction cord $.29
- Ceramic Block, wear and tear on burs $38
- Cost of technology (note /30 crowns per month) $73
- Warranty and software club (at 30 crowns per month) $2.5
- Permanent Cement $5.46
- Employee Salaries $37
- Square footage cost $10.27

Grand Total $168.95
Galileos-Cerec Integration for Guided Implant Surgery

www.drsmanda.com
Combining 3D Conebeam / CT Scan and Cerec Technology

- Reference Body Scan
- Cerec Virtual Crown
- Virtual Crown, Implant and Soft Tissue Superimposed on CT Scan

- Fiduciary Markers
- Crown
- Soft Tissue
- Implant
The Guide can be fabricated chairside with inexpensive materials and used to place implants for one to four missing teeth.

Reference Body
Thermoplastic Material

Implant Specific Drill Sleeve
Cerec Milled Drill Body

Package of two reference bodies and two drill bodies….. $80.

www.drsmanda.com
**Reference Body:**

- Radiopaque Markers

Medium is most commonly used size.

<table>
<thead>
<tr>
<th>Size</th>
<th>Color</th>
<th>Width at most narrow</th>
<th>Max Drill Ø</th>
<th>Mes/dis position correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Orange</td>
<td>6 mm</td>
<td>3.5 mm</td>
<td>≤ 1.5 mm</td>
</tr>
<tr>
<td>M</td>
<td>White</td>
<td>7.3 mm</td>
<td>4.3 mm</td>
<td>≤ 2 mm</td>
</tr>
<tr>
<td>L</td>
<td>Grey</td>
<td>11 mm</td>
<td>6 mm</td>
<td>≤ 4 mm</td>
</tr>
</tbody>
</table>

Concave tissue surface

Center reference body in edentulous space.
Combining 3D Conebeam / CT Scan and Cerec Technology

Thermoplastic material

Reference Body

Diagnostic Cast
Thermoplastic material softens and turns clear in 120° water.

Adapt material to edentulous space and adjacent teeth. Center reference body in space and press to place, making contact with ridge. Adapt material to sides of reference body.
Material adapted to adjacent teeth.

Material adapted to sides of reference body.

Reference body in contact with tissue of ridge.

www.drsmanda.com
Scan with Cerec guide and reference body in place intraorally:
Radiopaque fiduciary markers embedded in Reference Body will be used by Sidexis software for orientation.

Combining Galileos 3D Conebeam / CT Scan and Cerec® Technology
Software allows for viewing in three dimensions.

www.drsmanda.com
Locate and highlight the Mandibular nerve:
Implant selection using software library of multiple implant companies:
Implant Positioning:

Guidelines: 1. Implant positioned in sound bone.
   2. Avoid nerve by at least 2 mm.
   3. Minimum of 2mm bone thickness on buccal and lingual.
   4. Remain 3.5 mm away from adjacent teeth.
Center implant position within outline of reference body to insure accurate fabrication of drill body.

Implant Positioning:

Outline of Reference Body
Sidexis software directs Cerec machine to produce milled drill body.
Milled Drill Bodies:

- Tissue Surface
- Implant Drill Guide Channel
- Orientation Projection
- Vertical Stop
- Tissue Surface
Drill body produced in Cerec milling chamber.

Drill body snapped into Cerec Guide.

Orientation Notch

Reference body removed.
Implant site

Tissue punch used with drill sleeve to enter tissue while protecting the milled drill body.
Drill sleeves are specific to implant manufacturer and size.

Sleeves fit into drill body on stent and guide drill bits to pre-determined angle and depth.
Tissue punch technique provides:

1. Atraumatic entry into implant site.

Initial trephine drill guided to full depth.
Drill sleeves and drill bits of progressively larger sizes are used until implant can be placed at correct angle and pre-determined depth.

Multi-purpose fixture mount holds implant while its driven into bone.
Multi-purpose fixture mount.
Careful planning...........

.......leads to ideal implant positioning.
Guided implant surgery produces excellent results.

Zirconia Screw Retained Hybrid Implant Crown