Dental Technician Int’l Meeting was a success

By Dental Tribune MEA / CAPPmea

DUBAI, UAE: This May CAPP (Centre for advanced Professional Practices) hosted another meeting that was dedicated to the dental technicians from the MEA region and beyond. The meeting was a part of the annual congress, 13th CAD/CAM & Digital Dentistry Conference & Exhibition that was held in beautiful arena of Madinat Jumeirah Conference Centre on 04-05 May 2018. Dental Technician Sessions were an accomplishment not only for dental laboratory owners and dental technicians but also for the entire dental technology profession.

The event was spread over two very active days for all participants and welcomed 154 dental technicians. On the first day there were seven various tables where the hands-on trainings took place. The tables operated simultaneously with a rotation of several groups for each table. The trainings were help in small groups (20 seats available per session) in order to have the highest impact. Outstanding dental technicians presented various topics of a great interest to the dental technicians. The participants had an opportunity to interact immediately and ask their personal questions. The practical demonstrations, at the same time, provided inspiration and offer means of trouble shooting.

On the second day Saturday 05 May 2018, Dental Technician International Meeting scientific programme took place and a line-up extraordinary dental technicians who provided their best interpretations of the latest novelties in the dental technicians profession. Aiham Farah, CDT, from Syria spoke about flawless Lab-Fabri cated Dental Restorations, followed by Philippe De Moyer from Belgium who had a lecture on Innovative Method in Guided Surgery to Prepare Immediate Loading and Place Dental Implant. Rik Jacobs from the Netherlands introduced 3D Printing on the Edge of Conversion and Eric Berger from France finished the day with his lecture on “Aesthetic Realization with VITA: Cut Back on VITA Block”.

The next edition of Dental Technician Meeting will be held on 12-13 April 2019 in Madinat Jumeirah Conference Centre.

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Materials and systems for all ceramic CAD/CAM restorations

By Drs. Christian Brenes, Ibrahim Duqum & Gustavo Mendonza, USA

Dental crowns have been used for decades to restore compromised, heavily restored teeth, and for aesthetic improvements. New Computer Aided Design/Computer Aided Manufacturing (CAD/CAM) materials and systems have been developed and evolved in the last decade for fabrication of all-ceramic restorations. Dental CAD/CAM technology is gaining popularity because of its benefits in terms of time consuming, materials savings, standardisation of the fabrication process, and predictability of the restorations.

The number of steps required for the fabrication of a restoration is less compared to traditional methods (Fig. 1). Another benefit of CAD/CAM dentistry includes the use of new materials and data acquisition, which represents a non-destructive method of saving impressions, restorations and information that is saved in a computer and constitutes an extraordinary communication tool for evaluation.

The incorporation of dental technology has not only brought a new range of manufacturing methods and material options, but also some concerns about the processes involve-
ing restorations’ fit, quality, accuracy, short and long-term prognosis.

The purpose of this document is to provide a review of the literature regarding the different materials and systems available up until 2015 in the USA.

CAD/CAM materials

The first in-office ceramic material was Vitalblock Mark I (Vident), it was a feldspathic-based ceramic compressed into a block that was milled into a dental restoration. After the invention of the Mark I block, the next generation of materials for CAD/CAM milling fabrication of all-ceramic restorations were Vital Mark II (Vident) and Celay, which replaced the original Mark I in 1997 for fine feldspathic porcelains primarily composed of silica oxide and alumina oxide.11 Mark II blocks are fabricated from feldspathic porcelain elements embedded in a glass matrix and used for single unit restorations available in polychromic blanks nowadays. On the other hand, Celay ceramic inlays have been considered clinically acceptable by traditional marginal fit evaluation.12

Dixor-MGC was a glass ceramic material composed of 70 percent tetra-silicic fluorina crystals precipitated in a glass matrix, but this material is no longer available on the market.13 Studies from Isenberg et al. suggested that alloys of this type of ceramics were judged as clinically successful in a range from 3-5 years of clinical service.14 In 1997, Para-digm M200 (M200) were introduced as a highly filled ultrafine silica ceramic embedded in a resin matrix; the main advantage of this material is that it can be used as a milled dense composite to prevent possible shrinkage but cannot be sintered or glazed.15

In early 1998, IPS Procad (Ivoclar Vivadent) was introduced as a leucite reinforced ceramic, which was similar to IPS Empress but with a finer particle size; this material was designed to be used with the CEREC system (Sirona Dental) and was available in different shades. More recently, the introduction of IPS Empress CAD (Ivoclar Vivadent) and Paradigm C that according to the manufacturer (GM ESPE) is a 30 to 45 percent leucite reinforced glass ceramic with a fine particle size.16

To overcome esthetic problems of most CAD/CAM blocks having a monochromatic restoration, a different version was developed as a multiphased ceramic block, which was called VITA Telux (Vident) and also IPS Empress CAD Multiblock, the base of the block is a dark opaque layer, while the outer layer is more translucent; the CAD software allows the clinician to position or align the restoration into the block for the desired outcome of the restorations.17

Fig. 1: Number of steps comparison between traditional methods of all-ceramic restorations and CAD/CAM restorations.

Fig. 2: VITA Mark I block.

Fig. 3: In-house milled crown from an E Max block.

Fig. 4: Full arch implant supported prosthesis milled from a partially sintered (green state) zirconia puck.

Fig. 5: STL file of an intraoral scan.

Table 1: Recommended dimensions for E-Max CAD by Ivoclar Vivadent.

<table>
<thead>
<tr>
<th>Material thickness</th>
<th>Anterior</th>
<th>0.8</th>
<th>0.9</th>
<th>1.0</th>
<th>1.2</th>
<th>1.5</th>
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<tr>
<td>Staining technique</td>
<td>0.8</td>
<td>0.9</td>
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<td>Cut-back technique</td>
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<td>Values are expressed in millimetres</td>
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Zirconia

Zirconia has been used in dentistry as a biocompatible material for crown and bridge fabrications since 2004, it has been useful in the most posterior areas of the mouth where high occlusal forces are applied and there is limited interocclusal space.21

Zirconia is a polymorphic material that can have three different forms depending on the temperature—monoclinic at room temperature, tetragonal above 1700 °C, and cubic phase below 1170 °C (for 1999) the phase transitions are reversible and accompanied with volume expansion. Different authors state that when zirconia is heated to tetragonal phase above 1470 °C and 2100 °C and cooled, a volume shrinkage of 3 to 3.5 percent can occur that could affect marginal fit or passiveness of the restorations.22 This feature limited the use of pure zirconia until 1990 when Birck and Gupta developed the yttria-tetragonal zirconia polycrystal (YTZP) containing a 2 to 3 percent mol-yttria in order to minimize this effect.23

One of the most interesting properties of zirconia is transformation toughening, which creates a quasicrystalline structure when a fracture takes place by the extension of an already existing defect in the material structure, with tetragonal grain size and stabilizer, the stress concentration at the tip of the crack constitutes an energy source able to trigger the transformation of tetragonal lattice into the monoclinic phase. This process dissipates part of the energy that promotes progression of cracks in the restoration, thus promoting the desired expansion of around 3.5 percent that increases the energy that opposes the crack propagation.24

Zirconia restorations can be fabricated from fully sintered monoclinic oxide or partially sintered zirconium oxide blanks (green-state). Propo- nents of milling state that zirconia restorations have high mechanical properties, which are attractive for restorative dentistry, some of these properties are high mechanical strength, fracture toughness, radiopacity for marginal integrity evaluation, and relatively high hardness.

Different manufacturers are using zirconia as one of their main materials such as: Ceramill Zolid (Amann Girrbach), Zirain (DENTSPLY, Bruxite (Caldewell Laboratories), IPS Zirkal (Ivoclar Vivadent), Zirconat (Ivoclar Vivadent), inCOrs ZI (Sirona Dental), VITA In-Cor (Vitra), and other companies have introduced materials that are in combination with zirconia to improve its properties in different clinical situations. Lava Plus, for example, is a combination of zirconia and other materials to improve its properties in different clinical situations.

CAD/CAM systems

A number of different manufacturers are providing CAD/CAM systems that generally consist of a scanner,
Table 2: Most popular dental CAD systems available for 2015.

<table>
<thead>
<tr>
<th>System</th>
<th>Manufacturer</th>
<th>File output</th>
</tr>
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<tbody>
<tr>
<td>3Shape</td>
<td>Zirkonzahn</td>
<td>Prosthetic/STL</td>
</tr>
<tr>
<td>Sirona</td>
<td>Amann Girrbach</td>
<td>Prosthetic</td>
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<tr>
<td>Durgesch</td>
<td>Doveley</td>
<td>Prosthetic</td>
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<td>CEREC</td>
<td>Sirona DentalSys</td>
<td>Prosthetic</td>
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<tr>
<td>Procura</td>
<td>Nobel Biocare</td>
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<td>Alignex</td>
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Table 3: Most popular dental CAD systems available for 2015.

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Discussion

Some advantages can be drawn from including CAD/CAM dental technology and its use of mill materials for all ceramic restorations. Even though clinical studies often showed a marginal fit of CAD/CAM restorations is compared to conventional restorations the fabrication of dental restorations is still a complex task that requires experience, knowledge and skills.

The incorporation of new systems and materials may change the process for designing and manufacturing of CAD/CAM restorations. Some of the main concerns from clinicians and patients are the reproducibility of results between systems and protocols the reliability of the obtained results and the accuracy of restorations. Further investigations are needed to determine the reliability of CAD/CAM systems in real clinical settings.

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The development of dental CAD/CAM systems has evolved into a process of electronic design and manufacture. A digital system can be defined as a system that allows the design and manufacturing of dental restorations. The Procura system, introduced in 2002, is the first CAD/CAM system that allows the design and manufacturing of dental restorations.

The Procura system, introduced in 1994, was the first system to provide fabrication of a restoration using a network connection. According to research, the average area of a marginal gap of fit from these restorations varies from 0.4 to 0.6 mm.13 A system that was developed in 2002 was the CEREC system, which was able to copy-mill a ceramic restoration. The system duplicated an acrylic resin pattern replica of a restoration. Zirkonzahn developed a similar system called the Zirkofit, which was able to copy-mill a ceramic restoration. Some years after, the Cerec system (DENTSPLY CeramTec) was able to design and manufacture a ceramic restoration from scratch.14

Almost at the same time that these companies developed the first copy mills prototypes, the Lava (3M ESPE) system was introduced in 2002, the fabrication of yttria-tetragonal zirconia polycrystal (Y-TZP) crowns for full ceramic restorations. The system dispensed an optical design, the CAD software designs and the restoration or framework is then milled from a pre-sintered blank. Studies on marginal adaptation suggest that Lava crowns have a marginal fit that can be as low as 21 micrometers.15 Some other systems that were able to mill zirconia crowns were DCS Zirkon/Dentsply/TI-300 and Denza 1.

In the last decade, companies have decided to differentiate their products by having a full CAD/CAM platform or being integrated into specific areas of expertise like CAD software developers or scanners. These companies claim to be open platforms where their systems allow to export universal files such as STL or PDF to be used with the majority of restorative softwares and milling machines so they can be used to import them.

Defenders of closed platforms claim that the integrative nature of CAD/CAM systems does not allow for a good integration between parts and materials. Some of the most used CAD/CAM systems with their material recommendations and capabilities are:

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Most of the clinical studies for CAD/CAM restorations accuracy of fit are: scanning accuracy, limitations, and milling hardware limitations of accuracy. Clinicians' and patients' confidence in the CAD/CAM system integration is also a key factor for fabricating good restorations. In this way, the marginal fit of CAD/CAM restorations can be used as a clinical tool to evaluate the efficiency and feasibility of CAD/CAM systems in real clinical settings.

As the majority of dental professionals use digital impressions, they are interested in knowing if the digital information has been accurately transferred to the tooth. This issue is directly related to the gap parameter which is an important factor for obtaining good restorations. The gap parameter is the difference between the tooth and the restoration it is related to the gap parameter which is an important factor for obtaining good restorations. The gap parameter is the difference between the tooth and the restoration.

The most important factor for a digital impression is the calibration of hardware with the material and the material used. In this context, the accuracy of restorations is related to the gap parameter which is an important factor for obtaining good restorations.
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